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ORIGINAL ARTICLE

The Role of Budget Deficit Management in the Sustainability of Iran's Economic Growth: Dynamic Analysis with a Combined Wavelet-TVP-VAR Approach and Public Policy Recommendations

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EXTENDED ABSTRACT

Introduction

Iran's economy has long struggled with a persistent and deepening budget deficit, driven by interlocking structural vulnerabilities. The most important is heavy dependence on oil export revenues, which exposes the budget to sharp fluctuations in global oil prices.

In recent years, tightening international sanctions, restricted access to global financial networks, and an inflexible structure of current expenditures (especially subsidies and public sector salaries) have substantially eroded the government's fiscal space. At the same time, the country has failed to develop a resilient, broad-based non-oil tax system.

Consequently, revenue generation remains highly concentrated and unstable, leading to steady accumulation of public debt, crowding-out of private investment, and weakening of the government's ability to finance long-term development. Beyond macroeconomic consequences, the chronic deficit has seriously impaired the performance of government organizations, diminishing their planning capacity, operational efficiency, and accountability.

The theoretical relationship between budget deficits and economic growth remains one of the most debated issues in macroeconomics. Keynesian theory holds that, particularly in the short run and during economic downturns, deficit-financed public spending can act as a powerful fiscal stimulus, raising aggregate demand and temporarily lifting growth. Neoclassical and public debt theories, by contrast, warn that persistent deficits push up interest rates, crowd out private investment, and create expectations of future tax increases or spending cuts, all of which undermine long-run growth. The Ricardian equivalence hypothesis goes further. It argues that rational agents perceive current deficits as deferred taxation and adjust their savings accordingly, thus neutralizing any stimulative effect.

In the Iranian case, these competing mechanisms are complicated by overwhelming oil revenue instability, institutional rigidities, and a history of short-term, reactive fiscal policymaking. Existing empirical studies on Iran have largely relied on linear or time-invariant models. Those models cannot capture the multi-scale, nonlinear, and evolving character of the deficit-growth nexus under conditions of structural breaks and external shocks. Therefore, a research gap exists for a dynamic analytical framework that can simultaneously decompose data into different frequency layers and allow the strength of the fiscal transmission mechanism to vary over time. This study addresses that gap by deploying a combined wavelet-TVP-VAR approach. Its aim is to provide a nuanced understanding of how budget deficit management can either support or jeopardize the sustainability of economic growth in Iran's public sector. The research is guided by two hypotheses. First, the effect of the budget deficit on economic growth differs substantially between the short

run and the long run. Second, volatility in the budget deficit—rather than its average level alone—directly contributes to instability in the performance of government organizations and in overall economic growth.

Methodology

Annual data for the period 2011–2023 (corresponding to Iranian calendar years 1390–1402) were collected from multiple authoritative sources, including the Plan and Budget Organization, the Ministry of Economic Affairs and Finance, the Central Bank of Iran, the Statistical Center of Iran, as well as international databases such as the World Bank and the International Monetary Fund (IMF). The analytical framework integrates wavelet decomposition with a time-varying parameter vector autoregressive (TVP-VAR) model. Prior to wavelet analysis, the data were normalized and zero-padding was applied to extend the series to 16 observations, which is a power of two and a requirement for efficient wavelet transformation. A Daubechies 1 wavelet decomposition was then carried out up to level four, generating both approximation and detail coefficients. These coefficients capture multi-scale patterns, revealing short-run fluctuations and long-run trends simultaneously. All extracted coefficients were subsequently used as inputs to a TVP-VAR model, where the coefficient matrix is allowed to evolve over time. The parameters were estimated recursively using the Kalman filter, which provides efficient updating as new observations become available. To quantify estimation uncertainty, a bootstrap procedure with 50 iterations was employed. A series of pre-estimation tests were conducted: the Augmented Dickey-Fuller (ADF) test for stationarity indicated that the deficit series is non-stationary while the growth series is stationary; the Engle-Granger cointegration test confirmed the existence of a long-run equilibrium relationship among the variables; parameter stability tests validated the time-varying specification; the Durbin-Watson statistic showed no significant autocorrelation; the Jarque-Bera test confirmed normality of residuals; and homoscedasticity was also satisfied. Finally, a dynamic net spillover diagram was constructed to visualize the time-varying mutual influences among the variables, offering insights into how shocks propagate across the system over different horizons.

Findings

Wavelet decomposition revealed striking differences between the two series. Budget deficit coefficients exhibited large, multi-scale fluctuations. For example, detail coefficients at fine scales reached approximately 1,241,720 and -737,031 (values expressed in million Iranian rials; equivalent to about 1.24 and -0.74 billion rials, respectively). These magnitudes reflect sharp fiscal shocks and structural breaks, confirming that the deficit is driven by both a slow-moving trend and high-frequency volatility originating from oil price swings, international sanctions, and discretionary fiscal interventions. In contrast, economic growth coefficients were substantially smaller in scale; occasional mild signals appeared around 0.9 percent (at the finest wavelet scale), indicating relative stability and limited high-frequency variation in growth.

Coherence analysis demonstrated strong correlation within specific time-frequency zones where fiscal shocks and growth responses were aligned. The dynamic net spillover diagram illustrated evolving mutual influences. A deficit surge during 2012–2013 produced a modest, short-lived growth boost, consistent with a Keynesian stimulus effect. However, by 2017, a new deficit peak was followed by sharply negative growth. Between 2018 and 2021, both variables declined substantially, and the net spillover turned strongly negative, suggesting that the initial stimulus had given way to debt accumulation and crowding-out of private investment. In 2022–2023, the deficit rose again while growth remained subdued, indicating a decoupling.

Time-varying parameter estimates formalized the first hypothesis. Short-run coefficients were small and often negative (e.g., -1.36 for the GDP response) without a reliable positive effect, likely due to import leakages and expectations of instability. Medium-run coefficients fluctuated widely, from 1.81 to -2.85, confirming strong conditionality on oil market conditions, monetary accommodation, and the composition of public spending. Long-run coefficients turned consistently and strongly negative (deficit coefficients around -2.44 and -2.43; GDP response -3.06). These figures reveal that persistent deficits generate rising debt service costs, higher real interest rates, crowding-out of private

investment, and declining productivity.

The second hypothesis was also validated. The large wavelet coefficients and pronounced swings in net spillovers show that deficit volatility itself generates economic instability. This volatility disrupts medium-term planning in government organizations, discourages private investment, and complicates monetary policy, thereby transmitting fiscal instability into real economic instability.

Discussion and Conclusion

The empirical results reconcile seemingly contradictory theoretical perspectives by revealing a distinct temporal pattern. In the very short run and under conditions of severe economic slack, a controlled deficit expansion may provide a mild, temporary boost to demand. This is in line with Keynesian logic. However, medium-run effects are fragile and highly conditional. They can turn negative quickly if the deficit is perceived as unsustainable. Over the long run, the evidence overwhelmingly supports the neoclassical and public debt views. Elevated and persistent budget deficits exert a significantly negative impact on growth through debt overhang, diminished investment efficiency, and macroeconomic instability. The combined wavelet-TVP-VAR approach proved uniquely suited to uncovering these multi-scale, time-evolving dynamics. It separated transient noise from persistent trends and tracked the evolution of fiscal multipliers across different regimes with a high degree of flexibility.

From a public management and policy perspective, the findings carry profound implications. They make clear that the current approach to budget deficit management in Iranian government organizations is often reactive, short-term-oriented, and excessively reliant on volatile oil receipts. This approach is not only ineffective but actively detrimental to long-term economic performance. The observed pattern—short-lived boosts followed by protracted declines—underscores the absence of institutional mechanisms. These mechanisms should channel deficit spending into productive, self-sustaining investments and enforce fiscal discipline once the economy recovers.

In light of these conclusions, five policy and managerial recommendations are proposed. First, performance-based budgeting systems must be strengthened across government agencies. This ensures that all expenditure, especially deficit-financed spending, is transparent, outcome-oriented, and subject to rigorous oversight, thereby reducing the tendency toward structural deficits. Second, dedicated capacity-building programs should be designed for public sector financial managers. These programs should focus on dynamic fiscal analysis, public debt management, and risk assessment to shift from crisis-driven responses to strategic, anticipatory fiscal planning. Third, an enhanced institutional oversight architecture should be established under bodies such as the Supreme Economic Coordination Council. This architecture would continuously monitor deficit levels and their real-time impact on the performance of state organizations, triggering corrective actions when predefined thresholds are breached. Fourth, a gradual and credible strategy to reduce the budget's dependence on unstable oil revenues is essential. This strategy involves developing a diversified tax base, strengthening non-oil exports, and empowering provincial governments to generate own-source income. Fifth, a comprehensive good financial governance framework should be adopted. It should center on transparency, stakeholder participation, and modern management tools such as dynamic fiscal dashboards that provide real-time feedback on deficit fluctuations and their transmission channels.

In sum, this study demonstrates that effective budget deficit management is not simply a technical financial exercise but a strategic managerial imperative. Without deep structural reforms that embed fiscal discipline, predictability, and a long-term orientation into the fabric of public organizations, deficit financing will remain a source of chronic instability rather than a lever for sustainable growth. The transition from a short-sighted, oil-dependent fiscal model to a resilient, growth-supportive framework is both an urgent necessity and the central recommendation of this work.

KEY WORDS

Budget Deficit, Economic Growth, Iran, Mixed Wavelet Model, Fiscal Stimulus.

