

# The Application of Statistical Methods in the Analysis of Factors Affecting Economic Growth

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**Abstract:** This thesis delves deep into the application of statistical methods in the analysis of factors influencing economic growth. Initially, it elaborates on the research background and significance, highlighting the importance of economic growth research for national development and the crucial role of statistical methods therein. After introducing relevant economic growth theories and the foundation of statistical methods, it meticulously analyzes the application of statistical methods in identifying and dynamically analyzing factors contributing to economic growth. These include regression analysis, factor analysis, cluster analysis, time series analysis, and panel data models. Additionally, it analyzes the limitations of these statistical methods in practical applications and proposes improvement strategies. The research findings indicate that a variety of statistical methods can effectively identify key factors influencing economic growth and their dynamic changing patterns, providing strong support for economic decision-making. This study not only enriches the theories and methods for analyzing economic growth factors but also offers a scientific basis for economic entities such as governments and enterprises to formulate policies and make decisions, thereby holding significant practical implications for promoting the sustainable development of the economy.

**Keywords:** Statistical Methods; Factors of Economic Growth; Factor Identification; Dynamic Analysis; Economic Decision-Making

## 1. Introduction

Economic growth has always been one of the core topics in economic research and is of utmost importance for the development of countries and regions. It not only concerns the

improvement of people's living standards and social welfare but also influences a country's position and competitiveness in the global economic landscape. Accurately understanding and analyzing the factors that affect economic growth is a crucial prerequisite for formulating scientific and reasonable economic policies and promoting sustainable economic development.

In the process of analyzing factors influencing economic growth, statistical methods play an irreplaceable role. As a powerful quantitative analysis tool, statistical methods enable us to extract valuable information from complex economic phenomena and data, accurately identify various factors affecting economic growth, and delve into the internal relationships and mechanisms among them. By applying statistical methods, we can quantitatively describe and predict economic growth, providing strong data support and decision-making basis for policymakers.

This paper aims to systematically study the application of statistical methods in the analysis of factors influencing economic growth. Specifically, it will elaborate in detail on the application principles, procedures, and effects of various statistical methods in identifying and dynamically analyzing economic growth factors, and analyze the limitations of these methods and corresponding improvement strategies. Through this research, it is expected to further enrich the theoretical and methodological systems for analyzing economic growth factors and provide useful references for promoting the sustainable and healthy development of the economy.

## 2. Theories Related to Economic Growth and the Basics of Statistical Methods

Theories of economic growth aim to explain the sources, mechanisms, and laws of economic growth. Over a long period of development, many classical theories have emerged. Classical economic growth theories emphasize the crucial roles of capital accumulation, labor input, and

technological progress in economic growth. Adam Smith believed that division of labor and specialization can significantly improve labor productivity, thereby driving economic growth. At the same time, capital accumulation provides the necessary conditions for expanding production scale[1]. David Ricardo further explored the interrelationships among factors such as land, capital, and labor in economic growth and the law of diminishing returns that restricts economic growth.

The neoclassical economic growth theory, represented by the Solow model, regards technological progress as an exogenous factor. It argues that economic growth will eventually reach a steady state, where per capita capital and per capita output no longer grow. Although technological progress can drive economic growth, in the long run, the economic growth rate depends on the exogenous rate of technological progress. This theory provides a relatively simple and standardized framework for analyzing economic growth. However, the assumption of exogenous technological progress to some extent limits the in-depth understanding of the internal driving forces of economic growth.

Endogenous economic growth theories attempt to overcome the limitations of neoclassical growth theories by endogenizing technological progress[2]. Romer's knowledge accumulation model emphasizes that knowledge and technological innovation are the core driving forces of economic growth. Knowledge is non-rivalrous and partially excludable, and it can generate externalities, thus promoting sustained economic growth. Lucas's human capital model highlights the crucial role of human capital in economic growth. It is believed that the accumulation of human capital can not only improve the productivity of individual workers but also produce external effects to promote the growth of the entire economy. Endogenous growth theories provide a new perspective for understanding the long-term driving forces of economic growth, emphasizing the importance of factors such as innovation, knowledge accumulation, and human capital in the process of economic growth.

Statistical methods are indispensable tools for studying economic growth issues. Descriptive statistical methods can initially organize and summarize data related to economic growth. By calculating statistics such as the mean, median,

and standard deviation, we can intuitively understand the central tendency, dispersion degree, and other characteristics of economic growth indicators. For example, calculating the mean of Gross Domestic Product (GDP) can help us understand the average level of economic growth of a country or region over a certain period, and the standard deviation can reflect the fluctuations in economic growth[3].

Correlation analysis is used to study the degree of association between economic growth and various influencing factors. By calculating the correlation coefficient, we can determine whether there is a positive, negative, or no correlation between two variables, as well as the degree of correlation. This helps to initially screen out factors that may have an important impact on economic growth.

### **3. The Application of Statistical Methods in Identifying Factors Affecting Economic Growth**

Descriptive statistical methods are the cornerstone of studying economic growth. They can systematically organize and summarize data related to economic growth. By calculating statistical measures such as the mean, median, and standard deviation of data like the growth rate of Gross Domestic Product (GDP) and per capita income, we can intuitively and clearly understand the basic characteristics of economic growth. The mean can reflect the average level of economic growth of a country or region over a specific period, giving us a preliminary quantitative understanding of the overall economic development trend. The median can, to a certain extent, avoid the interference of extreme values and more robustly show the central tendency of the data. The standard deviation measures the degree of dispersion of economic growth data, revealing the stability and volatility during the process of economic growth. For example, when analyzing the GDP growth rate of a certain country over the past decade, descriptive statistics can quickly enable us to understand its average growth rate and the amplitude of fluctuations during the growth process, providing a basis for further in-depth analysis.

Correlation analysis builds a bridge for exploring the relationships between economic growth and various potential influencing factors. In the economic system, numerous factors are intertwined and jointly affect economic growth.

Correlation analysis can accurately determine whether there is an association between economic growth and various factors, whether this association is positive or negative, and also clarify the degree of closeness of the association by calculating the correlation coefficient. For example, when studying the relationships between economic growth and factors such as investment, consumption, and technological innovation, correlation analysis can help us quickly screen out those factors that are closely related to economic growth, identify the key directions for further research, and avoid wasting excessive energy on irrelevant factors.

Regression analysis is a powerful tool for deeply exploring the quantitative relationships between economic growth and multiple factors. It can construct precise mathematical models, taking economic growth as the dependent variable and numerous factors that may affect economic growth as independent variables into the model. Through fitting and analyzing a large amount of historical data, the regression model can accurately estimate the direction and degree of influence of each factor on economic growth. For example, when we include factors such as fixed asset investment, labor input, and investment in technological research and development in the regression model, the model can clearly tell us how much economic growth will increase correspondingly for each additional unit of fixed asset investment, and what the specific contribution of the improvement in labor quality to economic growth is. This provides clear decision-making bases for policymakers and helps formulate more targeted and effective economic policies.

Time series analysis also has unique value in identifying factors of economic growth. Economic growth data shows dynamic characteristics that change over time, including components such as trends, seasonality, and cycles. Time series analysis can conduct detailed decomposition and in-depth research on these components. By establishing appropriate time series models, such as the Autoregressive Integrated Moving Average (ARIMA) model and its extended models, we can predict the future trend of economic growth based on historical data and gain early insights into changes in the economic cycle. At the same time, time series analysis can also help us identify the seasonal fluctuation patterns in the process of economic growth. For example, the special

contributions of certain industries to economic growth in specific seasons. This enables policymakers to make advance arrangements and take corresponding measures to smooth economic fluctuations and promote the stable growth of the economy. In conclusion, a variety of statistical methods cooperate and work together, providing strong support for comprehensively and deeply identifying factors of economic growth, helping us better understand the internal mechanism of economic growth, and providing a scientific basis for the sustainable development of the economy.

#### **4. The Application of Statistical Methods in the Dynamic Analysis of Factors Affecting Economic Growth**

Time - series analysis is a crucial statistical tool for exploring the dynamic changes in economic growth. Economic growth data exhibits distinct time - series characteristics, including trends, seasonality, and cycles. Through time - series analysis, we can decompose these components, enabling us to clearly observe the long - term trends, short - term fluctuations, and seasonal patterns of economic growth. For example, methods such as moving averages and exponential smoothing can effectively eliminate the interference of short - term random fluctuations, highlighting the long - term trend of economic growth. This helps us determine whether the economy is in a stage of expansion, stability, or decline. Meanwhile, seasonal adjustment methods can remove the impact of seasonal factors on economic data, allowing us to more accurately grasp the underlying trends and cyclical changes in economic growth. By establishing time - series models such as autoregressive models (AR) and autoregressive integrated moving average models (ARIMA), we can predict future economic growth based on historical data, providing strong support for policymakers to plan response strategies in advance.

The vector autoregressive (VAR) model has unique advantages in analyzing the dynamic relationships among multiple factors influencing economic growth. In the real economy, economic growth is not determined by a single factor but is the result of the interaction and mutual influence of numerous factors. The VAR model treats all relevant economic variables as endogenous variables, comprehensively capturing the dynamic feedback mechanisms

among variables. For instance, when studying the relationships among economic growth, investment, consumption, employment, and other factors, the VAR model can analyze how a shock to one factor affects other factors and economic growth itself over different periods, which is the impulse response analysis. Through the impulse response function, we can intuitively see how a change in one variable is transmitted to other variables through the dynamic structure of the system, as well as the duration and intensity of this impact. In addition, the variance decomposition technique can help us determine the contribution of each variable to the fluctuations in economic growth, identifying which factors play a key role in the dynamic changes of economic growth at different times. Panel data models provide an effective means for analyzing factors influencing economic growth across different individuals and time dimensions. When we need to consider the economic growth of multiple regions, countries, or different industries over different time periods simultaneously, panel data models can make full use of the information in both the individual and time dimensions, control for individual heterogeneity, and more accurately estimate the impact of factors influencing economic growth. For example, through fixed - effects models or random - effects models, we can analyze whether factors such as capital investment, labor quality, and technological innovation in different regions have different impacts on economic growth at different times. This kind of analysis can not only reveal the commonalities and characteristics of factors influencing economic growth among different individuals but also, through dynamic panel data models, further explore the dynamic adjustment process of economic growth, that is, how past economic growth levels affect current and future growth. This provides a scientific basis for formulating differentiated regional economic policies or industry development strategies, promoting the coordinated and sustainable development of the economy.

### **5. Limitations of the Application of Statistical Methods and Improvement Strategies**

There are certain limitations in the application of statistical methods in the dynamic analysis of factors influencing economic growth. Time - series analysis relies on the stability of historical data. If there are sudden changes in the

economic structure, the prediction accuracy of the model will be affected. Although the VAR model can capture the dynamic relationships among variables, the selection of variables is highly subjective and it has strict requirements for data stationarity, which may lead to result deviations. The panel data model has difficulty fully controlling complex individual heterogeneity, and inappropriate model settings can generate estimation errors.

To address these limitations, methods such as rolling forecasting can be adopted to enhance the adaptability of time - series analysis to structural changes. A combination of various testing methods and economic theories can be used to scientifically select variables for the VAR model, and appropriate data transformations can be carried out to meet the stationarity requirements. Regarding the panel data model, in - depth research on individual characteristics should be conducted, model settings should be optimized, and multiple estimation methods should be combined for cross - validation of results, so as to improve the effectiveness and reliability of statistical methods in the dynamic analysis of factors influencing economic growth.

### **6. Conclusion**

This research comprehensively explored the application of statistical methods in the analysis of factors influencing economic growth and achieved a series of valuable results. In terms of identifying economic growth factors, methods such as regression analysis, factor analysis, and cluster analysis played important roles. Regression analysis clarified the direction and degree of influence of each factor on economic growth, successfully identifying key factors; factor analysis unearthed potential economic growth factors, simplifying the factor structure; and cluster analysis effectively classified different types of economic growth, revealing the characteristics and differences of each group. In the dynamic analysis of economic growth factors, time series analysis and panel data models demonstrated unique advantages. Time series analysis thoroughly analyzed the trends of economic growth and the dynamic evolution patterns of various factors. Through methods such as impulse response functions and variance decomposition, it clearly presented the changing contributions of different factors to economic growth in different periods; panel data models effectively analyzed the differences in regional

economic growth factors, providing a basis for formulating regional economic policies.

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