# China's Business Cycles and Early Warning Indicators

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## Abstract

We developed an early warning indicator of China economy which quickly forecast economic downturns. We determined peaks and troughs of China's business cycles by the Composite Index (CI) that is produced by The China Economic Monitoring and Analysis Center (CEMAC). Using the information of peaks and troughs, we developed the indicator that forecast the business conditions one year ahead by probit model. According to this indicator, China's economy could be in recession by as early as the first half of 2008. The reasons of recession are inflation, the over valued stock market price, and slowdown of United States' economy.

**Introduction**

With so much attention focused on China's economy, analysis of short-term trends has become all the more important. However, few essays have been written that offer analysis of China's business cycles. In this paper we explain the indicators necessary for understanding these business cycles and outline an early warning indicator we have created to quickly forecast economic downturns.

**1. The Three Types of Business Cycle**

The term business cycle refers to the repeated fluctuations between periods of vigorous economic activity and periods of economic stagnation.

There are three main types of business cycle: the classical cycle, the growth cycle, and the growth rate cycle. The classical cycle refers to repeated fluctuations around a certain steady state and makes no assumption of economic growth. When business conditions are gauged using an economic indicator according to a classical cycle, the lowest value of the indicator indicates a trough in the cycle (shown by point B in Figure 1 below), while the highest value marks a peak (point F).

The growth cycle, meanwhile, refers to repeated fluctuations around a growth trend. This method defines the business cycle based on how far a particular economic indicator strays from the trend. With this method, the point furthest from the trend on the low side represents a cyclical trough (point C), and the point furthest from the trend on the high side represents a peak (point E).

The growth rate cycle assumes that the growth rate of an economic indicator is cyclical. There are periods of high and low growth; the growth rate at its lowest point represents a trough in the economic cycle (point A), and the growth rate at its highest point represents a peak (point D).

In general, troughs register later in the growth cycle than in the classical cycle, but peaks appear earlier. With the growth rate cycle, there is a tendency for both the troughs and peaks to come earlier than in the other cycles.

Even if a single indicator is used to determine economic peaks and troughs, the timing of the peaks and troughs will vary depending on which type of business

**Figure 1 The Three Types of Business Cycle**
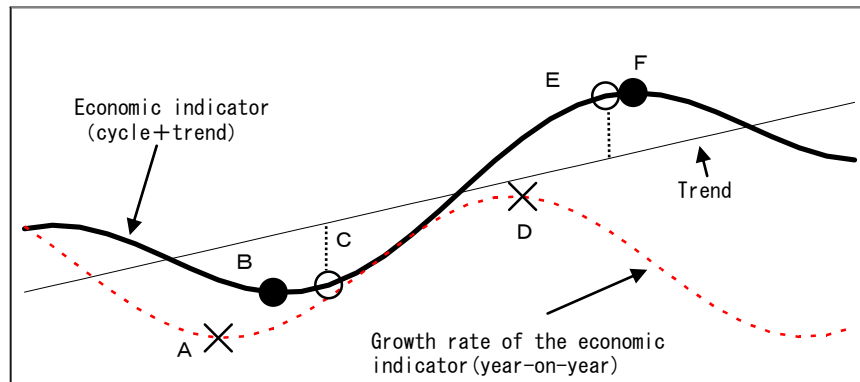


cycle is applied. Of the business indexes introduced below, the China Economic Monitoring and Analysis Center diffusion index and the Japan Center for Economic Research's business index provide growth rate cycles, while the business cycle index created by the Organization for Economic Cooperation and Development (OECD) yields growth cycles.

## 2. Indexes of China's Economy

Below is a survey of some of the main indexes of economic conditions in China. Each index was created by combining various economic indicators that fluctuate basically in line with the state of the Chinese economy.

### The China Economic Monitoring and Analysis Center Diffusion Index

The China Economic Monitoring and Analysis Center (CEMAC), a branch of China's National Bureau of Statistics, publishes monthly diffusion indexes of official statistics relating to economic indicators. These indexes were developed jointly by CEMAC and Goldman Sachs (Asia) and were first announced in November 2004. CEMAC produces three types of index: a leading index, a coincident index, and a lagging index. The specific indicators used in each are shown in the table below.

CEMAC produces its indexes of economic conditions by combining

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monthly year-on-year growth rates of time series data. The indexes are considered useful in identifying the growth rate cycle. They differ from composite indexes in the United States and Japan, which are composed mostly of raw figures.

Since the CEMAC indexes aggregate year-on-year comparisons, their movement is similar to that of the year-on-year real GDP growth rate, which is an expression of the whole of economic activity (see Table 1). Recently, however, the rise in these indexes has been moderate compared with the continuing high growth in China's GDP.

**Table 1    Component Indicators of CEMAC Indexes**

| Leading index | Coincident index | Lagging index |
|---|---|---|
| Hang Seng Mainland Free float Index | Index of industrial output | Government spending |
| $M_2$(money supply) | Industrial workers index | Commercial and industrial financing |
| Number of construction projects started | Tax revenue | Individual savings |
| Volume of freight transported | Industrial corporate profits | Consumer price index |
| Volume of cargo shipped and received at coastal ports | Disposal income of urban residents | Value of industrial finished goods |
| Area of land developed for real estate | Fixed asset investment | |
| Area of commodity housing on which construction started | Total sales of retail goods | |
| | Value of exports and imports | |

Source: CEMAC website

**Figure 2   Fluctuations in the CEMAC Diffusion Index and Year-on-Year Real GDP Growth**
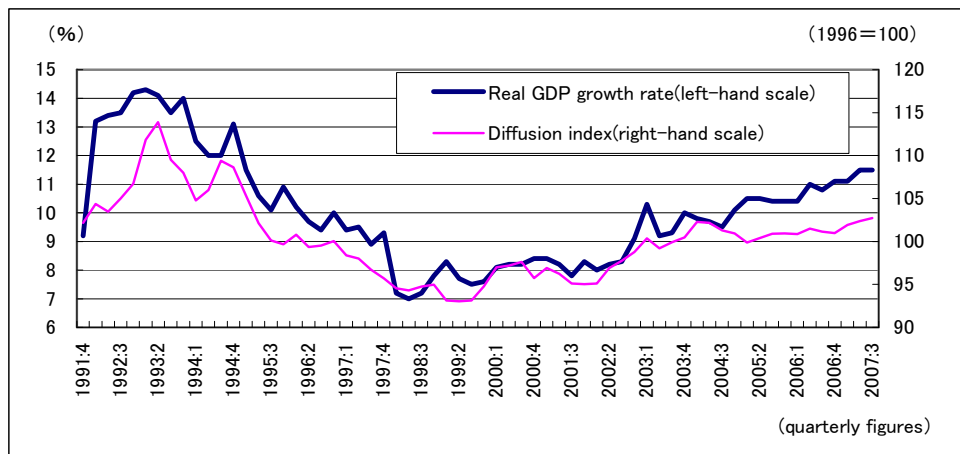


**Indexes Produced by a Chinese Domestic Think Tank**

The Center for Forecasting Science (CFS) at the Chinese Academy of Science, a private-sector think tank, has also created diffusion indexes to track economic conditions. The CFS produces the same three types of index as CEMAC—leading, coincident, and lagging—but uses fewer component indicators. Based on these indexes, the CFS has created business cycle reference dates from April 1998 onward (see Table 2). We will talk more about business cycle reference dates later in this essay.

**Table 2   Component Indicators of the Chinese Academy of Science Indexes**

| Leading index | Coincident index | Lagging index |
|---|---|---|
| Volume of steel production | Industrial production | Inventries |
| Volume of crude oil production | Investment in fixed assets | Current assets |
| Volume of chemical fertilizer production | Consumer goods | Consumer price index |
| Inventories of finished goods | M1(money supply) | Industrial goods price index |
| Direct investment | | |
| Volume of port cargo handled | | |

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**Leading Index Produced by the OECD**

The Organization for Economic Cooperation and Development (OECD) produces indexes, called Composite Leading Indicators (CLI), of economic conditions in OECD member countries and some nonmember countries.

The OECD produces the CLIs by aggregating time series data from the industrial production index (with the growth trend removed)—which it regards as representing fluctuations in economic conditions—with selected indicators that lead this data. The industrial production index, rather than GDP, is used so that the indexes can be generated on a monthly basis. The component indicators of the index for China are shown in Table 3. According to data from the OECD, the CLI for China precedes the business cycle turning points by an average of six months (Nilsson 2006).

**Table 3   Component Indicators of the OECD Composite Leading Indicator (China)**

| |
|---|
| $M_2$ (yuan) |
| Volume of cargo handled at ports (tons) |
| Volume of chemical fertilizer production (tons) |
| Corporate internal reserves (yuan) |
| Value of imports from Asia (dollars) |
| Volume of nonferrous metal production (tons) |

Source: OECD website

**The Japan Center for Economic Research Business Index (for China)**

The Japan Center for Economic Research (JCER) creates indexes to track business conditions in Asian countries. One of these is its China index, which is published monthly. Like the CEMAC index, it is created by aggregating year-on-year comparisons. The component indicators of the index are exports, real retail sales, and the production index. The difference between this index and CEMAC's is that it uses the average past growth rate, rather than the aggregate growth rate, of the component indicators.

The lagged correlation coefficient for the JCER index corresponds with that of the CEMAC index. The correlation between the leading index and lagging index is relatively weak.

**Figure 3   Lagged Correlation Coefficients of the JCER Asia Business Index and CEMAC Index**
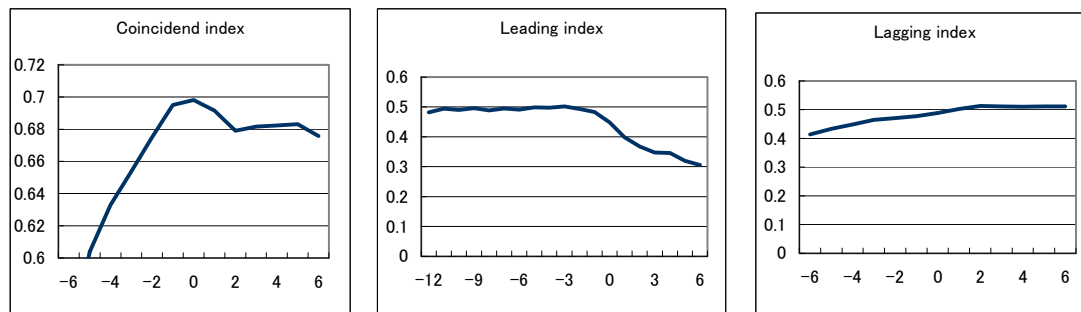


Note: The vertical axis is the value of the coefficient of correlation, and the horizontal axis represents time, with positive numbers representing movement forward and negative numbers backward movement in time.

**CESifo World Economic Survey**

The Ifo Institute for Economic Research, a German think tank, and the University of Munich's Center for Economic Studies jointly publish the World Economic Survey. The Ifo sends questionnaires to experts in countries around the world in order to gauge business sentiment; China is among the countries surveyed. These surveys emphasize the Economic Climate Index, which averages the current state of business and the six-month forecast. In contrast to the monthly indexes introduced above, this survey is conducted on a quarterly basis. A rating of five indicates neutral business sentiment, while one is the worst possible rating and nine the best.

**GDP Gap Does Not Show Short-term Cycles**

The GDP gap is the difference between (or the ratio of) potential and real GDP growth. The GDP gap expresses macro supply and demand and, in the case of developed countries like Japan, moves in concert with the economic situation. One of the objectives of this paper is to verify whether or not China's GDP gap reflects the actual economic situation.

China publishes its real GDP growth rate on a quarterly basis, but these announcements do not include the level of real GDP. The actual amount of real

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GDP is published on an annual basis. Using these figures, let us try to estimate China's GDP gap.

First we need to convert the annual growth rate of real GDP into a monthly rate. We made the monthly averages consistent with the yearly averages while smoothing the monthly indicators in line with a quadratic function. Next we used the Hodrick-Prescott filter to calculate latent GDP. The statistically prepared monthly indicators are a smooth series derived from annual figures, so 1 million was used as the coefficient $\lambda$ when smoothing (normally the coefficient is 14,400).

It is clear that the movements of the GDP gap are quite different from those of economic indexes like the CEMAC index. This difference is related to how one defines the state of the economy. In developed countries, the state of the economy is defined by fluctuations in the level of economic activity; the higher the level of activity, the healthier the economy is judged to be. If the rate of real GDP growth is consistently higher than that of potential GDP growth, the GDP gap will gradually expand even if the real growth rate does not increase.

In China, meanwhile, which has seen consistently high growth, the state of the economy is judged by fluctuations in the growth rate. In this case, a consistently high growth rate does not on its own indicate a booming economy; only if the growth rate continues to rise is the economy regarded as booming. The state of the economy in present-day China can be more readily determined by using a "growth rate cycle." This same cycle is used to assess economic peaks and troughs.

According to Shinohara (2006), China's nominal fixed capital formation and nominal rate of increase in GDP serve as indications of the mid-term cycle of capital investment. Looking at the graphs of these two measures, we see that the nominal fixed capital formation growth rate peaked in 1993, and the nominal GDP growth rate peaked in 1994. Both indicators troughed in 1999. What the GDP gap indicates is the mid-term cycle, not the short-term cycle.

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**Figure 4　The GDP Gap and an Index of Economic Conditions**
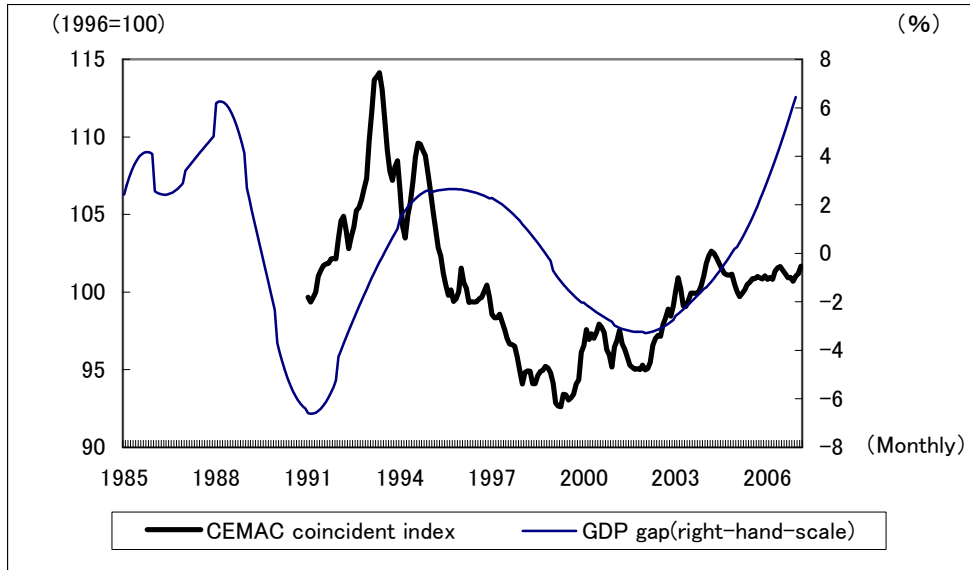


Source: National Bureau of Statistics of China

**Figure 5　Real GDP and Fixed Capital Formation**



Source: National Bureau of Statistics of China

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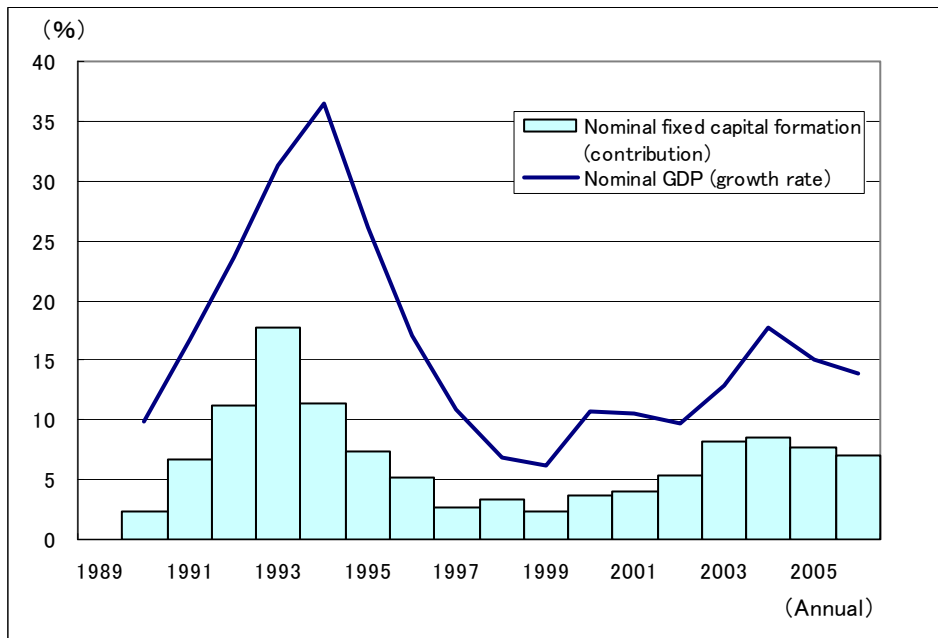
## 3. China's Economic Cycles

**Dates Announced by the National Bureau of Statistics**

CEMAC has announced three dates marking China's economic cycles: a peak in May 1993, a trough in April 1999, and a peak in March 2004 (http://www.cemac.org.cn/indexlea.htm).

Okamoto (2007) applied the Bry-Boschan method to the CEMAC coincident composite index and determined new peaks and troughs for the officially published data (see Table 4). Using these peaks and troughs as benchmarks, we determined and compared the peaks and troughs for other economic indexes.

No matter which indicator is used for the 2000s, there is almost no change in the timing of the turning points.

Since the OECD index is a leading index, one would expect its turning points to precede those of other indicators, but in fact peaks and troughs occur in the OECD index at the same times as in the other indexes. It is believed that this is because the OECD uses a growth cycle to determine peaks and troughs, while the other indexes use a growth rate cycle. Turning points appear earlier when a growth rate cycle is used.
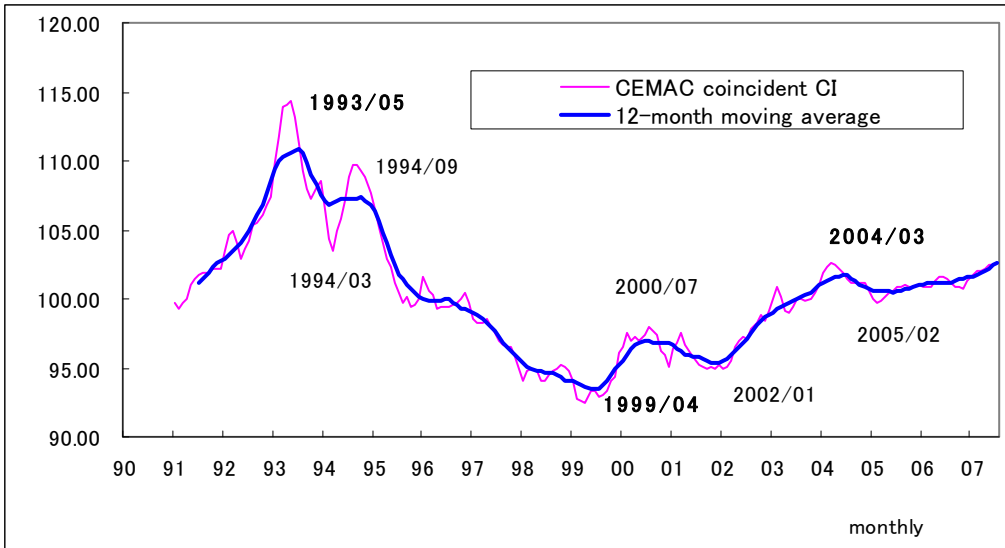
**Table 4    China's Economic Peaks and Troughs**

|  | CEMAC | Chinese Academy of Science | JCER index | OECD leading index |
|---|---|---|---|---|
| peak | May−93 |  | December−92 | September−92 |
| trough | March−94 |  |  | October−93 |
| peak | August−94 |  |  |  |
| trough |  |  | September−96 |  |
| peak |  |  | June−97 | January−97 |
| trough | April−99 | April−98 | December−98 | December−98 |
| peak |  | January−99 |  |  |
| trough |  | August−99 |  |  |
| peak | July−00 | July−00 | August−00 | August−00 |
| trough | February−02 | December−01 | December−01 | January−02 |
| peak | March−04 | March−04 | December−03 | April−04 |
| trough | February−05 | April−05 | February−05 | February−05 |

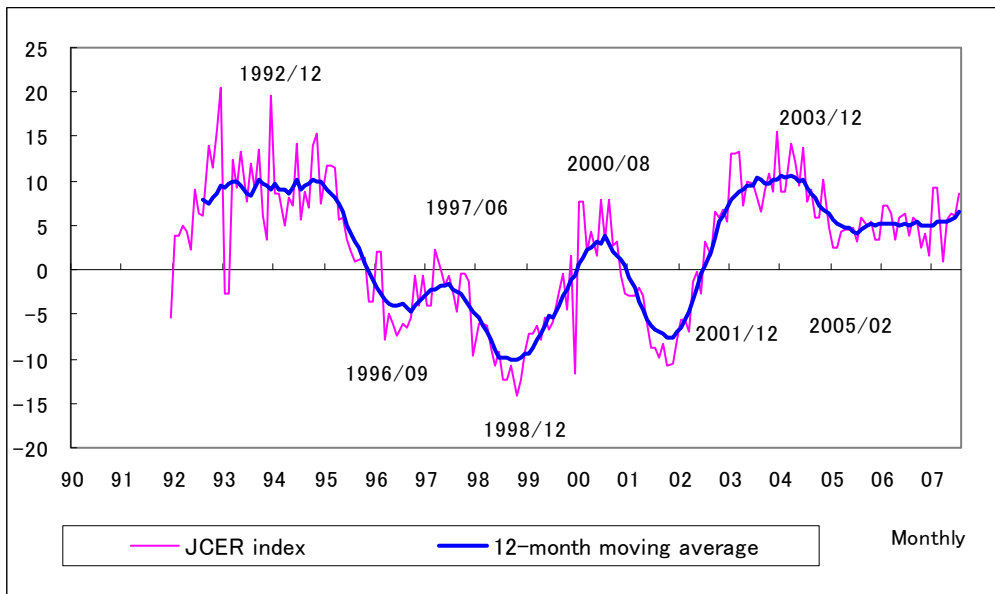Note: CEMAC turning points are according to Okamoto(2007).                    t

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**Figure 6  Economic Peaks and Troughs According to CEMAC**
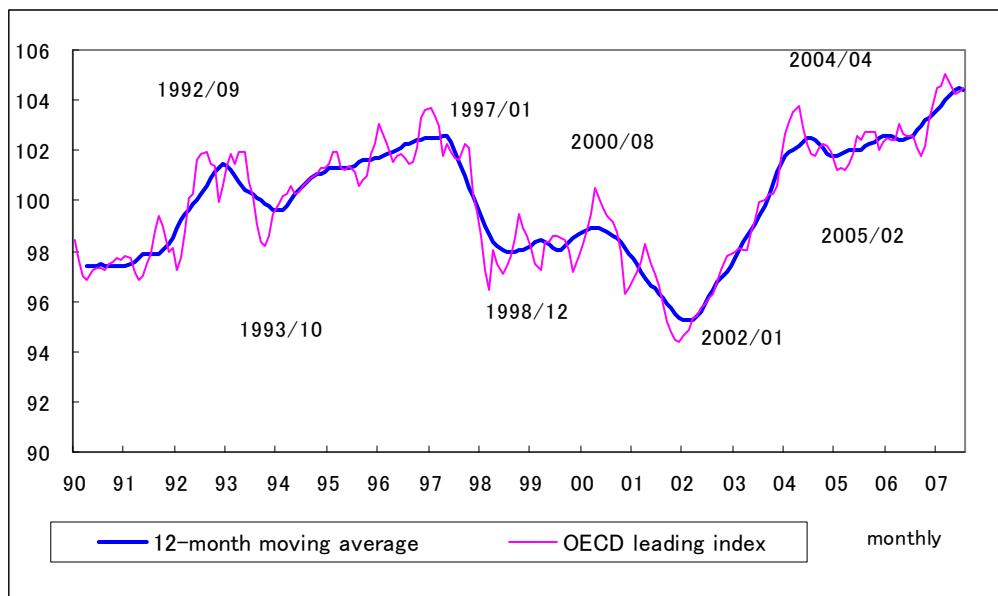


Source: National Bureau of Statistics of China

**Figure 7  Economic Peaks and Troughs According to the JCER Index**
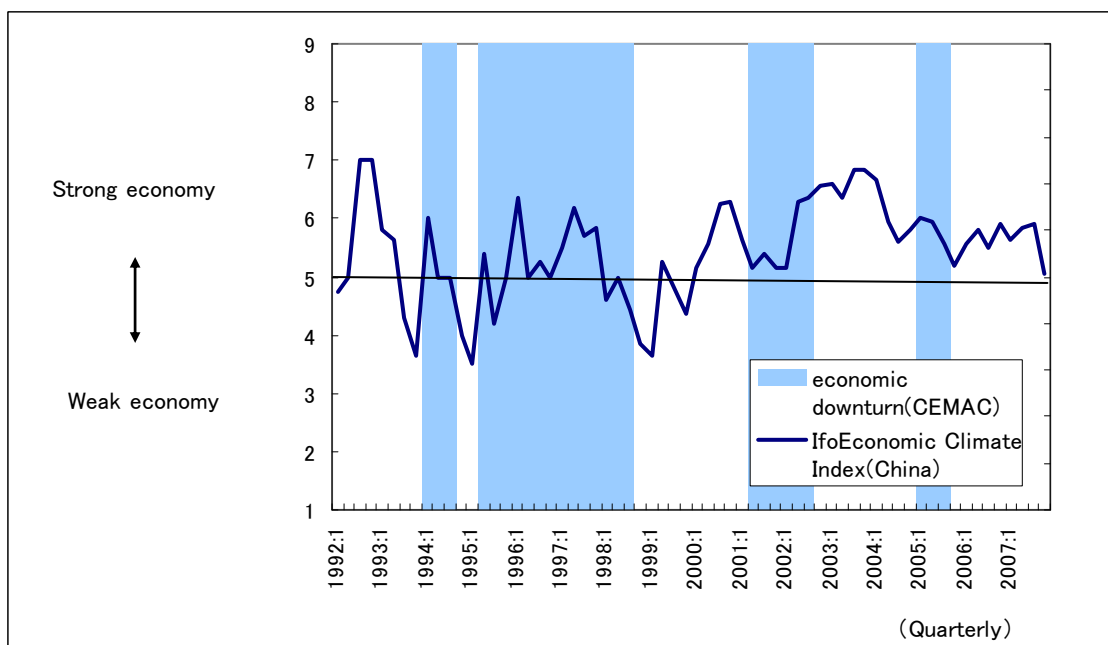


Source: Japan Center for Economic Research

**Figure 8   Economic Peaks and Troughs According to the OECD Leading Index for China**



Source: OECD website

**Figure 9   Ifo Economic Climate Index for China**



Source: CESifo World Economic Survey

**The Ups and Downs of the Chinese Economy**

Using the business cycle reference dates from CEMAC as benchmarks, let us examine in detail the phases that the Chinese economy has experienced since 1992.

**Increased Investment Following Deng Xiaoping's Southern Tour Lectures (1992 to April 1993)**

Growth accelerated following Deng Xiaoping's 1992 speeches in China's southern region, known as the Southern Tour Lectures. The policy of reform and opening up was affirmed, and the transition from a planned economy to a market economy ("socialist market economy") began in earnest. Investment increased rapidly as this process unfolded.

**Fiscal Tightening in Response to Rising Inflation (May 1993 to March 1994)**

Rapidly accelerating growth pushed up prices, and the inflation rate moved into double digits in January 1993. Among the factors that contributed to this situation were the rapid proliferation of real estate agents, the development zone construction boom, and a surge in investment in the automobile sector. The People's Bank of China tightened credit, ushering in a period of monetary restraint.

**Exports Rise as the Yuan Depreciates (March 1994 to September 1994)**

In 1994 the foreign exchange management system was reformed. Previously there were two separate rates for the yuan: the adjusted rate set by the Foreign Exchange Swap Center and the official rate. The Foreign Exchange Swap Center served as a brokering mechanism for foreign currency transactions among corporations. Subsequent to the reforms these two rates were unified into one official exchange rate, which depreciated from 5.3 yuan to the dollar in December 1993 to 8.7 yuan to the dollar in January 1994. Exports increased dramatically following this adjustment, but inflation also continued to rise.

**Continued Monetary Restraint (September 1994 to April 1999)**

Zhu Rongji, then governor of the People's Bank of China, continued to adhere to a

policy of restraint in order to control inflation. The CEMAC index shows a five-year economic downturn lasting from 1994 to 1999. The OECD leading index, however, shows the period from October 1993 to January 1997 as one of expansion, and the same can be said for the period September 1996 to June 1997 according to the JCER index. The CEMAC index is fundamentally an aggregate of growth rates, and during this period the growth rates of its component indicators were falling. The real GDP growth rate was also in a continuous decline. The OECD index, meanwhile, removes the downward trend in this period, and the JCER index—though based on the growth rate—is normalized, so these indexes indicate that the economy expanded. The Ifo index shows the period before the Asian currency crisis as one of economic expansion, as confirmed through its questionnaire surveys. This shows that looking only at growth rates carries the risk of misinterpreting the actual state of the economy.

All the indicators agree that China's economy entered a downturn at around the time of the Asian currency crisis. In the first half of 1997, real estate investment declined compared with the year before, direct investment fell, and inventories increased. The economy was already slowing due to the government's austerity measures; the effects of the Asian currency crisis added to the downward pressure. In 1998 the consumer price index fell compared with the preceding year. Both deposit rates and lending rates began trending downward in May 1996, and they continued to decrease gradually between 1997 and 1999.

The economy was predicted to overheat in 1998, as it is said to do in years ending in the numbers 3 or 8. This is because the Communist Party of China holds its National Congress every five years in the autumn of years ending in 2 or 7, and the congresses are where changes to the lineup of party officials are made. As new appointees take up senior posts in local governments, they are said to launch construction projects to boost their own career profiles, causing a surge in economic activity. In 1998, however, the signs of recession grew stronger. One explanation for this is that 1998 was the year when Zhu Rongji became premier of the State Council and undertook the restructuring of state-owned enterprises.

**The Switch to an Expansionist Fiscal Policy (April 1999 to August 2008)**

All of the economic indexes bottomed out between the end of 1998 and the beginning of 1999. The principal cause for this rebound was the switch from austere macroeconomic management to an expansionist fiscal policy.

In November 1999 a compromise was reached in China's bilateral trade negotiations with the United States, enabling China to join the World Trade Organization. This spurred an increase in direct investment in China. A global IT bubble (the "dotcom bubble") arose but subsequently collapsed.

**The IT Slump (August 2000 to February 2002)**

A worldwide economic slowdown following the "dotcom crash" caused the expansion of Chinese exports to lose momentum. The value of exports (in dollars) had registered year-on-year growth of 27.8% in 2000, but this slowed to 6.8% in 2001. The 9/11 terrorist attacks in the United States and the inevitable slowing of investment from the heady levels seen prior to China's WTO accession also weighed on the economy.

**Expansionary Policy Continues (February 2002 to March 2004)**

All of the indexes show a trough in either December 2001 or January 2002.

In 2002 Hu Jintao became general secretary of the Communist Party of China. Investment in real estate increased rapidly, and growth accelerated. The Ministry of Finance proposed the idea of "fading out" the expansionary fiscal policy, but this was met with resistance from various quarters, and in the end the policy was allowed to continue. The reasons for continuing this policy included (1) the economic downturn in the United States, (2) the desire to allay people's anxiety after China joined the WTO, and (3) the need to counter deflation.

The SARS outbreak caused consumer spending to fall in 2003, compelling the government to stimulate investment even further.

**Fiscal Austerity to Counter Inflation (March 2004 to March 2005)**

The government tightened its finances in response to signs that the economy was overheating. This is seen as a reaction to the investment boom that had been taking

place. Society-wide growth in fixed asset investment slowed, and prices increased. Consumer prices for 2004 increased 3.9% over the year before.

Interest rates were raised as part of the monetary tightening, and the government adopted a neutral fiscal policy in the economy.


**Pre-Olympic Investment Boom (February 2005 to the Present)**

According to both the CEMAC and OECD indexes, the Chinese economy experienced a trough in February 2005; the JCER index places the trough in July 2005. All three show that the economy has been expanding since this 2005 trough. The trade surplus continued to grow, with the 2005 trade surplus to GDP ratio rising to 6.0% compared with 3.1% for 2004.

In July 2005, the People's Bank of China revalued the yuan from 8.28 to 8.11 to the dollar and introduced a managed floating exchange rate system that allowed for some fluctuation in the value of the yuan against a basket of currencies. Even after the currency revaluation, however, the trade surplus has continued to expand. It appears the government has elected not to change its expansionary course as the Beijing Olympics draw near, and the investment boom continues.


**The Mechanisms of China's Economic Cycle**

One characteristic of the Chinese economic cycle is the relatively direct correlation between government policy and investment activity. If the government announces it is adopting an expansionary policy, there follows an economic boom; if it decides to raise interest rates in response to overheating and inflation, business confidence takes a downturn.

Yet since the start of the new millennium, it has become impossible for China to ignore what happens in other countries. The slowdown that began in China in the latter half of 2000 occurred under the influence of the world economy, particularly the United States.

Attention has also come to focus on stock market fluctuations. The Shanghai Composite Index has shot up, creating what some observers regard as a bubble. The crash in Chinese share prices at the end of February 2007 triggered a chain reaction in stock markets in Japan and the United States, even though the

Shanghai Composite Index, scene of the biggest falls, is a market for domestic Chinese investors and thus unlikely to have a direct impact on foreign economies. Thereafter both Chinese and world stock prices temporarily rebounded, and there appeared to have been no major damage. The value of Chinese stocks has been greatly affected, however, by the sub-prime mortgage crisis. Stock price trends have in the past had little effect on China's business cycles, but if the number of people in China who own shares increases, share price fluctuations will have a growing influence on corporate activity and on the consumption behavior of ordinary households.

## 4. Creation of an Early Warning Indicator

### Increasing Vigilance with Regard to China's Economy
Although China's economy continues to expand rapidly, there is a growing feeling of uneasiness. The source of this unease is the distorted dollar-yuan exchange rate. China's trade surplus has grown on the strength of its exports, and dollars are flowing into the Chinese market. Investment capital is also flooding into China. There are many who believe that if demand for the yuan increases, its market valuation should also increase. However the authorities continue to intervene with a policy of buying dollars and selling yuan, thereby suppressing the currency's appreciation.

Under the current exchange rate, the yuan is kept artificially low against the dollar. As a result there is upward pressure on exports, and China continues to enjoy brisk exports. This is one cause of the ballooning trade deficit with the United States and also one reason why the global trade imbalance continues to grow.

Another effect of intervention is the infusion of yuan into the domestic economy, which has resulted in excess liquidity. This can be tempered by raising domestic interest rates, but this is also difficult. If interest rates are raised, the yuan will become more attractive to foreign investors, inviting greater inflows of foreign capital. Further intervention would then be necessary to keep down the value of the yuan. There is also the possibility that higher interest rates could

dampen economic growth.

There is concern that excess liquidity will result in inflation. However, at present capital is flowing into stocks, land, and fixed assets rather than into goods and services. China today looks very much like Japan just before the collapse of the bubble economy: low interest rates, stable prices, and substantial increases in the value of stocks and land. Just as in Japan, China's overheated economy is sure to someday enter a period of huge adjustment. To head off this problem through a process of fine tuning, it is first necessary to raise the value of the yuan to a more reasonable level.

Revaluation of the yuan is quite a difficult task, though. This is because a higher yuan would be more damaging to rural areas at a time when the gap between development in the coastal regions and stagnation in agricultural communities is widening. Given that China's farming industry is not very competitive, the yuan's appreciation would encourage an increase in agricultural imports. The political leadership cannot readily adopt policies that would bring greater hardship to the rural sector.

Even though the potential for crisis has long been whispered in China, its economy has continued to grow rapidly for over five years. Gross domestic product in real terms continues to grow in double digits each year, and fixed assets are also growing at a high level. Demand is rising in step with China's expansion, but a day will come when supply outstrips demand. This could result in excess production capacity, which Japan experienced in the past. Land and share prices also bear watching. If a real estate or stock bubble were to burst, markets are likely to nosedive at the same speed at which they grew. Should the authorities give in to market pressure and allow the yuan to suddenly appreciate, this could unnecessarily accelerate the flight of capital from China.

**Creating an Early Warning Indicator**

Under the circumstances, we have tried creating an indicator that would show the degree of instability in the Chinese economy. One approach would be to calculate the divergence between the yuan's optimal and actual values. But we have focused on statistics that indirectly reveal a variety of imbalances and excesses to ascertain

levels of instability before such conditions become apparent. The unique feature of this indicator is that it does not simply incorporate variables that influence the economy but selects those that shift at an earlier stage. This enables one to grasp the turning points in the economy faster than with other indicators. A diffusion index's leading indicators typically identify economic trends six months in advance; the aim of this indicator is to identify trends a year in advance.

A qualitative choice model was adopted as my estimation method. Explanatory variables were adopted with periods of economic recession being assigned a value of 1 and periods of economic expansion a value of 0. Indicators linked to the economy were used, and estimations were carried out using a probit model. We referred to CEMAC statistics for the reference dates of business cycles. Data limitations restricted the estimation period to 1999 onward, and as a result economic turning points were registered at nearly the same time as in other indicators. This can be expressed as:

The state of the economy* = $1-\Phi(-(\alpha_0+\alpha_1 x_{1t}+\alpha_2 x_{2t}+\alpha_3 x_{3t}+u_t))$

* The state of the economy was assigned a value of 1 for periods of contraction and 0 for periods of expansion. $\Phi$=cumulative normal distribution function.

As explanatory variables, leading indicators showing the state of the economy one year hence was selected. Indicators with relevance to the business cycle were identified and graphed, and a probable leading series was sought. The indexes selected are displayed in the table below. An explanation of the reasoning behind the selection of each series is given later.

**Table 5   Indexes Used**

|  | Target country | Source |
|---|---|---|
| Money supply (M2) | China | People's Bank of China |
| Shanghai Composite Index | China | Shanghai Stock Exchange |
| Interest and lending rate (5 years and over) | China | People's Bank of China |
| NASDAQ Composite Index | US | NASDAQ |
| Dow Jones Industrial Average | US | Dow Jones and Company, Inc. |
| Composite index, leading series | US | The Conference Board |
| Commodity Research Bureau Index | US | CRB |

### Rises in Consumer Prices and the Money Supply

The M2 money supply is used by the CEMAC and OECD indicators as a leading indicator of the economy. A look at past movements shows that the money supply moves about one year earlier than the consumer price index. It can also be used as a warning indicator for inflation.

**Figure 10   The Money Supply and Inflation**
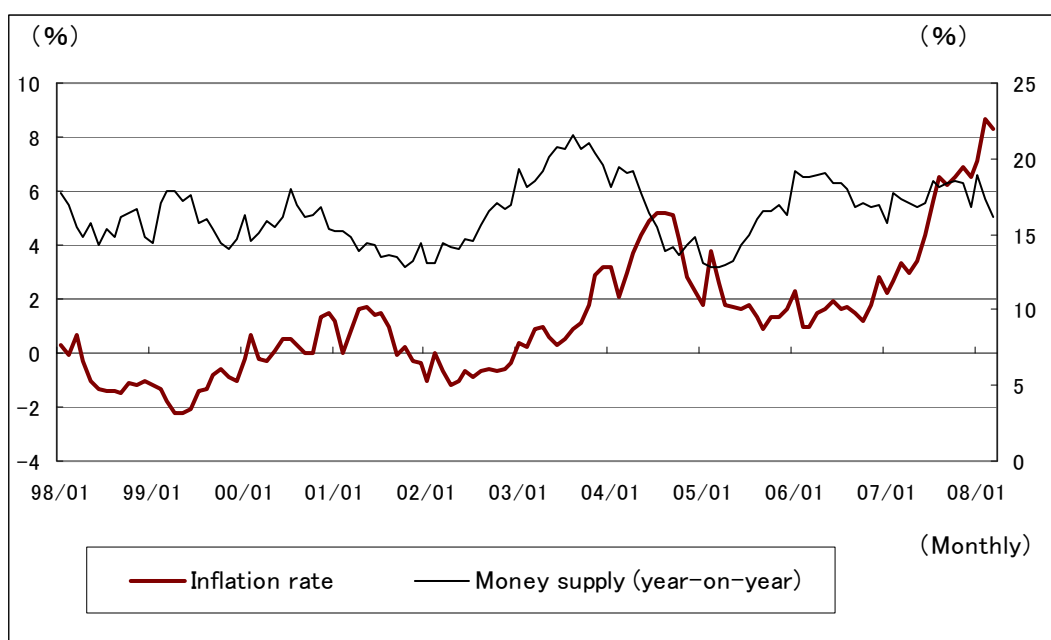


Source: National Bureau of Statistics of China, People's Bank of China

**Price-Earnings Ratio and Interest Rates**

Share prices represent the current value of the expected earnings of a corporation. However, if prices exceed expectations, a bubble may form whose collapse could adversely affect the economy. The price-earnings ratio is a tool that can be used to reveal disparities between the market and actual values of shares.

One analysis offered by Robert Shiller (2000) is that an increase in the P/E ratio has a negative effect on share prices. Using long-term data from the United States for the period 1881 to 1989—namely, Standard and Poor's inflation-adjusted composite index—any negative relationship between P/E ratios and real yields 10 years hence is shown in the figure. Annual yields in real terms are calculated assuming the sale of securities in 10 year's time, based on the S&P index.

By multiplying the P/E ratio and interest rates, it is possible to determine whether the stock price is higher compared to actual corporate earnings.

In an earnings capitalization model, S is set as the stock price, D as the per-share dividend, and the discount rate as the sum of the interest rate r plus the risk premium h.

*S=D/(r+h)*

If all earnings are distributed as dividends and the risk premium is ignored, S divided by D is the P/E ratio, and the inverse of the earnings yield.

*P/E ratio=S/D=1/r*

Multiplying the P/E ratio by interest rates should theoretically give a value of 1.

*P/E ratio×r=1*

If it is greater than 1, this shows that the price of a company's shares is too high compared to its business results. This value, along with the P/E ratio, demonstrates that the level of share prices during Japan's bubble era was too high. In the latter half of the 1980s these ratios were more than four times levels

warranted by actual performance. While the ratios were also high in the 1990s, this was caused not by market-inflated stock prices but by low levels of corporate earnings.

**Figure 11　Japan's P/E Ratio and Interest Rates**
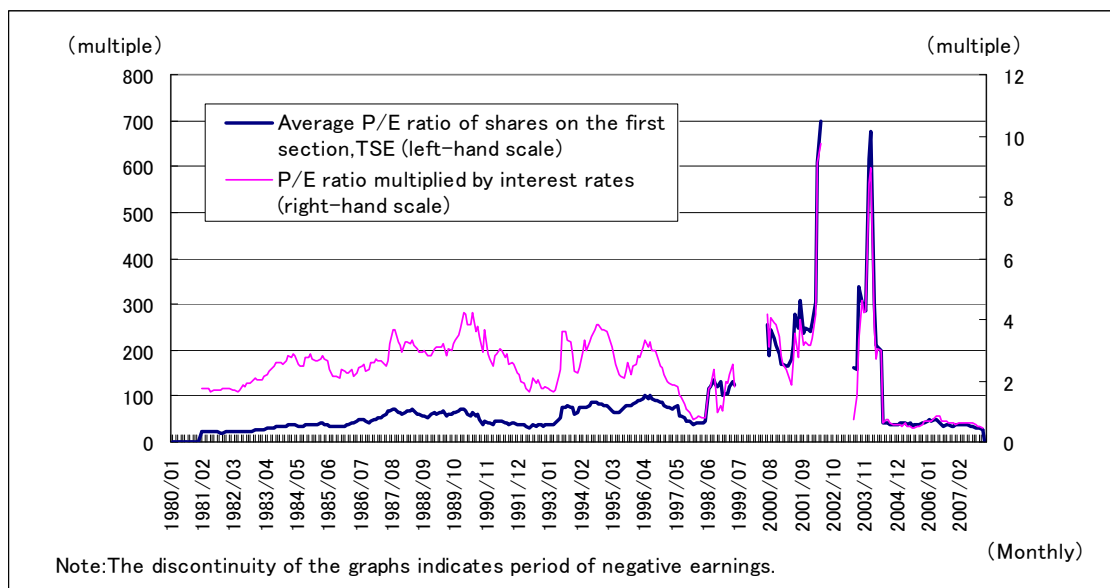


Note: The discontinuity of the graphs indicates periods of negative earnings.
Source: Tokyo Stock Exchange

Although stock prices in China are rising, retail sales are not expanding at nearly the same pace. And consumption has not produced an asset effect like that observed in developed countries. There is the danger, moreover, that rising shares prices are prompting companies to make excess investment. If so, should stock prices fall to more appropriate levels and the excessive investment becomes clear, it is very possible that the subsequent reduction in investment will have an adverse effect on the real economy.

**The CRB Index**

A commodity index was used as an indicator of the environment outside of China. The CRB index is a commodity futures index created by the Commodity Research Bureau. Here, we used the CRB-Reuters Index (CCI), which includes 17 different commodities: corn, soybeans, wheat, live cattle, lean hogs, gold, silver, copper,

cocoa, coffee, sugar, cotton, orange juice, platinum, crude oil, fuel oil, and natural gas.

**Figure 12    NASDAQ as a Leading Index for the Federal Funds Rate**
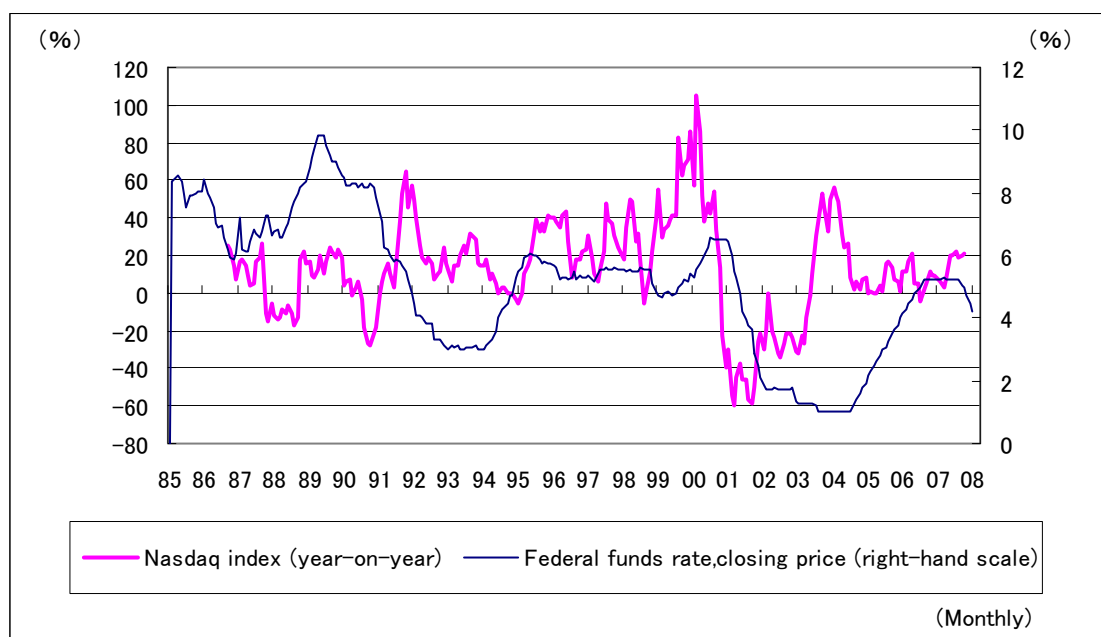


Source: NASDAQ, Federal Reserve Board

## US Diffusion Index

The United States is one of the main markets for Chinese exports, and it has a large influence on the world economy. Since this influence also extends to the Chinese economy, we have included a leading indicator from a US diffusion index in my newly developed indicator.

## NASDAQ Composite Index and Interest Rates

Stock prices are said to be a leading economic indicator, but if one looks at recent trends it becomes apparent that prices rise significantly prior to an increase in interest rates. The same is also true for the Dow Jones Industrial Average.

## Results of Estimation

Data constraints confine the estimation period to January 1999 to October 2007. The

Chinese money supply and the P/E ratio of the Shanghai Stock Exchange Composite Index multiplied by interest rates are the key explanatory variables (equation 1). The McFadden coefficient of determination for these two is around 0.357.

To this, explanatory variables that reflect trends in the world economy have been added. Using the year-on-year changes to the US diffusion index's leading indicators and the CRB index does not fulfill the signal condition for the US leading indicator (equation 2). Therefore, we combined them with the year-on-year changes to the NASDAQ index to get an equation that does fulfill the signal condition (equation 3).

If the US diffusion index's leading indicator is used as raw data, then the signal condition is fulfilled in the case of the CRB index and the Dow Jones Industrial Average (equation 5). Estimating the US diffusion index's leading indicator quarter-on-quarter obtained a mere 5-month leading period, rather than 12 months; while using the OECD leading index for all developed countries gave a 4-month lead. Using earlier data resulted in either statistically insignificant figures or the inversion of the signal condition.

Equations 3 and 5 therefore appear to be most appropriate as early warning indicators.

Both equations, incidentally, show a higher probability of recession during 2008.

## Table 6    Estimation Result

Explanataory variables: State of China's econony (expansion=0, contracction=1)

| Equation | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
|  | −17.24 *** | −16.72 *** | −30.60 *** | −22.50 *** | 14.45 | 92.16 * |
| P/E ratio multiplied by interst rates (China) | 2.09 *** | 2.80 *** | 4.65 *** | 2.95 *** | 1.81 ** | 2.47 ** |
| Money supply (China, year−on−year) | 0.67 *** | 0.45 *** | 0.97 *** | 0.77 *** | 0.82 *** | 0.76 *** |
| Volume of customs−cleared exports (China, year−on−year) |  |  |  | 0.10 *** |  |  |
| Leading economic indicator (US, year−on−year) |  | 0.25 * | −0.62 * |  |  |  |
| Leading economic indicator (US, raw series) |  |  |  |  | −0.31 ** |  |
| Leading eoconomic indicator (US,average change from 3month before)[a] |  |  |  | −2.63 ** |  |  |
| Leading economic indicator (OECD coountries total)[b] |  |  |  |  |  | −1.15 ** |
| CRB index (US, year−on−year) |  | 0.07 ** | 0.22 *** |  | 0.28 *** | 0.14 * |
| Nasdaq index (US, year−on−year) |  |  | 0.11 *** |  |  | 0.10 *** |
| Dow Jones Industrial Average( year−on−year) |  |  |  |  | 0.18 *** |  |
| McFadden's $R^2$ | 0.357 | 0.443 | 0.705 | 0.564 | 0.629 | 0.706 |
| Standard error | 0.362 | 0.339 | 0.239 | 0.297 | 0.268 | 0.251 |
| Sample size | 106 | 106 | 106 | 106 | 106 | 106 |

Notes: The estimation period is from January1999 to October 2007. Figures indicated with *** are significant to the 1% level, ** to the 5% level, and * to the 10% level.
Leading economic indicator (a) based on data from 5 months earlier, while OECD total (b) is from 4 months earlier. Other indicators are from 12 months earlier.

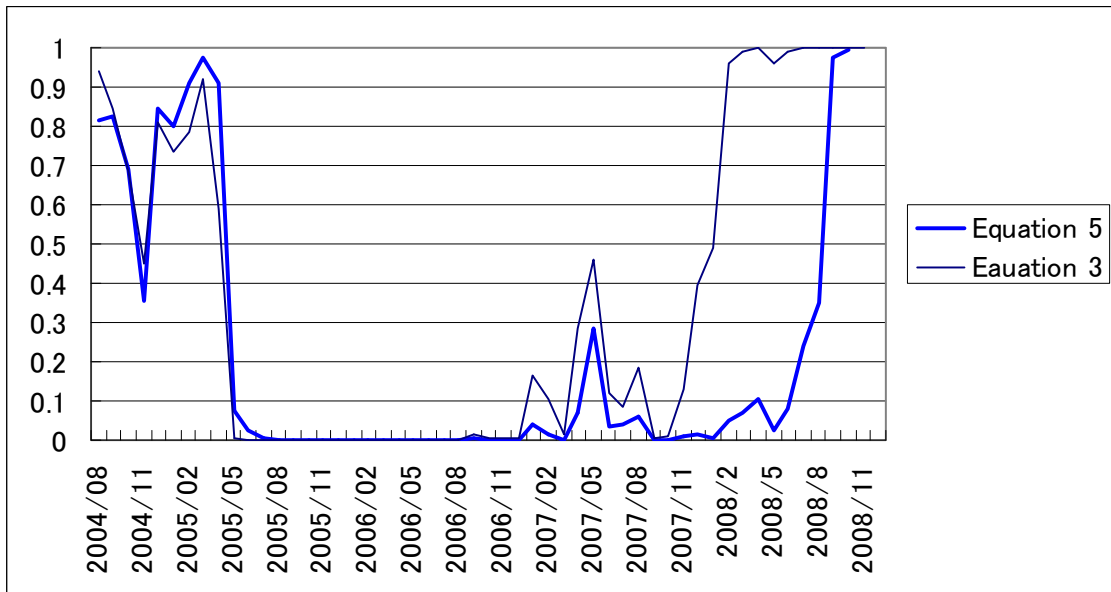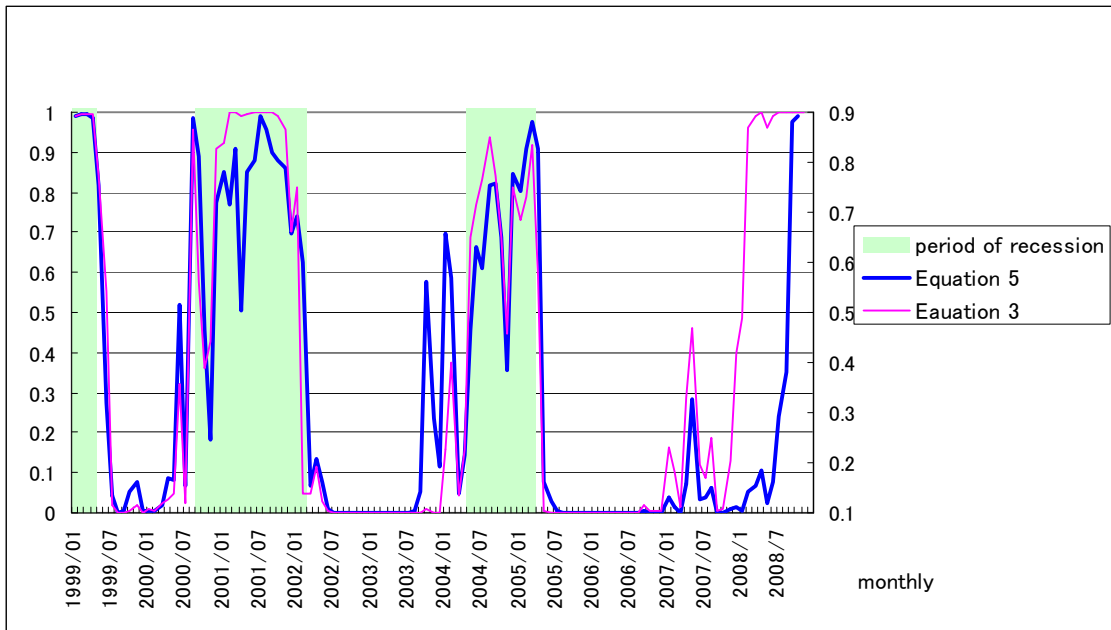**Figure 13　Probability of Recession According to Equations 3 and 5**
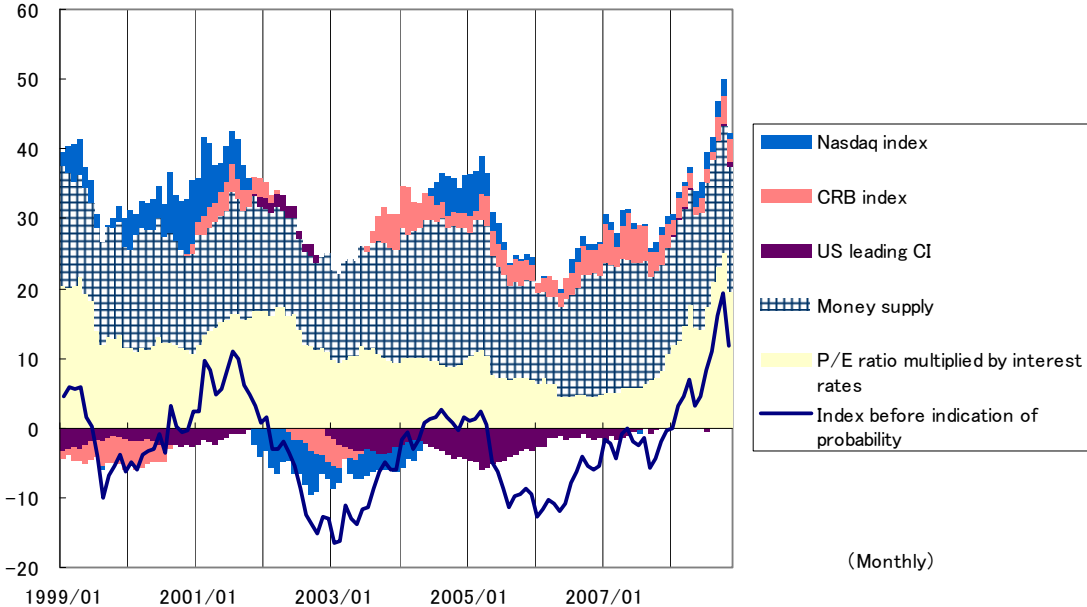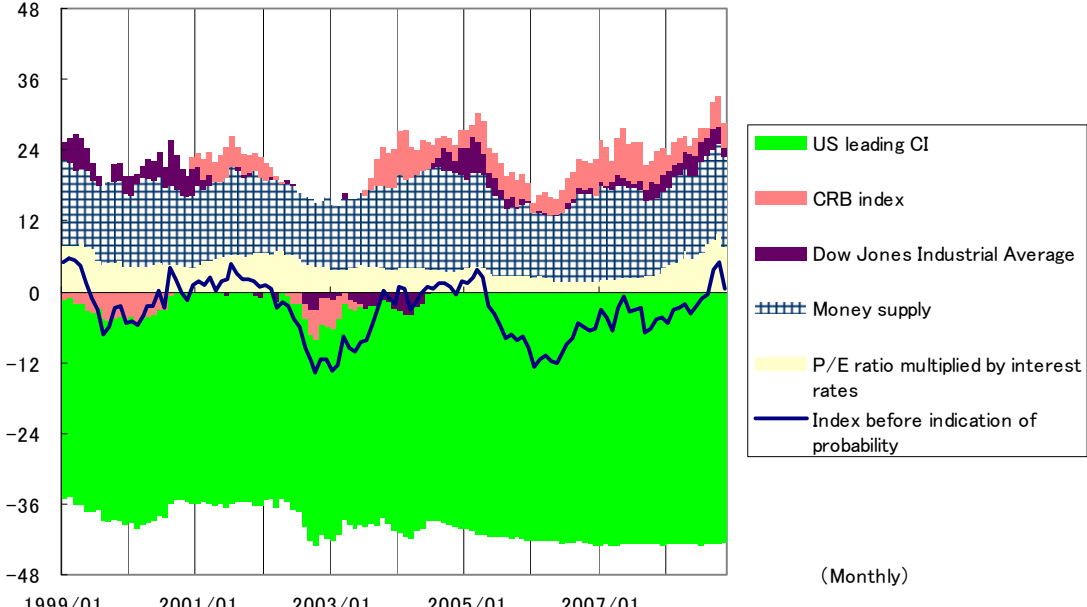
**Figure 14   Factor Analysis for Equation 3**



（Monthly）

**Figure 15   Factor Analysis for Equation 5**



（Monthly）

**Conclusion**

For this essay we have conducted an analysis of China's business cycle, and using the results of this analysis, constructed an early warning indicator. This was the first attempt at a thorough comparison of various research organizations' economic indicators relating to China's business cycle. There was overall consistency in the economic turning points as suggested by the various indicators.

The purpose of an early warning indicator is to detect economic recessions as quickly as possible. According to the indicator created, China's economy could be in recession by as early as the first half of 2008. However, with the Beijing Olympics scheduled for August 2008, this extraordinary factor may have the effect of extending China's boom. It will therefore be necessary to verify the compatibility of the results of this early warning indicator with future economic trends.

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# Reference

# China's Economic Indicators

| | Real GDP growth rate (%) | Consumer price index (% increase) | GDP deflator (% increase) | M2 (% annual growth) | Marshallian k (M2 share of GDP, %) | Budget deficit (% of GDP) | Customs-cleared exports (% growth, $) | Customs-cleared imports (% growth, $) | Direct investment ($ million) | Trade balance (% of GDP) | Current account balance (% of GDP) | External reserves ($ million) | Yuan to dollars | Lending rate (over 5 years, %) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1989 | 4.1 | 18.0 | 8.5 | 18.7 | 67.0 | -2.1 | 10.6 | 7.0 | 2613 | -1.2 | -1.0 | 18547 | 3.77 | 18.76 |
| 1990 | 3.8 | 3.1 | 5.8 | 34.2 | 81.9 | -2.8 | 18.2 | -9.8 | 2657 | 2.3 | 3.1 | 30209 | 4.78 | 12.81 |
| 1991 | 9.2 | 3.4 | 6.8 | 26.5 | 88.8 | -3.0 | 15.8 | 19.6 | 3453 | 2.1 | 3.2 | 44308 | 5.32 | 10.08 |
| 1992 | 14.2 | 6.4 | 8.2 | 31.3 | 94.3 | … | 18.1 | 26.3 | 7156 | 1.1 | 1.3 | 21230 | 5.51 | 9.72 |
| 1993 | 14.0 | 14.7 | 15.1 | 37.3 | 98.7 | … | 8.0 | 29.0 | 23115 | -1.7 | -1.9 | 22999 | 5.76 | 12.30 |
| 1994 | 13.1 | 24.1 | 20.6 | 34.5 | 97.4 | … | 31.9 | 11.2 | 31787 | 1.3 | 1.4 | 53560 | 8.62 | 14.04 |
| 1995 | 10.9 | 17.1 | 13.7 | 29.5 | 99.9 | … | 23.0 | 14.2 | 33849 | 2.5 | 0.2 | 76036 | 8.35 | 15.03 |
| 1996 | 10.0 | 8.3 | 6.4 | 25.3 | 106.9 | -1.8 | 1.5 | 5.1 | 38066 | 2.3 | 0.8 | 107676 | 8.31 | 14.06 |
| 1997 | 9.3 | 2.8 | 1.5 | 19.6 | 115.2 | -1.9 | 21.0 | 2.5 | 41674 | 4.9 | 3.9 | 143363 | 8.29 | 11.95 |
| 1998 | 7.8 | -0.8 | -0.9 | 14.8 | 123.8 | -2.4 | 0.5 | -1.5 | 41118 | 4.6 | 3.1 | 149812 | 8.28 | 9.17 |
| 1999 | 7.6 | -1.4 | -1.3 | 14.7 | 133.7 | -3.0 | 6.1 | 18.2 | 36978 | 3.3 | 1.9 | 158336 | 8.28 | 6.77 |
| 2000 | 8.4 | 0.4 | 2.1 | 12.3 | 135.7 | -2.8 | 27.8 | 35.8 | 37483 | 2.9 | 1.7 | 168856 | 8.28 | 6.21 |
| 2001 | 8.3 | 0.7 | 2.1 | 17.6 | 144.4 | -2.5 | 6.8 | 8.2 | 37356 | 2.6 | 1.3 | 218698 | 8.28 | 6.21 |
| 2002 | 9.1 | -0.8 | 0.6 | 16.9 | 153.7 | -2.6 | 22.4 | 21.2 | 46790 | 3.0 | 2.4 | 295202 | 8.28 | 5.80 |
| 2003 | 10.0 | 1.2 | 2.6 | 19.6 | 162.9 | -2.2 | 34.6 | 39.8 | 47229 | 2.7 | 2.8 | 412225 | 8.28 | 5.76 |
| 2004 | 10.1 | 3.9 | 6.9 | 14.9 | 158.9 | -1.3 | 35.4 | 36.0 | 53131 | 3.1 | 3.6 | 618574 | 8.28 | 5.85 |
| 2005 | 10.4 | 1.8 | 4.2 | 17.6 | 162.5 | -1.2 | 28.4 | 17.6 | 67821 | 6.0 | 7.2 | 825588 | 8.19 | 6.12 |
| 2006 | 10.7 | 1.5 | 2.9 | 15.7 | 165.0 | -0.7 | 27.2 | 19.9 | 60265 | 8.3 | 9.5 | 1072564 | 7.97 | 6.51 |
| 2007 | | | | | | | | | | | | | | 7.34 |

Source: Asian Development Bank Key Indicators. Shaded areas indicate years that include periods of recession based on CEMAC calculations.