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Establishment and empirical analysis of China's macroeconomic climate index and early-warning index

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Establishment and Empirical Analysis of China's Macroeconomic Climate Index and Economic Cycle Index

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Part One. Establishment of China's Macroeconomic Climate and Economic Cycle Index

.Introduction of macroeconomic climate index

The establishment of leading indicators, coincident indicators and lagging indicators system, which is economic cycle indicators system, has been continued by intervals by several China's universities and economic research institutes since the late 1980s, who calculated leading index tentatively on the basis of economic cycle indicators system in order to get a better grasp of national economic performance. Based on China Economic Climate Research Team in Department of Integrated Statistics of National Bureau of Statistics of China, National Bureau of Statistics of China, Economic Daily and Rural Development Research Center of the State Council set up China Economic Monitoring Center（CMAC）under the leadership of Dr. Wenzhong Zhang in 1993 to execute tentative calculation of climate index, setting a precedent for China's climate empirical research. The Economic Climate Research Team in Department of Integrated Statistics of National Bureau of Statistics of China withdrew from CMAC, and founded China Economic Monitoring&Analysis Center (CEMAC), which is a professional institution to research and analyze china economic cycle fluctuation. CEMAC analyzed and selected the existing statistical data of China on the basis of the original Index System, and established preliminary China economic cycle fluctuation climate index system with site instruction of specialists from American Conference Committee and Economic Cycle Research Institute. CEMAC started the cooperation with Goldman Sachs(Asia) in 2004, and did a lot of work in indicator system adjustment, quantitative approach research, data processing and application of the index results with the reference of CEMAC Goldman Sachs Index, improving CEMAC's China macroeconomic climate index system.

.Basic analysis methods of climate cycle

There are three analysis methods of climate cycle:

1. Classic cycle method. This method focuses on the fluctuation of time series of absolute quantity, mainly on trend and cycle fluctuation.

2. Growth cycle method. This method focuses on the fluctuation of time series of relative quantity by separating trend factor from cycle factor, considers the fluctuation of cycle factor as growth cycle fluctuation.

3. Growth rate cycle method. This method focuses on the growth rate and analyzes the law of its fluctuation. This method would also analyze the fluctuation of time series of growth rate in the aspects of trend factor and cycle factor after adjusting it seasonally.

At the present time, the three methods above are respectively adopted by different countries and organizations. For instance, the USA uses classic cycle method, OECD chooses growth cycle method, Japan and most developing countries adopts growth rate cycle method. We adopt growth rate cycle method to establish our national climate monitoring indicator system for the reason that economy of China is experiencing a period of expanding with the only difference in the aspect of growth rate.

.Determination of Reference Cycle

Climate monitoring indicators can be divided into three types according to their lags: leading indicator, coincident indicator and lagging indicator. But in order to determine some indicator belongs to which type, the first thing to do is to determine the Reference Cycle. Generally speaking, we choose the economic variables that can represent the economic fluctuation and determine turning points of peak and valley,. We will introduce the approach to determine reference cycle in the following part.

1. The formation principle of the reference cycle indicators

The determination of reference cycle is a relatively difficult job. We start this work with analyzing the characteristics of economic cycle fluctuation. Economic Cycle Theory figures out that economic cycle can be observed more easily in industrial society, as a result the reference cycle of the USA is determined on the basis of manufacturing industry。

China stepped into a period of speeding-up industrialization in 1990s, and afterwards manufacturing industry plays an important role in national economy and exerts noticeable influence on economic development. Consequently, China drew lessons from the reference cycle of the USA.

2. The structure of China's reference cycle

Considering the formation principle of the reference cycle indicators as well as the four targets of macroeconomic regulation and control——growing economy, full employment, equilibrium of balance of payments and stabilization of price, the structure of the reference cycle of China economic fluctuation can be considered in the following aspects, which are also considered when the structure of coincident cycle indicators is determined.

Indicator representing production

Social gross output comprises agricultural output, industrial output and tertiary industrial output.

During the period of economic cycle fluctuation, agricultural output impacts little on the whole economy for the reason that it accounts for a small share of total economy, although its fluctuating range is quite wide. Industrial production affects economic cycle fluctuation to the largest extent, furthermore, industrial output boasts relatively complete data, resulted by the solid base of industrial statistics. Tertiary industry develops on the basis of industrial development. So we take industrial output as the representative indicator of production.

Indicator representing employment

China's performance in employment statistics has been relatively inferior. According to the existing statistics, we can only choose number of employee of industrial enterprises as the indicator to reflect the condition of employment.

Indicators representing social demand

The most important indicator to describe economic growth is GDP growth rate or GDP index, which is calculated by season and consequently not able to be used to monitor economy monthly. Therefore, we adopt the three approaches of GDP accounting: production approach, distribution approach and expenditure approach to analyze China economic cycle fluctuation. GDP by expenditure approach comprises gross capital formation(gross fixed capital formation and changes in inventories), final consumption expenditure(government consumption expenditure and household consumption expenditure) and net export of goods and services. As monthly statistical indicators, investment in fixed assets approaches to gross fixed capital formation, total retail sales of consumer goods approaches to final consumption expenditure, balance of imports and exports at customs approaches to net export of goods trade. All the aspects above constitute major aspects to evaluate economic growth, taking merely one or some of them as leading or lagging indicators is inappropriate. For example, at the present stage, China is experiencing industrialization and urbanization with a higher growth rate of investment in real estate development than that of total investment in fixed assets in the whole country, which changes prior to the whole national economy, but it is quite wrong to take investment in fixed assets as a leading indicator. Also, in the recent years, the consumption structure of local residents changes a lot as educational, health-care, employment and housing reforms penetrate gradually, so total retail sales of consumer goods can't be taken as lagging indicator even though it lags behind macro-economy, The like, the value of import or export can neither be taken as leading or lagging indicator.

Indicators representing income

It is true that the fluctuation of GDP growth is an essential factor when it comes to reference cycle determination, but we should think about more than that. China boasted a high economic growth rate from 2000 to 2002, while no individual economic entity shares profits brought by growing economy. What

accounts for this situation is that when we talk about GDP by expenditure approach, one part of gross capital formation is changes in inventories, which not only includes stocks change of finished goods, but also includes abandoned and unfinished buildings made by investment projects given up halfway. Although enterprises or individuals gain nothing from these investments, they have been calculated as a part of GDP and resulted in a meaningless higher GDP growth.

Therefore, in combination of the characteristics of China, we choose some monthly statistical indicators to study the relationship between income fluctuation and economic climate fluctuation from three stages—nation, enterprise and individual .At the national level, we adopt state revenue and state tax revenue; at the enterprise level, we adopt total profits of enterprises; at the individual level, we adopt per capita disposable income of households and expenditures for wages in cash balance of financial institutions. State tax revenue, total profits of industrial enterprises and per capita disposable income of urban households comprise the social income index to constitute the coincident indicators group.

Based on the analysis above, China's coincident index that reflects reference cycle should comprise industrial output ,employment social demand and income. To be specifically, we choose industrial production index (added value) to reflect industrial output; number of employee of industrial enterprises to reflect the current condition of employment; social demand index composed by completion of the amount of investment in fixed assets, total retail sales of consumer goods and total value of imports and exports at customs; social income index composed by state tax revenue, total profits of industrial enterprises and disposable income of urban households. Then the coincident indicator which represents China's reference cycle can be calculated from industrial production index, number of employee of industrial enterprises, social demand index and social demand index.

The most important characteristic of the establishment of China's climate indicator system is that we pay more attention to the indicators' economic meaning than their lags when we determine indicators reflecting reference cycle. The next step, on the basis of reference cycle, we determine leading indicators and lagging indicators by considering their economic meaning through time difference correlation analysis and K-L information analysis.

Time difference correlation analysis of coincident index is shown as following:

	Reference Indicator	Indicators	Lag[1]	Correlation Coefficient[2]
Coincident Index	Industrial Added	Number of Employee of Industrial Enterprises	-1	0.54

[1] The difference in time by which one observation lags behind or is later than another .
[2] A correlation coefficient is a measure of the degree to which two variables tend to move together. The coefficient has a value between plus and minus 1, which indicates the strength and direction of association.

	Value	State Tax Revenue	0	0.32
		Total Profits of Industrial Enterprises	0	0.35
		Per Capita Disposable Income of Urban Households	6	0.42
		Completion of The Amount of Investment in Fixed Assets	-1	0.5
		Total Retail Sales of Consumer Goods	6	0.51
		Total Value of Imports and Exports at Customs	0	0.5

K-L information[3] analysis of coincident index is shown as following:

	Reference Indicator	Indicators	Lag	K-L Information
Coincident Index	Industrial Added Value	Number of Employee of Industrial Enterprises	-1	11.76
		State Tax Revenue	0	63.73
		Total Profits of Industrial Enterprises	2	1471.33
		Per Capita Disposable Income of Urban Households	6	43.31
		Completion of The Amount of Investment in Fixed Assets	-1	52.76
		Total Retail Sales of Consumer Goods	12	13.88
		Total Value of Imports and Exports at Customs	-11	61

.Determination of leading indicators

1. The structure of China's leading indicators

Using leading indicators system of the USA for reference, we established the leading indicators system of China macroeconomic cycle fluctuation climate index. The indicators follows :

Hang Seng mainland freefloat index, number of investment projects in fixed assets newly started, leading index of investment in real estate (composed by floor space of commercial buildings started and area of land developed for real estate), logistics index (composed by total freight traffic and volume of freight handled in major coastal ports), industrial ratio of sales to output, money and quasi-money(M2), consumer expectation index, market interest rate spread between short-term and middle-term treasury bill.

Among the indicators mentioned above, industrial ratio of sales to output

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[3] The Kullback–Leibler information(also information divergence, information gain, or relative entropy) is a non-symmetric measure of the difference between two probability distributions P and Q. KL measures the expected number of extra bits required to code samples from P when using a code based on Q, rather than using a code based on P. Typically P represents the "true" distribution of data, observations, or a precise calculated theoretical distribution. The measure Q typically represents a theory, model, description, or approximation of P.

reflects the condition of contract orders which is adopted in the USA's system. Number of investment projects in fixed assets newly started and leading index of investment in real estate (composed by floor space of commercial buildings started and area of land developed for real estate) is similar to license. Hang Seng mainland freefloat index represents stock price. Logistics index (composed by total freight traffic and volume of freight handled in major coastal ports) indicates the operation of upper-stream leading industry. Money and quasi-money(M2), market interest rate spread between short-term and middle-term treasury bill are financial indicators that change prior to economy. Consumer expectation index reflect households' purchase intention and expectation of future economic trends.

2. Some considerations in leading Indicators determination

During the selection of leading indicators, we tend to make some mistakes. The first mistake is that paying too much more attention to statistical lag than that is really needed while the economic meaning is neglected, and consequently place leading indicators in another indicator type. The second mistake is that we make judgment of indicators' type before its economic meaning is totally figured out. Inverse indicators, such as stocks of finished goods (inventory of industrial finished goods , vacant area of real estate, and so on) change in the opposite direct of economic climate, which is to say that they descend when economy ascends and ascend when economy descends. These indicators change consistently with climate fluctuation after inversed. There are also some indicators which sometimes change oppositely with economy and sometimes consistently, such as household savings deposits and receivables. The third mistake is about policy variable, which mainly includes loans of financial institutions and public finance expenditure. According to the general rule of market economy, finance loans are profit-hunting, which means that the credit scale is regulated by monetary policy- instead of affected by economic climate condition. But in China, government owns most bank fund and exerts influence on all the aspects of credit work, credit scale shouldn't be used directly as a leading indicator in China, but incremental credit is a relatively better indicator. When it comes to public finance expenditure, we can find that government expands its expenditure to boost economic recovery when economy declines and reduces its expenditure to prevent economy from overheating. It is true that in the next economic cycle, public finance expenditure is a leading indicator, but we only monitor current economic cycle instead of next economic cycle, so public finance expenditure is a lagging indicator.

In summary, the economic meaning of indicator is the most important thing to be considered when we select a leading indicator. Frankly speaking, we hardly or don't use an indicator which doesn't lead in the aspect of economic meaning. Furthermore, goodness-of-fit test by quantitative methods is a necessary step. If a group of leading indicators in economic meaning couldn't pass the goodness-of-fit test, or peaks or valleys didn't match well, the leading

index composed by these indicators would perform to an inferior level in its leading function. At the same time, the leading index would be of weaker economic meaning when it is composed by some indicators that merely pass the goodness-of-fit test but without leading economic meaning.

Time difference correlation analysis of leading index is shown as following:

	Reference Indicator	Indicators	Lag	Correlation Coefficient
Leading Index	Coincident Index	Hang Seng Mainland Freefloat Index	-9	0.62
		Industrial Ratio of Sales to Output	-9	0.43
		Money and Quasi-Money(M2)	-3	0.66
		Number of Investment Projects in Fixed Assets Newly Started	-12	0.04
		Total Freight Traffic	-12	0.13
		Volume of Freight Handled in Major Coastal Ports	-12	0.11
		Area of Land Developed For Real Estate	-1	0.38
		Floor Space of Commercial Buildings Started	-12	0.38
		Consumer Expectation Index	-11	0.57
		Market Interest Rate Spread Between Short-term and Middle-term Treasury Bill	12	-0.01

K-L information analysis of leading index is shown as following:

	Reference Indicator	Indicators	Lag	K-L Information
Leading Index	:Coincident Index	Hang Seng Mainland Freefloat Index	-12	1444.44
		Industrial Ratio of Sales to Output	-8	8.42
		Money and Quasi-Money(M2)	-3	8.56
		Number of Investment Projects in Fixed Assets Newly Started	-10	332.26
		Total Freight Traffic	-12	40.01
		Volume of Freight Handled in Major Coastal Ports	-12	27.23
		Area of Land Developed For Real Estate	-1	1065.43
		Floor Space of Commercial Buildings Started	-12	311.53
		Consumer Expectation Index	-11	10.26
		Market Interest Rate Spread Between Short-term and Middle-term Treasury Bill	-	-

Ⅴ.Determination of lagging Indicators

The determination of lagging indicators is relatively easier. According to the definition of recession, we select indicators following as lagging indicators:

short-term loans to non-agricultural sector, public finance expenditure (debt excluded), household savings deposits, consumer price index and inventory of finished goods produced by industrial enterprises above designated size.

Time difference correlation analysis of lagging index is shown as following:

	Reference Indicator	Indicators	Lag	Correlation Coefficient
Lagging Index	Coincident Index	Public Finance Expenditure(Debt Excluded)	7	0.02
		Short-term Loans to Non-agricultural Sector	12	0.57
		Household Savings Deposits	12	0.51
		Consumer Price Index	9	0.83
		Inventory of Finished Goods Produced by Industrial Enterprises Above Designated Size	6	0.77

K-L information analysis of lagging index is shown as following:

	Reference Indicator	Indicators	Lag	K-L Information
Lagging Index	Coincident Index	Public Finance Expenditure(Debt Excluded)	7	80.21
		Short-term Loans to Non-agricultural Sector	12	32.01
		Household Savings Deposits	12	35.95
		Consumer Price Index	9	7.08
		Inventory of Finished Goods Produced by Industrial Enterprises Above Designated Size	7	11.55

Ⅵ. Changes in statistical scope, seasonal adjustment and price index adjustment

1. Changes in statistical scope

The specific adjustment method is to determine the base year of time series of absolute quantity under the consideration of several adjustments in recent years, then to calculate the figures backward and forward through the growth rates and index published by statistical authorities until all the data start from January,1990.

Part of changes in statistical scope is shown as following:

Leading indicators	Current statistical scope	Changes in statistical scope
Ratio of sales to output	Industrial enterprises with an annual revenue over 5,000,000 CNY	(Before 2007) All state-owned enterprises, and non-state-owned industrial

		enterprises with an annual revenue over 5,000,000 CNY
Money supply(M2)	Money and quasi-money	Standard adjusted in 2002
Projects newly started	Urban investment projects in fixed assets with a scale over 500,000 CNY	(Before 2004) State-owned investment and investment projects in fixed assets with a scale of over 500,000 CNY (Before 1997) State-owned investment and investment projects in fixed assets with a scale over 50,000 CNY
Coincident indicators		
Industrial production index	Industrial enterprises with an annual revenue over 5,000,000 CNY	(Before 2007) All state-owned enterprises, and non-state-owned industrial enterprises with an annual revenue over 5,000,000 CNY
Number of employee of industrial enterprises	Industrial enterprises with an annual revenue over 5,000,000 CNY	(Before 2007) All state-owned enterprises, and non-state-owned industrial enterprises with an annual revenue over 5,000,000 CNY
Investment in fixed assets	Urban investment projects in fixed assets with a scale over 500,000 CNY.	(Before 2004) State-owned investment and other investment projects in fixed assets with a scale over 500,000 CNY (Before 1997) State-owned investment and other investment projects in fixed assets with a scale over 50,000 CNY
Lagging indicators		
Consumer price index	Currently 8 categories: food; tobacco, liquor and articles; clothing; household facilities, articles and services; health	In 2001, the category "tobacco, liquor and articles" was added, and the category "services" was removed.

	care and personal articles, transportation and communication; recreation, education and culture articles; residence	
Finished goods inventory of industrial enterprises	Industrial enterprises with an annual revenue over 5,000,000 CNY	(Before 2007) All state-owned enterprises, and non-state-owned industrial enterprises with an annual revenue over 5,000,000 CNY

2. Seasonal Adjustment

It is the X11 seasonal adjustment that we adopt to execute seasonal adjustment. But there are some matters that we should pay attention to when we do it. The seasonal adjustment is to adjust absolute quantity of monthly or quarterly data, afterwards, the data can be used for model construction.

The two series, growth rate over the same period last year and the index based on the same period last year, have eliminated some of seasonal factors preliminarily, so they can't be simply seasonally adjusted, otherwise, seasonal factors will be eliminated for a second time. In order to gain the growth rate over the same period last year we need to seasonally adjust the absolute quantity series firstly, then we calculate its growth rate.

The adjustment for the Spring- festival factor seems to be very easy but it is actually quite difficult. The Spring -festival factor mainly exerts influence on industry, investment, business and service industry. Take industry as an example, the Spring- festival factor affects less when heavy industry accounts for a considerable proportion of it, and vice versa. For business and service industry, the conditional factors are more complicated. The earlier the data concerns, the more important role the Spring -festival factor plays , and vice versa. So although theoretical and methodological research is necessary, it is difficult to handle in practical work. Generally speaking, part of the Spring -festival factor is eliminated as seasonal factor while the other part as random factor.

3. Price index adjustment

In China's current climate index system, the adjustment of price factor is not that important. Price factor is not taken into consideration when we compose business cycle signal. But we attempt to eliminate price factor of data in terms of value by price index during research.

Ⅶ. Changes in indicator system of China's macroeconomic climate index .

Changes in indicator system of China's macroeconomic climate index in recent years are shown as following:

Leading Indicator			
Before August 2004	**From August 2004 to May 2005**	**From June 2005 to December 2005**	**From January 2006**
Turnover of A Shares of Shanghai Stock Exchange	Turnover of A Shares of Shanghai Stock Exchange	Hang Seng Mainland Freefloat Index (HSMLFI)	Hang Seng Mainland Freefloat Index (HSMLFI)
Stock amplitudes of A Shares of Shanghai Stock Exchange	Stock amplitudes of A Shares of Shanghai Stock Exchange	Ratio of Sales to Gross Output Value	Ratio of Sales to Gross Output Value
Ratio of Sales to Gross output value	Ratio of Sales to Gross Output Value	Money supply (M2)	Money supply (M2)
Projects Newly Started	Projects Newly Started	Projects Newly Started	Projects Newly Started
Floor Space of Commercial Buildings Newly Started	Floor Space of Commercial Buildings Newly Started	Floor Space of Commercial Buildings Newly Started	Logistics Index
Logistics Index	Logistics Index	Logistics Index	Among which: Total Freight Traffic
Among which: Total Freight Traffic	Among which: Total Freight Traffic	Among which: Total Freight Traffic	Volume of Freight Handled in Major Coastal Ports
Volume of Freight Handled in Major Coastal Ports	Volume of Freight Handled in Major Coastal Ports	Volume of Freight Handled in Major Coastal Ports	Leading Index of Investment in Real Estate
Building Materials Production Index	Contracted Value of Foreign Direct Investment	Contracted Value of Foreign Direct Investment	Among which: Area of Land Developed For Real Estate
Among which: Cement production	Consumer Expectation Index	Consumer Expectation Index	Floor Space of Commercial Buildings Newly Started
Steel Production	Market Interest Rate	Market Interest Rate	Consumer

	Spread Between Short-term and Middle-term Treasury Bill	Spread Between Short-term and Middle-term Treasury Bill	Expectation Index
Wood Production			Market Interest Rate Spread Between Short-term and Middle-term Treasury Bill
Contracted Value of Foreign Direct Investment			
Consumer Expectation Index			
Imported Equipment and goods Used as Investment by Foreign Funded Enterprises			
Coincident Indicators			
Before August 2004	**From August 2004 to May 2005**	**From June 2005 to December 2005**	**From January 2006**
Industrial Production Index	Industrial Production Index	Industrial Production Index	Industrial Production Index
Money Supply (M1)	Money Supply (M2)	Number of Employee of Industrial Enterprises	Number of Employee of Industrial Enterprises
Social Income Index	Social Income Index	Social Income Index	Social Income Index
Among which: Total Government Revenue	Among which: Total Government Revenue	Among which: State Tax Revenue	Among which: State Tax Revenue
Profits of Industrial Enterprises	Profits of Industrial Enterprises	Profits of Industrial Enterprises	Profits of Industrial Enterprises
Per Capita	Per Capita	Per Capita	Per Capita

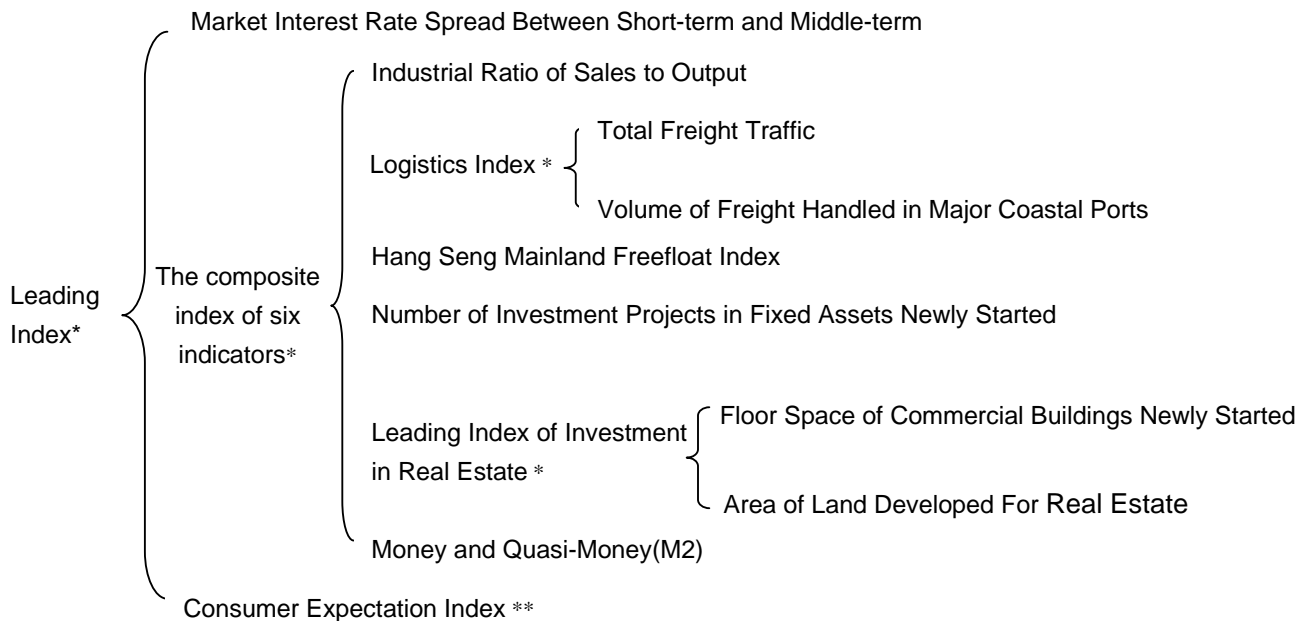|			
Disposable Income of Households	Disposable Income of Households	Disposable Income of Households	Disposable Income of Households
Social Demand Index	Social Demand Index	Social Demand Index	Social Demand Index
Among which: Investment in Fixed Assets	Among which: Investment in Fixed Assets	Among which: Investment in Fixed Assets	Among which: Investment in Fixed Assets
Total Retail Sales of Consumer Goods	Total Retail Sales of Consumer Goods	Total Retail Sales of Consumer Goods	Total Retail Sales of Consumer Goods
Total Value of Imports and Exports at Customs	Total Value of Imports and Exports at Customs	Total Value of Imports and Exports at Customs	Total Value of Imports and Exports at Customs
Lagging Index			
Before August 2004	**From August 2004 to May 2005**	**From June 2005 to December 2005**	**From January 2006**
Public Finance Expenditure	Public Finance Expenditure	Public Finance Expenditure	Public Finance Expenditure
Loans to Industrial and Commercial Sector	Loans to Industrial and Commercial Sector	Loans to Industrial and Commercial Sector	Short-term Loans to Non-agricultural Sector
Household Savings Deposits	Household Savings Deposits	Household Savings Deposits	Household Savings Deposits
Consumer Price Index	Consumer Price Index	Consumer Price Index	Consumer Price Index
Finished goods inventory of industrial enterprises	Finished goods inventory of industrial enterprises	Finished goods inventory of industrial enterprises	Finished goods inventory of industrial enterprises

Research department of Goldman Sachs (Asia), one of partners of we China Economic Monitoring & Analysis Center, proposed that climate index should contain more information, and that political factor tends to contribute crucially to China's economic development and consequently it shouldn't be

eliminated as a random factor. As a result, we amended the method of seasonal adjustment from eliminating seasonal and random factor to merely eliminating seasonal factor. We execute three-step moving average to smooth climate index series because that this amendment intensifies the fluctuation of climate index.

Ⅷ. Compilation of climate index

1. Compilation of leading index

Leading index is composed of the twelve leading indicators as are chosen in the preceding part of the essay. These twelve leading indicators can be divided into three levels, The structure is shown as following[4]:

Market Interest Rate Spread Between Short-term and Middle-term

Industrial Ratio of Sales to Output

Logistics Index *
Total Freight Traffic
Volume of Freight Handled in Major Coastal Ports

Hang Seng Mainland Freefloat Index

Number of Investment Projects in Fixed Assets Newly Started

Leading Index of Investment in Real Estate *
Floor Space of Commercial Buildings Newly Started
Area of Land Developed For Real Estate

Money and Quasi-Money(M2)

Leading Index*

The composite index of six indicators*

Consumer Expectation Index **

The first level is to calculate the logistics index and the leading index of investment in real estate. The logistics index is composed by total freight traffic and volume of freight handled in major coastal ports. The leading index of investment in real estate is composed by floor space of commercial buildings newly started and area of land developed for real estate. In the composition of leading index, the logistics index and the leading index of investment in real estate are of the same weight.

The second level is to calculate the composite index of six indicators needing seasonal adjustment, which is also called the composite index of six indicators. These indicators include Hang Seng mainland freefloat index, number of investment projects in fixed assets newly started, industrial ratio of sales to output, money and quasi-money (M2), logistics index and leading index of investment in real estate, with a total weight of six. These six indicators are adjusted seasonally, then the month-on-month growth rates

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[4] The indices with "*" are calculated by composite index method. The indexes with "**" don't need seasonal adjustment.

worked out are used to compile climate index in classic cycle method. We can also adjust these six indicators seasonally to calculate growth rate over the same period of last year.
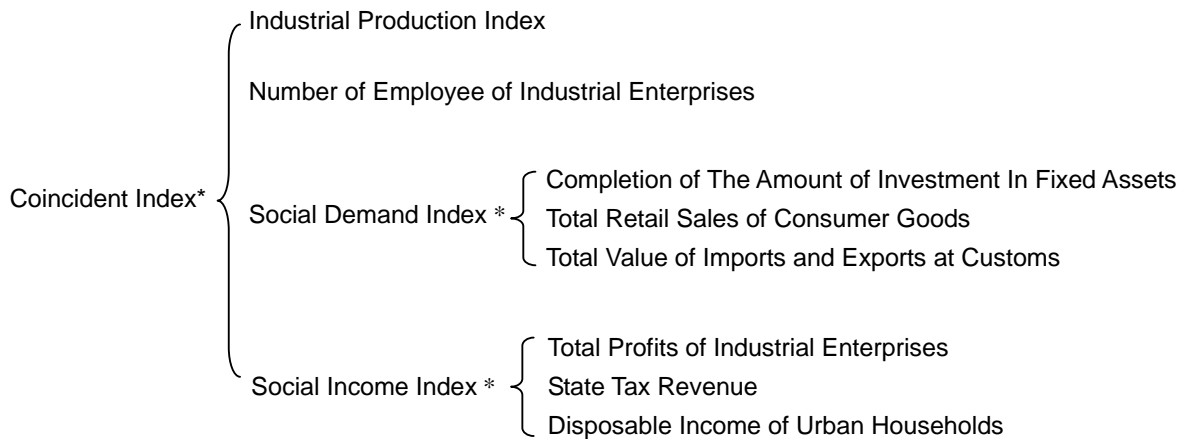
The third level is to calculate the leading index, which is composed by composite index of six indicators, market interest rate spread between short-term and middle-term treasury bill and consumer expectation index. We calculate the growth rate over the same period last year of the composite index of six indicators first, which is used with market interest rate spread between short-term and middle-term treasury bill and consumer expectation index(without seasonal adjustment or growth rate over the same period last year calculation) to calculate the leading index, the total weight of the three indicators is three.
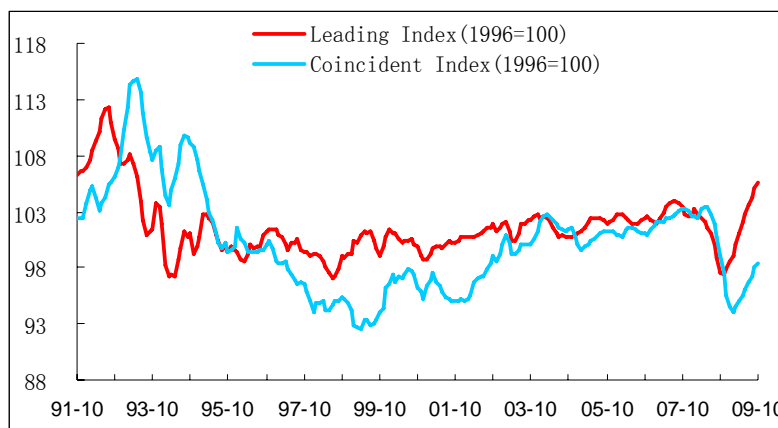
Macroeconomic Climate Coincident Index and Leading Index

2. Compilation of Coincident Index

Coincident index is composed of the eight coincident indicators chosen in the preceding part of the essay. These eight coincident indicators can be divided into two levels, the structure is shown as following[5]:

Coincident Index*
- Industrial Production Index
- Number of Employee of Industrial Enterprises
- Social Demand Index *
  - Completion of The Amount of Investment In Fixed Assets
  - Total Retail Sales of Consumer Goods
  - Total Value of Imports and Exports at Customs
- Social Income Index *
  - Total Profits of Industrial Enterprises
  - State Tax Revenue
  - Disposable Income of Urban Households

The first level is to calculate social demand index and social income index.

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[5] The index with "*" is calculated by composite index method.

Social Demand Index is composed by completion of the amount of investment in fixed assets, total retail sales of consumer goods and total value of imports and exports at customs, respectively with the weight of 1, 1.2 and 0.8.   Social income index is composed to reflect income by state tax revenue, total profits of industrial enterprises and disposable income of urban households with the weight respectively of 0.8, 1 and 1.2.

The second level is to calculate coincident index. We compose industrial production index, number of employee of industrial enterprises, social demand index and social income index, with the weight respectively 0.59, 0.50, 1.63 and 1.28.

3. Compilation of Lagging Index

Without divisions of levels, it is relatively easier to compile lagging index .The only point needed to pay attention to is that the consumer price index can be used directly after seasonal adjustment. The total weight of lagging indicators is 5.
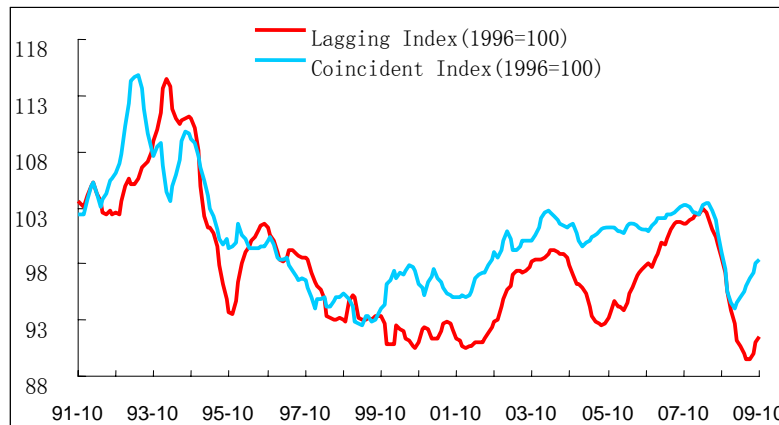
Macroeconomic Climate Coincident Index and Lagging Index

The result of calculation illustrates that the lagging indicators generally has an average time lag of five or six months following the coincident index. The time lag is stable under common conditions. But this relationship of time lag might be interrupted because of some non-economic factors.

Weights of macroeconomic climate indicators are shown as following:

Leading indicators	Weight
Leading Six Indicators Composite Index	**2.36**
Hang Seng Mainland Freefloat Index (HSMLFI)	0.60
Ratio of Sales to Gross Output Value	1.15

Money Supply (M2)	1.20
Projects Newly Started	1.20
Logistics Index	1.05
Among which: Total Freight Traffic	1.00
Volume of Freight Handled in Major Coastal Ports	1.00
Leading Index of Investment in Real Estate	0.80
Among which: Area of Land Developed For Real Estate	1.00
Floor Space of Commercial Buildings Newly Started	1.00
Consumer Expectation Index	**0.28**
Market Interest Rate Spread Between Short-term and Middle-term Treasury Bill	**0.36**
Coincident Indicators	
Industrial Production Index	**0.59**
Number of Employee of Industrial Enterprises	**0.50**
Social income index	**1.28**
State Tax Revenue	0.80
Profits of Industrial Enterprises	1.00
Per Capita Disposable Income of Households	1.20
Social Demand Index	**1.63**
Investment in Fixed Assets	1.00
Total Retail Sales of Consumer Goods	1.20

Total Value of Imports and Exports	0.80
Lagging Index	
Public Finance Expenditure	**0.68**
Short-term Loans to Non-agricultural Sector	**1.09**
Household savings deposits	**0.67**
Consumer Price Index	**1.05**

IX The construction of the Business Cycle Signal system and Macro-economic Monitoring Indicators

The Business Cycle Signal system is the signal showing the different level of economic performance: "the red light" indicates the overheated economy, "the yellow light" indicates the likely heating economy, "the green light" indicates the normal economic performance, "the light blue light" indicates the likely cool economy and "the blue light" indicates the cool economy. As part of the Macro-economic Climate Indices, the business cycle signal will make up for the insufficient descriptions of economic operational situation reflected by the coincident index, especially for the emerging economy of China.

1. The Indicator selection

1.1 The principles for Indicator selection

The selection of monitoring indicators is the first element which can decide the scientific level of the Business Cycle Signal system. Therefore, some principles need to be taken notice:

Importance: that is, mainly taking the importance of indicator variation to the whole economic development in to account, while the coincidence requirement can be achieved by coincidence index. (Based mainly on coincidence index), the discrepancy caused by inconsistent indicator will be eliminated by the definition of critical value.

Sensitivity: that is sensitive to economic fluctuation.

Stability: while dividing the variation range of selected indicator into different stage, the dividing principle is sustained and stable.

Feasibility: It means the indicators can be attained form present national accounts system, and not only for theoretical discussion.

1.2The selected monitoring indicators

According to the principles mentioned above, 3 monitoring indicators----Loans of Financial Institutions, Money and Quasi-money(M2) and Consumer Price Index are added to the coincidence indicators group of economic climate index, Industrial Employed Persons is removed, and Total

Tax Revenues is substituted for Total Government Revenue as a reflection of governmental income, because it includes not only tax revenue, but also Non-tax Revenue. Finally, 10 indicators are chosen as the monitoring indicators and constitute out National Business Cycle Signal System.

<p align="center" style="color:red">Business Cycle Signal System.</p>

Business Cycle Signal System	Industrial Production
	Investment in Fixed Assets
	Total Retail Sales of Consumer Goods
	Total Value of Imports and Exports
	Total Government Revenue
	Total Profits of Industrial Enterprises
	Per capita Disposable Income of Urban Households
	Loans of Financial Institutions
	Money and Quasi-money(M2)
	Consumer Price Index

We can see that the Business Cycle Signal System includes not only the coincidence indicators, but also leading indicators and lagging indicators. This is the most important difference between Business Cycle Signal System and Macro-economic Climate Indices. The Business Cycle Signal System emphasize on indicators' importance and contents that to what extent it related the economy, while the Macro-economic Climate Indices highlights the time relation.

2. Division of different stage and definition of critical value

Division of different stage of the monitoring indicators is to divide macro-economic variation into several levels. Critical value is a quantity stander for the judgment of all the monitoring indicators and comprehensive economic climate situation. Division of different stage and definition of critical value is a critical element which can decide the scientific level of the Business Cycle Signal System.

2.1 Division of different stage

According to the economic development trajectory in 30 Years since the Reform & Opening Up policies has been made, we divide our economic situation into 5 stages: "overheated economy", "likely heating economy", "normal economy", "likely cool economy", and the "cool economy", which are represented respectively by the "red light", "yellow light", "green light", "light blue light", and "blue light". The "green light" is in the middle which stands for regular or stable stage.

2.2 Definition of critical value each indicator

Definition of critical value each indicator plays an important role in the building of the Business Cycle Signal System and it is a very complicated and

painstaking work. Tow principles must be obeyed: first of all, defined the average line with the historical data of each indicator and make the average line as the center of normal stage. Then define the critical value according to the probability that the indicator appeared at different area. Secondly, if there is not enough time series or the economy experiences a long abnormal stage, it's time to delete the outlier, redefine the average line and adjust the critical value.

Define the critical value according to the probability that the indicator appeared at different area. The reasons are as follows: first, the principle of "the green light" is in the middle. The "green light" stands for normal stage, the probability that the indicator appeared is between 40%－60%, and we choose 50%. Secondly, the "red light" and "blue light" areas stand for drastic stages, which respectively indicate the "overheated economy" and the "cool economy", and the probability are both up to 10%.So we choose 10% for them. At last, the "yellow light" and the "light blue light" area are relatively stable and respectively indicates "likely heating economy" and "likely cool economy", and the probability are higher than drastic stages, so we choose 15% for the two areas.

judging form the economic situation, delete the outlier, adjust the average line and the critical value, redefine the probability that the indicator appeared at different area, make sure it's consist with the economic situation and decide the final critical value. While defining the critical value of other indicators apart from the standard indicator, it's also need to take the critical value of standard indicator into account. For example, the critical value of constant price indicators should be consist with the standard indicator (at least the variation extent is simultaneous), while the current price indicators should add the inflation fluctuation. What's more, economic theories and practice need to be considered.

3.Define the critical value

The average line of the "green light" area is N×3(N means the quantity of indicators);

The dividing line for the "green light" area and the "light blue light" area is N ×（3+2）/2(that is, the quantity of indicators which appears at the "green light" area and the "light blue light" area is half-and-half);

The dividing line for the "green light" area and the "yellow light" area is N× （3+4）/2(that is, the quantity of indicators which appears at the "green light" area and the "yellow light" area is half-and-half);

The dividing line for the "light blue light" area and the "blue light" area is（N ×2）-1(all the indicators appear at the "light blue light" area while anyone appears at the "blue light" area);

Indicators and the critical value of

Business Cycle Signal System of CEMAC

	overheated ≥		> likely heating >		≥ normal ≥		> likely cool >		≥ cool	weight
Industrial Production		18.4		16.4		10.7		8.85		1.2
Investment in Fixed Assets		45		30		15		11		1
Total Retail Sales of Consumer Goods		28.9		18.3		9.34		7.2		1.2
Total Value of Imports and Exports		34.34		26.84		10.83		2.9		0.8
Total Government Revenue		28.12		24		11.02		4		0.8
Total Profits of Industrial Enterprises		223.88		47.05		2.33		−12.7		1
Per capita Disposable Income of Urban Households		17.66		13.44		8.72		4.4		1.2
Loans of Financial Institutions		24.73		22.92		13.3		10		0.8
Money and Quasi-money(M2)		30.58		23.4		14.97		14.13		0.8
Consumer Price Index		118		108		100		99		1.2
Business Cycle Signal		41		35		25		19		–
Business Cycle Signal (standardization)		136.7		116.7		83.3		63.3		–

4. The calculation of Business Cycle Signal

According to the critical value of each monitoring indicators, we can define their stage by different operation situation, and then give them a score. Add them up and we get the Business Cycle Signal.
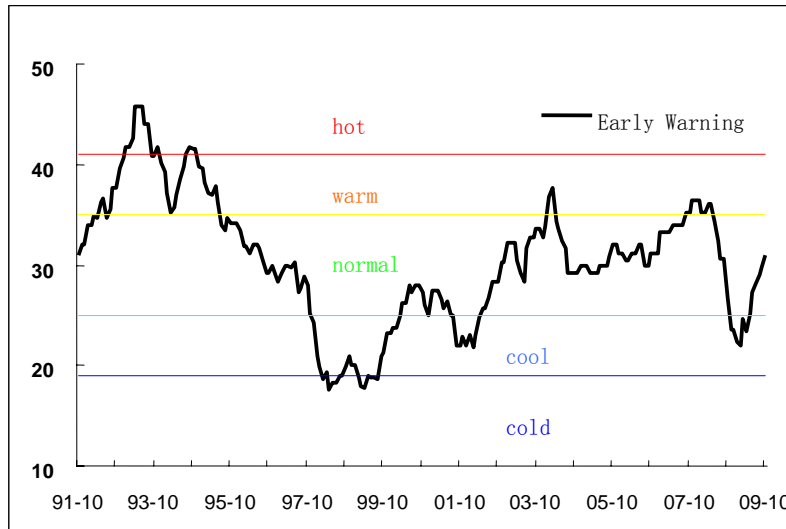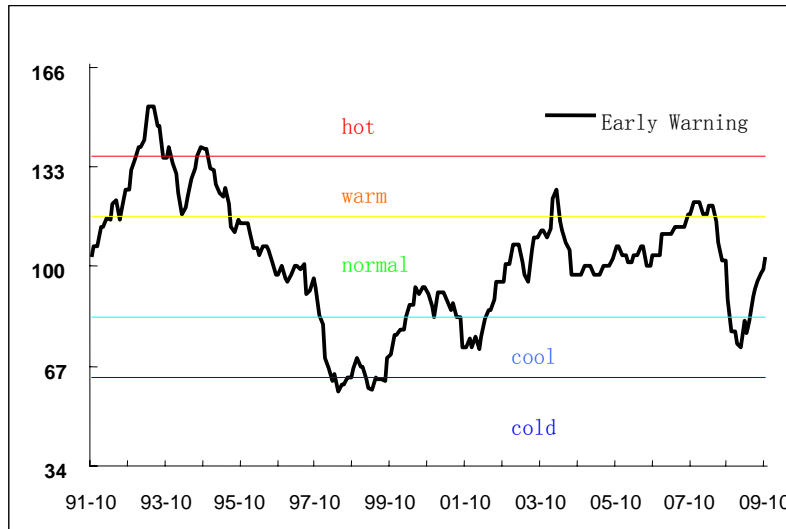
The Tendency of Business Cycle Signal

5. The standardization of Business Cycle Signal

Monitoring lights are all using scores to indicate the operation status of comprehensive economic climate and individual indicators. There are two kinds of principles to mark at present. One is give 1-5 to each indicator, and the score of comprehensive economic climate is the sum of each indicator's score. CEMAC is using this method. The other one is define 100 as the maximum (extremely overheated) of comprehensive economic climate, then divided other macro-economic climate stages into different percentage, and making the relative indicators.

Both methods have advantages and disadvantages. Taking the 10 indicators of Business Cycle Signal for example, the maximum score is 50, and over 41 means economic overheated. However, the score can't reflect the economic stages. For the second method, the full mark is 100, and it means economy is extremely overheated, but it's quite different from the Macro-economic Climate Indices which defines 100 as the dividing line.

To make the Business Cycle Signal more comparable and direct, we standardized it through certain method as follows: first of all, using the first method mentioned above calculate the Business Cycle Signal and then do the standardization. The formula is: Business Cycle Signal(standardization)=Business Cycle Signal/（3×N）×100，that is divided by the figure, which is the average line of the "green light" area of the Business Cycle Signal. Therefore, 100 is the most proper level for Business Cycle Signal(standardization), and can be compared with Macro-economic Climate Indices. We can also use the sane method calculate the standardized critical value.

6. The Tendency of Business Cycle Signal(standardization)

Whether the Business Cycle Signal is reasonable or not need to be further confirmed. Usually, we use the curve line and the peak and valley scores of both coincident index and Business Cycle Signal to examine. Although the coincident index is consist of coincident indicators while Business Cycle Signal highlights the economic representativeness of each indicator and the total scores(could and must bring in some non-coincident index), and the calculation methods of the two index are completely different, both of them are a comprehensive index which can reflect the present economic condition. The Business Cycle Signal not only reflects the economic tendency, but also more directly reflects the present economic situation. Therefore, the trend of both index curve line should be exactly the same. To be specifically, the peak and valley scores of both coincident index and Business Cycle Signal should be corresponding, correlation coefficient is greater than 0.9, and reference indicator should be between ±1.
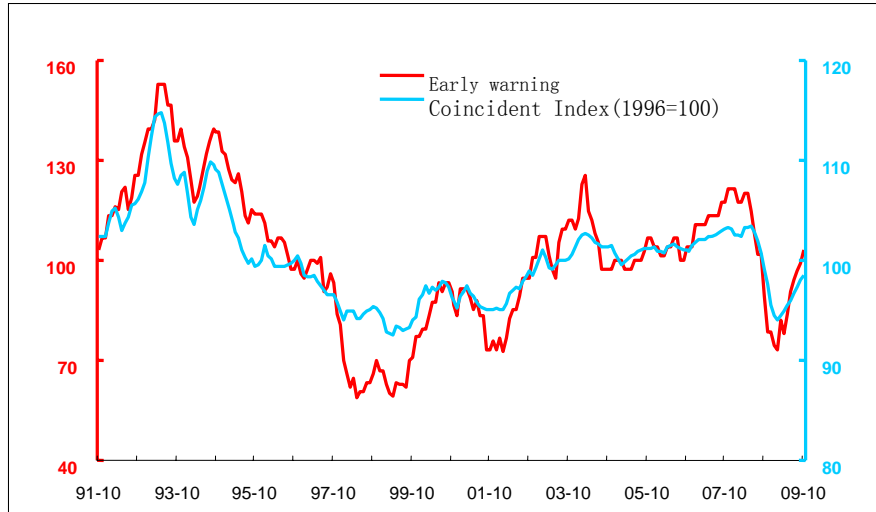
The Tendency of Macro-economic Climate Coincident Index&Business Cycle Signal

Finally, we find the time difference correlation coefficient between coincident index and Business Cycle Signal is 0.94, and the time lag is 0. To our point of view, the tendency of Business Cycle Signal and coincident index are the same and it confirms that the Business Cycle Signal is scientific and reasonable.

Part Two An Empirical Study on Macro-economic Climate Indices and Business Cycle Signal

Ⅰ. Analysis on the tendency of Macro-economic Climate Indices, Business Cycle Signal and GDP

As mentioned above, Macro-economic Climate Indices and Business Cycle Signal are all comprehensive index that reflects the present economic development condition, so they are inevitably compared with GDP, an indicator which reflects the economic aggregate.

Making comparison among Coincidence Index, Business Cycle Signal (using 3 months' simple arithmetic average figure to get quarterly data) and quarterly DGP, just see the picture below:
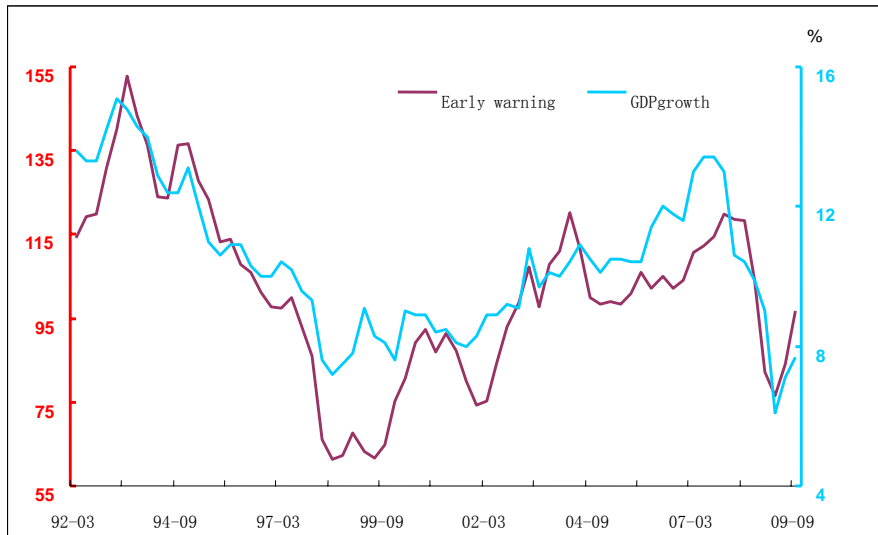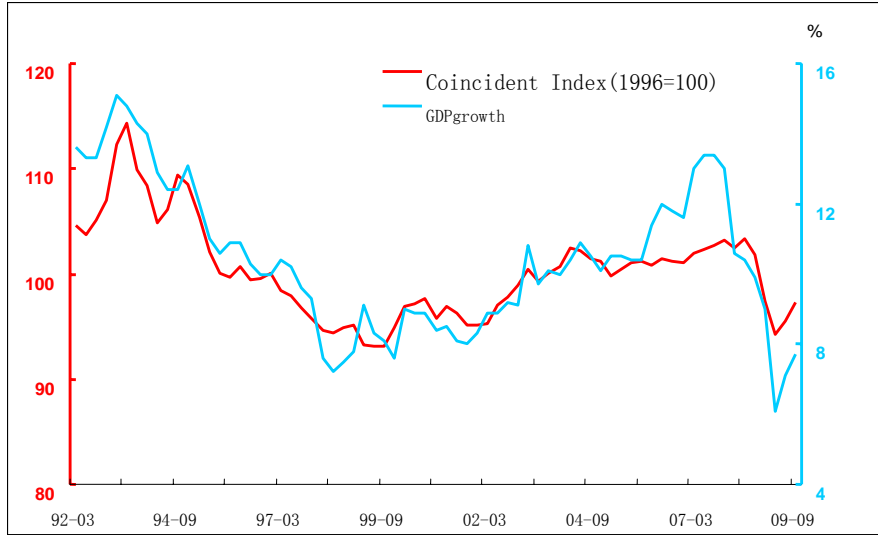
It's obvious that, the development tendency of Coincidence Index, Business Cycle Signal and GDP are almost the same. Then we analyze them with time difference correlation coefficient analysis method, and find out that when the three figures fluctuate spontaneously, correlation coefficient achieves its maximum.

	reference indicator	time lag	correlation coefficient
Coincidence Index	GDP Growth Rate	0	0.91
Business Cycle	GDP Growth Rate	0	0.88

Therefore, it comes to the conclusion that: as the Coincidence Index and Business Cycle Signal are consist of indicators which are more comprehensive and representative than GDP, they can reflect not only the fluctuation of economic aggregate but also the structure of economic growth. What's more, the two indices are monthly monitoring data while GDP is quarterly data, and can be used for economic analysis when GDP data is not available. Therefore, the construction of the Macro-economic Climate Coincident Index and the Business Cycle Signal system are quite useful and helpful.

Ⅱ. The guidance from Macro-economic Climate Indices and the Business Cycle Signal system for Chinese economic monitoring

Scholars, investors and other business man pay close attention to the Macro-economic Climate Indices and the Business Cycle Signal since they are published on the database of National Bureau of Statistics of China in 2006. The data will be quickly used by some famous Chinese media the first time after it published, and have great influence on the society, especially in the second half of 2008, Chinese economic growth rate sharply decline and the debate about the time when our economy will bottom out never cease. However, CEMAC constructed the Macro-economic Climate Indices which reflected the economic recovery process the very first.

The Leading index of the Macro-economic Climate Indices rebounded firstly and has been upgraded since Dec.2008. The coincidence index also has rebounded since Mar.2009. This tendency was confirmed by the quarterly GDP data and also the Lagging index which has been upgraded since Jul.2009, and implied the economy was bottom up.

Ⅲ. Problems on for Macro-economic Climate Indices and the Business Cycle Signal system

At present, our national statistic system is not perfect enough, statistic scope is not widespread enough and the time series is not long enough, which can't be solved in a short time. And those imperfections brought intractability for the construction of Macro-economic Climate Indices and the Business Cycle Signal system. Take the unemployment rate as an example, on the one hand, we only have the data for registered unemployment rate in cities and towns, which can't fully reflect the economic meaning of unemployment rate; on the other hand, it's just a yearly data. Look at the data about enterprises contracted oders and PMI which is paid close attention by the society, these indicators are all of leading meaning for economy, but the time series are not long enough and we just collect the data from 2005. Therefore, they can be included into the Macro-economic Climate Indices.

Normally speaking, time lag relationship of the leading index and coincidence index is relatively stable, and the leading index is 8-9 months ahead of coincidence index. The relationship doesn't exist under non-economic influence, as the marketization level of Chinese economy is limited and the macro-control policies have great influences. For example, the influence of SARS on macro-economy in 2003 and the macro-control policies to avoid economic growth rate being too fast, and we deal with such natural unpredictable factor or policy change as random factor. Under such circumstances, leading index may not have leading and forecasting function. It also influence the lagging index the same, and also the time relationship between lagging index and coincidence index. If that, the prediction on the future economic development tendency will be questioned.

	reference indicator	time series	time lag	correlation coefficient
Leading Index	Coincidence Index	1991.01 until now	-9	0.75
		2002.01 until now	-4	0.87

Ⅳ.Prediction on the economic tendency next year based on the Macro-economic Leading Index

The leading index strongly increased for months, and the marginal utility effect of government stimulus package is diminishing unless new stimulate policy has been installed, so the leading index can't keep on upward while coincidence index is bouncing back but not to a high extent and some indicators rebounced quickly result from the number of the same period of last year is small. Taking the effort made on consolidating the economic foundation, the coincidence index is supposed to increase in the next months. Our prediction on Chinese economic growth in 2010 is "fast to stable", to be specific, the economy upgraded rapidly during the first half of 2009 and slowed down in the last 6 months and keep stable. The possibility for a second economic downturn does not exist.

According to the judgment above, we predict the growth rate of GDP for next year is 9.4, Investment in Fixed Assets is 29.5% and CPI is around 2.6-3.2%.