




# Consequences of Government Expenditure Shocks with Influence from Effectiveness and Efficiency Indices on National Economic Activities: A Smooth Transition Threshold Regression (LSTAR) Approach

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## Article Info

### Article type:

Original Research

### How to cite this article:

Salari, A., Damankeshideh, M., & Afsharirad, M. (2023). Consequences of Government Expenditure Shocks with Influence from Effectiveness and Efficiency Indices on National Economic Activities: A Smooth Transition Threshold Regression (LSTAR) Approach. *International Journal of Innovation Management and Organizational Behavior*, 3(5), 130-137. <https://doi.org/10.61838/kman.ijimob.3.5.16>



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## ABSTRACT

**Objective:** The primary objective of this study is to investigate the asymmetric effects of government current and capital expenditures on economic growth in Iran from 1994 to 2021. This research aims to understand how different levels of government spending, influenced by the indices of effectiveness and efficiency, impact national economic activities.

**Methodology:** This study employs the Smooth Transition Threshold Regression (LSTAR) method to analyze the nonlinear relationships between government expenditures and economic growth. The data was collected from the World Bank and the Central Bank of Iran. The analysis involves determining the optimal lag using the Schwarz criterion, testing for nonlinear relationships, selecting appropriate transition variables, and estimating the model parameters. The estimation process includes examining the linear and nonlinear impacts of various variables on economic growth.

**Findings:** The findings reveal that government current and capital expenditures have significant asymmetric effects on economic growth in Iran. In the linear section, government expenditures positively impact economic growth, while in the nonlinear section, the effects are negative. The results indicate that there is a threshold level for government spending (28.09% of GDP), beyond which the effects on economic growth become negative. Additionally, the study finds that economic corruption negatively impacts economic growth, and taxes have a negative and significant effect in both linear and nonlinear contexts.

**Conclusion:** The study concludes that while government current and capital expenditures can stimulate economic growth through various channels, such as employment and infrastructure development, there is a critical threshold beyond which these expenditures may hinder growth. Policymakers should consider this threshold when planning and allocating government budgets to optimize the positive effects and mitigate the negative impacts. The research also highlights the detrimental effects of economic corruption and excessive taxation on growth,

suggesting the need for effective anti-corruption measures and balanced tax policies.

**Keywords:** *Current and Capital Expenditures, Economic Growth, Government Size, Government Expenditure Shocks, Smooth Transition Threshold Regression (LSTAR).*

## 1 Introduction

Two main tools of fiscal policy are taxation and government expenditures. Changes in the level and composition of taxes and government spending can affect key economic variables, including consumption, wages, employment, and investment in the economy. Expansionary fiscal policy is chosen in conditions of less than full employment, especially during market and economic recessions, and consists of increasing government spending or reducing taxes, or a combination of both, to expand economic activities (Hajamini, 2019; Karkesh et al., 2023). Conversely, contractionary fiscal policy is selected in conditions of full employment and inflation resulting from overutilization of production resources. It is an appropriate policy to reduce demand pressure and inflation, implemented through increasing taxes and reducing government spending, or a combination of both (Onifade et al., 2020; Romer & Romer, 2019).

Economic experts disagree on economic policies and their outcomes. Some economists argue that the economic system experiences shocks that continuously affect aggregate supply and demand. If policymakers use monetary and fiscal policies to stabilize the economic system, they can minimize the impact of economic shocks on macroeconomic variables such as production, inflation, and unemployment (Bouakez et al., 2020; Cevik & Zhu, 2020; Dungey & Pagan, 2000; Sara, 2012). In contrast, economists like Milton Friedman believe that the economic system is fundamentally stable, and inappropriate economic policymaking is the main cause of abnormal economic fluctuations (Bouakez et al., 2020).

Governments often use various tools to achieve desired economic objectives, considering existing conditions and limitations within the framework of monetary, fiscal, and revenue policies, among others. However, the extent to which government intervention in the economy can influence the quantitative and qualitative improvement of the economic system has been a subject of discussion and investigation among many economic experts for years. The question remains whether the expansionary and contractionary fiscal policies implemented by governments in different economic conditions can effectively and

continuously impact the country's economic activities (Karkesh et al., 2023; Romelli, 2022).

A glance at global economic trends over recent decades reveals that increasing effectiveness and efficiency, transparency, and precision in economic processes and policymaking have practically become a global approach. This reality has been further highlighted by the emergence and expansion of information. Consequently, the processes and activities related to economic corruption have also become more complex, continuing with minimal transparency (Lupa et al., 2019). In these conditions, recognizing, diagnosing, analyzing, and policymaking in this part of the economy seems necessary. Analyzing the economic and social impacts of economic corruption can provide researchers with a better understanding of these activities. Among the effects of economic corruption are its impact on national economic activities, the policymaking process, productivity, tax revenues, false employment, the monetary exchange system, and the public budget deficit (Eskandaripour et al., 2019; Holden, 2023). As economic corruption expands, government revenues decrease, leading to budget deficits and increased financial constraints. Consequently, governments raise tax rates to compensate for budget deficits, which in turn exacerbates corruption and reduces the volume of government tax revenues, creating a vicious cycle.

Corruption is a phenomenon present to varying degrees in all countries. However, its type, form, extent, and impact vary by country, as do its outcomes, depending on the political and economic organization and the level of development. Nonetheless, corruption causes degeneration, aligns government policies against the majority's interests, wastes national resources, reduces the effectiveness and efficiency of governments in managing affairs, and erodes public trust in both governmental and non-governmental institutions. Corruption increases indifference, laziness, and incompetence while undermining societal moral values, increasing the cost of doing business, and hindering competitiveness (Sufian & Habibullah, 2010). It discourages investment and hampers economic growth and development by misdirecting talents and resources towards wrongful activities for easy gains, leading to widespread stagnation.

On the other hand, as corruption takes root, it becomes increasingly difficult to combat, as its roots deepen within society. Furthermore, the growing responsibilities of governments in recent centuries, such as pursuing economic growth, employment, equitable income distribution, financial system development, and economic security, have exacerbated their challenges, particularly in the economic realm. Government revenues and reducing budget deficits have become crucial compared to other income sources in many countries for controlling adverse economic impacts. Without careful attention and oversight, corruption, underground economies, and increased budget deficits will prevail (Sufian & Habibullah, 2010).

Moreover, in recent decades, financial crises have directly and indirectly impacted the economies of many countries. Therefore, to counter these crises, a coherent set of policies must be adopted in all affected countries, whether directly or indirectly, as economic stagnation will dominate the global economic growth outlook otherwise. Delays in implementing necessary policies will only intensify the crisis and accelerate its effects on other sectors. Although the country needs financial adjustments to escape the crisis, the severity of these adjustments depends on the specific economic conditions. Identifying factors influencing the uncertainty of a country's fiscal and economic policies and economic crises is crucial, and results should be made available to economic policymakers to inform appropriate policies.

Thus, numerous empirical studies have examined the quantitative and qualitative relationship between fiscal policies and the economies of various countries. Given that studying the asymmetric effects of government spending influenced by the indices of government expenditure effectiveness and efficiency on national economic activities is a crucial topic in policymaking, the main focus of this research is to examine the asymmetric effects of government spending shocks influenced by these indices on national economic activities using the Smooth Transition Threshold Model and Structural Vector Autoregression (SVAR) model. Therefore, this study will be highly practical.

## 2 Methods and Materials

In this study, the Smooth Transition Autoregressive (STAR) approach will be used to analyze the data. The STAR method is briefly described below. In statistics, STAR models are typically applied to time series data as an extension of autoregressive models to provide a higher

degree of flexibility in model parameters through smooth transitions. Given a time series of data  $x_{t|x\_txt}$ , the STAR model is a tool for understanding and predicting future values in this series, assuming that the series' behavior changes based on the value of the transition variable. This transition may depend on past values of the series  $xxx$  or exogenous variables.

The STAR model consists of two autoregressive (AR) sections linked by a transition function. This model is generally referred to as STAR(p), with "p" representing the order of the autoregressive part. STAR models were introduced and comprehensively developed by Chan and Tong (1986). Due to the limitations of linear models, many studies have suggested using various nonlinear models to capture the nonlinear behaviors present in time series. This study will employ the Smooth Transition Autoregressive model developed by Teräsvirta and Anderson (1992) and Teräsvirta (1994). Unlike Threshold Autoregressive (TAR) models, which use an indicator function to control the regime-switching process, STAR models use exponential and logistic functions for this purpose.

The STAR model estimation process begins with selecting the optimal lag length for the dynamic model, testing for nonlinear relationships among the variables, and choosing the transition variable and the number of regime switches. In the second step, the selected STAR model is estimated using the Newton-Raphson algorithm and maximum likelihood estimation. Finally, diagnostic tests are conducted to ensure reliable results. The general STR regression method includes three primary steps:

**Step 1: Model Specification** In this step, a linear AR model is specified as the starting point for analyzing the Smooth Transition Regression. The nonlinear relationship is tested, and the number of regime switches is determined.

**Step 2: Model Estimation** Initial suitable values are determined for estimating the nonlinear relationship using the Newton-Raphson algorithm and maximum likelihood method.

**Step 3: Model Evaluation** Evaluating and assessing the estimated model based on goodness-of-fit criteria is crucial. In this regard, various criteria exist for model evaluation, depending on the method used. In the STR method, tests such as the absence of serial correlation between residuals, parameter stability across different regimes, and the absence of nonlinear relationships in residuals are conducted to verify the reliability of the empirical model (Teräsvirta, 2004).

In this research model, using the Smooth Transition Threshold Model (STAR), the asymmetric effects of government expenditure shocks influenced by the indices of government expenditure effectiveness and efficiency on national economic activities will be examined

The function GGG is a logistic, continuous, and bounded function between zero and one, showing smooth transitions between regimes. All necessary data for this study were collected from the World Bank website and the Central Bank of Iran.

### 3 Findings and Results

The first step in estimating an STR model is to determine the optimal lag using information criteria. Given that the number of observations in this study is less than 100, the Schwarz criterion was used to determine the optimal lag. Based on the estimation results, the optimal lag was found to be 1. In the second step, the nonlinear relationship between the research variables must be examined. In this step, if a nonlinear relationship is confirmed, an appropriate transition variable must be selected from among the model variables, followed by selecting the number of regimes based on suitable statistics. The results of this section are presented in Table 1.

**Table 1**

*Shape of the Model Transition Variable*

Transition Variable	Probability F Statistic	Probability F4 Statistic	Probability F3 Statistic	Probability F2 Statistic	Proposed Model
GDP(-1)	0.25	0.17	0.17	0.20	Linear
GDP(-2)	0.17	0.21	0.09	0.08	Linear
TAXR	0.14	0.11	0.14	0.08	Linear
TAX(-1)	0.18	0.17	0.17	0.19	Linear
OLLR	0.11	0.18	0.12	0.08	Linear
OILR(-1)	0.06	0.09	0.14	0.13	Linear
EXP	0.14	0.35	0.37	0.41	Linear
EXP(-1)	0.49	0.51	0.36	0.37	Linear
GE	0.19	0.25	0.17	0.06	Linear
GE(-1)	0.05	0.04	0.02	0.02	LSTR1
CC	0.05	0.14	0.09	0.13	Linear
CC(-1)	0.14	0.17	0.18	0.23	Linear
INV	0.08	0.07	0.17	0.12	Linear
INV(-1)	0.00	0.08	0.35	0.12	LSTR1
FD	0.18	0.08	0.11	0.13	Linear
FD(-1)	0.02	0.11	0.09	0.10	LSTR1

According to the results of Table 1, based on the F1, F2, and F3 statistics, the proposed model for the transition variable (t-1) GE is a logistic model with one threshold point. Based on the estimation results, the smoothness parameter ( $\gamma$ ) is 1.089, and the threshold value for

government size is 28.09. Therefore, the transition function is as follows:

$$GE (1.089, 28.09, GE_{t-1}) = \frac{1}{(1 + \exp\{-1.089(GE_{t-1} - 28.09)\})^{-1}}$$

**Table 2**

*Results of the Model Estimation*

Variable	Coefficient	t-Statistic	Probability
Linear Section			
Constant	0.149	2.24	0.038
TAX(-1)	-0.023	-1.67	0.102
OLLR(-1)	0.138	2.06	0.047
EXP(-1)	0.208	1.98	0.056
GE(-1)	-0.106	-1.88	0.078
CC(-1)	-0.117	-1.59	0.110
INV(-1)	0.273	2.19	0.037
FD(-1)	0.065	1.91	0.061

Nonlinear Section			
Constant	0.198	3.22	0.000
TAX(-1)	-0.173	-1.69	0.010
OLLR(-1)	0.065	1.77	0.085
EXP(-1)	-0.083	-1.90	0.060
GE(-1)	-0.103	-1.99	0.050
CC(-1)	-0.048	-2.06	0.044
INV(-1)	0.186	2.18	0.040
FD(-1)	0.020	1.82	0.079

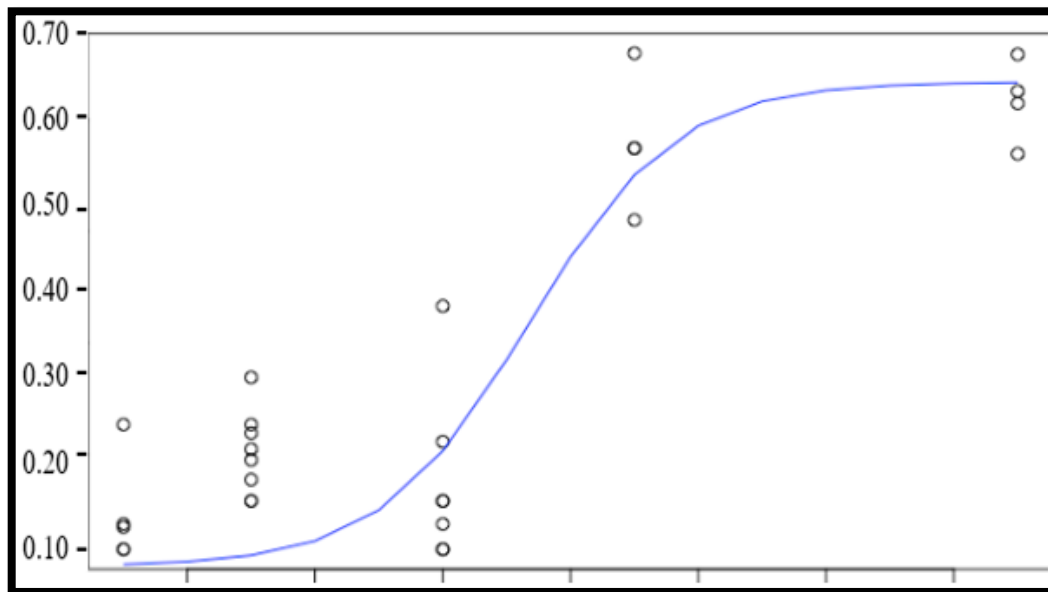
The results [Table 2](#) that government current and capital expenditures have positive and significant effects in the linear section and negative and significant effects in the nonlinear section on economic growth. These results indicate the asymmetric effects of government current and capital expenditures on economic growth in Iran during the study period. Government current expenditures, such as employee salaries and wages, can help create and maintain employment. This employment increases household incomes, thereby stimulating domestic consumption and demand. Expenditures on public services such as health, education, and security improve the quality of collective life. This allows for a better-trained and healthier workforce, which in turn increases production and productivity. Government investment in public infrastructure leads to its improvement and expansion. Building and improving roads, ports, airports, and communication networks facilitate trade and transportation of goods and services, thereby stimulating economic growth. The development of public infrastructure creates favorable economic justification for investors and increases their confidence in domestic markets. This can attract domestic and foreign investment, accelerating economic growth.

Thus, government current and capital expenditures affect economic growth. Government current expenditures can stimulate employment, public services, and domestic consumption, while government capital expenditures can improve infrastructure, attract investment, and enhance production and productivity. However, this variable does not always have positive effects on growth, and it may have negative effects beyond a certain threshold, which in Iran is

28.09%. This phenomenon is referred to as asymmetric effects. Various inferences can be made regarding the negative effects of current and capital expenditures on economic growth. Beyond a certain threshold, the effects of current and capital expenditures on economic growth may become negative. Increasing government current and capital expenditures may lead to higher government debt. If government debt becomes so high that it leads to an inability to pay debts and interest, investor and market confidence in the economy decreases, slowing economic growth. Additionally, increasing government current and capital expenditures may create financial pressure on the economy. If the government lacks sufficient financial resources and resorts to inflation or raising taxes on the private sector to meet its expenses, production and investment decrease, slowing economic growth. Increased government current and capital expenditures may raise concerns about the government's financial sustainability. These concerns can reduce investor and public confidence in the economy, affecting economic growth.

According to other results, the economic corruption index has had a negative impact on economic growth. Economic corruption diverts resources from public purposes to serve the interests of a select few in society. Moreover, corruption reduces the efficiency of monetary and fiscal policies. Additionally, the linear and nonlinear effects of taxes on economic growth are negative and significant, indicating the negative role of taxes on economic growth with 90% confidence. In the final stage, the model is evaluated, and the regime change point for the estimated model is presented.



**Figure 1***Logistic Transition Graph Related to Regime Change*

According to the results, the transition process between the two extreme regimes has been gradual. Therefore, it can be said that the regime change process in the nonlinear effects of current and capital expenditures on economic growth has not experienced significant changes around the threshold point, and the parameter changes have occurred slowly and gradually.

#### 4 Discussion and Conclusion

Studying and examining the threshold effects of government expenditures on economic growth is crucial for policymaking. The government expenditure threshold refers to the percentage of the Gross Domestic Product (GDP) that the government consumes as public expenditures. This has a direct impact on economic growth and development, and its examination can provide a better understanding of these impacts and offer suggestions and strategies for improvement. Examining government expenditure thresholds helps researchers and policymakers better understand the balance between government revenues and expenditures. This study can help policymakers make better decisions regarding budgeting and resource allocation. Government expenditure thresholds can have a significant impact on economic growth. Examining the effects of these thresholds can help policymakers improve the country's economic performance and provide suitable strategies for increasing economic growth. Government expenditure

thresholds can have a significant impact on income distribution in society. Examining these effects helps researchers identify existing weaknesses or inequalities in income distribution and propose strategies to improve the situation.

Given this context, this study examined the consequences of government expenditure shocks influenced by the indices of government expenditure effectiveness and efficiency on national economic activities during the period from 1994 to 2021 using the LSTAR method. The findings indicate the asymmetric effects of government current and capital expenditures on economic growth during the study period. The threshold for regime change in government current and capital expenditures was approximately 11.08%. To enhance the positive effects of current and capital expenditures on economic growth and mitigate their negative effects, the following strategies can be used:

- Proper Planning: Accurate and efficient planning in the use of current and capital expenditures can significantly improve their effects. Planning includes prioritizing, evaluating projects, and selecting the best options. This can lead to better project quality, higher productivity, and reduced resource wastage.
- Investment in Infrastructure: Investing in economic infrastructure such as roads, ports, airports, and energy and communication networks can have significant positive effects on economic growth.

These investments can facilitate production capacity, exports, employment, and attract foreign investment.

- **Inter-Sectoral Interaction:** Improving coordination and interaction between different sectors of the economy, such as the public sector, private sector, and universities, can enhance the positive effects of current and capital expenditures. This interaction can lead to job creation, technology transfer, innovation, and local industry development.
- **Development of Emerging Sectors:** Investing in emerging and new sectors can have significant positive effects on economic growth.
- **Entrepreneurship Development:** Supporting entrepreneurship and establishing small and medium-sized enterprises can help create employment and economic growth. Providing financial and technical facilities, entrepreneurial training, networking, and creating a friendly business environment can strengthen entrepreneurship.
- **Export Sector Development:** Developing the export sector and diversifying export products can help economic growth. Encouraging the production of high-value-added goods and services, discovering new markets, improving product quality and standards, and developing export infrastructure can significantly improve export performance.
- **Support for Research and Development:** Investing in research and technology development can play a crucial role in economic growth. Establishing research infrastructure, encouraging scientific-industrial partnerships, enhancing knowledge and technology, and facilitating access to technical and scientific knowledge can lead to innovation, improved product quality, and increased productivity.
- **Government Expenditure Optimization:** Careful examination of government expenditures and identifying areas for improvement and higher productivity can be beneficial. This includes reviewing government programs, public projects,

social expenditures, and other relevant laws and regulations.

- **Balance Between Revenue and Expenditure:** Policymakers should pay special attention to balancing revenue and expenditure. Carefully examining the threshold effects of expenditures on economic growth can help make better decisions regarding the level of government expenditures and prevent inequalities and economic problems.

### Authors' Contributions

All authors have contributed significantly to the research process and the development of the manuscript.

### Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

### Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

### Acknowledgments

We would like to express our gratitude to all individuals helped us to do the project.

### Declaration of Interest

The authors report no conflict of interest.

### Funding

According to the authors, this article has no financial support.

### Ethical Considerations

In this research, ethical standards including obtaining informed consent, ensuring privacy and confidentiality were observed.

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