

Study the Two-Way Relationship between Electric Power and Economic Development from the Perspective of Cycle Theory

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Abstract: The main problem of the development of the power industry is whether it can accurately grasp the growth trend of power demand combined with the background of China's economic development, and provide a reliable basis for the rational development of the power industry. In recent years, economists and policy makers have increased their attention and research on the relationship between economic growth and power industry development. This paper uses the cycle theory to review the relationship between power and economic development, and gives a brief review, in order to provide reference for the research of power and economic relations.

1. Conceptual Framework

For a long time, the theoretical basis of academic macroeconomic operation monitoring method is mainly the measurement and description of economic operation cycle. There are cyclical fluctuations in macroeconomic operation, which can study the law of economic operation through relevant data and predict and early warning the economic prosperity.

Economic cycle refers to the cyclical fluctuations of national income and economic activities. It is the phenomenon of alternating fluctuation of expansion and contraction and relatively regular economic level and contraction. It can be divided into four stages: prosperity, recession, depression and recovery.

"Prosperity" is the abbreviation of economic prosperity, is a concept of describing the active degree in western developed countries, is a comprehensive description of economic development, to illustrate the concept of economic activity. It refers to the production growth, active business, prosperous market, and increased employment phenomena in the rising stage of the reproduction cycle. This concept, which has been widely adopted by countries in economic analysis.

Climate research methods and application cases have a history in the West for a hundred years, and only in the late 1980s, China began to pay attention to boom research.

2. Development History

In 1909, the Babson (Babson) statistical agency released the Babson economic activity index composed of 12 sensitive indicators in business, currency, investment, which was together with relevant charts to reflect the macroeconomic operation of the United States, the first index in the world to monitor macroeconomic operation.

In 1911, the Brookmire Economic Research Institute (Brookmire Economic Service) in the United States also compiled and released economic boom indicators involving the stock, commodity, and currency markets. But the most influential and accomplished economic climate index of this period was the US business sentiment index, compiled by Professor Persons at Harvard University ([1]).

The "Harvard Index" aimed to describe macroeconomic volatility cycles for macroeconomic forecasts, which began publishing regularly in the US journal "Economic Statistical Review" in

January 1919. The basic idea of its construction is: according to the macroeconomic time series, identify three categories 17 most sensitive and regular indicators, its long-term trend, seasonal changes and irregular factors influence, according to calculate the change rate, compiled three economic boom trend index, describe economic cycle fluctuations, predict macroeconomic prosperity. The first published Harvard Index, compiled from US economic statistics from 1875-1913, had a significant impact at the time in successfully predicting U. S. economic volatility. Since then, it has made more accurate predictions for the boom in the 1919 economy, the sharp recession in 1920, and the economic recovery in 1922. Since then, fame has been popular in the western world, many countries have followed their compilation principle, designed their own economic climate monitoring index.

However, the Harvard Index, facing the 1929 economic crisis, mistakenly signals that the economy would continue to expand, and failed predictions frustrated its reputation. To recover the defeat, the Harvard index designers revised the preparation method several times, but it was consistently ineffective, having to declare it closed in 1941.

The failure of the Harvard Index declared the decline of similar boom indexes, marking the end of the early stage of boom monitoring, but the monitoring activities of macroeconomic operations did not end. Harvard index left the precious thought is that before economists in the economic cycle, generally is to use single indicators to reflect the condition of economic operation, due to the lack of GDP such total indicators, single index is difficult to more comprehensively and accurately reflect the condition of economic operation, harvard index using a set of indicators to reflect the changes of economic operation, can do more accurate. Moreover, in order to accurately determine and analyze economic cycle fluctuations, the influence of seasonal factors must be removed from the time series of economic variables to detect the circulating elements that truly reflect economic cycle fluctuations. Seasonal volatility was early noticed by economists, but the widely used seasonal adjustment method was first by the US W.M. Persons (W.M. Persons) proposed in the development of studying the Harvard Index, after which seasonal adjustment methods have become a basic method and tool for detecting economic fluctuations.

Founded in January 1920, the National Economic Administration (N B E R), chaired by prominent American economist Close ill (Mitchell), shifted the focus of research to macroeconomic monitoring. In 1927, Close (Mitchell) published the book *Business Cycle: Problems and Adjustment*, which summarized the progress and achievements in the establishment of economic cycle fluctuation measurement and climate index in the early 10th century and 20s, discussed the problem of monitoring macro-economic cycle fluctuations, especially discussed the changing time difference of economic variables and reflected economic fluctuations in advance. This series of studies has had profound implications for the widely used macroeconomic monitoring methods today. In 1946, Close Er and economic statisticians Burns) published the book "Business economic cycle measure", which more systematically discussed the monitoring theories and methods of economic prosperity. The book studied the trend of time series elimination, smoothing technology, especially the first time mentioned the diffusion of economic fluctuations, that economic fluctuation is a process of gradually "diffusion" in the macroeconomic system, so the economic fluctuations have certain differences in time, which became the development of "diffusion index" laid the theoretical basis.

After the end of World War II, governments put economic development in the first place in the government work. The research and monitoring of the economic climate index developed by leaps and bounds, and the macroeconomic monitoring system focusing on the study of "diffusion index" and "synthetic index" was gradually formed and become increasingly mature.

In 1950, NBER economic statistician Moore (M) drew on the diffusion of Close and Burns, selected 21 indicators from nearly a thousand indicators, divided them into first, synchronization and lag, and developed the *D i f f u s i o n I n d e x* (DI), which greatly advanced the compilation theory created by the Harvard Index (averaging economic cycle fluctuations from stock price, production and currency). Since DI can only measure the direction of economic fluctuations but not the amplitude, Commerce Department economist Shiskin (MD) developed the new boom index *C o*

m p o s i t e I n d e x (; CI). The breakthrough in the calculation of synthetic index is the method of standardizing different class indexes, which lays the foundation for the synthesis of different indexes. Therefore, CI can not only reflect the direction of economic fluctuations, but also measure the amplitude of economic fluctuations, thus compensating for the lack of diffusion index.

The emergence of the synthetic index has had a significant influence on the monitoring of the economic cycle fluctuations, and has become one of the basic methods to construct the economic cycle fluctuation monitoring system. From November 1968, the Commerce Department published both climate indexes D I and C I in the Business Summary (BCD).

According to the compilation principles of DI and CI, some countries have designed their own economic boom indexes, such as: Japan, Great Britain, Germany, etc. The Organization for Economic Cooperation and Development (OECD) also compiled the climate index of each member state, based on the idea of "growth cycle" in the 1970s.

In 1988, J.H. Stoke & M.H. Watson (J.H. Stock and Mark W. Watson) proposed the new concept and production method of the climate index. They believe that boom changes should not only be aimed at GNP changes, but should regard the boom cycle as a broader cycle of overall economic activities, including the financial market, labor market and commodity sales market. In order to reflect the common changes in multiple aggregate economic indicators in these aspects, it can be considered that there is a common factor behind the common changes in these variables, which can be reflected by a single, unobservable basic variable. This fundamental variable represents the total state of the economy, and its fluctuations are the real boom cycle. This unobservable fundamental variable is known as the Stock-Watson climate index, or the SWI. Subsequently, Japanese scholar Yoshiichi Mori and others made the SWI boom index suitable for the Japanese economy.

In the 1990s, the climate index method began to expand from the economic field to other fields, and the industry climate index began to play an increasingly important role in many fields such as industry analysis and prediction, macro monitoring and early warning. Among them, the diffusion index and the synthetic index are the basis and core of the climate analysis, which provide strong support to quantify the fluctuation amplitude and change trend of the index.

3. Use Cycle Theory to Study the Short-Term Relationship between Electricity and Economy Development

In addition to the long-term and stable relationship between electricity and economic development, the short-term volatility relationship is also worthy of concern. Moreover, the connection between short-term fluctuations can be essentially attributed to the relationship between periodic terms, and the short-term fluctuations have an important impact on the long-term supply and demand relationship of electric power. In different stages of economic development, economic cycle fluctuations and power cycle fluctuations have different change characteristics; when the economy spans different stages of development, it only shows that the long-term relationship cannot meet the actual needs.

Under the condition of market economy, if the power system cannot accurately grasp the profound cause of power cycle fluctuations and the mutual relationship between power cycle and macro-economic cycle, it will bring a negative impact on power planning and cannot meet the demand of the national economy for power.

Power climate analysis is based on the relevant analysis in statistics, combined with economy, finance, industry, foreign trade and other fields of mature methods, climate analysis into the power industry, through the establishment of power boom index reflects the contradiction between power supply and demand, for power planning, construction, production and operation macro control and scientific decision to provide important basic information, and then provide quantitative indicators for economic operation.

So far, little has been systematic studies of the link between Chinese power and short-term economic fluctuations. Nevertheless, a few scholars have studied the fluctuation of the power demand cycle in China.

Liang Yali [2] analyzed the fluctuation characteristics of power demand cycle in the whole

society and sub-industries; Yang Shuxia [3] used the structural time series model and the spectral analysis method to measure the power demand cycle in China, Relevant analysis and clustering analysis of our regional power demand cycle are conducted, And measured the turning point of China's electric power demand cycle; Zhang Yu and the [4] et al [4] preliminarily studied and discussed the periodic interaction relationship between urban power and economy based on the maximum entropy estimation method, It is concluded that there is a long-term balance between power consumption and economic growth in typical Chinese cities, Both urban economy and electric power consumption show the characteristics of "long wave"; They found that, There are certain differences in the economic cycle and the power consumption cycle of each typical city, Some cities are ahead of GDP over power consumption, While some other cities have power consumption ahead of the development of GDP, They believe that power load forecasting and urban planning should consider the cyclical fluctuation relationship between the economy and power consumption.

Liu Chang and high-speed railway Mei [5] established the power industry boom index using the climate analysis method, analyzed the cyclical fluctuations characteristics of the power industry since 2000, established the error correction model using monthly data, and studied the long-term economic factors and short-term dynamic adjustment effects affecting the fluctuations of the power industry. The results show that the power industry has a same trend, but the fluctuation range is different.

Wu Mingxing and Chen Qianling [6] built an industry climate index model based on big data such as electricity consumption, which also considers the macroeconomic indicators, industry economic indicators and industry electricity consumption indicators, and adopts the growth rate cycle method and time difference correlation analysis method to divide the indicators into first, consistent and lag indicators. The principal component analysis method is used to determine the weight of each index, and build the consensus index and advance index to analyze the development cycle and development trend of the industry, and then provide reference for power construction and government decision-making.

Shi Lei, Wang Ying [7] introduced the economic climate index model into power market analysis prediction, studied the climate index screening method, index pretreatment method and climate index preparation method, and based on the whole social electricity consumption, from the social economic development level and main industry economic development level, through the K-L information method to determine the power climate index, compiled the power index and the tianjin social electricity demand prediction work, make up for the lack of traditional prediction method.

Sun Runhan and other [8] have built a regional power boom early warning system framework based on multi-dimensional data such as economy, energy, power and environment. The framework mainly includes three aspects: one is to realize the function of "economy from power", mainly reflecting the macroeconomic operation status through electricity climate index and user consumption willingness index. The electricity climate index is to select the first index from the electricity consumption and expansion index, and synthesize power sentiment index is to establish power PMI according to PMI production method to reflect the macro economic prosperity situation. The second is to realize the function of "power from economy", which mainly reflects the power demand index and power industry climate index, which selects the power demand index from the key industry product output, fixed asset investment and other indicators, and then combines the power demand index. The power industry sentiment index uses the output value, total profit, accounts receivable and warning index to reflect the operation of the power industry. Third, in view that ensuring the dynamic balance of power supply and demand is the core content of the healthy operation of the power industry, the power supply and demand index is constructed to warn the gap and surplus of power supply and demand.

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