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Research on the Impact of Economic Development on Financial Derivatives

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Abstract: This paper aims to further investigate the impact of economic growth on the demand for financial derivatives, provide effective support to financial market participants and investors, and promote the stable development of financial markets. Firstly, time series analysis models, including autoregressive, mixed autoregressive, and moving average regression, are established by considering various factors in the financial market. Secondly, the basic characteristics of financial derivatives are thoroughly analyzed, and relevant variables are selected for explanation. Finally, the paper elucidates the fundamental functions of financial derivatives and their role in economic growth. The empirical results show that the correlation coefficient between non-financial institution derivatives and enterprise value is 0.2049, and the impact of enterprise economic growth on derivatives demand is 0.0003. Through time series analysis, the study reveals the impact mechanisms of economic cycles, business fluctuations, and other factors on the financial derivatives market, providing effective support for investors and participants.

Keywords: Economic Growth; Time Series Analysis; Financial Derivatives; Decision Support; Correlation Coefficient

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1. Introduction

With the rapid development of the current financial market, the types of financial products [1] are becoming more numerous, and the number of financial investors is increasing. This situation places higher demands on the timeliness of product data processing [2]. Professional financial investment companies are particularly concerned about the analysis and prediction of the changing trends of financial products. In this context, relying on the Internet for data processing and investment decision-making has become indispensable. In the operation management and investment decision-making of financial product investment institutions, excellent financial product analysis software [3] is becoming increasingly critical and indispensable.

In order to reveal the relationship between financial derivatives and economic development more comprehensively, this paper constructs a time series analysis model. Through a detailed study of the functions of financial derivatives, this paper highlights the importance of these factors in risk allocation and price discovery, and then analyzes how these functions interact with economic development. The results of the empirical analysis show that financial derivatives play a significant role in indirectly promoting economic growth. This promotional effect is not only reflected in overall economic growth but also in deepening the financial structure and promoting the overall development of the financial industry.

2. Time series analysis model

In this paper, multiple variables and factors are considered comprehensively, and the dynamic nature of time series [4]data is fully utilized. Through the in-depth exploration of the relationship between economic growth and the[5]demand for financial derivatives, we can capture the potential patterns and trends between them. The model takes full account of the complexity and uncertainty of the financial market, so that the model can more accurately grasp how economic growth affects the demand for financial derivatives. For a stable time series, p the order autoregressive

model is expressed $AR(p)$ as, satisfying the following equation:

$$u_t = c + \phi_1 u_{t-1} + \phi_2 u_{t-2} + \ldots + \phi_p u_{t-p} + \varepsilon_t, t = 1, 2, \ldots, T \quad (1)$$

Where, c is a constant, $\phi_1, \phi_2, \ldots, \phi_p$ is the coefficient of the autoregressive model, p represents the order of the autoregressive model, and ε_t represents the mean value of 0.

For the q order moving average model, it can be expressed as follows:

$$u_t = \mu + \varepsilon_t + \theta_1 \varepsilon_{t-1} + \ldots + \theta_q \varepsilon_{t-q}, t = 1, 2, \ldots, T \quad (2)$$

Also in the above equation, μ represents a constant, which $\theta_1, \theta_2, \ldots, \theta_q$ is the q average coefficient of the order moving average model, and ε_t represents the mean value of 0.

A mixture of autoregressive and moving average models is typically used $ARMA(p,q)$ that satisfies the following equation:

$$u_t = c + \phi_1 u_{t-1} + \phi_2 u_{t-2} + \ldots + \phi_p u_{t-p} + \varepsilon_t + \theta_1 \varepsilon_{t-1} + \ldots + \theta_q \varepsilon_{t-q}, t = 1, 2, \ldots, T \quad (3)$$

At p 0, $ARMA(0,q) = MA(q)$; At q 0, $ARMA(p,0) = AR(p)$.

For non-stationary time series, it can be transformed into stationary series by d subdifferencing. Let y_t be a d simple integral sequence of order, that is $y_t \sim I(d)$, then $\omega_t = \Delta^d y_t = (1-L)^d y_t \omega_t$ is a stationary sequence, then $y_t \sim I(0)$. Then, the stationary sequence ω_t $ARMA(p,q)$ can be modeled to satisfy the following equation:

$$\omega_t == c + \phi_1 \omega_{t-1} + \ldots + \phi_p \omega_{t-p} + \varepsilon_t + \theta_1 \varepsilon_{t-1} + \ldots + \theta_q \varepsilon_{t-q} \quad (4)$$

The lag operator representation is used to obtain $\Phi(L) = 1 - \phi_1 L - \phi_2 L^2 - \ldots - \phi_p L^p$ the sum $\Theta(L) = 1 + \theta_1 L - \theta_2 L^2 - \ldots - \theta_q L^q$, and the $ARMA(p,q)$ model after d sub-variance conversion is expressed as $ARMA(d,q)$, and the regression formula is:

$$\Phi(L)(1-L)^{d} y_t = c + \Theta(L)\varepsilon_t \quad (5)$$

3. Selection of variables and parameters

3.1 Selection of variables and parameters

Basic financial products [6] refer to financial assets such as stocks, currencies, foreign exchange, and bonds, as well as financial assets like interest rates, exchange rates, and stock price indices. The emergence of financial derivatives not only meets the needs of investors seeking to speculate and earn money but also promotes changes in financial market prices. The value of financial derivatives [7] depends on the expected market price trends of stock prices, interest rates, and exchange rates over a period of time. Table 1 shows the selection and explanation of variables. There are various types of financial derivatives traded in the market, including futures contracts, options, interest rate swaps, and credit derivatives.

In theory, financial derivatives [8] are financial products based on the expected price changes of a related asset. They can also refer to instruments that predict the market trends of financial products such as stock prices, interest rates, and exchange rates over a certain period of time. These instruments involve participating in forward contracts or swap contracts of different financial products by paying a small amount of margin. By integrating traditional financial products with other products, these contracts are transformed into new and more complex financial derivatives.

Table 1 Variable Selection and Explanatory Significance

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Variables	The meaning of the variable
GPR	Economic growth rate
M2	Ratio of broad money supply to GDP
DV	An indicator of the degree of capital market development, the ratio of the circulating market value of the stock market to the gross domestic product.
CR	Ratio of total loans to GDP in the financial sector
GEXP	Ratio of government expenditure to GDP
OR	Ratio of net exports to GDP

SSE	Total number of employed urban residents
DM	The development level of financial derivatives market, the ratio of futures market trading volume to GDP

3.2 Basic functions of financial derivatives

For many people who do not understand finance, the financial derivatives [9] market can bring significant risks. Financial derivatives trading aims to transfer the risk of investment from risk-averse individuals to risk-seeking participants, thereby promoting each participant to reach an appropriate level of risk, attract more funds, and invest in the underlying market. The basic functions of financial derivatives are as follows:

(1) Risk Avoidance: One of the main processes of risk aversion is hedging, which is the necessary basis for the existence and development of financial derivatives [10].

(2) Price Discovery: The financial derivatives market brings together participants from various levels and stages, providing numerous pieces of supply and demand information about the underlying assets of financial derivatives and the required market expectations. The discovery of prices in the financial derivatives market helps to improve market transparency, and the correlation between transparency and the underlying market can enhance the efficiency of the entire financial market.

(3) Speculative Function: Some individuals bet on future changes based on particular trends, creating a risk mechanism that has not been seen before. Participants expect to make profits by taking risks, and if they speculate in a fair and open environment, it will have a positive impact on the improvement of market efficiency.

(4) Structural Combination: Financial derivatives can be used to reconstruct a specific transaction or risk exposure to achieve the desired result for the client.

4. Analysis on the Demand Impact of Financial Derivatives

4.1 Prediction accuracy

With the development of economic and financial globalization, financial derivatives

have become fundamental risk management tools for various real economies. According to statistics, more than 90% of enterprises worldwide use financial derivatives to hedge market risks. Almost all large financial institutions are utilizing financial derivatives, and the larger the scale of the financial institution, the higher the frequency of using financial derivatives, and the more stable the returns. This has become a universal law and trend globally.

Based on the statistical description of derivative financial assets disclosed by all listed companies from 2012 to 2022, this paper aims to accurately predict the demand for financial derivatives for economic growth under time series analysis. Figure 1 shows the demand for derivatives and assets of listed companies. In terms of the number of enterprises, the number of listed companies disclosing derivative financial assets increased from 14 in 2012 to 185 in 2022. The proportion of listed companies increased from 0.7% to 5% between 2012 and 2022. From the scale of the entire financial market, the proportion of derivative assets increased from 36 billion yuan to 545 billion yuan between 2012 and 2022, and the proportion of all listed companies increased from 0.6% in 2012 to 4% in 2022. In terms of asset size, the disclosed derivatives assets increased from 36 billion yuan in 2012 to 545 billion yuan in 2022, an increase of more than 15 times, and the proportion of total assets of enterprises increased from 3.51% in 2012 to 9.40% in 2016.

From the perspective of derivatives, from 2012 to 2022, the number of listed companies using various types of derivatives has changed significantly. The number of companies using exchange rate derivatives increased year by year from 14 in 2012 to 80 in 2022, after a leap-forward growth in 2021. The number of interest rate, commodity, and other derivatives used has gradually increased every year, from 6, 4, and 5 in 2012 to 60, 72, and 38 in 2022, respectively. After a brief decline during the subprime mortgage crisis, with the listing of stock index futures, the number of companies using stock financial derivatives began to rise gradually. In 2022, the number of equity derivatives used was 49.

4.2 Sensitivity analysis

4.2.1 Impact sensitivity of enterprise value

The main functions of financial derivatives are to promote price growth, reduce transaction costs, and optimize the risk allocation of enterprises or banks. The use of derivatives by enterprises or banks can directly or indirectly promote the development of the real economy. To analyze the impact of non-financial institutions' use of derivatives on their enterprise value, this paper chooses enterprise value as a proxy variable. This variable not only measures the value of the enterprise but also reflects its growth. A dummy variable for derivatives is set up for time series analysis.

Table 2 presents an analysis of the impact of derivatives of non-financial institutions on enterprise value. The correlation coefficient of derivatives is 0.2049, which is significant at the 1% confidence level, indicating that the enterprise value will increase by 0.2049 units for each additional unit of financial derivatives assets. The use of financial derivatives can significantly enhance the value of enterprises and increase the capital reserves of real enterprises.

Table 2 Impact of derivatives of non-financial institutions on enterprise value

Table 2 Impact of non-financial institution derivative products on corporate value

Variables	Dummy variable	Fair value	Nominal amount
Derivative products	0.2049	0.0070	0.0273
Size of assets	−0.5283	−0.5271	−0.5280
Net profit	0.0000	0.0000	0.0000
Asset-liability ratio	−0.1823	−0.1825	−0.1850
Growth rate	0.0854	0.0851	0.0854
Book to market ratio	−5.9031	−5.9021	−5.9041
Return on assets	3.1461	3.1431	3.1532
Constant term	10.2482	10.2421	10.2489
Industry	Control	Control	Control
Time	Control	Control	Control

4.2.2 Sensitivity of demand factor of financial derivatives

This paper analyzes the impact of economic growth on the demand for financial derivatives through two channels: banks and non-financial companies. Table 3 shows the impact coefficient of economic growth on derivatives demand. According to data from 2012 to 2022, the real GDP of banks will increase by 0.0103 units per quarter

for each additional unit of derivatives assets. For every unit of derivative assets added by listed companies, quarterly real GDP will increase by 0.0003 units. The use of derivatives by listed non-financial companies and listed banks has contributed to the growth of the real economy, and economic growth has also contributed to the demand for financial derivatives.

Table 3 Impact coefficient of economic growth on derivatives demand

Table 3 Coefficient of the Impact of Economic Growth on the Demand for Derivatives

Sample interval 2012-2022	coefficient
The Marginal Impact of Banks' Use of Derivatives on Their Corporate Lending	0.2257
The Marginal Impact of Bank Loans on Economic Growth	0.0448
The Impact of Banks' Economic Growth on the Demand for Derivatives	0.0103
The Marginal Impact of Derivatives on Corporate Value	0. 0085
The Marginal Effect of Corporate Value on Economic Growth	0. 0272
The Impact of Corporate Economic Growth on the Demand for Derivatives	0.0003

5. Conclusion

This paper constructs a time series analysis model based on the dynamics of time series data and selects financial variable parameters for explanation. The study analyzes the quantity and structural changes of financial derivatives of listed companies and their impact on the development of the real economy. Firstly, this paper provides a statistical description of the derivative financial assets of listed companies from 2012 to 2022 and accurately predicts the demand for financial derivatives. The proportion of listed companies has increased from 0.6% in 2012 to 4% in 2022. Then, a sensitivity analysis of the impact of enterprise value and financial derivatives demand is carried out. The correlation coefficient of derivatives is 0.2049, and the real GDP of listed companies increases by 0.0003 units per quarter for each additional unit of derivatives assets. Through the rational use of time series analysis, we can establish a strong foundation for the in-depth study of the role of the financial derivatives market in promoting economic growth. To better play this role, further

measures need to be taken, including increasing the participation of institutional investors such as banks, insurance companies, and securities firms. This can effectively improve the level of financial derivatives market serving the real economy and create more favorable conditions for sustainable economic growth.

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