

Optimization of Asset Allocation Strategies in Major Categories—Theories, Indicators, Assets and Timing

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Abstract

Due to the defects of Merrill Lynch Clock, this paper aims to put forward Pringle Clock for theoretical improvement. In addition, strategic optimization for Pringle from perspectives including indicators, assets and timing is made, and finally its effectiveness in domestic market is tested. The results show as follows. 1) Stages of the Pringle cycle divided by three indexes (leading, consistent and lagging) can accurately grasp allocation opportunities of assets in different categories. 2) Researches and investments in the subdivided industries of the equity market are conducive to improving portfolio returns, and Markowitz mean-variance model can be used for portfolio optimization. 3) Selecting appropriate leading interest rate indicators (by using wavelet cross analysis) and predicting the characteristics of the next stage in advance (by using VAR model) are of great help to improve the flexible timing ability of the asset allocation strategies.

Keywords

Pringle's Periodic Theory, Indicators, Assets Allocation, Timing

1. Introduction

1.1. Classical Merrill Lynch Theory

In 2004, Merrill Lynch put forward its investment clock theory. Based on historical data, it reasonably divided the economic cycle and explored asset allocation strategies for each stage. This theory is one of the most classic in the field of asset allocation. Jiang (2021) made a relatively complete analysis of it from two dimensions (economic growth and inflation). First of all, in the recession stage,

economy and inflation fall in resonance, bond is the best asset; Secondly, in the recovery stage, actual output gradually recovers to its potential level and inflation decreases, and the best asset is stock; Thirdly, in the overheated stage, actual output starts to exceed its potential level, which leads to demand gradually exceeding supply, pushing up overall inflation level, and it is better to invest in commodities; Finally, in the stagflation stage, economy goes down and inflation goes up, and cash is king.

1.2. Localization Improvement of Merrill Lynch Clock

In the past decade, with the reform and turbulence of financial market, the applicability of Merrill Lynch theory in China has attracted extensive attention. Although some studies believe that this theory has local adaptability, most researchers hold opposing views and give corresponding empirical results. For example, Wu (2018) selected four yield indicators to represent the performance of four categories of assets. By analyzing the data of past 20 years, he found that the cyclical phenomenon confirmed by Merrill Lynch investment clock is not obvious in China's economic development. While questioning the effectiveness of Merrill Lynch Clock, domestic scholars also put forward many improvement methods to build an investment clock with Chinese characteristics. Specific optimization researches mainly lie in the following three levels.

Firstly, replacement of economic cycle indicators. Gao (2015) proposed that the key step for the application of the investment clock theory is to use appropriate indicators to judge the inflection point of the economic cycle, but the indicators used by Merrill Lynch are not fully applicable to the Chinese market, because many indicators are difficult to obtain in China and need to be replaced with more appropriate ones. Most domestic securities use value-added of large industrial enterprises and CPI as two indicators, but the leading and lagging indexes published by the National Bureau of Statistics are more appropriate. The leading index includes information of consumer expectations, new projects and other indicators that can reflect expected economic growth, while the lagging index combines a series of indicators (fiscal expenditure, household savings, CPI, etc.) that can better reflect limited resources in the national economic system. Both indicators can show overall economic operation of the country in a more detailed and accurate way. Jiang (2021) also put forward a similar point of view; by analyzing historical data, he finds that the leading index can basically cover the curve of industrial added value, and the lagging index can also basically cover the curve of CPI. In terms of the application of these two indexes, Zhou (2018) constructed cointegration equations between them and the returns of stocks, bonds and commodities respectively, and found that signs and significance of the model coefficients were consistent with expectations. The above research shows that the leading index and the lagging index can make a more accurate division of China's economic cycle.

Secondly, localization of the quantitative method of the return on major types

of assets. Zhou (2018) provided the selection logic of measurement indicators. He believes that performance of stocks could be measured by the yield of CSI 300 Stock Index which can comprehensively reflect the situation of the stock market, performance of commodities could be measured by the yield of South China Commodity Composite Index which is the earliest and most comprehensive commodity index in China, performance of bonds could be measured by the yield of China Bond Comprehensive Wealth Index and performance of cash could be measured by the monthly data of SHIBOR interest rate which has small volatility and can well reflect the cash demand in the market.

Thirdly, enrich the choice and optimize the strategy of asset allocation. Gao (2015) applied Markowitz's mean-variance theory to the allocation of assets and proposed an optimization method based on Monte Carlo simulation; Li (2016) proposed that attention should be paid to the importance of cash after quantitative easing and the role of real estate in real economy; Zhou (2018) added leverage on four major categories of assets based on the principle of risk parity, which increased risk but improved overall Sharpe ratio; Hsu et al. (2018) find that after accounting for data-snooping bias, the 1/N rule outperforms most strategies. From the time-varying perspective, Bessler et al. (2021a) employ a sample-based approach in which the sample moments are the input parameters for the model of asset allocation.

1.3. Theoretical Improvements of Merrill Lynch Clock by Pringle's Periodic Theory

In fact, Merrill Lynch Clock has limitations in theory reflected in the following three aspects, which cannot be overcome by indicator replacement and strategy optimization. First of all, it ignored counter-cyclical regulation of the central bank, that is, central bank would reduce excessive fluctuations in economic operation through monetary policy, which would make economic cycle turn counterclockwise or cross phases. Secondly, the classification of equity market in Merrill Lynch Clock is quite rough. With the development of the times, new sectors and industries have also emerged in the equity market, and their importance cannot be ignored. Therefore, the investment framework needs to classify the assets more carefully to make more targeted and timely recommendations on equity investment. Bessler et al. (2021b) find that industry-based asset allocation strategies have better performance compared to country-based allocations. In addition, Merrill Lynch Clock did not take into account the feedback from investors on macro indicators. For example, if capital market keeps improving, consumers will gradually hold optimistic expectations and will further increase consumption, thus affecting macro-economy.

Martin J. Pringle is known as "the technical analyst among technical analysts". The Pringle Clock proposed by him is an effective improvement on Merrill Lynch Clock in theory, which is mainly reflected in the following aspects:

First of all, based on existing consistent indicators (economic growth) and lagging indicators (inflation), Pringle cycle adds leading indicators to better

adapt to the era of monetarism. During the economic depression, financial institutions will issue loans at low interest rates to meet social needs and will provide liquidity, thus promoting economic growth. However, credit expansion will lead to an increase in non-performing loans, causing institutions to stop issuing loans (they are reluctant to lend), and economic prosperity will end accordingly. Therefore, the liquidity cycle (credit cycle) will start earlier than the profit cycle (economic growth cycle) and the inflation cycle, it is necessary to take leading indicators into consideration when dividing economic cycle stages. Li (2016) proposed a similar idea in the framework improvement of Merrill Lynch Clock. He pointed out the importance of money after the 2008 subprime crisis and put forward the concept of money gap, that is, the difference between money supply and nominal economic growth. In fact, it has similar function of leading indicators.

Secondly, Pringle Clock divides the economic cycle into six stages. Based on the four stages of Merrill Lynch Clock, government's regulation is considered, which makes the stage division more accurate and clearer. The complete process of Pringle economic cycle is: credit drives production, production drives inflation, inflation influences interest rate, interest rate influences credit. It can be seen that interest rate directly affects credit, so interest rate can be considered as "the leading indicator of leading indicator", reflecting government's intervention. The characteristics of the six stages and the recommended asset allocation are summarized as follows (Table 1).

It should be noted that compared with Merrill Lynch Clock, Pringle Clock has one more asset to choose-metal (such as gold), and its yield can be measured by the spot price of gold in London. Compared with commodities, gold has a weak anti-inflation ability but a high risk-aversion value. Therefore, it is recommended to allocate gold during stagflation and depression.

1.4. Summary

To sum up, as the "upgraded version" of Merrill Lynch Clock, Pringle Clock is more meaningful for asset allocation. However, the work and the articles about it are not very much, and its local applicability needs to be verified. The innovations of this paper are transferring previous optimization methods (indicators, asset allocation, timing, etc.) from Merrill Lynch to Pringle and test their

Table 1. Features of six stages and recommended categories of assets.

Stages	Features	Leading	Consistent	Lagging	Recommended Assets
1	adjustment	↑	↓	↓	bond
2	recovery	↑	↑	↓	stock (equity)
3	transition	↑	↑	↑	stock ↑ + commodity ↑
4	overheated	↓	↑	↑	stock ↓ + commodity ↑
5	stagflation	↓	↓	↑	commodity ↓ + metal ↑
6	depression	↓	↓	↓	metal ↓ + bond ↑

effectiveness in China's Financial Market. Firstly, based on Pringle Clock theory, three indicators (the leading, consistent and lagging index) can be used to divide the Pringle circle (shown in 2.2 and 2.3); Secondly, detailed classification of the equity market from the perspective of industries is made for the optimization of assets (shown in 2.4); Finally, appropriate interest rates are selected for predicting the leading indicator and enhance the timing ability of Pringle Clock (shown in 2.5) (**Figure 1**).

2. Strategy Application and Optimization

2.1. Data Acquisition

The framework of Merrill Lynch Theory is based on the economic data from 1970 to 2004, and its applicability to the market after 2005 has not been strongly confirmed. Therefore, data from 2006 to date is selected for empirical analysis.

1) Data range: 2006-2022

2) Data source: iFinD database

3) Selected indicators: three indexes (leading, consistent and lagging), assets in four major categories (CSI 300 Stock Index, South China Commodity Composite Index, China Bond Comprehensive Wealth Index and the spot price of gold in London), Shenwan Hongyuan Indexes of Secondary Industries, interest rates (SHIBOR, DR007, SLF, excess deposit reserve ratio)

2.2. Indicator Selection

According to the above description of Pringle's periodic theory, the traceable economic indicators are leading indicators, consistent indicators and lagging indicators. Based on the thought of Gao (2015), the leading index, consistent index and lagging index of the National Bureau of Statistics are selected as representatives, their trends are shown in **Figure 2**. It can be seen that three pairs of indicators are highly correlated, indicating that the three indexes have strong economic importance and can effectively divide the economic cycle.

2.3. Application

The HP filtering method is used to extract periodic fluctuations of the three indexes (**Figure 3**), and the period from 2006 to (June) 2022 is divided based on Pringle's periodic theory. **Table 2** summarizes the statistical results. It can be

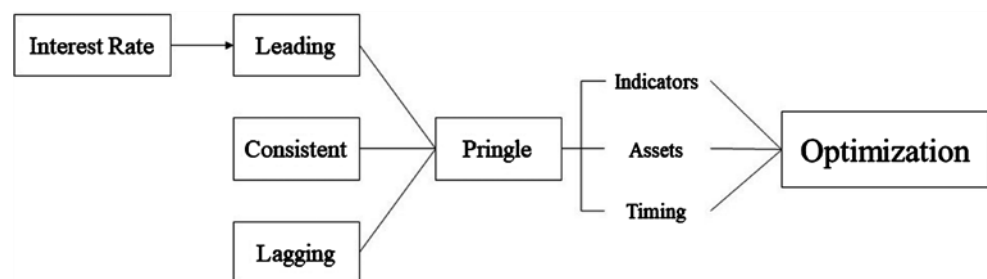


Figure 1. Optimization framework.

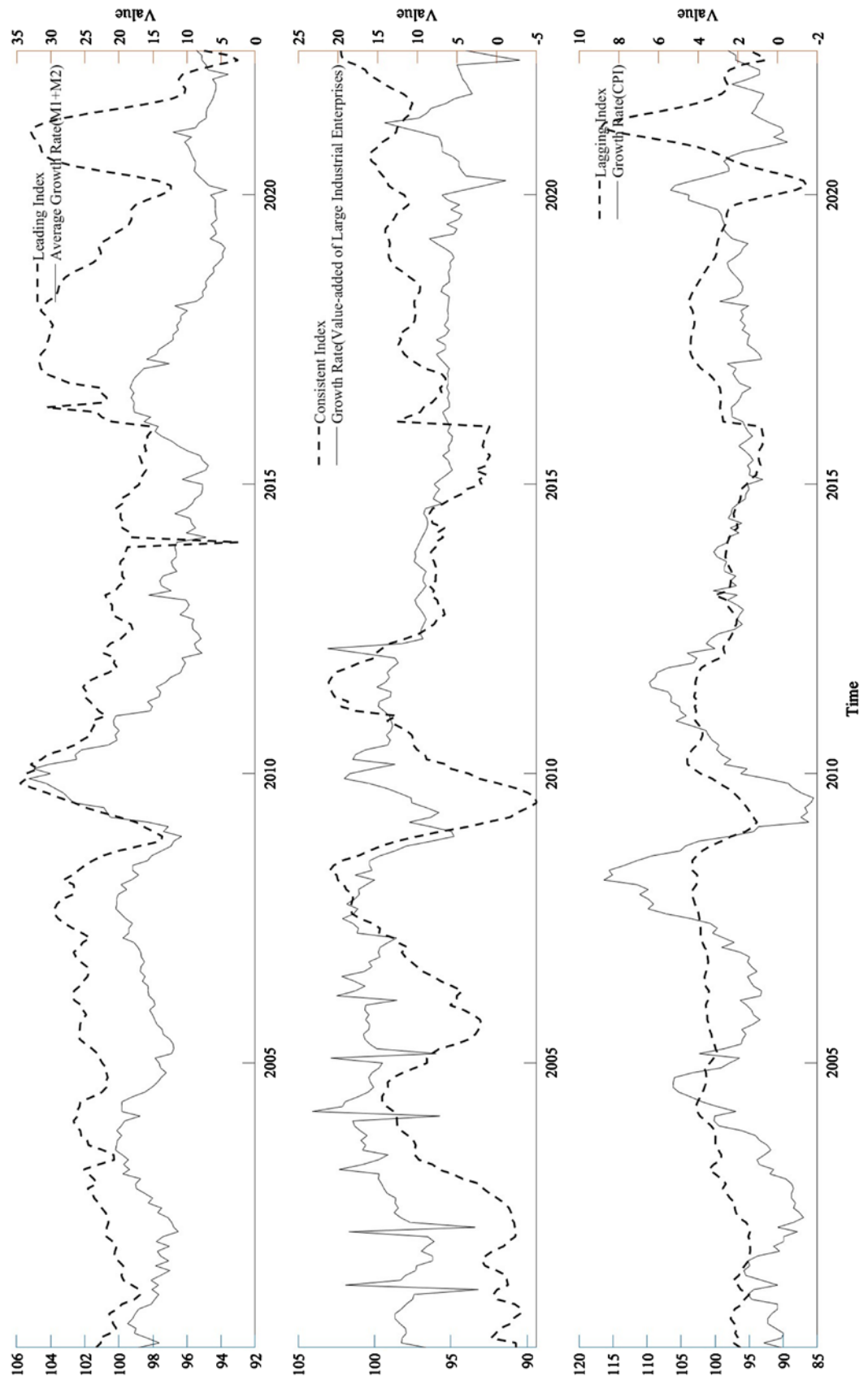


Figure 2. Trends comparison.

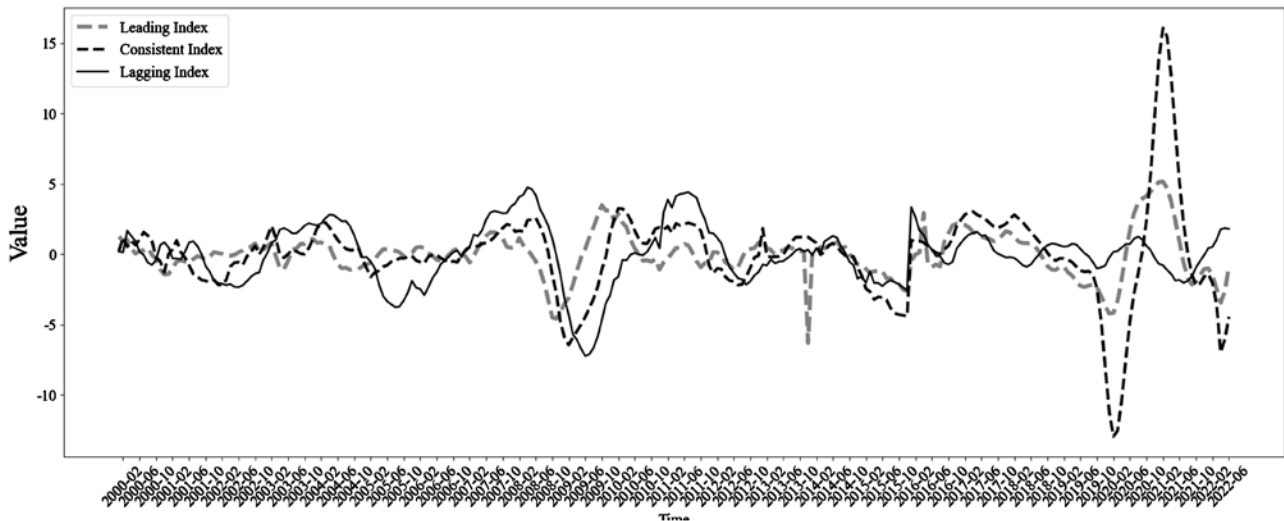


Figure 3. Division (HP Filtering).

Table 2. Historical performance of assets at different stages.

Stages	Average Historical Return				Recommendation	P (positive)
	Stock	Metal	Commodity	Bond		
1	3.032%	4.891%	0.923%	0.629%	bond	76.47%
2	9.634%	0.768%	4.977%	0.472%	stock	81.82%
3	3.497%	0.840%	2.108%	0.183%	stock/commodity	78.95%
4	2.596%	3.897%	2.440%	0.120%	stock/commodity	100.00%
5	-5.971%	0.320%	-0.464%	0.825%	commodity/metal	63.16%
6	-0.615%	-0.507%	-2.262%	1.393%	metal/bond	100.00%

seen that the performance of assets at different stages confirms the correctness of the theory.

In addition, as shown in Figure 4, investing in the assets recommended by Pringle theory at each stage (For example, the “50% + 50%” strategy at stage 3 means investing 50% stock + 50% commodity at this stage) can obviously obtain excessive return compared with holding a single asset for a long time. Therefore, in most cases, Pringle theory can accurately grasp asset allocation opportunities.

2.4. Enrich Asset Allocation Elements

Standard Pringle theory involves four categories of assets: bonds, stocks, commodities and precious metals. According to the ideas proposed above, the asset allocation strategy can be optimized as follows.

Firstly, Li (2016) proposed the financial attributes of real estate and its role in the real economy, so it can be added to the investment framework. As the investment period of physical real estate (or REITS) is relatively long and can basically span multiple cycles, it can be viewed as an underlying asset. Investors can

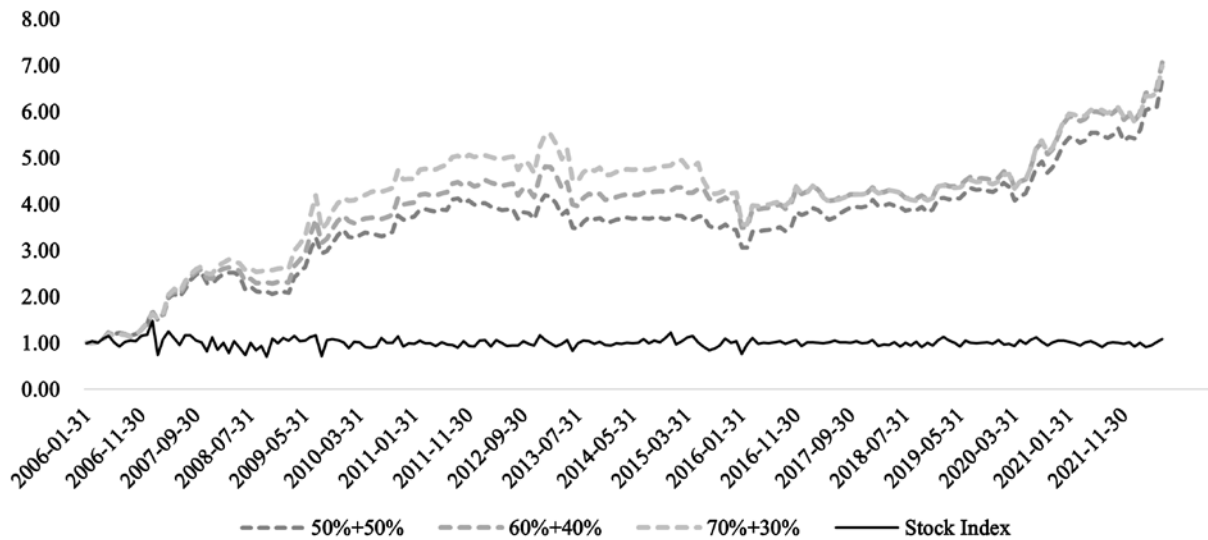


Figure 4. Backtesting results.

Table 3. Optimal equity portfolio at each stage.

Stages	Secondary Industries
1	*Other Electronics II + Photovoltaic Equipment
2	*Electronic Components + Consumer Electronics + White Spirit II + Other Power Supply Equipment
3	*Feed + White Electric Appliances + Kitchen and Bathroom Appliances + Cement + Aviation Equipment II
4	Automobile Parts + *Passenger Cars
5	Medical Services + *Motor II
6	White Spirit II + *Professional Social Services

allocate it in their portfolio, and the proportion depends on their own risk preferences.

Secondly, like Merrill Lynch, the classification of equity market in Pringle Clock is also rough. It is necessary to formulate detailed investment strategies according to the characteristics of various industries. The screening results are summarized in Table 3 (*Indicates the best-performing secondary industries at a certain stage, the industry classification is based on the criteria of Shenwan Hongyuan Securities).

It can be seen that there are two or more secondary industries that meet the conditions at each stage. In addition to the method of average allocation, Markowitz mean-variance model (Yang, 2022) can also be used to determine weights.

1) If there are only two eligible secondary industries (stage 1, stage 4, stage 5 and stage 6), the optimal weight can be calculated based on the following formula, and the investment goal is to maximize the Sharp ratio:

$$w_1 = \frac{(E(r_1) - r_f)\sigma_2^2 - (E(r_2) - r_f)\rho_{12}\sigma_1\sigma_2}{(E(r_1) - r_f)\sigma_2^2 + (E(r_2) - r_f)\sigma_1^2 - (E(r_1) + E(r_2) - 2r_f)\rho_{12}\sigma_1\sigma_2}; w_2 = 1 - w_1$$

2) If there are more than two qualified secondary industries, Python can be used. For example, the nearest stage 2 is June 2022. The effective frontier of the portfolio is plotted, as shown in **Figure 5**. Calculation results are shown in **Table 4**. It can be seen that the mean-variance model can identify invalid strategy (in this case, the equal-weights allocation strategy is invalid).

However, the mean-variance method also has defects. First, the calculation results based on historical data have limitations; Secondly, the duration of each stage is relatively short, indicating that the number of time observations is small (László, 2022), so the distribution of asset return does not satisfy the normal distribution assumption; Finally, when there are only two assets in the portfolio, this method tends to give up the asset with lower return and higher volatility and pour all the funds into another asset. In practice, asset allocation can still be done based on the mean-variance model, but the input parameters should be the

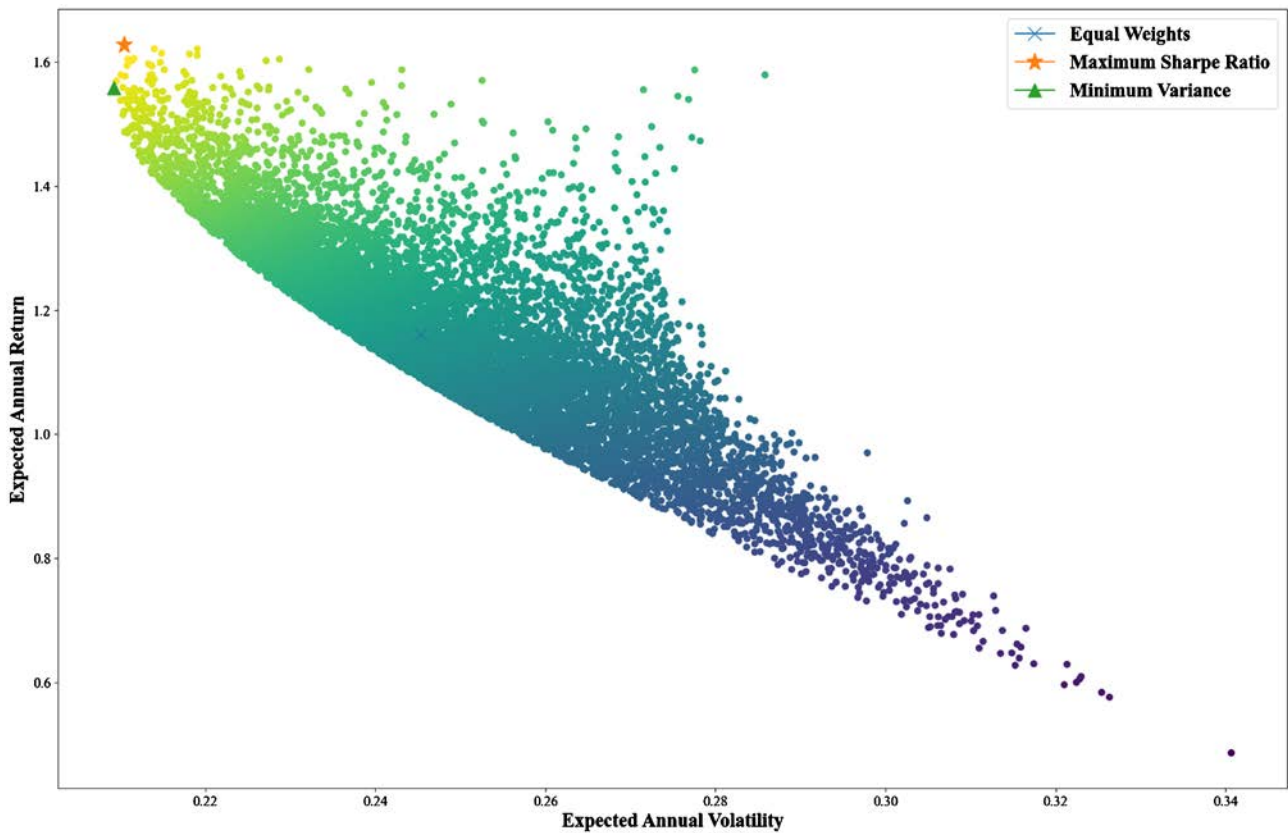


Figure 5. Efficient frontier.

Table 4. Asset allocation strategies.

Strategy	Electronic Components	Consumer Electronics	White Spirit II	Other Power Supply Equipment	Sharpe Ratio
Equal-weights	25%	25%	25%	25%	4.6097
Min-variance	10.2%	0	65.4%	24.4%	7.2991
Max-Sharpe	0	0	69%	31%	7.5918

analyst's expected rate of return rather than the historical rate of return.

The above equity strategy is simplified here (the secondary industry with the highest historical rate of return in each stage is invested), the simulation back test result (**Figure 6**) shows that the return rate of the equity portfolio has reached 5007.67% since 2006.

2.5. Improve Flexibility

Great uncertainty exists in the real economy, which puts forward higher requirements for the flexible timing ability of asset allocation strategies.

2.5.1. Improve Sensitivity

As mentioned above, as “the leading indicator of the leading indicator”, the interest rate should be forward-looking and can enhance the sensitivity of Pringle's strategy. It is of great importance to find interest rate indicators that meet the above characteristics. The indicators in the “interest rate corridor” are closely related to monetary policy regulations of the central bank. Take SLF (upper limit), excess deposit reserve ratio (lower limit), DR007 (implicit lower limit) and SHIBOR as alternative indicators, analyze their correlation with the leading index, and select the best prospective one.

On the one hand, the average elasticity of the leading index to SLF is -0.19 , and the average elasticity to the excess deposit reserve ratio is 0.003 . The former is larger and the sign is consistent with our expectation (the leading index decreases as SLF increases, and the elasticity is negative), indicating that SLF is more suitable.

On the other hand, it can be seen from **Table 5** that there are significant negative correlations between the two indicators (DR007 and SHIBOR) and the leading index. By plotting the wavelet cross graphs (at lag 7 order) (Li, 2018), it can be seen that within the 95% confidence level represented by the black outline, the former has left (opposite) and down (leading) impacts on the latter,

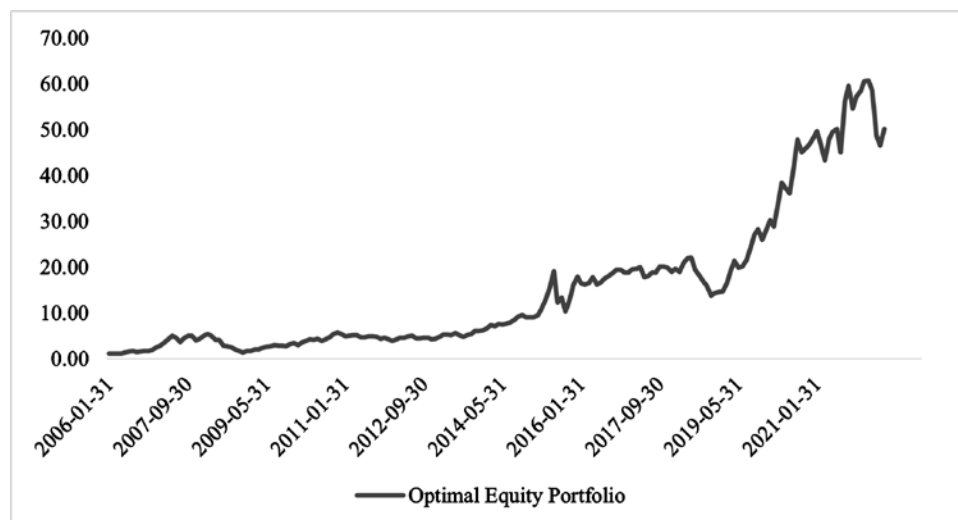


Figure 6. Backtesting results of equity investment strategy after optimization.

Table 5. Correlation coefficients.

Lag Order	0 (Current)	1	3	5	7
DR007	-0.1057	-0.1280	-0.2153	-0.2888	-0.3170
SHIBOR	-0.0788	-0.135	-0.22679	-0.2963	-0.33157

indicating that DR007 and SHIBOR are all forward-looking: when they decline in the current period, we can predict that the leading index will rise after about half a year (Figure 7).

2.5.2. Improve Predictability

Whether the lagging index, the consistent index or the leading index, the release of their data is not timely. Therefore, it is necessary to predict the subsequent trends of the three indexes based on historical data.

Simply, we can predict the future value of a certain index based on its own historical data. As shown in Figure 8, all the indexes have downward trends. Therefore, it is expected that the economy will be in stage 6 (depression) in the near future, which is suitable for allocating precious metals or bonds.

However, since the three indexes are used to divide the economic cycle together, the correlation between them cannot be ignored. A VAR model can be built for overall prediction. First of all, because the three are single integral sequences and the residuals of the regression equation are stationary and uncorrelated, it is considered that there is a cointegration relationship between them, so a vector autoregression model can be constructed based on the original sequence. Secondly, stability test results (Figure 9) show that all characteristic roots are in the unit circle, so the system is stable. Thirdly, Granger test results show that the lagging index is the one-way cause of the consistent index (p-values are 0.000 and 0.433, respectively), and the consistent index and the leading index are mutually causal (p-values are 0.000). Finally, it can be seen that after considering the interaction between the three indexes, the forecast results (Figure 9) are that the leading index continues rising, the lagging index continues declining and the consistent index will firstly drop and then rise, which indicate that the economy is expected to enter stage 1 in the near future and will gradually transits to stage 2 (recovery), and bonds are still valuable assets.

3. Conclusions and Suggestions

Based on the defects of Merrill Lynch Clock, Pringle Clock is put forward for theoretical improvement, strategic optimization from perspectives including indicators, assets and timing is made, and finally the effectiveness in domestic market is tested. The results show as follows. Firstly, stages of the Pringle cycle divided by three indexes can accurately grasp allocation opportunities of assets in different categories. Secondly, researches and investments in the subdivided industries of the equity market are conducive to improving portfolio returns. Thirdly, selecting appropriate leading interest rate indicators and predicting the

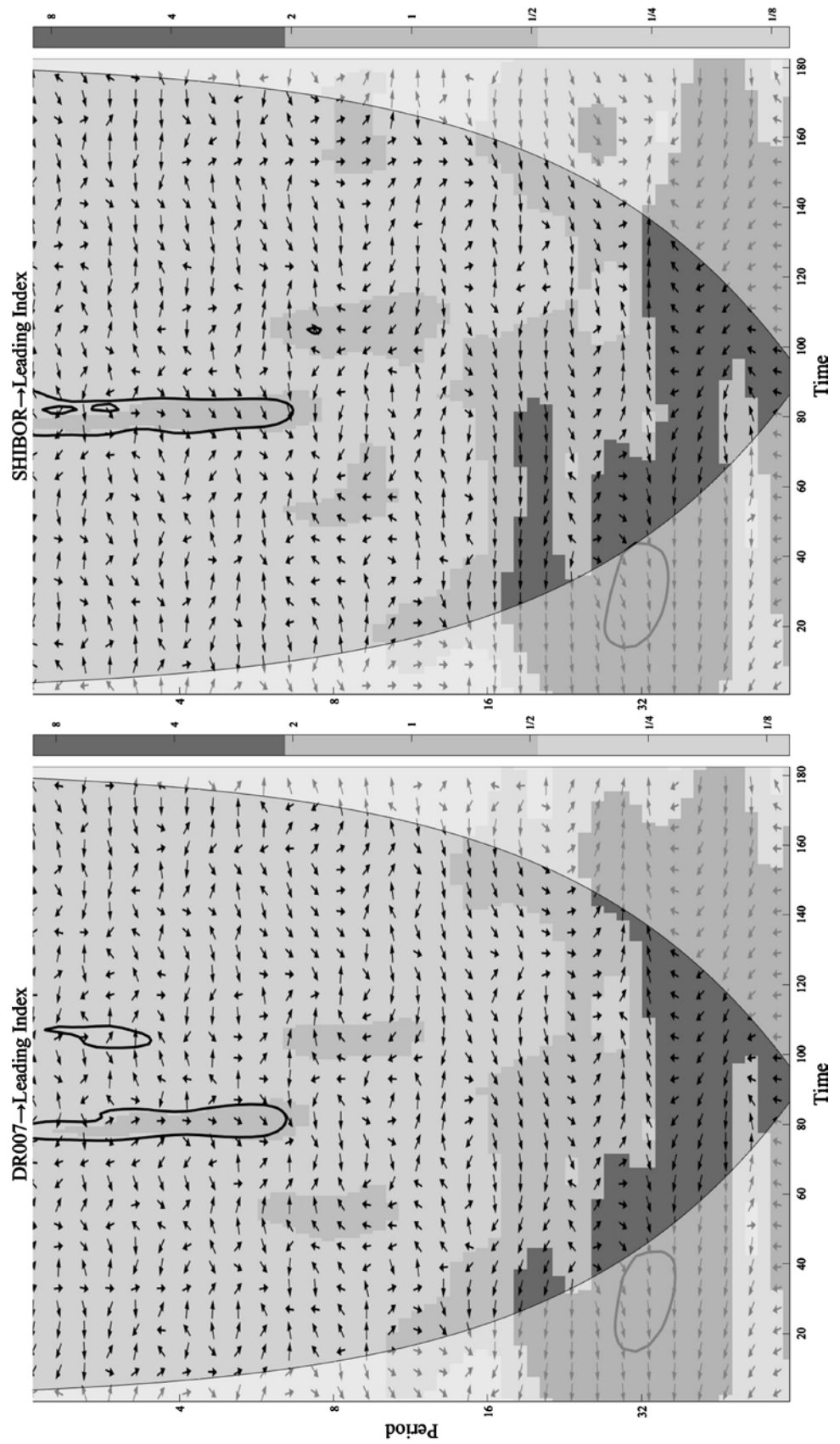


Figure 7. Wavelet cross analysis.

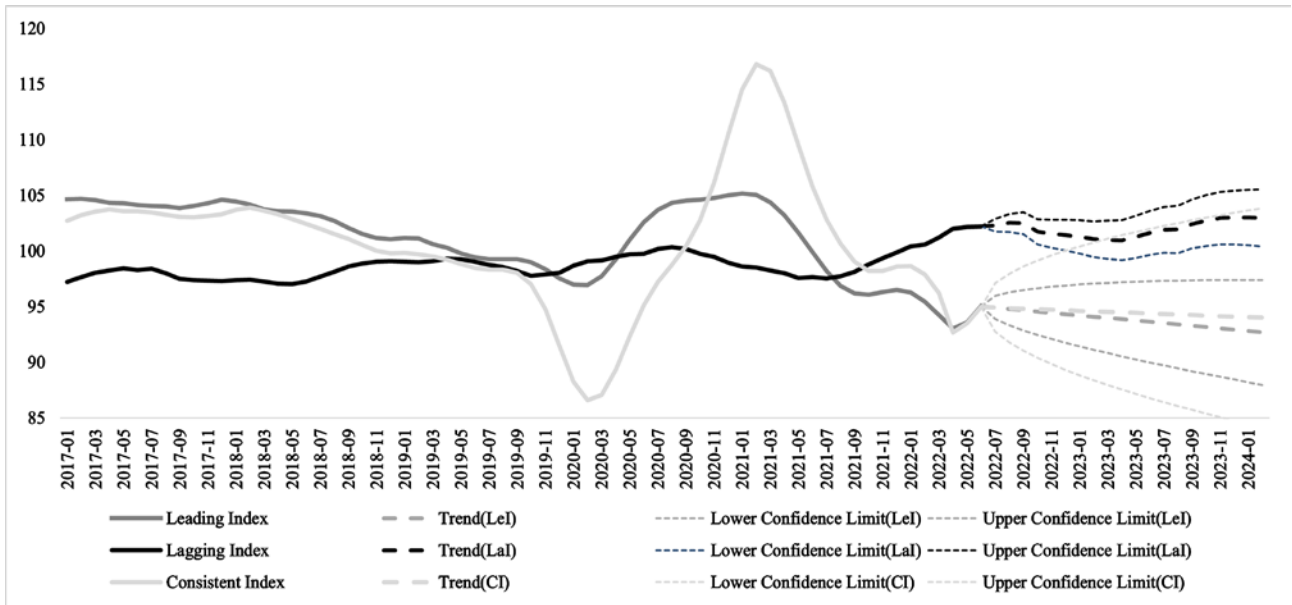


Figure 8. Trends prediction.

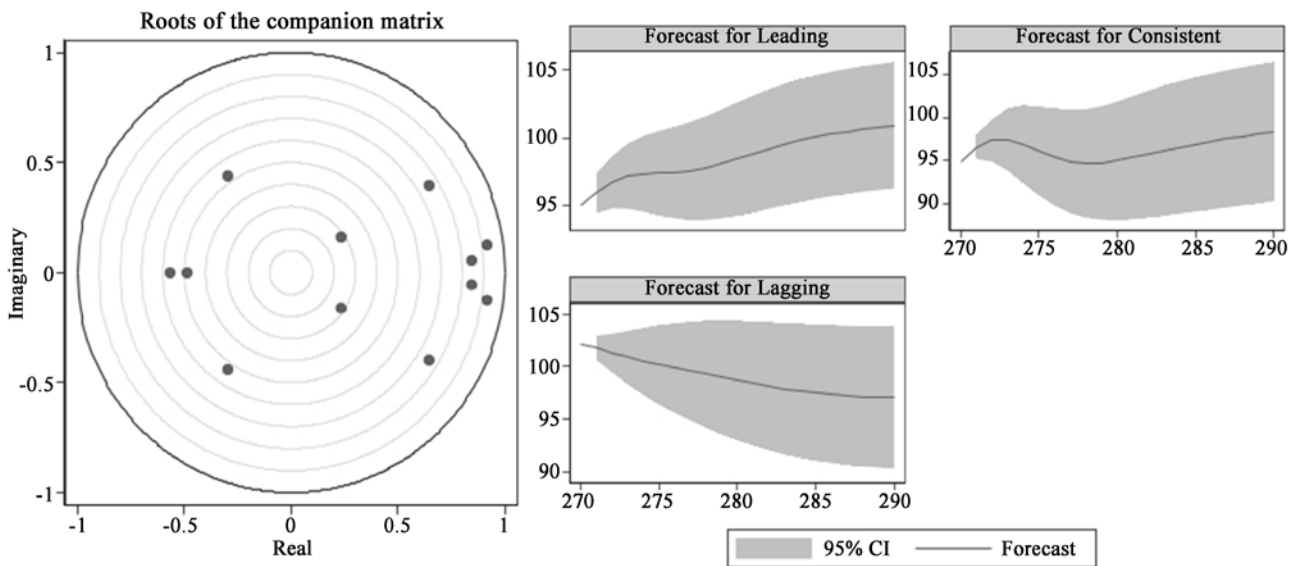


Figure 9. Predictions of VAR model.

characteristics of the next stage in advance are of great help to improve the flexible timing ability of the asset allocation strategies. The above three points can provide useful reference for investment decision-making. However, the above analyses cannot be applied mechanically in practical applications. They still need to be mutually verified from multiple dimensions, with more reference to international situations, domestic policies and public trading sentiment.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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