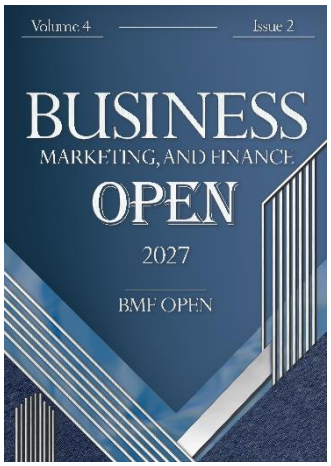
Threshold Effects of Government Governance Quality on the Relationship Between Culture, Economic Freedom, Oil Volatility Spillovers, and Tax Avoidance in Selected Oil-Producing Countries



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Abstract: The present study aims to investigate the threshold effects of government governance quality on the relationship between culture, economic freedom, oil volatility spillovers, and tax avoidance in selected oil-producing countries. Due to the limited availability of reliable data on tax avoidance, many researchers have employed various methods to estimate it, some of which directly and others indirectly measure tax avoidance and tax evasion. In the current study, the Tanzi currency demand approach was used to estimate the volume of tax avoidance and tax evasion. The study is applied in terms of purpose and descriptive-analytical in nature, and it falls within the category of ex post facto research. The research model was estimated using panel data for selected countries over the period 1995–2024 through the Panel Smooth Transition Regression (PSTR) approach. The statistical population consisted of selected oil-producing countries, including Iran, Kuwait, Qatar, Saudi Arabia, the United Arab Emirates, Venezuela, and Algeria. According to the model estimation results, in the nonlinear component of the model, the coefficients of the cultural index variables, including H and CI, were -0.120704 and -0.496421, respectively, indicating an inverse relationship between these cultural dimensions and tax avoidance in the selected oil-producing countries. The corresponding p-values for these coefficients were 0.0487 and 0.0069, respectively, demonstrating that these effects are statistically significant at the 95% confidence level. Furthermore, the coefficient of the economic freedom variable was -0.394485, with a corresponding probability value below 0.05, indicating a negative and statistically significant effect of economic freedom on tax avoidance in the selected oil-producing countries. In the nonlinear part of the model, the coefficient of government governance quality was negative and statistically significant at the 5% significance level.

Keywords: Government Governance Quality; Cultural Index; Economic Freedom; Oil Volatility Spillovers; Tax Avoidance.

1. Introduction

Tax avoidance has become one of the most persistent challenges of fiscal governance, particularly in economies where the state's revenue structure is shaped not only by taxation but also by natural-resource rents, political relationships, institutional capacity, and exposure to external shocks. In its broadest sense, tax avoidance refers to the use of legal or quasi-legal mechanisms to reduce tax liabilities, often through exploiting ambiguities,

exemptions, loopholes, or weaknesses in regulatory enforcement. Although tax avoidance differs from tax evasion because it may occur within the formal boundaries of law, its macroeconomic consequences can be similarly damaging when it erodes the tax base, weakens fiscal capacity, distorts corporate decision-making, and undermines perceptions of fairness in the tax system. Recent studies in corporate finance and accounting indicate that tax avoidance is closely linked with firm-level performance, debt policy, cost of debt, ownership structure, capital intensity, and political connections, showing that tax behavior is not merely a technical accounting issue but a strategic economic decision shaped by institutional and governance conditions [1-4].

The importance of tax avoidance becomes more pronounced in oil-producing economies because these countries often operate under a dual fiscal structure in which oil revenues reduce the immediate pressure to develop broad, transparent, and accountable tax systems. When governments rely heavily on oil rents, the fiscal relationship between state and citizens may weaken, because public expenditure can be financed without sustained reliance on taxation. This rent-based fiscal structure can reduce the perceived necessity of tax compliance among taxpayers and reduce the incentive of governments to strengthen tax administration. At the same time, oil price volatility creates instability in public revenues, investment behavior, inflation, and economic growth. Studies on oil-dependent economies show that oil price shocks and fluctuations affect economic development, inflationary dynamics, corporate investment, and macroeconomic performance, indicating that oil volatility is transmitted to fiscal and real-sector outcomes through multiple channels [5-8].

Oil price volatility spillovers are especially relevant to tax avoidance because resource booms and busts can alter both governmental and private-sector incentives. During periods of rising oil prices, governments may delay tax reforms because oil revenues temporarily compensate for weak tax collection. During periods of declining oil prices, fiscal pressure may increase, but weak institutions may be unable to expand the tax base efficiently, which can intensify avoidance behavior among firms and individuals. Moreover, oil volatility can affect corporate liquidity, investment expectations, and risk perception, thereby influencing firms' incentives to minimize tax payments. In this context, tax avoidance should not be understood only as a firm-level financial strategy; rather, it must be analyzed as part of a broader political-economic system in which natural-resource dependence, institutional quality, economic freedom, and cultural norms jointly shape fiscal behavior.

Economic freedom is another critical determinant of tax behavior. In theory, economic freedom may reduce tax avoidance by improving property-rights protection, strengthening market transparency, reducing arbitrary intervention, and creating predictable rules for economic actors. When firms operate in a transparent and competitive environment, tax compliance may become less costly and more compatible with long-term business planning. However, economic freedom may also produce ambiguous effects in settings where governance institutions are weak. Liberalization without regulatory capacity can expand opportunities for concealment, aggressive tax planning, capital mobility, and exploitation of legal gaps. Therefore, the effect of economic freedom on tax avoidance is likely conditional rather than uniform. This means that the same level of economic freedom may reduce avoidance in countries with strong governance but may fail to do so, or may even intensify avoidance, where institutional oversight, transparency, and accountability are weak.

Culture also plays a central role in explaining tax avoidance because compliance behavior is shaped by shared values, trust, perceived legitimacy, civic responsibility, and social norms. Cultural indicators such as education, media development, participation in cultural activities, and labor-market engagement may influence taxpayers' perceptions of government, legality, collective responsibility, and fairness. A society with higher levels of civic awareness, educational development, and institutional trust may display lower tolerance for opportunistic tax

behavior. Conversely, where distrust, rent-seeking, or dependency on resource income becomes normalized, tax avoidance may become socially tolerated or even strategically rationalized. The cultural dimension is therefore essential for understanding why similar economic incentives may produce different tax behaviors across countries. In oil-producing countries, the interaction between rentier culture and tax culture is particularly important, because the presence of oil rents may weaken the reciprocal relationship between taxation, representation, and public accountability.

Government governance quality provides the institutional environment within which culture, economic freedom, and oil volatility affect tax avoidance. Governance quality includes the effectiveness of public institutions, regulatory consistency, transparency, accountability, legal enforcement, control of corruption, and the capacity to manage public resources. In countries with stronger governance, governments can convert resource revenues into stable development policies, maintain fiscal discipline, improve tax administration, and reduce opportunities for avoidance. In countries with weaker governance, oil rents may reinforce opacity, clientelism, political privilege, and inefficient fiscal structures. Recent governance literature emphasizes that institutional performance cannot be assessed only through formal rules; it must also be understood through implementation capacity, power relations, participation, justice, and knowledge systems [9-11].

The broader governance literature on sustainability transitions and bioeconomy policy provides useful theoretical insights for the present study because it shows that governance outcomes depend on policy mixes, institutional change, actor coordination, and the distribution of power. Studies on forest-based bioeconomy governance argue that transitions require coherent institutions, inclusive participation, and the capacity to manage trade-offs among economic, environmental, and social objectives [12-14]. Although these studies are located mainly in the field of forest policy and bioeconomy, their conceptual implications are relevant to fiscal governance in oil economies: policy outcomes are shaped not only by economic resources but also by institutional arrangements, governance paradigms, and the ability of public authorities to manage complex transitions. Oil-producing countries similarly face the challenge of moving from rent-dependent fiscal structures toward more accountable, diversified, and tax-based governance systems.

The concept of governance transition is particularly important because oil economies are often required to respond simultaneously to resource volatility, economic diversification pressures, public expectations, and institutional reform demands. In this regard, the literature on circular and forest-based bioeconomy transitions highlights that sustainability-oriented transformations are not linear processes; they are marked by competing interests, uncertainty, ambiguity, and governance challenges [15, 16]. This perspective is relevant to the analysis of tax avoidance because fiscal reform in oil economies also involves conflicting incentives: governments need stable non-oil revenues, firms seek to reduce costs, citizens evaluate the legitimacy of taxation, and institutions must enforce rules in environments affected by rent-seeking and volatility. Thus, the relationship between governance quality and tax avoidance may follow threshold patterns rather than simple linear effects.

The threshold perspective is important because governance quality may not influence tax avoidance uniformly across all levels. At low levels of governance, improvements in institutional quality may be insufficient to change taxpayer behavior because distrust, weak enforcement, and administrative inefficiency remain dominant. However, once governance quality passes a certain threshold, its effect on tax avoidance may become stronger, because institutional reforms begin to reinforce each other. For example, greater transparency may improve trust, stronger legal enforcement may reduce opportunistic behavior, and more accountable public spending may increase voluntary compliance. This logic is consistent with multilevel governance research showing that

institutional effects depend on coordination across levels, policy instruments, and administrative capacity [17]. It also aligns with broader governance studies emphasizing that policy effectiveness depends on institutional design as well as the social legitimacy of governance arrangements.

Power, justice, and knowledge are also critical in explaining how governance quality shapes fiscal behavior. Studies on global bioeconomy governance show that unequal power relations, exclusionary knowledge systems, and weak justice mechanisms can reproduce existing inequalities even when policy reforms appear progressive [11, 18]. This insight is relevant to taxation because taxpayers are more likely to comply when they perceive the tax system as fair, transparent, and socially legitimate. If tax rules are perceived as favoring politically connected firms, rent-seeking groups, or privileged economic actors, tax avoidance may increase even when formal regulations exist. Similarly, if citizens believe that public revenues are mismanaged or captured by elites, the moral foundation of tax compliance weakens. Therefore, governance quality affects tax avoidance not only through enforcement but also through legitimacy and perceived justice.

The role of discourse and policy narratives should also be considered. Research on bioeconomy policy demonstrates that policy fields are often shaped by competing coalitions, promises, and narratives that frame reforms as developmental, sustainable, or inclusive while sometimes preserving existing power structures [19, 20]. In fiscal policy, similar narratives may appear around economic liberalization, tax reform, anti-corruption, and diversification. Governments may promote tax reform rhetorically, but if reforms are not supported by effective institutions, transparency, and administrative capacity, avoidance may persist. Therefore, examining tax avoidance requires attention not only to formal policy variables but also to the institutional and cultural context in which reforms operate.

Transcultural and participatory governance perspectives further suggest that policy effectiveness depends on whether governance systems reflect local values, social norms, and community-level understandings. Studies on transcultural bioeconomy governance and Indigenous knowledge show that development policies may fail when they neglect cultural legitimacy, local participation, and plural knowledge systems [21, 22]. In the context of tax avoidance, this implies that fiscal compliance cannot be achieved solely through technical enforcement; it also requires a culture of accountability, social trust, and perceived reciprocity between state and society. In oil-producing countries, where resource rents may reduce the visibility of taxation, strengthening tax culture becomes a central condition for sustainable fiscal governance.

Digital infrastructure and state capacity are also increasingly relevant to governance and taxation. High-capacity broadband and digital transformation can improve administrative efficiency, information exchange, and monitoring capacity, while also enabling more transparent service delivery [23, 24]. Although digital infrastructure alone does not guarantee tax compliance, it can support better tax administration when embedded in a broader governance framework. Digitalization may reduce opportunities for concealment, improve taxpayer services, and strengthen the traceability of transactions. However, without institutional accountability and legal safeguards, technological capacity may remain underutilized or may reinforce existing administrative weaknesses.

Taken together, the literature suggests that tax avoidance in oil-producing countries is shaped by a complex interaction among fiscal structure, oil volatility, culture, economic freedom, and governance quality. Firm-level studies indicate that tax avoidance is connected to financial strategy, debt policy, ownership structure, capital intensity, and political connections [1-4]. Macroeconomic studies show that oil shocks and oil price fluctuations affect growth, inflation, and investment, thereby influencing the broader environment in which tax behavior occurs [5-8]. Governance studies demonstrate that institutional quality, policy coordination, justice, participation, and

power relations determine whether policy systems can manage complex economic transitions effectively [9, 10, 12, 13].

Despite these contributions, an important gap remains in the literature. Existing studies often examine tax avoidance at the firm level or analyze oil price shocks and governance separately, but fewer studies integrate these dimensions into a nonlinear framework that captures the threshold role of government governance quality. In oil-producing countries, this omission is significant because governance quality may not merely have a direct effect on tax avoidance; rather, it may condition the effects of culture, economic freedom, and oil volatility spillovers. A threshold approach is therefore appropriate because it allows the analysis to identify whether the impact of explanatory variables changes when governance quality moves beyond a certain level. Such an approach can provide deeper insight into why similar oil-dependent economies may display different levels of tax avoidance and why institutional reforms may become effective only after reaching a minimum level of governance capacity.

Accordingly, the aim of this study is to examine the threshold effects of government governance quality on the relationship among culture, economic freedom, oil price volatility spillovers, and tax avoidance in selected oil-producing countries.

2. Methodology

The present study is applied in terms of purpose and descriptive-analytical in nature and is categorized as an ex post facto study. The objective of this article is to examine the threshold effects of government governance quality on the relationship between culture, economic freedom, oil price volatility spillovers, and tax avoidance in selected oil-producing countries. The research model was estimated using panel data for selected countries over the period 1995–2024 through the Panel Smooth Transition Regression (PSTR) approach. The statistical population consisted of selected oil-producing countries, including Iran, Kuwait, Qatar, Saudi Arabia, the United Arab Emirates, Venezuela, and Algeria. Following the studies of Sonouris (2024), Allam et al. (2023), and Mazaheri (2017), the research model is specified as follows:

$$SHADO_{it} = \alpha_0 + \beta_1 L_{it} + \beta_2 H_{it} + \beta_3 CI_{it} + \beta_4 M_{it} + \beta_5 FREED_{it} + \beta_6 GS_{it} + \beta_7 PF_{it} + (\theta_1 L_{it} + \theta_2 H_{it} + \theta_3 CI_{it} + \theta_4 M_{it} + \theta_5 FREED_{it} + \theta_6 GS_{it} + \theta_7 PF_{it}) F(S_{it}, \gamma, c) + u_{it}$$

where the transition function $F$is defined as:

$$F(S_{it}, \gamma, c) = (1 + \exp\{-\gamma(s_{it} - c)\})^{-1}, \gamma > 0$$

To examine the characteristics of the PSTR model with a logistic transition function based on the framework proposed by Van Dijk (1999), it is assumed that the dependent variable ($SHADO$) depends solely on its own lagged values. Under this assumption and considering a two-regime transition function, the following relationship is obtained:

$$SHADO_t = (\theta_0 + \theta_1 SHADO_{t-1} + \cdots + \theta_p SHADO_{t-p}) + (\phi_0 + \phi_1 SHADO_{t-1} + \cdots + \phi_p SHADO_{t-p}) G(GS_t, \gamma, c) + u_t$$

$$G(GS_t, \gamma, c) = \frac{1}{1 + \exp\{-\gamma(GS_t - c)\}}$$

The results of this specification constitute a two-regime PSTR model in which the location parameter $c$represents the transition point between the two limiting regimes, $G(SHADO_t, \gamma, c) = 0$and $G(SHADO_t, \gamma, c) = 1$, where

$G(SHADO_t, \gamma, c) = 0.5$. The parameter γindicates the speed of transition between regimes, with larger values of γreflecting a more rapid regime shift.

Many researchers have employed various approaches to estimate tax avoidance due to the limited availability of direct information. Some methods directly estimate tax avoidance and evasion, while others rely on indirect measures. In the present study, the Tanzi currency demand approach was used to estimate the volume of tax avoidance and tax evasion. According to Tanzi's monetary approach, the fundamental assumption is that all transactions within the underground economy are conducted in cash in order to remain concealed. Therefore, to estimate the size of the underground economy using this approach and based on an Autoregressive Distributed Lag (ARDL) framework, the ratio of currency in circulation to broad money is estimated through Equation (1):

$$\left(\frac{C}{M_2}\right)_t = \beta_0 + \beta_1 TaxBar_t + \beta_2 RGDPG_t + \varepsilon_t \qquad (1)$$

where (C/M_2)represents the ratio of currency in circulation to the money supply and serves as the dependent variable. $TaxBar$denotes the tax burden, measured as the ratio of total tax revenues to gross domestic product, while $RGDPG$represents economic growth.

After estimating the ratio of currency to money supply, $\left(\frac{C}{M_2}\right)_t$, the coefficient of the tax burden variable is set equal to zero without altering the remaining regression coefficients, and the ratio of currency to money supply in the absence of a tax burden, $\left(\frac{C}{M_2}\right)_{WTAX}$, is calculated. Subsequently, illegal money (IM) is obtained by multiplying the difference between the two ratios by the money supply according to Equation (2):

$$IM = \left[\left(\frac{C}{M_2}\right)_{TAX} - \left(\frac{C}{M_2}\right)_{WTAX}\right] \times M_2 \qquad (2)$$

Thereafter, legal money (LM) is obtained by subtracting the estimated illegal money from the money supply (M_2). Using Equation (3), the velocity of money circulation is calculated based on the quantity theory of money:

$$V = \frac{GNP}{LM} \qquad (3)$$

Assuming that the velocity of money is identical in both the formal and informal sectors of the economy, the volume of tax avoidance and tax evasion $(Shado)$ is estimated by multiplying the volume of money circulating in the underground economy (illegal money) by the velocity of money, as shown in Equation (4):

$$Shado = IM \times V \qquad (4)$$

To measure culture, the following variables are employed. Lrepresents the employed labor force, referring to all employed individuals aged ten years and above. Hdenotes the level of university education and serves as a cultural indicator. CIrepresents cinema capacity utilization, considered as the cinema index and used as a cultural indicator. Mrefers to the number of published journals and newspapers per one million inhabitants and is also regarded as a cultural indicator.

Economic freedom, or the right to economic freedom, reflects the ability of members of a society to engage in economic activities. The concept is widely used in economics, public policy discussions, and political economy. Similar to the broader concept of freedom, economic freedom has multiple definitions, although no universally accepted definition exists. The Fraser Economic Freedom Index is a weighted composite indicator consisting of five

dimensions: size of government, legal structure and protection of property rights, access to sound money, freedom to trade internationally, and regulation of credit, labor, and business activities.

$FREED_{it}$denotes the economic freedom index. This variable is measured using the Gwartney Index, which incorporates economic indicators within five major dimensions: size of government, property rights, monetary stability, international trade, and bureaucracy. The international trade dimension includes sub-components such as tariffs on foreign trade, regulatory trade barriers, the actual size of the trade sector, differences between official and black-market exchange rates, and controls on international capital markets. Each component ranges from 0 to 10, where lower values indicate lower economic freedom and higher values indicate greater economic freedom.

PFrepresents oil price volatility spillovers. Oil price volatility is estimated using the ARCH–GARCH methodology.

GSdenotes the average governance quality index. To measure governance quality, five major categories are combined: (1) size of government, (2) legal system and property rights, (3) accountability and transparency, (4) freedom of international trade, and (5) regulation of credit, labor, and business. Each category consists of several primary and secondary components that collectively form the overall governance quality index. The Fraser Institute calculates an average score across these five dimensions to obtain a comprehensive governance quality index for each country. Within this index, a value of 0 indicates the lowest level of governance quality, whereas a value of 10 represents the highest level of governance quality.

3. Findings and Results

First, oil price volatility spillovers are measured using ARCH and GARCH models.

To calculate oil price volatility spillovers, in accordance with the existing literature on volatility models, oil prices must first be modeled using ARMA models, and the relevant lags of oil prices must be determined. For this purpose, the Box–Jenkins methodology was employed, and the results obtained from oil price modeling are presented in the following table.

Table 1. Estimation of the Oil Price Model

Variable	Coefficient	Std. Error	z-Statistic	Prob.
AR(1)	1.014930	0.011936	85.03441	0.0000
MA(1)	-0.275550	0.037883	-7.273665	0.0000

Based on the above model, oil price is associated with its own first lag, $AR(1)$, and with the first lag of its disturbance term, $MA(1)$.

To examine the existence of conditional heteroskedasticity in oil prices, the ARCH test should be used. The results of this test are presented in Table 2.

Table 2. ARCH Test

Heteroskedasticity Test: ARCH	Statistic	Probability
F-statistic	2.214044	Prob. F(1,80) = 0.0364
Obs*R-squared	2.218810	Prob. Chi-Square(1) = 0.0363

Given the obtained probability value, the null hypothesis of no conditional heteroskedasticity in oil prices is rejected. Therefore, oil prices exhibit conditional heteroskedasticity.

Finally, to obtain oil price volatility spillovers, the EGARCH model proposed by Nelson (1991) is used. One of the major limitations of ARCH and GARCH models concerns their symmetry, meaning that the effects of negative

and positive shocks of the same magnitude on volatility are assumed to be equal. However, fluctuations in the government debt ratio do not respond identically to different types of news, namely negative and positive shocks. Accordingly, to overcome this limitation and analyze the volatility behavior of the series, it is necessary to use an asymmetric model (Verbeek, 2005).

$$\ln\ \sigma_t^2 = \alpha_0 + \alpha_1 \frac{|\ u_{t-1}\ |}{\sqrt{\sigma_{t-1}^2}} + \beta \ln\ \sigma_{t-1}^2 + \gamma \frac{u_{t-1}}{\sqrt{\sigma_{t-1}^2}}, \alpha_0 = \omega - \alpha\sqrt{\frac{2}{\pi}}, \alpha_1 = \alpha$$

This model has several advantages. First, in this model, the dependent variable, σ_t^2, is expressed in logarithmic form; therefore, the coefficients of the right-hand-side variables can be either positive or negative, while σ_t^2remains positive in all cases. Thus, there is no need to impose non-negativity restrictions on the coefficients. Second, this model also accounts for the effects of asymmetric shocks, because $\gamma$is the coefficient of u_{t-1}, and u_{t-1}can be either positive or negative. The parameter γcaptures the effects of positive and negative shocks, whereas $\alpha$is the coefficient that only considers the absolute value $|\ u_{t-1}\ |$. If $\gamma = 0$, the model is symmetric; otherwise, it is asymmetric. The effect of positive shocks is equal to $\alpha + \gamma$, and the effect of negative shocks is equal to $\alpha - \gamma$. If $\gamma$is negative, it indicates that the effect of negative shocks is greater than that of positive shocks, and vice versa.

Table 3. EGARCH Model for Oil Price

Dependent Variable: OIL				
Method: ML ARCH – Normal distribution (BFGS / Marquardt steps)				
$\log(GARCH) = C(3) + C(4) \times ABS(RESID(-1)/@SQRT(GARCH(-1))) + C(5) \times RESID(-1)/@SQRT(GARCH(-1)) + C(6) \times \log(GARCH(-1))$				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
AR(1)	1.014930	0.011936	85.03441	0.0000
MA(1)	-0.275550	0.037883	-7.273665	0.0000
Variance Equation				
C(3)	-1.460988	0.302531	-4.829211	0.0000
C(4)	-0.557479	0.164041	-3.398404	0.0007
C(5)	0.118678	0.138461	0.857123	0.3914
C(6)	-0.842610	0.171831	-4.903725	0.0000

At this stage, the level of volatility resulting from oil prices was calculated. To use this measure in the main model, which is estimated using the panel data approach, it is converted into a variable. For this purpose, the Make Variance GARCH command should be used, and this volatility measure is transformed into an independent variable.

Next, the stationarity of the research variables is examined using the Im–Pesaran unit root test.

The application of traditional econometric methods is based on the assumption that variables are stationary. Therefore, to avoid the occurrence of spurious regression when estimating the model, it is first necessary to examine and test the stationarity of the variables. The presence of non-stationary variables in the model causes the t- and F-tests to lack the required validity, and the critical values provided by the $t$and Fdistributions are not appropriate for conducting the tests. Under such conditions, the critical values derived from $t$and Fbehave in such a way that,

as the sample size increases, the probability of rejecting the null hypothesis increases. By incorrectly rejecting the null hypothesis, one may conclude that a strong and significant relationship exists among the variables of the model, whereas in reality this is not the case, and the estimated regression is nothing more than a spurious regression. Therefore, before estimating a regression model, it is necessary to ensure the stationarity of all independent and dependent variables.

The hypotheses related to the stationarity of the variables are as follows:

H_0:The variable is non-stationary

H_1:The variable is stationary

Since the stationarity of a variable can have a substantial effect on its behavior and characteristics, if the variables used in model estimation are non-stationary, even when no logical relationship exists between the independent and dependent variables, the estimated coefficient of determination may be very high and may lead the researcher to make incorrect inferences about the degree of association among the variables. Therefore, non-stationarity of variables causes a spurious increase in the coefficient of determination and in the model estimation results. The results of the stationarity test for the variables are presented in the following table.

Table 4. Results of the Unit Root Test for the Variables

Abbreviation	IPS Statistic: Selected Oil-Producing Countries	Probability Level	Stationarity Level
CI	-10.0533	0.0000	I(0)
FREED	-6.12122	0.0000	I(0)
GS	-2.55594	0.0004	I(0)
H	-2.90942	0.0076	I(0)
L	-3.44439	0.0003	I(0)
M	-2.73976	0.0031	I(0)
PF	-3.47333	0.0003	I(0)
SHADOO	-6.69253	0.0000	I(0)

The results in Table 4 and the examination of the calculated statistics and their probability values indicate that all research variables are stationary at level.

The results of the Limer test are presented in the following table.

Table 5. Results of the Model Selection Test

Type of Test	Test Statistic	Degrees of Freedom	Probability	Selected Model
Limer test	16.086520	(7,225)	0.0000	Panel data
Limer test	97.386736	7	0.0000	Panel data

According to the above table, since the probability value is below 0.05, the null hypothesis that the model should be estimated using the pooled data method is rejected, and the research model is selected as a panel data model.

To examine whether the relationship among the model variables is linear or nonlinear, it should be determined whether m, the number of regime parameters, is equal to one or not. It should be noted that in the following tests, the null hypothesis assumes that the model is linear, while the alternative hypothesis is either a logistic PSTR model ($m = 1$)or an exponential PSTR model ($m = 2$). The diagnostic test results in Table 6 show that the linearity of the model, namely the null hypothesis, is rejected. Therefore, there is a nonlinear relationship involving government governance quality in the relationship among culture, economic freedom, oil volatility spillovers, and

tax avoidance in selected oil-producing countries. Consequently, the PSTR method should be used to estimate the model parameters.

Table 6. Results of the Linearity Hypothesis Test of the Model (BBC Test)

Selected Oil-Producing Countries	Null Hypothesis/Test	F-Statistic	Significance Level
Selected oil-producing countries	Wald test	3.785	0.000
Selected oil-producing countries	Fisher test	2.638	0.001
Selected oil-producing countries	LRT test	2.957	0.012

As shown by the test results in Table 6, the hypothesis of linearity in the relationship among the variables is rejected; therefore, the possibility of a linear relationship among the variables is ruled out. It should also be noted that the PSTR model proposed through the selected transition variable, namely government governance quality, is chosen as the optimal model for estimating the model in selected oil-producing countries. For this purpose, following González et al. (2005) and Colletaz and Hurlin (2006), the null hypothesis of the existence of a PSTR model with one transition function was tested against the alternative hypothesis of a PSTR model with at least two transition functions. The results are presented in Table 7. The findings show that the null hypothesis concerning the adequacy of including one transition function is not rejected in either the case of one threshold or two thresholds. Therefore, one transition function is capable of specifying the threshold effects of government governance quality on the relationship among culture, economic freedom, oil volatility spillovers, and tax avoidance in selected oil-producing countries.

Table 7. Test for the Existence of a Remaining Nonlinear Relationship

Selected Oil-Producing Countries	Case of Two Thresholds, (M=2)			Case of One Threshold, (M=1)		
	LR	LMf	LMw	LR	LMf	LMw
(H_0: r=1,\ H_1: r=2)	1.297 (0.802)	1.362 (0.751)	1.425 (0.675)	1.432 (0.654)	1.471 (0.630)	1.352 (0.743)

With the confirmation of a nonlinear relationship among the variables and the adequacy of one transition function for specifying nonlinear behavior, the optimal case between a transition function with one threshold and a transition function with two thresholds must be selected. For this purpose, the corresponding PSTR model is estimated for each case, and based on the criteria of the residual sum of squares, Schwarz criterion, and Akaike criterion, the PSTR model with one threshold is identified as the optimal model. Therefore, a PSTR model with one transition function and one threshold is selected to examine the nonlinear behavior among the variables under study.

Using a PSTR model in which the transition variable is government governance quality, the tax avoidance function and the threshold effects of government governance quality on the relationship among culture, economic freedom, oil volatility spillovers, and tax avoidance in selected oil-producing countries are modeled. Given the confirmation of the nonlinear model, the results of the nonlinear component of the model are analyzed below.

According to the model estimation results, in the nonlinear component, the coefficients of the cultural index variables, including $H$and CI, for tax avoidance are $-0.120704$and -0.496421, respectively. This indicates an inverse effect of these variables on tax avoidance in selected oil-producing countries. The corresponding probability values for these coefficients are 0.0487 and 0.0069, respectively, indicating that the effects of these variables on tax avoidance are statistically significant at the 95% confidence level. Moreover, the coefficient of the economic freedom variable in the model is -0.394485, and its corresponding probability value is below 0.05, indicating a negative

and statistically significant effect of economic freedom on tax avoidance in selected oil-producing countries. In the nonlinear component of the model, the coefficient of government governance quality is negative and statistically significant at the 5% error level.

Tax avoidance has been recognized as one of the main challenges facing tax systems. This phenomenon refers to the legal or quasi-legal efforts of individuals and firms to reduce the amount of tax payable. Unlike tax evasion, it occurs within the framework of the law but through the exploitation of legal loopholes. Tax avoidance has broad economic, social, and political consequences and can affect public resources, social justice, government efficiency, and the sustainability of the tax system. In oil-producing countries, this phenomenon becomes particularly important because of governments' high dependence on oil revenues and their volatility, since oil resources may reduce both governmental and public incentives to comply with taxation and may create a cycle of dependence on windfall revenues. Tax culture and economic beliefs play a key role in shaping citizens' tax behavior. Studies show that societal attitudes toward tax justice, trust in government, and social responsibility determine the level of tax avoidance. In countries where a culture of rent-seeking or exploitation of natural resources has become institutionalized, the motivation of individuals and companies to pay taxes declines. Conversely, societies in which tax education and a culture of social participation are strengthened show greater commitment to tax payment. This relationship demonstrates that tax avoidance is not merely an economic issue, but rather the product of a complex cultural and institutional interaction. Economic freedom, as a set of policies and regulations that guarantee private property, trade freedom, investment, and reduced government intervention, has an important effect on tax avoidance. Increased economic freedom is usually accompanied by greater transparency and reduced economic instability, which can strengthen the incentive to comply with tax laws. However, in the absence of effective institutions and efficient governance, economic freedom may also increase tax evasion and tax avoidance, because adequate oversight and control over economic activities are lacking. This multidimensional relationship shows that the effect of economic freedom on tax avoidance cannot be properly analyzed without considering governance quality. One of the specific characteristics of oil-producing countries is the volatility of oil revenues and their spillover effects on the economy. Oil volatility spillovers refer to the transmission of positive and negative effects of oil price fluctuations to other economic sectors, government revenues, and tax behavior. Unexpected oil revenues may reduce the government's incentive to develop the non-oil tax base and increase citizens' expectations for receiving services or the distribution of windfall resources. Such conditions may lead to the formation of a cycle of tax avoidance in which dependence on oil resources and reduced mutual tax participation expose the economy to vulnerability. Government governance plays an intermediary and moderating role in this process. Institutional quality, transparency, accountability, and corruption control are factors that can reduce the effects of culture, economic freedom, and oil volatility on tax avoidance. Governments with strong governance are able to manage oil resources in a way that prevents oil price fluctuations from having a negative effect on the tax base and citizens' behavior. Smart tax policies, budget stabilization instruments, sovereign wealth funds, and revenue transparency all play an important role in strengthening citizens' motivation to pay taxes and reducing the vicious cycle of dependence on windfall revenues. Empirical evidence in selected oil-producing countries shows that oil volatility and economic dependence on natural resources negatively affect the collection of direct and indirect taxes in the absence of effective governance. For example, in some Middle Eastern and Latin American countries, the decline in oil revenues has increased fiscal pressure on governments and intensified tax avoidance, whereas countries with strong institutions have been able to control these effects through transparency and efficient tax policies. In such countries, trust in government and tax education also play a reinforcing role and significantly reduce tax avoidance

across different social groups. Theoretical foundations indicate that the interaction among culture, economic freedom, oil volatility spillovers, and governance shapes tax avoidance as a complex and multidimensional process. Tax culture, belief in justice and social responsibility, the level of economic freedom, and institutional transparency all jointly affect the tax behavior of individuals and companies. Oil volatility and windfall resources can intensify this behavior, but effective governance can act as a moderating factor and reduce the negative effects of tax avoidance. Within the theoretical framework, economic and financial models show that analyzing tax avoidance in oil-producing countries requires simultaneous attention to four dimensions: culture and tax beliefs, economic freedom and regulatory transparency, oil volatility spillovers, and governance institutions. These four factors interact with one another and can shape the economic behavior of citizens and companies, thereby affecting the tax base and economic development in the long run. Ultimately, the theoretical foundations emphasize that economic and tax policymaking in oil-producing countries will face serious limitations if these four factors are not considered. To reduce tax avoidance and strengthen the tax base, a combination of cultural, institutional, and economic policies is required, including the promotion of tax education, strengthening trust in government, increasing regulatory transparency, and smart management of oil resources. Without this comprehensive approach, tax avoidance may become a structural challenge that threatens both social welfare and macroeconomic sustainability.

Table 8. Model Estimation Using the PSTR Model

Model: Tax Avoidance				
Linear Component of the Model				
Variable	Coefficient	Standard Error	t-Statistic	Probability
CONSTANT	0.329059	0.136048	-2.418698	0.0234
C	-0.096233	0.026454	-3.637702	0.0003
L	-0.158886	0.075984	-2.091051	0.0419
H	-0.016839	0.006021	-2.796881	0.0049
CI	-0.197885	0.085146	-2.324058	0.0201
M	-0.204690	0.089165	-2.295631	0.0300
FREED	-0.022717	0.010298	-2.205968	0.0274
GS	-0.212527	0.090308	-2.353357	0.0356
PF	0.053752	0.022425	2.396934	0.0165
Nonlinear Component of the Model				
CONSTANT	0.439091	0.154176	2.847986	0.0048
L	-0.433451	0.159418	-2.718959	0.0218
H	-0.120704	0.060604	-1.991677	0.0487
CI	-0.496421	0.175702	-2.825358	0.0069
M	-0.642607	0.230948	-2.782475	0.0200
FREED	-0.394485	0.197090	-2.001547	0.0465
GS	-0.979800	0.289830	-3.380603	0.0008
PF	0.393667	0.142781	2.757139	0.0201
Threshold ($\boldsymbol{C}$)	0.964102	0.158623	6.077495	0.0000
Slope Parameter ($\boldsymbol{\gamma}$)	6.675325	2.934622	2.274678	0.0284
Adjusted $\boldsymbol{R^2}$	0.92			

The comparison of coefficients across the two different regimes is conducted based on the transition variable and its values, and the value of the transition variable can determine the transition function and, consequently, the prevailing regime. In the above estimation, the transition variable is the government governance quality index, and the estimated threshold value for this variable is 0.96 for selected oil-producing countries. Based on the distance of the government governance quality index from this threshold value, the model follows two different limiting regimes. By comparing the model coefficients across the two regimes, it can be observed that when the government

governance quality index passes the threshold level of 0.96, that is, when it moves from the linear component to the nonlinear component, the response of tax avoidance to changes in this variable increases sharply. Thus, as the status of the government governance quality index improves, the effectiveness of tax avoidance becomes more strongly influenced by this variable and the other explanatory variables.

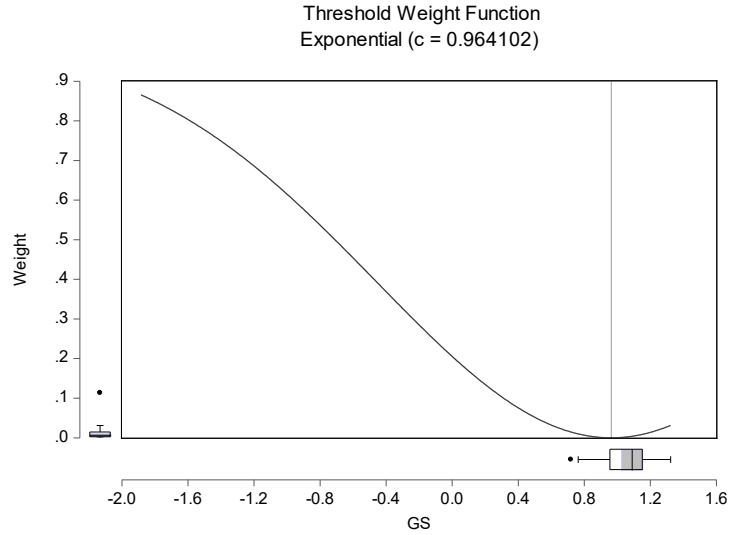

Figure 1. Relationship Between the Transition Function and the Transition Variable of the Government Governance Quality Index

In the present study, the Durbin–Watson test is used to examine autocorrelation.

Table 9. Results of the Autocorrelation Test

	F-Statistic	Prob.	Durbin–Watson
Selected oil-producing countries	1.235	0.69	2.036

As shown in the above table, the results of the Durbin–Watson autocorrelation test indicate that there is no correlation among the disturbance components. Therefore, the third classical standard assumption concerning the absence of autocorrelation among the error terms is not violated. Accordingly, the estimators possess the required properties, namely minimum variance and efficiency.

Another classical standard assumption is homoskedasticity. In the present study, the Breusch–Pagan–Godfrey test is used.

Table 10. Results of the Heteroskedasticity Test

	F-Statistic	Prob.	Breusch–Pagan–Godfrey
Selected oil-producing countries	1.298	0.556	1.327

As shown in the table, the test results indicate the absence of heteroskedasticity.

Another appropriate measure for evaluating the quality of the estimated model is to examine coefficient changes between the two regimes. If the estimated model provides an appropriate estimation, the coefficients are expected to remain stable and unchanged when the regime changes.

Table 11. Results of the Smooth Transition Parameter Stability Test

	Null Hypothesis	F-Statistic	Prob.
Selected oil-producing countries	$b_1 = b_2 = b_3 = b_4 = 0$	0.745	0.754
Selected oil-producing countries	$b_1 = b_2 = b_3 = 0$	0.798	0.712
Selected oil-producing countries	$b_1 = b_2 = 0$	0.821	0.695

Selected oil-producing countries	$b_1 = 0$	0.836	0.674

As shown in the table, the test of coefficient stability between the two regimes indicates that the coefficients do not change as a result of regime shifts.

4. Discussion and Conclusion

The present study examined the threshold effects of government governance quality on the relationship among culture, economic freedom, oil price volatility spillovers, and tax avoidance in selected oil-producing countries during the period 1995–2024 using a Panel Smooth Transition Regression (PSTR) framework. The findings confirmed the existence of a nonlinear relationship among the study variables and demonstrated that government governance quality acts as a threshold variable through which the effects of cultural indicators, economic freedom, and oil price volatility spillovers on tax avoidance are transmitted. The results revealed that the cultural variables represented by higher education and cinema participation exert a negative and statistically significant effect on tax avoidance in the nonlinear regime. Furthermore, economic freedom was found to reduce tax avoidance significantly, while government governance quality itself exerted a strong negative effect on tax avoidance. In contrast, oil price volatility spillovers exhibited a positive and significant impact on tax avoidance. These findings suggest that tax avoidance in oil-producing countries is not merely a consequence of firm-level financial decisions but is deeply embedded within broader institutional, cultural, and macroeconomic structures.

One of the most important findings of the study is the inverse relationship between cultural indicators and tax avoidance. The negative coefficients associated with educational attainment and cultural participation imply that societies characterized by stronger educational systems and richer cultural engagement tend to exhibit lower levels of tax avoidance. This finding can be explained by the role of culture in shaping civic responsibility, social trust, ethical norms, and perceptions of legitimacy. Education contributes to greater awareness of the social and economic functions of taxation and strengthens understanding of collective responsibilities toward public goods provision. Similarly, cultural participation reflects social integration and civic engagement, which can increase voluntary compliance with tax regulations. These findings are consistent with governance and institutional studies emphasizing that effective governance is not merely a matter of formal regulations but also depends on societal values, participation, and legitimacy [10, 11]. The results are also aligned with studies emphasizing the importance of knowledge systems, institutional trust, and social participation in improving governance outcomes and promoting responsible economic behavior [18, 21]. The findings therefore suggest that strengthening educational and cultural infrastructures may indirectly enhance tax compliance and reduce opportunities for avoidance.

The results further indicate that economic freedom has a negative and significant effect on tax avoidance. This finding suggests that higher levels of economic freedom contribute to lower tax avoidance in selected oil-producing countries. One possible explanation is that economic freedom improves transparency, strengthens property rights, reduces regulatory uncertainty, and creates more predictable economic environments. When businesses operate within stable and transparent institutional frameworks, the incentives to engage in aggressive tax planning and avoidance strategies may diminish. This interpretation is consistent with research emphasizing the importance of institutional quality and governance structures in supporting sustainable economic transitions and effective policy implementation [12, 13]. Furthermore, studies examining governance systems have highlighted that transparent regulatory environments and coherent policy frameworks encourage compliance-oriented behavior among economic actors [9, 17]. The current findings therefore support the argument that economic freedom is most effective in reducing tax avoidance when it is accompanied by effective governance and institutional accountability.

Another major finding concerns the role of government governance quality. The estimated coefficient for governance quality in the nonlinear regime was negative and highly significant, indicating that improvements in governance quality substantially reduce tax avoidance. This result supports the theoretical proposition that governance institutions play a critical role in shaping fiscal behavior. Effective governance improves accountability, transparency, regulatory quality, corruption control, and public-sector efficiency. These institutional improvements strengthen tax administration, reduce opportunities for loophole exploitation, and increase public confidence in government. As a result, both firms and individuals become more willing to comply with tax obligations. This finding is strongly supported by recent governance literature emphasizing the central role of institutions in managing economic transitions, coordinating policy implementation, and ensuring the legitimacy of public interventions [10-12]. It also aligns with studies highlighting the importance of institutional dynamics, governance reforms, and policy coherence in achieving desired socioeconomic outcomes [13, 14]. The findings suggest that governance quality functions as both a direct determinant and a moderating mechanism influencing the effectiveness of other factors affecting tax avoidance.

The threshold nature of governance quality represents another significant contribution of this study. The estimated threshold value of approximately 0.96 indicates that governance quality influences tax avoidance differently across regimes. When governance quality remains below the threshold, improvements may generate relatively limited reductions in tax avoidance because institutional weaknesses continue to constrain enforcement and compliance. However, once governance quality surpasses the threshold level, its effectiveness increases substantially. This finding is theoretically consistent with studies on governance transitions suggesting that institutional reforms often exhibit nonlinear effects, where benefits become more pronounced only after reaching a critical level of institutional maturity and coordination [15, 16]. Similar observations have been reported in research examining governance transformations and policy transitions, where institutional capacity, stakeholder participation, and policy coherence interact in nonlinear ways to produce significant improvements in performance outcomes [10, 12]. Consequently, the study demonstrates that governance reforms should not be viewed as producing immediate linear outcomes but rather as cumulative processes capable of generating stronger effects once institutional thresholds are crossed.

The positive relationship between oil price volatility spillovers and tax avoidance is another important result. Oil price volatility introduces uncertainty into government revenues, private investment decisions, and broader macroeconomic conditions. In oil-dependent economies, fluctuations in oil prices affect public finances directly because governments rely heavily on oil revenues. During periods of favorable oil prices, governments may become less dependent on tax revenues and may postpone necessary tax reforms. Conversely, during periods of declining oil prices, fiscal pressures intensify, but weak institutions may struggle to expand the tax base efficiently. These circumstances can create incentives for tax avoidance among economic actors. The current findings support previous studies showing that oil price fluctuations influence economic development, investment behavior, inflation, and fiscal stability [5-8]. The results also suggest that oil volatility affects tax avoidance indirectly through its influence on fiscal uncertainty and institutional performance. In resource-dependent economies, volatile oil revenues may weaken incentives for tax compliance while simultaneously limiting the government's capacity to strengthen enforcement mechanisms.

The findings further indicate that governance quality can mitigate the adverse effects of oil volatility spillovers on tax avoidance. This observation is consistent with the broader governance literature emphasizing the importance of institutional resilience in managing uncertainty and facilitating effective adaptation to external shocks [14, 15].

Governments with higher-quality institutions are generally better equipped to stabilize public finances, diversify revenue sources, maintain transparent fiscal policies, and implement countercyclical measures that reduce the negative consequences of resource-price volatility. Consequently, governance quality serves as a protective mechanism that reduces the transmission of oil-related shocks into tax avoidance behavior.

The study's findings also provide valuable insights into the relationship between governance, legitimacy, and taxpayer behavior. Research on governance systems increasingly emphasizes that compliance depends not only on enforcement but also on perceptions of fairness, justice, and institutional legitimacy [11, 18]. When citizens and firms perceive public institutions as transparent, accountable, and responsive, voluntary compliance increases. Conversely, perceptions of corruption, inequality, or misuse of public resources can weaken tax morale and encourage avoidance behavior. The negative effect of governance quality identified in this study supports this perspective by demonstrating that institutional legitimacy is a crucial determinant of tax compliance in oil-producing countries.

The findings also complement firm-level research on tax avoidance. Previous studies have demonstrated that tax avoidance is associated with debt policy, capital intensity, ownership structures, political connections, and corporate performance [1-4]. While these studies primarily focus on internal organizational factors, the present study extends the literature by highlighting the importance of macro-level institutional and economic conditions. The results suggest that firm-level tax behavior cannot be fully understood without considering broader governance, cultural, and economic contexts. Therefore, future theoretical frameworks should integrate both microeconomic and macroeconomic determinants of tax avoidance to achieve a more comprehensive understanding of fiscal behavior.

Another important implication concerns the interaction between governance and broader socioeconomic transformations. Recent studies on governance transitions emphasize that successful policy outcomes require coordination among institutions, stakeholders, and policy instruments [9, 10, 12]. The present findings indicate that reducing tax avoidance similarly requires a coordinated approach involving cultural development, economic liberalization, governance improvement, and effective management of resource revenues. Isolated policy interventions may produce limited results if underlying institutional weaknesses remain unresolved. Consequently, comprehensive governance reforms are likely to be more effective than narrowly focused fiscal measures.

Overall, the results demonstrate that tax avoidance in oil-producing countries emerges from the interaction of cultural, institutional, and economic factors. Government governance quality acts as a critical threshold variable that determines the effectiveness of culture and economic freedom in reducing tax avoidance while simultaneously moderating the adverse effects of oil price volatility spillovers. The findings reinforce the argument that institutional quality remains one of the most important prerequisites for sustainable fiscal systems, effective tax administration, and long-term economic development.

One limitation of the present study is that it focuses on a selected group of oil-producing countries, which may limit the generalizability of the findings to non-oil-producing economies or countries with different institutional structures. Additionally, the measurement of tax avoidance relied on indirect estimation methods because of the limited availability of direct tax avoidance data. Furthermore, governance quality was represented by a composite index that may not fully capture all dimensions of institutional effectiveness, political accountability, and administrative capacity.

Future research could expand the geographical scope of analysis by including both oil-producing and non-oil-producing countries to compare institutional effects across different economic structures. Researchers may also investigate additional governance dimensions such as corruption control, political stability, regulatory quality, and judicial independence separately. Moreover, future studies could employ alternative nonlinear methodologies, dynamic panel approaches, or firm-level datasets to examine whether threshold effects differ across industries, ownership structures, and stages of economic development.

From a practical perspective, policymakers should prioritize strengthening governance institutions, improving transparency, enhancing accountability mechanisms, and increasing public trust in government. Investments in education, cultural development, and civic engagement can contribute to stronger tax compliance by improving tax awareness and social responsibility. Governments in oil-producing countries should also pursue economic diversification strategies and reduce excessive dependence on volatile oil revenues. Strengthening tax administration systems, adopting digital governance technologies, and implementing transparent fiscal management practices can further reduce opportunities for tax avoidance and support the development of a more sustainable and resilient tax base.

Authors' Contributions

Authors equally contributed to this article.

Ethical Considerations

All procedures performed in this study were under the ethical standards.

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Conflict of Interest

The authors report no conflict of interest.

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