

Design of Financial and Economic Cyclical Model and Validation of Domestic Economic Effects

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Abstract

Financial economic cycle theory is the latest development in the field of economic cycle theory at the forefront of the hotspot. In this paper, credit, financial leverage, real estate asset prices, and stock asset prices are selected to measure financial cycles, gross domestic product (GDP) is used to measure gross national output in China, and consumer price index (CPI) is used to reflect the total price level, and the year-on-year growth rate of the above indexes is taken as the corresponding proxy variables, to design a financial economic cyclical model. The model is calibrated based on the quarterly data of the real Chinese economy from 1992Q1 to 2011Q1, and the effect of the model fitting the real Chinese economy is investigated.

Keywords

Financial Economic Cyclicity Model, Domestic Economy, Real Estate Asset Prices, Gross Domestic Product, Consumer Price Index, Credit, Financial Coverage, Stock Asset Price

1. Introduction

The cyclical model of financial economy has always been one of the important fields of economics and finance research. The economic cycle refers to the long-standing fluctuations in economic activities caused by various internal and external factors, which reflect the unbalanced state of economic development and have important guiding significance for policy makers, investors and researchers (Bauer et al., 2023). Financial economic cyclicity modeling aims to quantitatively describe and predict economic cyclical fluctuations, help people better understand the operating law of the economy, and provide a basis for deci-

sion-making by enterprises, governments and so on. With the changes in the domestic and international economic environment and the advancement of economic globalization, financial economic cyclical models are facing more and more challenges and opportunities. Especially in a large developing country like China, the complexity and diversity within the economic system bring special challenges to the establishment and application of the model. The complexity and diversity within the economic system will affect the variables of the periodic model of financial economy, enhance the complexity of the model, increase the error when establishing and applying the periodic model of financial economy, and reduce the accuracy of the model. It is impossible to analyze and characterize the development characteristics and change characteristics of domestic financial economy by using the model. In order to better adapt to the development and changes of the domestic economy, this study aims to design and validate a financial-economic cyclical model for the Chinese economy and evaluate its performance in the domestic economic environment. In the 1980s, in order to meet the needs of the Chinese economy, many financial and economic cycle models were developed as representatives of the Real Business Cycle (RBC) theory, and for a long time, the Business Cycle (RBC) was considered the orthodox research method of cycle theory. However, subsequent studies have demonstrated that the basic RBC models have obvious shortcomings, the most important of which is that these models do not include money, and thus cannot discuss the effects of monetary policy; in addition, the predictions of these models on the real wage are significantly stronger than the relationship between the real wage and aggregate output in the real economy. On this point, the traditional Keynesian models go to the other extreme, predicting significantly lower real wages than the relationship between real wages and total output in the real economy. The two schools of thought criticized each other absorbed each other's advantages, and gradually merged after the 1990s to produce a further improved modern cyclical model—the General Business Cycle (GBC) model, which some scholars refer to as a synthetic model.

Until a few years ago, GBC theory was basically regarded as a standard tool for the theoretical research of dynamic macroeconomics, and its basic framework and research methods were widely used in almost all macro issues such as monetary policy, public finance, labor economics, public economics, international trade and so on. So much so that people have begun to think that the methodology is close to perfection. But in fact, the traditional RBC model, the Keynesian model, and their fusion into the GBC do not believe that financial and credit markets affect the real economy (based on the Modigliani-Miller theorem). In the research of scholars at home and abroad, the financial and economic cyclicity model has been widely applied and developed (Bartscher et al., 2022). Especially in Western developed countries, many scholars and institutions are researching and developing cyclical models applicable to their own economies. However, in China, the related research is still in its infancy, and it needs to be

constantly improved and expanded. Therefore, the development of this study has important theoretical and practical significance, which will promote the development and improvement of China's financial and economic cyclical model and provide a more scientific and accurate basis for policy-making, enterprise management, and investment decision-making.

2. Modeling Financial Economic Cyclicity

2.1. Selection of Variables for the Financial Cycle

When measuring the financial cycle, Chinese and foreign scholars have chosen many financial variables. Although there is no uniform standard, credit, interest rate, real estate price, stock asset price, and social financing scale are recognized and widely used indicators. Therefore, credit, financial leverage, real estate asset prices, and stock asset prices are selected to measure the financial cycle and to examine the linkage between the financial cycle and the economic cycle and policy tools.

Credit: Borio believes that credit, as the most traditional form of credit creation, is a bridge between savings and investment and represents a function of the financial market that measures the degree of cyclical expansion and contraction of the financial sector. China's financing structure, which is dominated by financial intermediaries, allows credit to visualize the functioning of the financial system and suggests the credit risk situation, while non-financial private sector credit contains three parts: domestic credit, cross-border bank credit, and credit from other domestic financial institutions, which can better reflect the link between finance and the real economy (Fernández et al., 2021). Therefore, this paper takes the year-on-year growth rate of non-financial private sector credit as a proxy variable for credit.

Financial leverage: This paper chooses the year-on-year growth rate of the ratio of credit to gross domestic product (GDP) as a proxy variable for financial leverage. Morn and Taylor point out that credit/GDP is a variable that measures the high level of macro leverage and can observe the outbreak of economic crises to a certain extent prospectively (Fleissig & Jones, 2023). When macro leverage is high, profitability increases while risk rises and reduces people's risk tolerance; when prices are on a downward trend, speculators will compete to sell assets and an avalanche of asset prices will result in the outbreak of an economic crisis (Langley & Leyshon, 2021). Existing studies also show that the endogenous correlation mechanism exists between financial leverage, economic cycles, and financial crises. Therefore, this paper introduces financial leverage into the variable system to measure the financial cycle, so as to reflect the leverage ratio of the macroeconomy and the ability of the financial system to absorb losses.

Real Estate Asset Prices: Real estate assets played an important role in the subprime mortgage crisis of 2008. Real estate can be used as high-quality collateral for credit, as well as the underlying physical assets for asset securitization, and it is featured in numerous financial derivatives (Manullang et al., 2023).

Therefore, real estate asset prices are usually considered as an important variable affecting the financial cycle. From the perspective of China's reality, its price fluctuations often cause fluctuations in the financial system and the macroeconomy, and the real estate cycle is very closely associated with the credit cycle and the economic cycle. In this paper, the year-on-year growth rate of real estate prices is used as a proxy variable for real estate asset prices (real estate prices = total sales of commercial real estate/commercial real estate sales area).

Equity asset prices: the rise and fall of equity asset prices are inextricably linked to market expectations, monetary policy, and even the state of the real economy (Mikhaylov, 2021). In recent years, with the high-quality development of China's economy, the stock market's position in the national economic system has risen, and the impact of stock asset prices on the financial cycle is self-evident. In this paper, the year-on-year growth rate of the Shanghai Composite Index, which is more representative and comprehensive, is chosen as a proxy variable to measure the overall price of the stock market.

2.2. Variable Selection for Economic Cycles

Referring to the existing literature, this paper uses the Gross Domestic Product (GDP) to measure the total national output in China, and the Consumer Price Index (CPI) to reflect the total price level (Minesso et al., 2022). In addition, considering that the economic cycle may be affected by expectations, the enterprise prosperity index is added to express the production and operation status of enterprises and entrepreneurs' feelings and expectations of the macroeconomic environment, and the year-on-year growth rate of the above indicators is taken as the corresponding proxy variable.

2.3. Financial Economic Cyclicity Measure

Because financial data may be unstable, it is necessary to test the stationarity of variables before using the HP filtering method to measure the financial cycle and economic cycles. After obtaining the smooth series, it is first necessary to eliminate the short-term noise and long-term trend in each financial factor to obtain its cyclical fluctuation curve, and finally measure the financial and economic cycle using principal component analysis (Mujahidin, 2022). The basic economic cycle fluctuations are transmitted and diffused through the activities of a series of economic variables, behind which there is an unobservable common factor driving them, and this common factor explains and represents the economic cycle (Ridwan, 2022). Based on the basic meaning of Dynamic Factor Analysis (DFA): the movements of two components constitute the overall movement of a multidimensional system of time series indicators, the first component is the common movement caused by a single or a few multiple dynamic factors, and the second component is the differentiated movement of the individual variables as represented by the disturbance term with a mean value of zero. The following model can be constructed on the basis of its basic implications:

$$F_t = ZR_t + \delta_t \quad (1)$$

Where F_t denotes the financial-economic cyclical model, i.e. the financial-economic cyclical measure; Z denotes the coefficient matrix; R_t denotes the financial cyclical variable; δ_t denotes the economic cyclical variable; and denotes the economic cyclical variable (Sohail et al., 2021). The pre-processed variables are inputted into the model to realize the financial-economic cyclical measurement, thus completing the model design.

3. Validation of Domestic Economic Effects

This part of the research is the basis of this paper. The time interval of macroeconomic aggregate we are concerned about is from the first quarter of 1992 to the first quarter of 2011. Economic variable series data include: real GDP growth rate; Inflation rate (expressed by GDP deflator); Investment in fixed assets; Capital construction investment; Consumer expenditure; Financial and policy series data include: stock asset prices; Statutory deposit reserve ratio, deposit and loan interest rates; The total amount of credit, the loan-to-deposit ratio, the proportion of employed labor in the financial sector to the total labor, etc. These data were collected from the People's Bank of China and the Statistical Yearbook respectively. Among them, the nominal GDP is directly found, and the real GDP is obtained by dividing the GDP deflator. The total amount of money is expressed by the price of stock assets. Because of the difficulty of obtaining accurate data on total investment in society as a whole, capital investment was approximated using only available data from the Statistical Yearbook as an indicator. Resident consumption data from the statistical yearbook is used as an approximation of total consumption. Changes in the statutory reserve requirement ratio are random, and the magnitude of each change is also random, but the overall trend of change is basically clear. We carry out quarterly smooth averaging on the actual values given by statistical data. For example, if there is more than one adjustment in the same quarter, simple arithmetic averaging is used as the quarterly value. The deposit and loan interest rates are also randomly changed by policy, which is similar to the smooth approximation of the reserve ratio data. Labor data in the financial sector can be found directly. Fluctuation characteristics of China's macroeconomic aggregate: **Figure 1** reports the actual situation of quarterly output and inflation in China's economy from 1992 to 2012.

From this figure, it can be seen that: 1) real GDP has an independent trend and its own fluctuation cycle, with 1992-1999 being a period of decline, 1999-2008 being a period of boom and rise, and there should be a period of decline after 2008, but there is a downward short-term gap due to external shocks, but the potential trend should be a smooth downward curve connecting the two ends of this gap so that if the impact of external shocks is not considered, this gap should be removed to obtain the medium-term potential trend; 2) In terms of medium-term characteristics, nominal volume fluctuations have a pro-cyclical relationship with real GDP, but the short-term relationship is not obvious enough to

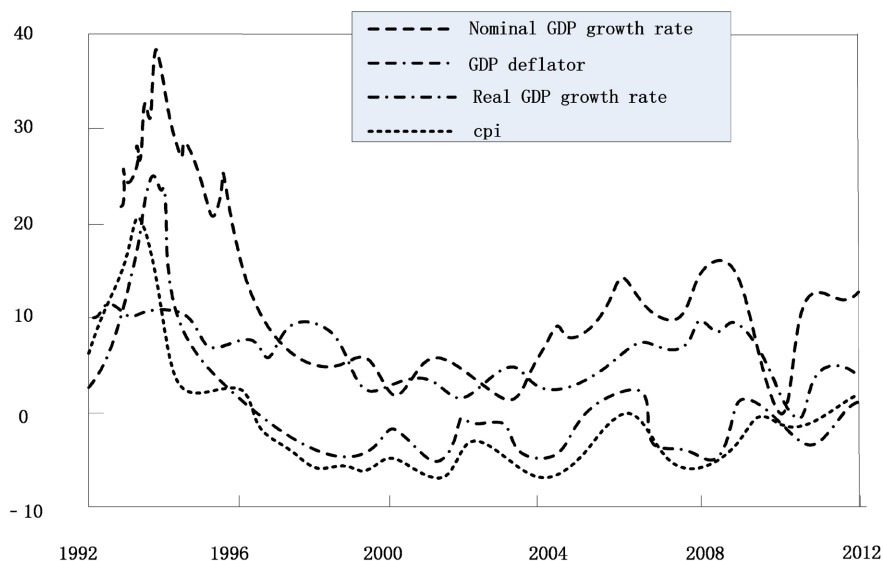


Figure 1. Quarterly data on real domestic economic output and inflation.

be discerned. **Figure 2** reports the year-on-year growth rates of interest rates, credit, real estate asset prices, stock asset prices, and the waveform of the consumer price index for the Chinese economy between 1992 and 2012 (all normalized by dividing by the maximum value to facilitate comparisons on a single chart).

From the above graphic, it is clear that the financial factor variables are generally procyclical concerning the medium-term characteristics of the economic aggregates. Short-term fluctuations are mainly due to financial and monetary policies, which do not affect the economy in the medium term, so the study of the short-term real economy-nominal volume relationship requires the removal of medium-term trends. For this reason, we select the BP filter parameters to capture the pure short-term volatility component, specifically, we select a stage order of $k = 5$ and high and low spectral parameters of 2 and 8 respectively; i.e., BP5 (2, 8) This is quite different from the usual standard parameter selection for quarterly data filtration, e.g., BP12 (6, 32) in Baxter and King (1995), but the goal of their study is to characterize fluctuations in the medium term and beyond. Volatility characteristics and need to filter out short-term volatility factors, while in this paper we wish to leave precisely the short-term factors.

Equity asset price-GDP relationship: **Figure 2** shows that before 1999, equity asset prices and GDP were on a joint downward trend in the medium term, with equity asset prices more volatile than GDP in the short term; after 1999, the medium-term trend in GDP was positive (until the 2007-2008 external shocks) but the medium-term trend in equity asset prices was relatively flat and slightly downward (until 2007). The magnitude of equity asset price volatility intensified further after 2007, but equity asset prices exhibited follow-through and passivity relative to the more substantial fluctuations in GDP. This suggests that equity asset price volatility is not a causal factor in GDP volatility.

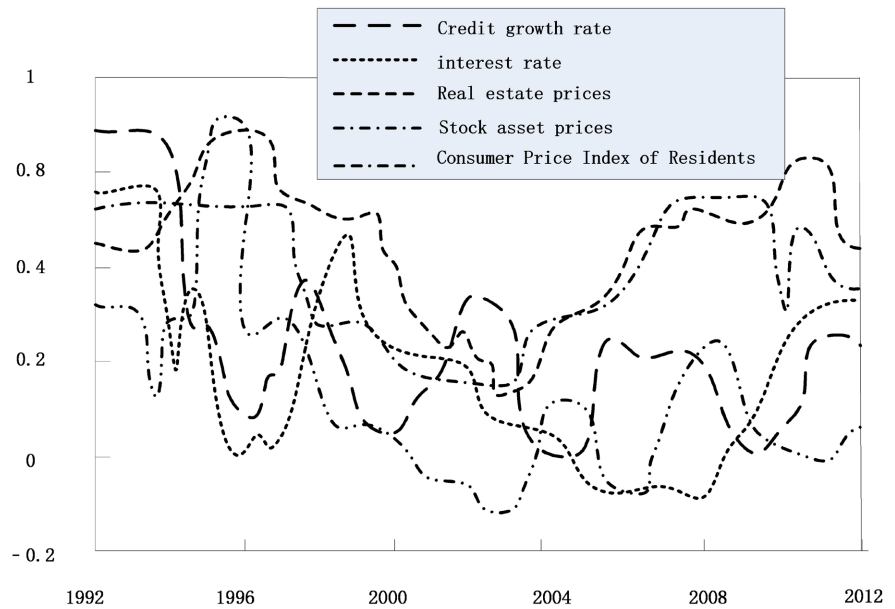


Figure 2. Normalized data on real economic and financial aggregates.

Equity asset prices, year-on-year growth rates of credit, and GDP: year-on-year growth rates of credit exhibit lagged pro-cyclicality (which was evident after 1998 and even more pronounced after the crisis), with fluctuations approximating GDP, as shown by the statistical characteristics in **Figure 2**, which shows that year-on-year growth rates of credit lagged by three quarters, with a peak co-movement of 0.54. **Figure 2** shows that, over the period from 2000 to 2008, the level of the year-on-year growth rate of credit has been trending upward moderately and gradually, with an average trend roughly close to GDP, while the average trend of equity asset prices has been trending slightly horizontally downward during this period, and thus the medium-term trend of rising year-on-year growth rate of credit during this period is not monetary in origin. It should be considered to be mainly structural or aggregate demand-side factors. However, the short-term wave profile of inflation between 2000 and 2008 has a strong lagged correlation with equity asset prices, as shown in **Figure 2**.

Taken together, the medium-term trends in the year-on-year growth rates of GDP and credit are independent of equity asset prices, whose short-term fluctuations have a large impact on inflation (highly correlated) but a limited impact on GDP (not highly correlated).

Consumer Price Index, Real Estate Asset Prices, and GDP: Benchmark interest rates lagged output by 3 quarters, with a peak correlation of 0.39 with GDP, as can be seen in **Figure 2**, which shows that interest rates fluctuated very little after 2000. The cycle of interest rates as an important monetary policy tool has been characterized by a lagged procyclicality, which was essentially flat between 2000 and 2006, and a steady rise in the real economy.

On the basis of the above empirical research, the model parameters are corrected according to the actual macroeconomic aggregate in China's economy, so

that the model economy can fully fit the actual economy. Then we compare and analyze the degree of fit between the waveform characteristics of the output of the model economy and the waveform characteristics of the pure volatility part of the filtered macro aggregates of the actual economy. It is worth pointing out in particular that the model in this paper is quite different from the general standard cyclical model, the most important difference being that the model in this paper takes into account very specific covariates such as credit, interest rates, real estate prices, stock asset prices, etc., which are all determined endogenously by the model. At the same time, the model has the unprecedented advantage of allowing us to analyze the dynamics of fluctuations affecting the trade-off behavior of bank intermediaries, such as spreads, and to gain insights into the various mechanisms involved in the fluctuation process of the real economy through the dynamics of these micro-behavioral but profoundly macro-impacting dynamics of the financial system. This kind of model is still in the exploratory initial development stage, and the mature development in the future will be further extended to the application analysis of various specific macro-prudential policy management tools, such as the systematic risk prediction of financial institutions, the systematic impact of private finance and underground finance on the regional economy, the capital ratio effect of various financial institutions stipulated in Basel III, and the optimal management allocation.

In addition, while the individual variable characteristics still have some error from the actual economy, the overall order of magnitude is essentially the same. For such a still very simple cyclical model to be able to predict this is pretty good. Although China's overall situation, including the degree of marketization, economic system, and many other factors, is very different from that of the Western economies, our experiments show that the financial-economic cycle model developed in this paper can be calibrated to fit the Chinese economy. Using more accurate calibration techniques and more detailed policy equations and parameter tests, we will surely be able to get a better financial cycle model that fits the actual Chinese economy (most of the model parameters used in this paper are not subject to stringent requirements, and thus the sensitivity of the parameters is not high, which implies that the applicability of this type of model to fit the actual situation is good).

4. Concluding Remarks

The cyclical model of the financial economy plays an important role in analyzing and understanding the causes, development trends, and potential risks of economic cycles. By establishing an appropriate model, we can better understand and predict the fluctuations in economic activities and provide effective tools for policymakers to stabilize and manage economic activities. There are many challenges in designing and validating financial and economic cyclical models. These challenges include how to accurately define and measure economic cycles, how

to select and process data, and how to construct and maintain the validity and reliability of models. While these challenges present difficulties, they also provide valuable learning opportunities to gain a deeper understanding of the nature of economic cycles and the modeling process. In this study, it was found that the models generally performed relatively well in the domestic economic environment. However, this does not preclude possible biases that may occur at particular stages or conditions. For these deviations, further research and modeling improvements are needed to better accommodate the complexity and dynamics of the domestic economic environment. Although the model has shown validity to a certain extent, there are still many directions in which it can be improved and extended. For example, consideration can be given to introducing more economic indicators, refining data processing and analysis methods, as well as optimizing the parameters and structure of the model. In addition, with the accumulation of data and the development of technology, the predictive ability and accuracy of the model can be further improved in the future.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

References

- Bauer, M. D., Bernanke, B. S., & Milstein, E. (2023) Risk Appetite and the Risk-Taking Channel of Monetary Policy. *Journal of Economic Perspectives*, 37, 77-100. <https://doi.org/10.1257/jep.37.1.77>
- Bartscher, A. K., Schularick, M., Kuhn, M. et al. (2022) Monetary Policy and Racial Inequality. *Brookings Papers on Economic Activity*, 2022, 1-63. <https://doi.org/10.1353/eca.2022.0018>
- Fernández, M. Á. E., Alonso, S. L. N., Jorge-Vázquez, J. et al. (2021) Central Banks' Monetary Policy in the Face of the COVID-19 Economic Crisis: Monetary Stimulus and the Emergence of CBDCs. *Sustainability*, 13, 1-18. <https://doi.org/10.3390/su13084242>
- Fleissig, A. R., & Jones, B. E. (2023) UK Household-Sector Money Demand and Divisia Monetary Aggregates in the New Millennium. *Macroeconomic Dynamics*, 28, 1-23. <https://doi.org/10.1017/S1365100522000724>
- Langley, P., & Leyshon, A. (2021) The Platform Political Economy of FinTech: Reintermediation, Consolidation and Capitalisation. *New Political Economy*, 26, 376-388. <https://doi.org/10.1080/13563467.2020.1766432>
- Manullang, A. L., Hutasoit, D. H., Matondang, K. A. et al. (2023) Monetary Policy Effectiveness on Inflation and Growth Economy in Century Covid-19 Pandemic. *International Journal of Business and Applied Economics*, 2, 51-58. <https://doi.org/10.55927/ijbae.v2i1.2120>
- Mikhaylov, A. (2021) Development of Friedrich von Hayek's Theory of Private Money and Economic Implications for Digital Currencies. *Terra Economicus*, 19, 53-62. <https://doi.org/10.18522/2073-6606-2021-19-1-53-62>
- Minesso, M. F., Mehl, A., & Stracca, L. (2022) Central Bank Digital Currency in an Open Economy. *Journal of Monetary Economics*, 127, 54-68. <https://doi.org/10.1016/j.jmoneco.2022.02.001>

- Mujahidin, M. (2022) Time Value of Money and Sharia Legitimacy. *Al-Amwal: Journal of Islamic Economic Law*, 7, 81-93. <https://doi.org/10.24256/alw.v7i2.3567>
- Ridwan, M. (2022) Determinants of Inflation: Monetary and Macroeconomic Perspectives. *KINERJA: Jurnal Manajemen Organisasi dan Industri*, 1, 1-10.
- Sohail, M. T., Yu, X. Y., Usman, A., et al. (2021) Renewable Energy and Non-Renewable Energy Consumption: Assessing the Asymmetric Role of Monetary Policy Uncertainty in Energy Consumption. *Environmental Science and Pollution Research*, 28, 31575-31584. <https://doi.org/10.1007/s11356-021-12867-0>