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Investigating the Asymmetric Relationship of Tax Revenue and Financial Development: NARDL Approach

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Highlights

- **There is a unidirectional asymmetric causality running from tax revenue to financial development.**
- **Positive shocks to tax revenue are associated with a negative effect on financial development,**
- **Negative tax revenue shocks exert a positive and clearly asymmetric effect.**

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Abstract

In oil-dependent economies like Iraq—where oil revenues constitute over 90% of government income and tax receipts remain negligible—understanding the asymmetric impacts of upward and downward shocks in the relationship between financial development and tax income is crucial. These insights can guide policies promoting economic diversification, reduced oil dependence, fiscal risk mitigation amid price volatility, and sustainable public finances in a shifting global energy landscape. This study examines the asymmetric causality between financial development and tax revenue in Iraq from 1993 to 2023 using the Nonlinear Autoregressive Distributed Lag (NARDL) model. This approach distinguishes the effects of positive and negative shocks, providing clear advantages over traditional linear models. The results indicate unidirectional asymmetric causality running from tax revenue to financial development. Positive shocks to tax revenue (increases in collections) are associated with a negative effect on financial development, likely due to reduced incentives for private investment and lower profitability of loans. By contrast, negative tax revenue shocks (declines in collections) exert a stronger positive and clearly asymmetric effect, presumably by releasing resources that facilitate private-sector credit expansion and overall financial deepening. Among the control variables, economic growth and government expenditure show positive and significant effects, boosting demand for financial services and supporting infrastructure development. Inflation and trade openness, however, exert negative influences: inflation erodes real returns on assets and raises transaction costs, while greater openness may subject domestic financial sectors to heightened external competition. The estimated error correction coefficient of –0.879 suggests rapid adjustment, with roughly 87.9% of short-run disequilibria corrected within one period. Overall, the findings highlight the importance of carefully calibrated tax policies to strengthen financial resilience in resource-dependent economies.

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1. Introduction

Fiscal policy, particularly taxation, interacts closely with the financial system. Tax revenue serves as not only a stable source of government funding but also as a key instrument for fiscal policy design and implementation, exerting significant direct and indirect effects on the financial sector. Beyond fulfilling various economic objectives, tax revenue plays an essential role in preserving the soundness and stability of national financial systems (Çilek, 2024). An increase in tax revenue has dual implications: on one hand, it reduces households' disposable income, dampens aggregate demand, and may weaken investment incentives; on the other hand, it enables higher public expenditures on social programs, research and development, and infrastructure, thereby contributing to sustainable development goals. Overall, changes in tax revenue influence financial development through multiple channels, including loan profitability, municipal bonds, economic growth, and the market performance of publicly traded taxable firms (Samira and Toufik, 2021).

Conversely, financial development can influence tax revenue through its effects on the real economy. In particular, greater financial development may enhance tax collection by promoting economic expansion and broadening the tax base. Moreover, it can reduce the size of the shadow economy, thereby limiting opportunities for tax evasion and increasing formal tax revenue. Financial development also facilitates the monitoring of economic activities**,** improves tax compliance, and boosts collection efficiency (Nnyanzi et al., 2018). In summary, financial development affects tax revenue through channels such as employment, productivity, economic growth, access to financial services, the size of the shadow economy, and international trade.

The global financial crisis of 2008–2009, which saw asset values plummet by approximately 40 percent between September 2008 and February 2009, underscored the critical role of the financial sector in achieving national economic objectives (Lane, 2012). In developing countries, tax administration and collection face significant challenges. According to a report by the United Nations Conference on Trade and Development (UNCTAD, 2015), corporate tax evasion and avoidance deprive developing economies of approximately USD 100 billion annually, resulting in the loss of a substantial portion of government financing resources. The International Monetary Fund (IMF, 2017) notes that developing countries exhibit the lowest tax-to-GDP ratios worldwide, while their public expenditure needs are considerably greater due to more severe structural constraints.

Consequently, the interaction between financial development and taxation holds particular importance for developing countries such as Iraq. Iraq is a developing economy endowed with substantial oil resources and a strategic geographical position, conferring considerable economic and geopolitical significance. However, as a developing nation, it grapples with persistent budget deficits, limited loanable funds, a distinctive banking structure dominated by the state, inadequate information management, and high levels of financial repression. The country has **also** experienced multiple domestic and external crises in recent

decades, contributing to a weak and nascent financial system that remains highly vulnerable to economic shocks.

Furthermore, as one of the world's major oil exporters, Iraq relies heavily on oil revenues, leading to the prevalence of oil rents, a large informal economy, and persistently low tax revenue. In addition, Iraq is among the developing countries lacking strong institutional quality and governance, owing to factors such as regime change, international sanctions, political instability, and natural resource rents. As a result, increases in tax revenue may not be optimally utilized by the government—due to sanctions on certain banks and poor public sector performance—thereby limiting their potential to foster financial development. Conversely, reductions in tax revenue can exacerbate corruption and rent-seeking, with significant adverse effects on financial development. This suggests that tax revenue may exhibit an asymmetric relationship with financial development in Iraq.

Iraq provides a particularly compelling case for examining asymmetric fiscal–financial linkages due to its unique combination of structural features**.** First, the country's extreme dependence on oil revenues (often exceeding 90% of fiscal income) creates a rentier state dynamic in which tax policy plays a marginal role and is often perceived as discretionary rather than developmental (Beblawi and Luciani, 1987; Ross, 2012). In such contexts, increases in tax revenue may signal stronger state extractive capacity but—given weak institutions and widespread rent-seeking—frequently fail to translate into productive public investment or financial deepening. Instead, they may crowd out private investment through higher effective tax burdens or perceived corruption risks. Conversely, declines in non-oil tax revenue (e.g., during fiscal austerity or informal sector dominance) can paradoxically free up resources in a financially repressed environment, enabling greater private-sector credit access through reduced state competition for funds or lower perceived fiscal pressure. Second, Iraq's banking sector remains heavily state-dominated, with limited private participation, high financial repression, and legacies of sanctions that restrict international integration and information flows. These institutional rigidities amplify asymmetric responses: positive tax shocks may further constrain already scarce private credit, while negative shocks may relieve liquidity pressures in an underdeveloped credit market. Third, frequent regime shifts, conflict episodes (post-2003 reconstruction, 2014–2017 ISIS crisis), and oil price volatility introduce nonlinear transmission channels that linear models are likely to miss. These factors make Iraq an ideal setting to test whether asymmetric causality holds and whether negative shocks exert stronger effects, as predicted by theories of rentier states and financial repression in resource-rich economies. By focusing on Iraq, this study contributes to the literature on fiscal-financial interactions in rentier and post-conflict economies, where conventional symmetric assumptions may not hold.

Given the critical roles of financial market development and fiscal policy, as well as the importance of their interaction, this paper examines the causal link between financial development and tax collection in Iraq. To this end, it employs the Hatemi-J asymmetric causality test and estimates the asymmetric relationship

using the nonlinear autoregressive distributed lag (NARDL) approach over the period 1993–2023.

The remainder of the paper is organized as follows. Section 2 reviews the relevant theoretical and empirical literature on the relationship between tax revenue and financial development. Section 3 describes the causality test and the econometric methodology employed. Section 4 presents and discusses the empirical findings. Section 5 concludes and provides policy implications based on the results.

2. Literature Review

2.1 Theoretical Literature

A. Financial Development

Financial development serves as a primary measure reflecting the health and effectiveness of country's financial system. Shaw (1973) broadly defined it as the accumulation of financial assets at a faster rate than nonfinancial assets. Levine (2005) offered a more comprehensive framework, positing that financial development takes place as financial instruments, markets, and intermediaries decrease—without necessarily removing—the costs associated with information acquisition, contract enforcement, and transaction execution. This process enhances the provision of five core financial functions: producing information about investment opportunities, efficiently allocating capital, monitoring investments and exerting corporate control, facilitating risk management, and easing the exchange of goods and services.

The World Bank (2020) conceptualizes financial development as a process that lowers information asymmetries, contract enforcement costs, and transaction frictions more generally. Amid rapid transformations in global financial markets over recent decades, the concept has garnered increasing attention from economists.

B. Tax Revenue

Taxation entails compulsory payments levied by the government on individuals' and firms' income, profits, or wealth to achieve specific developmental objectives. The portion of national output collected through taxation represents total government tax revenue, serving as a primary indicator of the state's command over economic resources. Governments rely on such revenue to finance expenditures, sustain public investment, and deliver social services, with taxation constituting the main non-resource-based source for these purposes (Okon, 2018).

In general, tax revenue is one of the most important policy instruments available to governments for financing public expenditures, allocating economic resources, and redistributing income (Mansouri et al., 2021). However, tax collection and enforcement pose inherent challenges in all countries. Consequently, enhancing tax revenue has emerged as a major policy priority. Developing countries face particularly acute difficulties in this regard, stemming from large agricultural sectors, narrow tax bases, high informality, and dependence on a limited range of revenue sources (Okon, 2018).

C. The Impact of Tax Revenue on Financial Development

Tax revenue can exert significant effects on financial development. The theoretical literature on taxation suggests that an efficient tax policy framework influences corporate competitiveness and the overall efficiency of the financial sector (Taha et al., 2013). Akram (2016) posits that, under the assumption of equivalence between financial and investment activities, higher tax rates affect financial development through three primary channels: loan profitability (via taxation of interest income), municipal bonds, and the publicly traded shares of taxable firms.

Changes in taxation may also influence financial development indirectly through their effects on economic growth. In exogenous growth models, such as the neoclassical Solow model (1956), taxation has no impact on the long-run growth rate. In contrast, endogenous growth models allow taxation to exert persistent effects on growth. For instance, in Lucas's (1990) model, which endogenizes long-run growth, taxation can be examined explicitly as a determinant of economic expansion. Taxes may affect growth by altering investment incentives, the marginal productivity of capital, or labor supply through changes in the marginal utility of leisure and the substitution between leisure and labor. Faramerzi et al. (2015) argue that personal income taxes and corporate taxes diminish production incentives and thereby weaken economic growth. However, the effects of taxation on labor supply and savings are complex, involving opposing income and substitution effects. The income effect—stemming from reduced real income—increases the marginal utility of income and may raise labor supply, whereas the substitution effect reduces labor supply due to lower after-tax wages relative to leisure. As these forces operate in opposite directions, the net impact of taxation on economic growth remains theoretically ambiguous. Nonetheless, changes in taxation can substantially influence growth trajectories.

From the demand-following perspective, economic growth induced by tax policy adjustments can, in turn, promote financial development. This hypothesis, originally advanced by Robinson (1952), posits that improvements in real economic conditions increase demand for goods and services, thereby raising the demand for financial services and instruments. In essence, expansion of the real sector stimulates the need for financial intermediation, fostering deeper and more efficient financial development.

D. The Impact of Financial Development on Tax Revenue

Financial development can exert both direct and indirect effects on tax revenue. Demirgüç-Kunt and Huizinga (2001) highlight that the financial sector contributes substantially to value added, employment, and potential tax revenue. Bose et al. (2012) argue that improved access to financial services enhances tax collection and compliance by enabling better tracking and enforcement of tax obligations. Financial institutions gather valuable information—such as income and asset details from loan applicants—that can be shared with tax authorities to strengthen tax administration. Consequently, a more developed financial system tends to expand the formal economy, leading to higher tax revenue.

Moreover, financial development influences tax revenue indirectly through several macroeconomic channels, including economic growth, the shadow economy, international trade, and tax evasion. Schumpeter (1961) posits that a well-functioning financial system promotes efficient resource allocation by channeling funds from surplus to deficit units, thereby fostering economic growth. Similarly, McKinnon (1973) and Shaw (1973) emphasize that financial liberalization—reducing government intervention and increasing competition—accelerates growth in the real sector. Levine (2000) further details how financial development improves information production on investment opportunities, investment monitoring and corporate governance, risk management, savings mobilization, and transaction facilitation. These functions shape saving and investment decisions, ultimately supporting sustained economic growth.

Empirical studies, such as Ajide and Bankefa (2017) and Akçay et al. (2016), indicate that growth induced by financial development expands taxable economic activities, thereby increasing tax collection. Economic growth also improves social welfare, boosts demand for goods and services, and generates additional investment, all of which broaden the tax base and enhance revenue. Furthermore, growth helps constrain the informal economy and strengthens tax monitoring and enforcement (Çilek, 2024).

Beyond growth-related channels, financial development affects tax revenue through international trade. Beck (2002) demonstrates that a developed financial system facilitates trade transactions and enhances firms' international competitiveness, leading to higher export and import volumes and, consequently, greater revenues from trade-related taxes. In this vein, Agosin et al. (2012) underscore the detrimental role of liquidity constraints in limiting firms' entry into international markets and argue that alleviating these constraints enables export diversification, thereby contributing to expanded trade and higher tax revenue.

2.2 Empirical Background

Krasniqi et al. (2026) examined the effects of fiscal policy on financial development in Southeast European countries over 2005–2023. Using panel data regression techniques—including fixed effects, random effects, and dynamic generalized method of moments (GMM)—they reported positive and statistically significant impacts of government tax revenue, public debt, and government effectiveness on financial development. In contrast, government expenditure and financial freedom showed no significant effects.

Kamasa et al. (2025) investigated the impact of financial sector development on tax revenue in Ghana from 1980 to 2021. Employing the autoregressive distributed lag (ARDL) approach and fully modified ordinary least squares (FMOLS), the findings indicate that financial development has a significant positive effect on tax income in the long run, with indirect taxes, corporate taxes, and personal income taxes showing particularly strong responsiveness to financial sector development. The study also demonstrated that formalizing informal sector activities reduces the shadow economy and thereby enhances tax revenue.

Çilek (2024) analyzed the link between financial development and tax collections in Turkey over 1985–2021. Applying the Hatemi-J asymmetric causality test, the analysis detected no causal relationship from shocks in financial development to shocks in tax revenue, nor any reverse causality from tax revenue shocks to financial development shocks.

Karas and Saygılı (2024) assessed the impact of tax structure on financial development in Turkey using data from 2000 to 2022. Through the ARDL bounds testing approach, they concluded that the tax structure—encompassing direct and indirect taxes—exerts a significant positive effect on financial development in both the short and long run. Causality tests further indicated unidirectional causality running from direct and indirect taxes to financial development.

Ekpeyong and Adewowin (2023) explored the interplay among tax policy, financial development, and economic growth in Sub-Saharan Africa from 2000 to 2019. Employing the pooled mean group (PMG) estimator and panel ARDL techniques, they found that private sector credit-to-GDP and foreign direct investment significantly contribute to economic growth, while liquidity, inflation, population, and taxation showed no statistically significant effects on growth.

Jabbari et al. (2023) examined the impact of taxing financial services on economic growth in Iran. Employing a computable general equilibrium (CGE) model and RANGIT software to simulate ten scenarios, they determined that social welfare gains from taxing financial services are maximized at a 4 percent tax rate, while the optimal rate for insurance services is 9 percent.

Omodero and Iyoha (2021) examined the impact of tax revenue on financial development in emerging markets, with a focus on Nigeria as a key growing economy. Using Nigerian data from 2000 to 2019 and a multiple regression framework that included tax revenue, foreign direct investment (FDI), and inflation as explanatory variables, they found that tax revenue exerts a positive and statistically significant effect on financial development. The authors recommend enhanced government and citizen efforts to mobilize tax revenue.

Abbaszadeh and Shamsaldini (2021) investigated the relationship between fiscal policy and capital market efficiency using data on firms listed on the Tehran Stock Exchange from 1996 to 2019. Employing a vector error correction model (VECM), they identified significant associations between taxation and stock price changes, trading value, and dividend yields.

Tsaurai (2020) applied a nonlinear panel generalized method of moments (GMM) approach to assess the effect of tax revenue on financial development and the complementary role of tax revenue and FDI in emerging markets, using panel data from 2001 to 2017. According to the results, the lagged values of financial development significantly affect its current values. Tax revenue demonstrated a significant positive impact on financial development, while the effect of FDI varied depending on the financial development indicator. Notably, the interaction between tax revenue and FDI exerted a positive and significant influence on financial development in emerging economies.

Sotoudeh et al. (2020) analyzed the effects of fiscal policy on stock market performance in selected oil-exporting countries over 2004–2018. Using a panel vector autoregression (PVAR) approach, they found that the output gap positively affects stock returns, budget balance has a negative effect, public debt exerts a positive influence, and stock market return volatility positively impacts returns. The study also confirmed bidirectional interactions between stock markets and fiscal policy variables.

Chaman et al. (2019) explored the impact of financial development on tax evasion in Iran from 1978 to 2014 using the autoregressive distributed lag (ARDL) approach. Their results indicate that the rise a long-run link between tax evasion and independent variables, including financial development, literacy rate, government size, and the industrial value-added share of GDP. Financial development, along with literacy rate, government size, and industrial share, exerted negative and statistically significant effects on tax evasion.

Asadzadeh and Fuman Ajirloo (2017) investigated the effects of banking system functions and equity market dynamics on tax revenue in Iran over 2000–2013, employing the ARDL methodology. Their findings indicated heterogeneous effects: components of financial activities that directly contribute to tax payments had positive and significant impacts on tax revenue.

Fakhrhosseini (2017) adopted a multiple-equilibrium framework within a labor search model to examine the effects of fiscal policy on asset market performance in Iran. The analysis demonstrates that, under pessimistic expectations—where individuals anticipate a decline in the value of their capital—economic output falls, and the severity of this decline diminishes the effectiveness of fiscal policy in restoring performance. Moreover, to counteract reductions in stock market values, a more aggressive expansionary fiscal policy generates larger increases in real rates of return and output.

3. The Model

This study employs the asymmetric causality test developed by Hatemi-J (2012) to examine the asymmetric relationships between financial development and tax revenue. This approach extends the Toda–Yamamoto (1995) causality procedure, which in turn builds on the foundational Granger (1969) causality framework.

Granger causality constitutes a statistical test for detecting predictive relationships between time-series variables. It assesses whether past values of one variable, X, improve forecasts of the current value of another variable, Y, beyond what is achievable using only past values of Y. If so, X is said to Granger-cause Y. The null hypothesis posits no Granger causality (i.e., Granger non-causality), meaning that lagged values of X do not provide incremental predictive power for Y.

The Hatemi-J (2012) test advances this framework by decomposing variables into positive and negative cumulative partial sums, thereby distinguishing the causal effects of positive shocks from those of negative shocks. This asymmetry is

particularly relevant when economic relationships exhibit nonlinear or regime-dependent behavior, as positive and negative changes may produce differing impacts on the dependent variable. Hatemi-J (2012) argues that agents in real-world settings often respond asymmetrically to shocks. In financial markets, investors exhibit heterogeneous behavior, reacting differently to positive and negative random shocks. Consequently, the impact of positive and negative shocks is not symmetric and should be decomposed and analyzed separately to capture potential nonlinear causal relationships. To implement asymmetric causality testing, consider two time-series, x and y. These can be expressed as:

$$y_t = y_{t-1} + \varepsilon_{1t} = y_0 + \sum_{t=1}^{T} \varepsilon_{2t} \quad (1)$$
$$x_t = x_{t-1} + \varepsilon_{1t} = x_0 + \sum_{t=1}^{T} \varepsilon_{1t}$$

Where x0 and y0 denote initial values and the error terms capture random innovations. Equation (2) decomposes these innovations into positive and negative shocks.

$$\varepsilon_{1i}^{+} = \max(\varepsilon_{1t}.0)\,.\,\varepsilon_{2i}^{+} = \max(\varepsilon_{2t}.0)\,.\,\varepsilon_{1i}^{-} = \min(\varepsilon_{1t}.0)\,.\,\varepsilon_{2i}^{-} = \min(\varepsilon_{1t}.0) \quad (2)$$

Where $\varepsilon_{1t} = \varepsilon_{1i}^{+} + \varepsilon_{1i}^{-}$ and $\varepsilon_{2t} = \varepsilon_{2i}^{+} + \varepsilon_{2i}^{-}$. Based on this decomposition, Equation (1) can be rewritten as Equation (3).

$$x_t = x_{t-1} + \varepsilon_{1t} = x_0 + \sum_{t=1}^{T} \varepsilon_{1i}^{+} + \sum_{t=1}^{T} \varepsilon_{1i}^{-} \quad (3)$$
$$y_t = y_{t-1} + \varepsilon_{2t} = y_0 + \sum_{t=1}^{T} \varepsilon_{2i}^{+} + \sum_{t=1}^{T} \varepsilon_{2i}^{-}$$

The positive and negative shocks, $x_t^{+}, x_t^{-}, y_t^{+}, y_t^{-}$, are defined in Equation (4).

$$x_t^{+} = \sum_{t=1}^{T} \varepsilon_{1i}^{+}\,.x_t^{-} = \sum_{t=1}^{T} \varepsilon_{1i}^{-} \quad \text{and} \quad y_t^{+} = \sum_{t=1}^{T} \varepsilon_{2i}^{+}\,.y_t^{-} = \sum_{t=1}^{T} \varepsilon_{2i}^{-} \quad (4)$$

In the presence of symmetric causality, asymmetric causality can still be tested by decomposing shocks into positive and negative components and analyzing their separate effects. If asymmetric causality is detected, the analysis proceeds to estimate the asymmetric long-run and short-run relationships using the nonlinear autoregressive distributed lag (NARDL) model developed by Shin et al. (2014). This approach is well-suited to the present context, as both theoretical and empirical literature indicate that financial development and tax revenue may respond differently to positive and negative shocks in each other—due to factors such as asymmetric investor behavior, institutional frictions, or resource dependence. The theoretical foundation for the asymmetric causal relationship in this study draws on the framework proposed by Çilek (2024), which employs the Hatemi-J test to

explore bidirectional asymmetry in a developing-country setting. The specification of the financial development model is adapted from Omodero and Iyoha (2021), with modifications informed by Mohammadi et al. (2014) to incorporate relevant controls and asymmetry considerations. In summary, the asymmetric relationship can be expressed as Equation (5):

$$FD_t = \beta_0 + \sum_{i=1}^{q} \alpha_i \mathrm{FD}_{t-i} + \sum_{i=0}^{p1} \beta_{11i} TR_{t-i}^{+} + \sum_{i=0}^{p1} \beta_{2i} TR_{t-i}^{-} + \sum_{i=0}^{p2} \beta_{2i} \mathrm{FDI}_{t-i} + \sum_{i=0}^{p3} \beta_{3i} \mathrm{INF}_{t-i} + \sum_{i=0}^{p4} \beta_{4i} GDP_{t-i} + \sum_{i=0}^{p5} \beta_{5i} \mathrm{OP}_{t-i} + \sum_{i=0}^{p6} \beta_{6i} GE_{t-i} + \lambda_1 TR_{t-1} + \lambda_2 FDI_{t-1} + \lambda_3 INF_{t-1} + \lambda_4 GDP_{t-1} + \lambda_5 OP_{t-1} + \lambda_6 GE_{t-1} + \varepsilon_t \quad (5)$$

Where FD denotes financial development, measured as the log-transformed value of domestic credit extended to the private sector; TR represents the natural logarithm of total government tax revenue; FDI is the ratio of foreign direct investment to GDP; INF denotes the inflation rate; GDP is the logarithm of gross domestic product; OP represents trade openness, measured as the ratio of the sum of exports and imports to GDP; and GE denotes government consumption expenditure as a ratio of GDP. To ensure comparability across variables and facilitate elasticity interpretation, level variables are entered in logarithmic form, while percentage or ratio values are retained in their original non-logarithmic scale. For robustness, an alternative specification is estimated in which financial development is proxied by the ratio of broad money to GDP.

The tax revenue equation is derived from the theoretical model proposed by Tsaurai (2022) and can be expressed in a simplified form as Equation (6).

$$TR_t = \beta_0 + \sum_{i=1}^{q} \alpha_i \mathrm{TR}_{t-i} + \sum_{i=0}^{p1} \beta_{11i} FD_{t-i}^{+} + \sum_{i=0}^{p1} \beta_{2i} FD_{t-i}^{-} + \sum_{i=0}^{p2} \beta_{2i} \mathrm{GDP}_{t-i} + \sum_{i=0}^{p3} \beta_{3i} \mathrm{INF}_{t-i} + \sum_{i=0}^{p4} \beta_{4i} \mathrm{OP}_{t-i} + \sum_{i=0}^{p5} \beta_{5i} \mathrm{URB}_{t-i} + \sum_{i=0}^{p6} \beta_{6i} \mathrm{POP}_{t-i} + \sum_{i=0}^{p7} \beta_{7i} \mathrm{HC}_{t-i} + \lambda_1 FD_{t-1} + \lambda_2 GDP_{t-1} + \lambda_3 INF_{t-1} + \lambda_4 OP_{t-1} + \lambda_5 URB_{t-1} + \lambda_6 POP_{t-1} + \lambda_7 HC_{t-1} + \varepsilon_t \quad (6)$$

In this model, URB denotes the urbanization rate, POP represents the natural logarithm of population size, and HC denotes the human capital index**.** The study empirically examines Iraq during 1993–2023. Data for the variables are sourced from the World Bank World Development Indicators database and the Central Bank of Iraq. The main econometric approach employed is the nonlinear autoregressive distributed lag (NARDL) model introduced by Shin et al. (2014). This approach is particularly suitable for investigating nonlinear relationships and asymmetric responses to positive and negative shocks in financial development and tax revenue. A major strength of NARDL is its flexibility in accommodating variables integrated of mixed orders—specifically combinations of I(0) and I(1) processes—without requiring pre-testing for unit roots beyond confirming no I(2) variables. Furthermore, the framework enables bounds testing for cointegration (Pesaran et al., 2001), estimation of long-run asymmetric coefficients, and decomposition of short-run dynamics via an unrestricted error correction model (ECM).

While the NARDL model and Hatemi-J asymmetric causality test provide evidence of predictive relationships and asymmetry, the estimates are reduced-form and do not fully address potential endogeneity issues, including simultaneity bias, omitted variable bias (e.g., unobserved institutional changes or global oil price shocks affecting both variables), or common shocks. The theoretical framework suggests possible bidirectional interactions between tax revenue and financial development; however, we estimate a single-equation model due to the small sample size (n=30) and data limitations in post-conflict Iraq, which render instrumental variables, simultaneous equations, or system-based approaches (e.g., VECM with exogeneity restrictions) challenging or unreliable. Coefficients and causality results should therefore be interpreted as conditional associations rather than fully structural causal effects. This approach is consistent with similar single-country NARDL studies in developing and resource-rich economies (e.g., Çilek, 2024; Kamasa et al., 2025; Tsaurai, 2020). Future research could explore panel data or alternative identification strategies to strengthen causal claims.

4. Empirical Results

To investigate the asymmetric causality between tax collections and financial development, and to estimate the related asymmetric relationships, this study applies the NARDL approach. The empirical analysis begins with an examination of the descriptive statistics for the variables. Table 1 presents the descriptive statistics, including the mean, minimum, maximum, standard deviation, and other relevant summary measures for each variable over the period 1993–2023.

Table 1. Descriptive Statistics

Variables	Mean	Min	Max
FD_t	11000000	46004	42800000
TR_t	1040000	1111	2490000
FDI_t	0.4589	-4.5415	3.7590
INF_t	42.4470	-16.1173	448.5
GDP_t	332000	86600	636000
OP_t	77.4715	0.0209	154.2345
GE_t	20900	50	47100

Source: *Research Findings*

It should be noted that domestic credit to the private sector, used as a proxy for financial development, and total tax revenue are measured in millions of Iraqi dinars (IQD). In contrast, government expenditure and gross domestic product are expressed in millions of US dollars (USD). The descriptive statistics reveal that the average value of domestic credit to the private sector over 1993–2023 is approximately 11,000,000 IQD, implying that, on average, credit extended to the private sector in Iraq averaged roughly this level over the sample period. The minimum and maximum values of this indicator are 46,004 and 42,800,000, corresponding to 1993 and 2022, respectively. Average tax revenue over the period 1993–2023 is approximately 1.04 million. The lowest recorded tax revenue, equal

to 1,111, occurred in 1993, while the highest value, around 2.49 million, was observed in 2023. Overall, the descriptive statistics suggest that both financial development and tax collections in Iraq exhibit an upward trend over the sample period.

The presence of asymmetric causality between financial development and tax revenue is examined using the Hatemi-J (2012) approach. Prior to conducting the causality tests and estimating the model, unit root tests are performed. Table 2 shows the results of stationarity test applying Augmented Dickey–Fuller (ADF). The results show that all variables are either stationary in level or become stationary after first differencing. Therefore, the series are integrated of order I(0) or I(1). This mixed integration order confirms the appropriateness of the NARDL approach.

Table 2. Unit Root Test

Variables	Statistics I(0)	P-Value	Statistics I(1)	P-Value
FD_t	-3.760	0.0033		
TR_t	-6.594	0.0000		
FDI_t	-1.695	0.0506	-1.817	0.0404
INF_t	-2.264	0.0158		
GDP_t	-1.927	0.6405	-3.655	0.0255
OP_t	-4.748	0.0001		
GE_t	-2.708	0.0726	-6.285	0.0000

Source: *Research Findings*

The next step examines the existence and direction of causality between financial development and tax revenue. The analysis first tests for symmetric Granger causality, followed—conditional on its presence—by evaluation of asymmetry using the Hatemi-J (2012) approach. Table 3 reports the results of the symmetric Granger non-causality tests. The findings indicate that tax revenue Granger-causes financial development at conventional significance levels, whereas financial development does not Granger-cause tax revenue. Thus, the results support unidirectional causality running from tax revenue to financial development. This evidence is consistent with several prior empirical studies in developing and emerging-market contexts, including Karas and Saygılı (2024).

Table 3. Symmetric Causality Test

Null H.	Chi2	P-Value
FD_t *Does Not Cause* TR_t	2.70	0.2590
TR_t Does Not Cause FD_t	6.51	0.0385

Source: *Research Findings*

To determine whether the detected causal relationship is symmetric or asymmetric, the Hatemi-J (2012) asymmetric causality test is applied. Table 4 presents the results of the asymmetric Granger non-causality tests. According to the confirmation of asymmetric causality in three out of four examined cases, it can be

concluded that there exists asymmetric causality running from tax income to financial development.

Table 4. Asymmetric Causality Test

Null H.	Chi2	P-Value
TR_t^+ *Does Not Cause* FD_t^+	11.07	0.0040
TR_t^- *Does Not Cause* FD_t^+	13.44	0.0038
TR_t^+ *Does Not Cause* FD_t^-	1.98	0.5759
TR_t^- *Does Not Cause* FD_t^-	1145.41	0.0000

Source: *Research Findings*

Given the presence of asymmetric causality, the asymmetric model is estimated using the NARDL approach. Before interpreting the estimation results, CUSUM, CUSUMQ, and Ramsey RESET tests were performed to ensure the absence of structural instability. Figures 1 and 2 show that there is no structural instability in the period under review. Rejection of the null hypothesis in Table 5 also confirms this result.

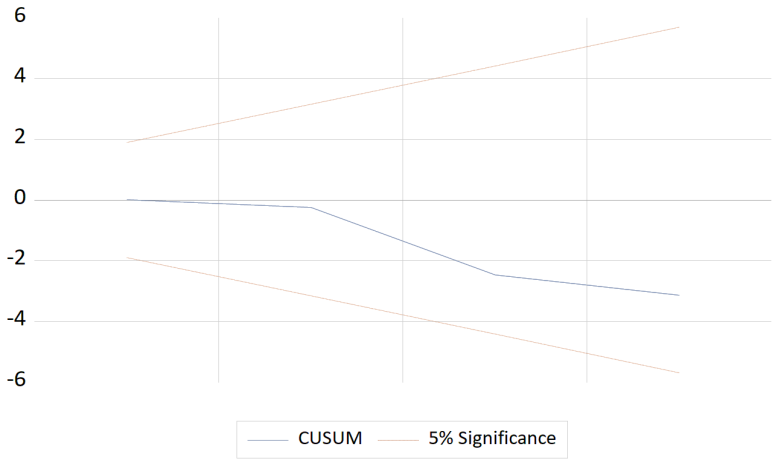

Figure 1. The Result of CUSUM Test

Source: *Research Findings*

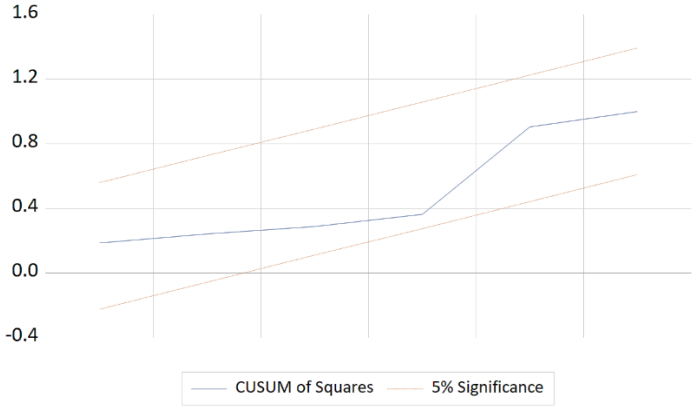

Figure 2. The Result of CUSUMQ Test
Source: *Research Findings*

Figure (1) and Figure (2) show that there is no structural failure in the period under review. Rejection of the null hypothesis in Table 5 also confirms this result.

Table 5. Ramsey RESET Test

Null hypothesis	F Statistics	P-Value
Correct Specification	0.7553	0.4487

Source: *Research Findings*

In addition, Table (6) reports the results of standard diagnostic tests for the model specification. LM method was used to examine the autocorrelation test, Jarque-Bara test was used to examine the normality, and Breusch-Pagan-Godfrey test was used to test for heteroskedasticity. According to not rejection of the null hypothesis based on the absence of autocorrelation, homoskedasticity, and normality, it can be stated that the classical assumptions related to the econometric model are valid and the results can be reliable, efficient, and unbiased.

Table 6. Results of Diagnostic Tests

Null hypothesis	Statistics	P-Value
No Autocorrelation	0.0503	0.9521
Homoskedasticity	0.5723	0.8259
Normality	0.2658	0.8755

Source: *Research Findings*

Tables 7 and 8 report the estimated long-run and short-run coefficients of the AR (2,2,2,2,2,2) model, respectively.

Table 7. Asymmetric Long-Run Model Coefficients

Variable	Coefficient	St. Dev.	P-Value
TR_t^+	-0.279	0.0031	0.0030

TR_t^-	0.8495	0.0928	0.0009
GDP_t	0.4920	3.1487	0.0010
OP_t	-0.0360	0.0526	0.0010
FDI_t	-0.0720	0.0215	0.0057
GE_t	9.1779	0.3872	0.0004
INF_t	-0.0325	0.0058	0.0004
CEM Coef.	-0.8792	0.1396	0.0033
R2	0.9923	Adjusted R2	0.9483
F	22.5494		0.0039

Source: *Research Findings*

The long-run results, presented in Table 7, reveal asymmetric effects of tax revenue shocks on financial development. Positive shocks to tax revenue exert a negative and statistically significant impact, whereas negative shocks have significantly positive effect. These opposing directions and differing magnitudes confirm clear asymmetry: an increase in tax revenue reduces financial development in Iraq, while a decrease in tax revenue contributes to its expansion. Notably, the magnitude of the effect from negative tax revenue shocks substantially exceeds that from positive shocks. The inverse relationship between tax revenue shocks and financial development is consistent with both theoretical and empirical studies, including Lucas (1990), Robinson (1952), Taha et al. (2013), and Akram (2016). This finding can be explained by the fact that higher tax revenue reduces private sector investment incentives, lowers the marginal productivity of capital, and encourages labor to substitute leisure for work. These mechanisms weaken economic growth, which in turn reduces demand for goods, services, and financial instruments. In this context, the substitution effect of taxation dominates the income effect, leading to adverse effects on economic growth and, consequently, financial development. The asymmetric nature of the relationship between tax revenue and financial development is also consistent with the findings of Çilek (2024).

In addition, the results indicate that economic growth and government expenditure have positive and statistically significant impacts on financial development, while inflation and trade openness have negative and statistically significant effects. The positive influence of economic growth on financial development supports the demand-following view, originally advanced by Robinson (1952) and extended in works such as Lewis (1965) and Shams Gharneh et al. (2023), which posit that real-sector expansion increases the demand for financial intermediation and services and thus promotes financial development. The adverse effect of inflation is consistent with established theoretical and empirical literature such as Boyd et al. (2001), Huybens and Smith (1998), and Salimifar et al. (2012), which demonstrates that higher inflation erodes real asset returns, exacerbates financial frictions, induces credit rationing, and ultimately impedes financial development.

The positive impact of government expenditure on financial development aligns with Keynesian perspectives and empirical evidence such as Kagochi (2019) and Afonso et al. (2021). Government debt markets contribute to financial

development by establishing and strengthening essential financial infrastructure—including legal frameworks, institutions, financial instruments, repo markets, and derivatives—and by providing reliable information signals and pricing benchmarks for private-sector debt markets. As a result, increases in government spending are frequently interpreted as positive signals by financial market participants. Moreover, the negative long-run effect of trade openness on financial development aligns with theoretical and empirical studies such as Levine (2003) and Kose et al. (2003). These works argue that greater integration with more advanced economies can expose developing countries to competitive pressures that contract domestic production in sectors heavily reliant on external finance. This contraction reduces the demand for local financial intermediation, thereby constraining the depth and efficiency of the domestic financial system.

The estimated error correction coefficient is −0.879, indicating that approximately 88 percent of any short-run disequilibrium is corrected within one period. The negative and statistically significant coefficient, together with the high coefficient of determination and the rejection of the null hypothesis of model insignificance based on the F-statistic, confirms the robustness and reliability of the estimated model.

Table 8. Asymmetric Short-Run Model Coefficients

Variable	Coefficient	St. Dev.	P-Value
TR_t^+	-0.0140	0.0021	0.0030
$L.\mathrm{TR}_t^+$	0.0143	0.0023	0.0038
TR_t^-	0.6499	0.0732	0.0009
$L.\mathrm{TR}_t^-$	-0.1042	0.0258	0.0156
GDP_t	0.2679	0.0314	0.0010
$L.GDP_t$	0.0147	0.0229	0.5555
OP_t	0.0469	0.0054	0.0010
$L.OP_t$	0.0251	0.0040	0.0036
FDI_t	-0.1163	0.0215	0.0057
$L.FDI_t$	0.2425	0.0453	0.0059
GE_t	4.2170	0.3872	0.0004
$L.GE_t$	-1.6652	0.2108	0.0014
INF_t	-0.0618	0.0058	0.0004
$L.INF_t$	-0.0088	0.0017	0.0069

Source: *Research Findings*

The short-run estimation results, reported in Table 8, indicate that both positive and negative tax income shocks exert asymmetric and statistically significant effects on financial development in the short run as well. Specifically, positive tax shocks negatively affect financial development, whereas negative tax shocks have a positive effect, with the magnitude of the latter being larger. The short-run results further show that economic growth, trade openness, and government expenditure positively affect financial development, while foreign direct investment and inflation exert negative effects. The signs and magnitudes of these coefficients are broadly consistent with the long-run estimates.

To formally test for asymmetry, symmetry tests are conducted on the short-run and long-run coefficients associated with positive and negative tax revenue shocks. The results, reported in Table 9, indicate that the hypothesis of symmetry in both short run and long run is strongly rejected. Therefore, it can be said that the link between tax revenue shocks and financial development is asymmetric in both time horizons.

Table 9. Symmetry Test

Model	F	P-Value
Long-Run	85.4634	0.0008
Short-Run	75.7981	0.0010
Long-Run and Short-Run	43.0385	0.0020

Source: *Research Findings*

Finally, the results of the ARDL bounds test are presented in Table 10. The computed F-statistic, equal to 23.2648, exceeds the upper critical bound. This strongly rejects the null hypothesis of no long-run relationship between financial development and its determining factors.

Table 10. Bounds Test

	1%		5%		10%	
Sample	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
30	2.277	3.498	2.730	4.163	3.864	5.694
Asymptotic	1.920	2.890	2.170	3.210	2.730	3.900
Calculated F			23.2648			

Source: *Research Findings*

Robustness Tests

To assess the robustness of the main findings, two alternative proxies for financial development—broad money supply as a percentage of GDP, and financial sector deposits as a percent of GDP—is employed in place of domestic credit to the private sector. The results of the long run and short run estimation of the broad money model (an alternative indicator for financial development) are in the form of AR (1,2,2,2,2,2,2) and are reported in Table (11) and Table (12).

Table 11. Asymmetric Long-Run Model Coefficients (Broad Money)

Variable	Coefficient	St. Dev.	P-Value
TR_t^+	-0.2432	0.0711	0.0189
TR_t^-	5.3738	0.7034	0.0252
GDP_t	-0.8940	0.1661	0.0030
OP_t	-0.5480	0.1811	0.0292
FDI_t	-2.8235	1.0548	0.0440
GE_t	0.4300	0.0837	0.0037
INF_t	-0.7834	0.1546	0.0039
CEM Coef.	-0.8417	0.1552	0.0029
R2	0.9726	Adjusted R2	0.8521
F	8.0745		0.0144

Source: *Research Findings*

The results are qualitatively similar to the baseline model. in Table (7). Therefore, the validity of the results can be confirmed. According to Table (11), the adjustment coefficient of the model is about -0.8417. Given that this coefficient is also close to the adjustment coefficient of the model presented in Table (7), the accuracy of the model and the validity of the results can be assured. However, the high error correction term can be attributed to the structural features of Iraq economy. The key reason can be the fact that Iraq public finance is extremely dependent on oil revenues, rendering the tax base narrow. In such a context, the fiscal space to absorb deviations is extremely limited. Therefore, any significant divergence frim the long-run equilibrium path must be corrected rapifly to prevent acute fiscal distress, liquidity crises, or inflationary pressures. Accordingly, any shift in taxation tends to generate outsized and immediate effects on financial variables. Moreover, Iraq has experienced repeated external and internal shocks like oil price collapses and political instability. This implies that deviations arising from taxation changes must be corrected swiftly in order to survive and maintain viability.

Table 12. Asymmetric Short-Run Model Coefficients

Variable	Coefficient	St. Dev.	P-Value
TR_t^+	-0.2473	0.0692	0.0160
$L.\mathrm{TR}_t^+$	0.0048	0.0468	0.9208
TR_t^-	7.0814	1.609	0.0070
$L.\mathrm{TR}_t^-$	1.9735	0.9339	0.0883
GDP_t	-0.6426	0.1219	0.0033
$L.GDP_t$	0.2326	0.1587	0.2026
OP_t	-0.5315	0.1072	0.0043
$L.OP_t$	0.2229	0.0742	0.0300
FDI_t	0.3180	0.9241	0.7447
$L.FDI_t$	1.8825	1.1162	0.1525
GE_t	9.0678	5.0545	0.1328
$L.GE_t$	-9.8027	5.7837	0.1509
INF_t	-0.6556	0.1190	0.0027
$L.INF_t$	-0.0771	0.0522	0.1996

Source: *Research Findings*

The results of symmetry test are shown in Table (13). The test rejects the null hypothesis of symmetry in both short run and long run. Therefore, the presence of asymmetry of the impact of tax income shocks on broad money\ is confirmed.

Table 13. Symmetry Test

Model	F	P-Value
Long-Run	10.7905	0.0218
Short-Run	41.4632	0.0010
Long-Run and Short-Run	21.6267	0.0035

Source: *Research Findings*

The results of the ARDL bounds test for cointegration in the robustness model, are reported Table (14). The computed F-statistic is equal to 10.1177, which is

greater than the upper critical value. Therefore, there is a long-run equilibrium relationship between broad money and its determinants.

Table 14. Bounds Test

	1%		5%		10%	
Sample	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
30	2.277	3.498	2.730	4.163	3.864	5.694
Asymptotic	1.920	2.890	2.170	3.210	2.730	3.900
Calculated F			10.1177			

Source: *Research Findings*

The results of the long-term and short-term estimation of the financial sector deposits model (an alternative indicator for financial development) are in the form of AR (1,1,2,2,2,2,2) and are reported in Table (15) and Table (16).

Table 15. Asymmetric Long-Run Model Coefficients (Financial Sector Deposits)

Variable	Coefficient	St. Dev.	P-Value
TR_t^+	-0.0108	0.0040	0.0357
TR_t^-	0.4177	0.1323	0.0196
GDP_t	0.2337	0.0717	0.0173
OP_t	-0.0143	0.0080	0.1264
FDI_t	-0.0148	0.0359	0.6936
GE_t	4.7497	1.1312	0.0057
INF_t	-0.0164	0.0074	0.0679
CEM Coef.	-0.6356	0.1531	0.0060
R2	0.9846	Adjusted R2	0.9311
F	18.3867		0.0008

Source: *Research Findings*

The results are qualitatively similar to the baseline model, in Table (7). Therefore, the robustness of the model and the validity of the results can be assured.

Table 16. Asymmetric Short-Run Model Coefficients

Variable	Coefficient	St. Dev.	P-Value
TR_t^+	-0.0041	0.0031	0.2396
$L.TR_t^+$	0.0070	0.0021	0.0163
TR_t^-	0.3197	0.1063	0.0238
$L.TR_t^-$	-0.0623	0.0351	0.1267
GDP_t	0.0813	0.0409	0.0941
OP_t	0.0175	0.0050	0.0130
$L.OP_t$	0.0149	0.0041	0.0109
FDI_t	-0.0201	0.0328	0.5621
$L.FDI_t$	0.1025	0.0369	0.0322
GE_t	1.6927	0.4951	0.0142
$L.GE_t$	-1.0086	0.2693	0.0096
INF_t	-0.0303	0.0095	0.0189
$L.INF_t$	-0.0083	0.0025	0.0172

Source: *Research Findings*

Symmetry test is reported in Table (17). The test rejects the null hypothesis of symmetry in both short run and long run.

Table 17. Symmetry Test

Model	F	P-Value
Long-Run	10.04815	0.0193
Short-Run	7.1411	0.0369
Long-Run and Short-Run	5.0709	0.0514

Source: *Research Findings*

The results of the ARDL bounds test for cointegration in the second robustness model, are reported Table (18). According to the fact that the computed F-statistic is greater than the upper critical value, there is a long-run relationship between financial sector deposits and its determinants.

Table 18. Bounds Test

	1%		5%		10%	
Sample	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
30	2.277	3.498	2.730	4.163	3.864	5.694
Asymptotic	1.920	2.890	2.170	3.210	2.730	3.900
Calculated F			10.7438			

Source: *Research Findings*

5. Concluding Remarks

The finding of unidirectional asymmetric causality from tax revenue to financial development aligns with several studies in developing and emerging economies (e.g., Karas and Saygılı, 2024; Tsaurai, 2020), but contrasts with evidence of bidirectional or insignificant links in other contexts (e.g., Çilek, 2024 in Turkey). The stronger positive effect of negative tax revenue shocks compared to the negative effect of positive shocks is particularly noteworthy. This pattern is consistent with theories of financial repression and rentier states (Beblawi and Luciani, 1987; Ross, 2012), where tax reductions in resource-dependent economies can relieve liquidity constraints and encourage private credit in an already repressed banking system, whereas tax increases may exacerbate disincentives and rent-seeking without translating into productive financial deepening.

The control variables yield expected signs: economic growth and government expenditure promote financial development (supporting the demand-following hypothesis; Robinson, 1952; Lewis, 1965), while inflation and trade openness exert adverse effects (consistent with Boyd et al., 2001; Kose et al., 2003). These results reinforce the importance of macroeconomic stability and selective openness in resource-rich settings.

Several limitations should be acknowledged. First, the reduced-form nature of the NARDL model precludes strong structural causal inferences due to potential endogeneity (simultaneity, omitted variables, common shocks), as discussed in the Methodology. Second, the small sample size (n=30) and data quality issues in post-

conflict Iraq limit statistical power and the feasibility of advanced identification strategies. Third, while CUSUM and CUSUMQ tests indicate overall stability, multiple regime shifts (e.g., 2003 regime change, 2014–2017 conflict and oil crash) may influence results in ways not fully captured by these tests. These constraints suggest that the findings should be interpreted cautiously and as context-specific to Iraq's rentier and institutionally fragile environment.

The policy implications are therefore suggestive rather than prescriptive. Targeted tax incentives and exemptions for productive sectors could help preserve private investment incentives and mitigate disincentive effects. Policies fostering real-sector growth and aggregate demand may indirectly support financial intermediation. Maintaining price stability and improving trade facilitation could reduce adverse effects on the domestic financial system. However, the effectiveness of these measures will depend heavily on improvements in institutional quality, governance, and banking sector reforms—areas where Iraq continues to face significant challenges.

Future research could strengthen these insights by incorporating structural breaks more explicitly (e.g., threshold NARDL), governance indicators, or panel data from comparable resource-dependent economies. In conclusion, the asymmetric fiscal-financial relationship documented here highlights the need for nuanced tax policies in oil-reliant economies like Iraq, where conventional approaches may produce unintended consequences due to institutional and structural rigidities.

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