

**The Business Cycle in China since the Lehman Crisis**  
**How major macroeconomic variables move around their medium-term trends**

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## **1. Introduction**

For China, stabilizing economic growth (and thus employment) and inflation are the major objectives of macroeconomic policy. The economic growth rate and the inflation rate in turn are major determinants of key “prices,” including the policy interest rate, the renminbi (RMB) exchange rate, and stock prices.

By noting that the inflation rate (in terms of the year-on-year increase in the Consumer Price Index, CPI) tends to follow the economic growth rate (in terms of the year-on-year increase in real GDP) with an average time lag of three quarters, this paper analyses economic fluctuation in China since the Lehman crisis in September 2008 in terms of a business cycle consisting of four phases, namely (1) a recession phase, with low growth and low inflation; (2) a recovery phase, with high growth and low inflation; (3) an overheating phase, with high growth and high inflation; and (4) a stagflation phase, with low growth and high inflation. While the Lehman crisis pushed China into a deep recession in early 2009, stimulus measures taken by the government during the recession phase and tightening measures implemented during the overheating phase have helped minimize the fluctuation of major macroeconomic variables over the business cycle.

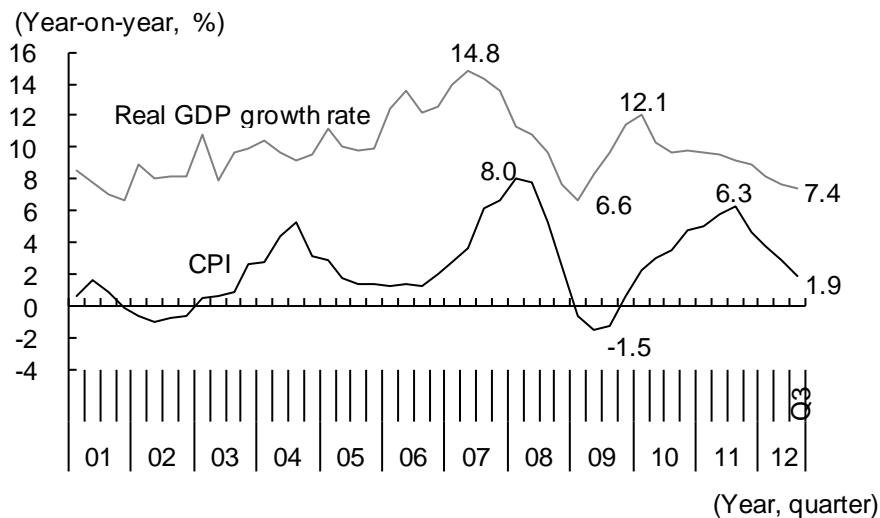
The latest statistics show that China’s economic growth rate dropped to 7.4% in the third quarter of 2012, its lowest level since the first quarter of 2009 when the economy fell into a recession and millions of workers lost their jobs after the collapse of Lehman Brothers. No serious employment problem has arisen this time, however, suggesting that the slower growth may reflect not only the short-term factor of weakening demand, but also the medium- to long-term factor of a lower potential growth rate associated with the shortage of labor accompanying the arrival of the Lewisian turning point (Lewis, 1954).

## **2. Inflation rate lags behind economic growth rate**

In the wake of the collapse of Lehman Brothers in September 2008, the Chinese economy plunged into a recession with its growth rate falling to 6.6% in the first quarter of 2009. Then economic stimulus measures amounting to four trillion yuan and a loose monetary policy drove a V-shaped recovery and economic growth reached 12.1% in the first quarter of 2010. Subsequently, however, growth started to decelerate, thanks to another global economic turmoil (this time triggered by the sovereign debt crisis in Europe), the fading of the economic stimulus effect from the earlier measures, and a

shift in monetary policy from easing to tightening in order to curb inflation, which rose from  $-1.5\%$  in the second quarter of 2009 to  $6.3\%$  in the third quarter of 2011 (Figure 1). The slowdown in economic growth, in turn, has been followed by a fall in the inflation rate.

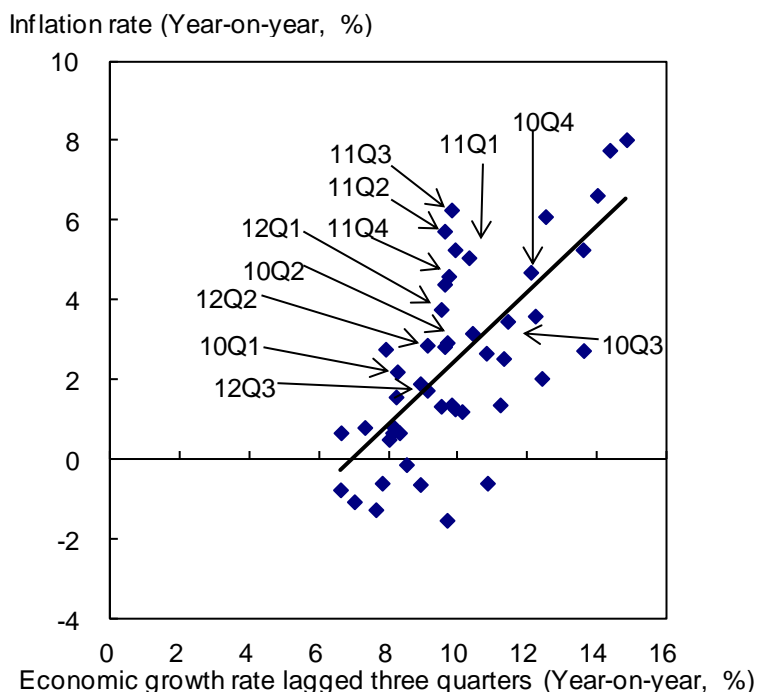
Figure 1 Economic Growth versus Inflation in China



Source: Compiled by Nomura Institute of Capital Markets Research based on CEIC database.

As a general rule, inflation rates lag economic growth rates, and this applies to China as well. When the economic growth rate goes up, the inflation rate tends to rise with a certain lag, and likewise, when the economic growth rate moves down, the inflation rate tends to fall with a lag. When we analyze data for China for the period since 2001, we can see that changes in the inflation rate on average follow about three quarters behind changes in the economic growth rate. Indeed, a plot of the economic growth rate from three quarters prior along the x-axis and the inflation rate for the current quarter along the y-axis reveals a very strong correlation between them (Figure 2). Simple regression shows that a one percentage point change in the economic growth rate three quarters earlier tends to change the current inflation rate by 0.82 percentage points in the same direction.

Figure 2: Correlation between the Economic Growth Rate and the Inflation Rate (2001Q1–2012Q3)



Note: Estimation results:

$$\text{Inflation rate} = -5.70 + 0.82 \times \text{economic growth rate lagged three quarters} \quad (6.54)$$

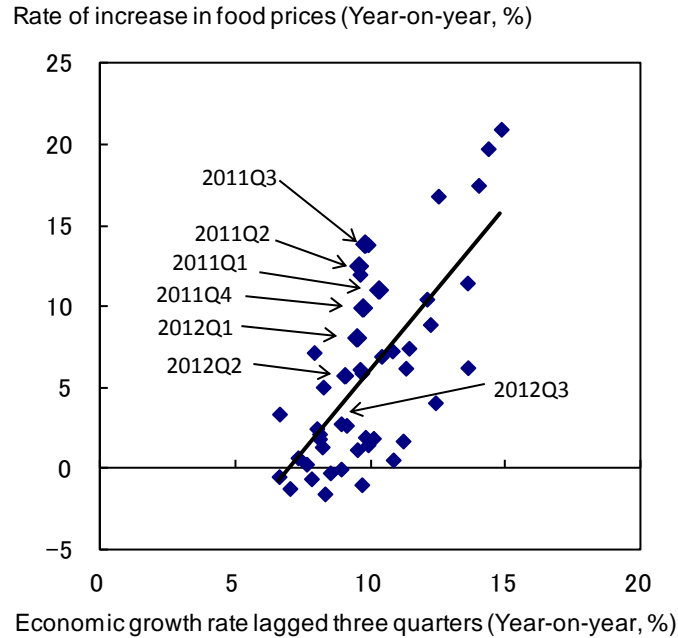
The number in parentheses denotes t-value.  $\bar{R}^2 = 0.48$

Estimation period: Q1 2001 through Q3 2012.

Source: Compiled by Nomura Institute of Capital Markets Research based on CEIC database.

Our hypothesis that the inflation rate in China lags the economic growth rate still holds, even taking into consideration the dominant role that food prices (which are affected by weather and movements in overseas markets) play in determining the consumer price index (CPI). In fact, the year-on-year rate of increase in food prices also correlates strongly with the economic growth rate three quarters ago, with the elasticity estimated at 2.00 (Figure 3). Thus the response of food price inflation to the economic growth rate is greater than the response of the overall inflation rate as measured by the CPI. This reflects the fact that the supply of food falls as more peasants move to work in the cities during economic booms, and increases as peasants return to work in the countryside during recessions.

Figure 3: Correlation between the Economic Growth Rate and Increase in Food Prices (2001Q1–2012Q3)



Note: Estimation results:

$$\text{Rate of increase in food prices} = -14.00 + 2.00 \times \text{economic growth rate lagged three quarters} \quad (6.62)$$

The number in parentheses denotes t-value,  $\bar{R}^2 = 0.48$

Estimation period: Q1 2001 through Q3 2012.

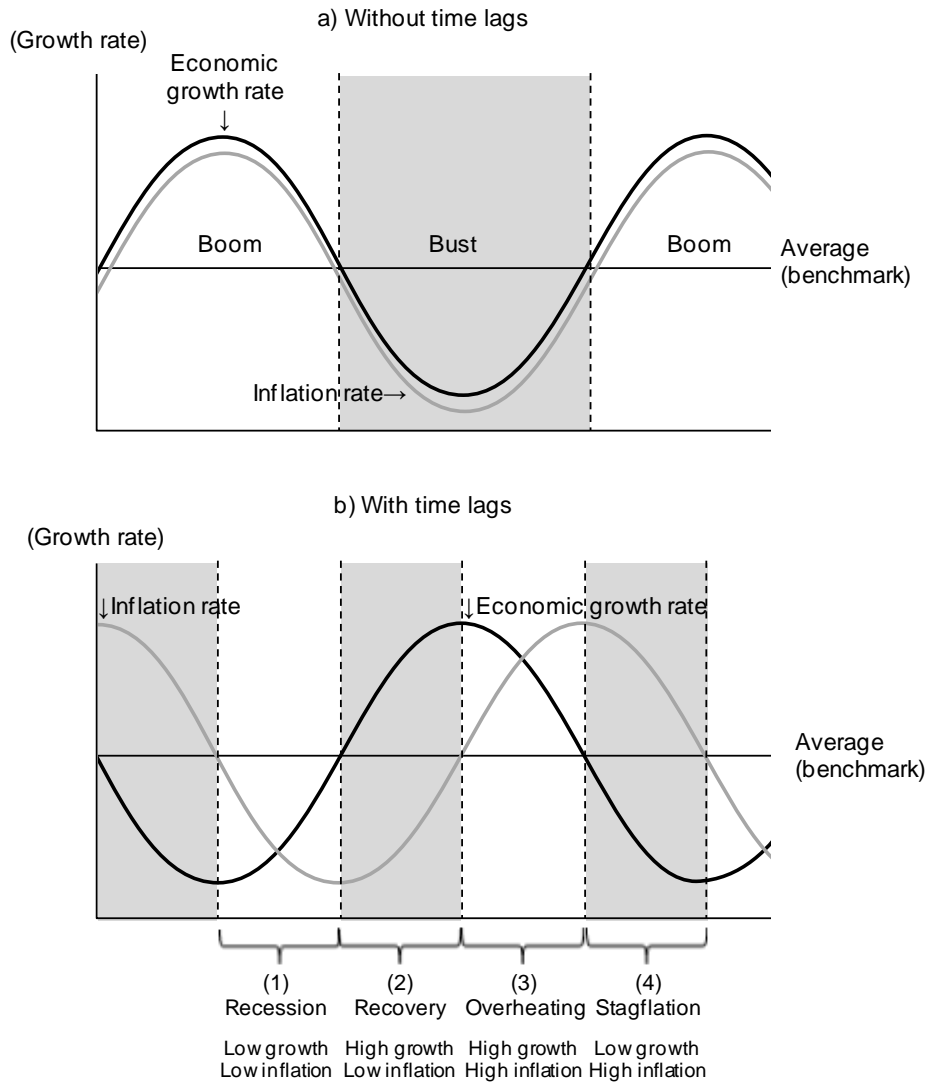
Source: Compiled by Nomura Institute of Capital Markets Research based on CEIC database.

### 3. Business cycle centering on economic growth and inflation – conceptual framework

If we delineate the phases of a business cycle according to whether the economic growth rate and the inflation rate are higher or lower than their respective benchmark (average) values, then the business cycle exhibits a different overall pattern depending on whether the inflation rate coincides with or lags the economic growth rate.

Suppose the inflation rate coincides with the economic growth rate. In this case, the business cycle has only two phases, namely, a high growth–high inflation phase (boom period) and a low growth–low inflation phase (bust period) (Figure 4a). When the economy is in a boom period, the central bank tightens monetary policy and, as a result, both the economic growth rate and the inflation rate will decrease. Conversely, in a bust period, the central bank eases monetary policy, leading to an increase in both economic growth and inflation rates. The business cycle alternates between two phases and the economy goes from a boom to a bust and then returns to a boom again.

Figure 4: Phases of the Business Cycle Defined by the Relationship between the Economic Growth Rate and the Inflation Rate



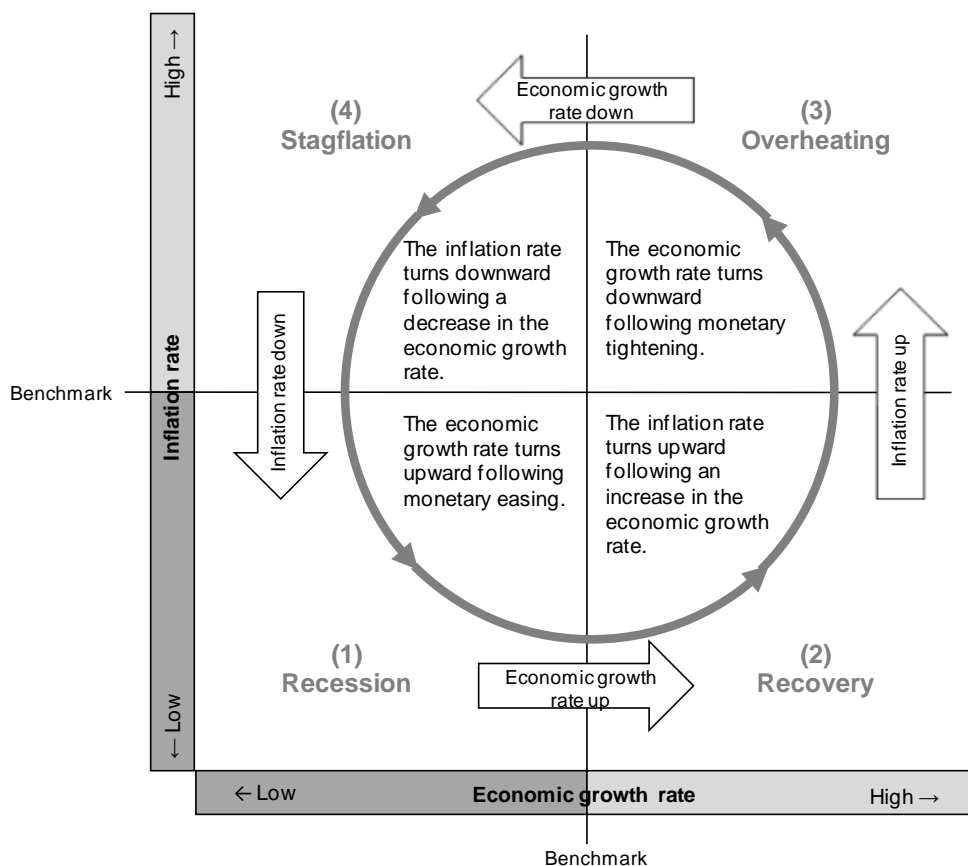
Source: Compiled by Nomura Institute of Capital Markets Research.

In contrast, if the inflation rate lags the economic growth rate, the business cycle has four phases: 1) low growth and low inflation, 2) high growth and low inflation, 3) high growth and high inflation, and 4) low growth and high inflation. These phases correspond to periods when the economy is in recession, in recovery, overheating, and in stagflation (Figure 4b). In a recession phase characterized by low growth and low inflation, the central bank eases monetary policy, which leads to an increase in the growth rate thereby guiding the economy into a recovery phase characterized by high growth and low inflation. Then, following behind the economic growth rate, the inflation

rate moves up, and the economy enters an overheating phase which is marked by high growth and high inflation. When the business cycle enters this phase, the government shifts its policy stance to a tightening mode, which in turn triggers a drop in the economic growth rate thereby leading the economy into stagflation, with low economic growth and high inflation. As the economy slows, inflation cools down, ushering in a phase of low economic growth and low inflation, hence, a return to recession.

The path of the economy under this four-phased business cycle can be depicted as a counter-clockwise rotation on a coordinate plane with the economic growth rate on the x-axis and the inflation rate on the y-axis (Figure 5). Easy monetary policies implemented in times of recession and monetary tightening in times of overheating help the economy rotate through the circle.

Figure 5: Business Cycle Described by the Interaction between Economic Growth and Inflation

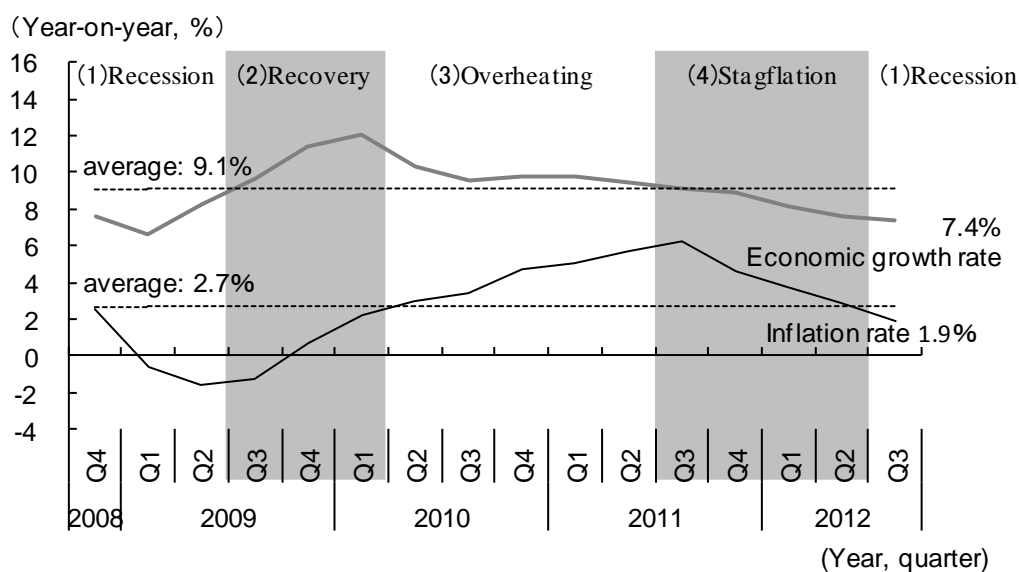


Source: Compiled by Nomura Institute of Capital Markets Research.

#### 4. Business cycle centering on economic growth and inflation – application to China

In applying this analytical framework to post-Lehman China, we must first define the benchmarks against which to determine whether the economic growth and inflation rates at each point in time are high or low. Here, we use the average economic growth rate (9.1%) and average inflation rate (2.7%) for the period from the fourth quarter of 2008 through the third quarter of 2012 as the benchmark values (Figure 6).

Figure 6: Phases of the Business Cycle in Post-Lehman China



Note: Phase (1): low growth and low inflation; phase (2): high growth and low inflation; phase (3): high growth and high inflation and phase (4): low growth and high inflation.  
 Source: Compiled by Nomura Institute of Capital Markets Research based on CEIC database.

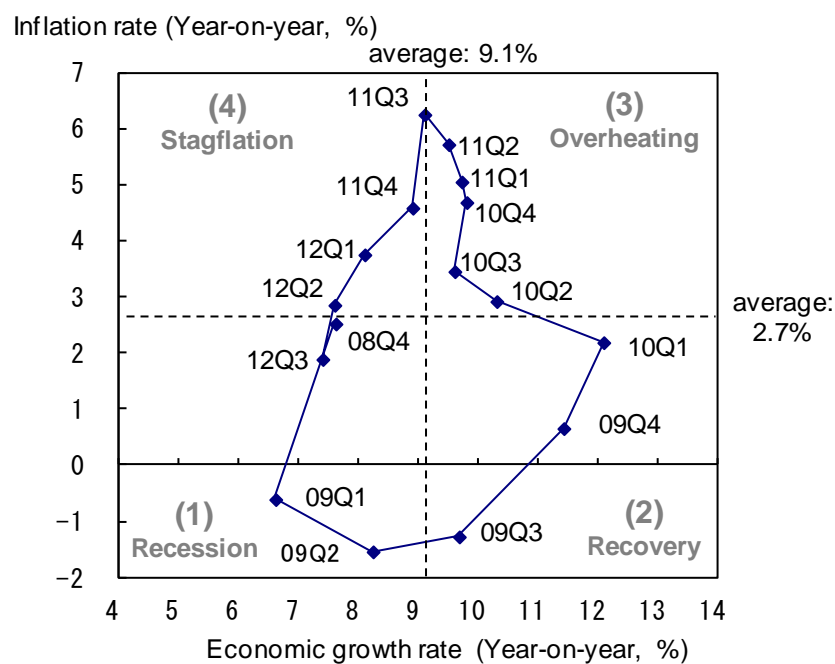
Referring to these benchmarks, we can infer that the Chinese economy entered into recession, a period of low economic growth and low inflation, in the fourth quarter of 2008 after the Lehman bankruptcy. In response to the weak economy, China quickly shifted its monetary policy stance from tightening to easing and implemented a massive four-trillion yuan fiscal stimulus package. These measures produced the intended results, with China's economic growth rate bottoming out at 6.6% in the first quarter of 2009. In the third quarter of 2009, the economic growth rate exceeded the benchmark level of 9.1%, but inflation remained below the 2.7% benchmark, indicating that the economy had entered a recovery phase with high economic growth and low inflation. Then, in the second quarter of 2010, the inflation rate exceeded its benchmark following the earlier rise in the economic growth rate, and the economy moved into an overheating phase characterized by high economic growth and high inflation. The



central bank responded by shifting its monetary policy stance from easing to tightening. As a result, the economic growth rate turned downward, dipping below its benchmark in the third quarter of 2011, and the economy entered into a stagflation phase with low economic growth and high inflation. Subsequently, the inflation rate also started to fall, and by the third quarter of 2012, the economy moved into a recession phase with low economic growth and inflation.

Looking at China’s business cycle in terms of the relationship between the economic growth rate and the inflation rate, we can see that the economy has just completed one full rotation since the collapse of Lehman Brothers (Figure 7).

Figure 7: Cyclical Changes in the Economic Growth and Inflation Rates in Post-Lehman China



Note: Phase (1): low growth and low inflation; phase (2): high growth and low inflation; phase (3): high growth and high inflation and phase (4): low growth and high inflation. The economy circulates counterclockwise in the order of (1)→(2)→(3)→(4)→(1).

Source: Compiled by Nomura Institute of Capital Markets Research based on CEIC database.

## 5. Determinants of key “prices” over the business cycle – empirical analysis based on the Taylor rule

The economic growth rate and the inflation rate, which have been the focus of our analysis so far, are also major determinants of key prices in China, including the policy

interest rate, the exchange rate and stock prices.

The Taylor rule has been widely used to analyze how interest rates are affected by changes in inflation and economic growth rates. Here, we apply the Taylor rule formula to China and use regression estimates to explain how, not only interest rates, but also the exchange rate and stock prices respond to changes in inflation and economic growth rates. The period examined is from the third quarter of 2005, which began in July that year when China shifted from the dollar-peg regime to the managed floating exchange regime, to the third quarter of 2012.

### 1) The Taylor rule

The Taylor rule was put forward by John B. Taylor, former Under Secretary of the U.S. Treasury (2001-2005) and current professor of economics at Stanford University, as a guide to formulating monetary policy (Taylor, 1993). The rule proposes that the policy interest rate should be determined in response to the divergence of actual inflation from the long-term inflation target and the divergence of current economic activity from its equilibrium level (measured by the GDP gap). The monetary authorities should raise the policy interest rate when the actual inflation rate exceeds the target inflation rate or when actual GDP exceeds potential GDP, and lower it when the opposite applies. The optimal level of the policy interest rate ( $i^*$ ) under the Taylor rule is obtained by the following equation:

$$\begin{aligned} i^* &= \text{actual inflation rate} + \text{equilibrium real interest rate} \\ &+ 0.5 \times (\text{actual inflation rate} - \text{target inflation rate}) \\ &+ 0.5 \times (\text{GDP gap}).^1 \end{aligned}$$

Using the example of the United States, if we assume that the equilibrium real interest rate is 2% and the target inflation rate is 2%, then the optimal level of the federal funds rate (FF\*), which is the policy interest rate, can be obtained by the following equation:

$$\begin{aligned} \text{FF}^* &= \text{actual inflation rate} + 2\% + 0.5 \times (\text{actual inflation rate} - 2\%) \\ &+ 0.5 \times (\text{GDP gap}) \\ &= 1.5 \times (\text{actual inflation rate}) + 0.5 \times (\text{GDP gap}) + 1\% \end{aligned}$$

Thus, according to the Taylor rule, the U.S. Federal Reserve should raise the FF rate by 0.5 percentage points in response to a one-percentage point expansion of the GDP gap

and by 1.5 percentage points in response to a similar one-percentage point rise in the inflation rate. The idea that the policy interest rate must be raised by more than the rise in the inflation rate in order to stabilize the macro economy is called the Taylor principle.

While the Taylor rule was originally developed to determine the optimal level of the policy interest rate, it has also been widely used to examine how the U.S. Federal Reserve actually reacts to macroeconomic changes. In this case, the policy interest rate is formulated as a function (known as “reaction function”) of the inflation rate and GDP gap, whose parameters are to be derived from empirical data instead of being given *a priori*.

## **2) Determinants of the policy interest rate**

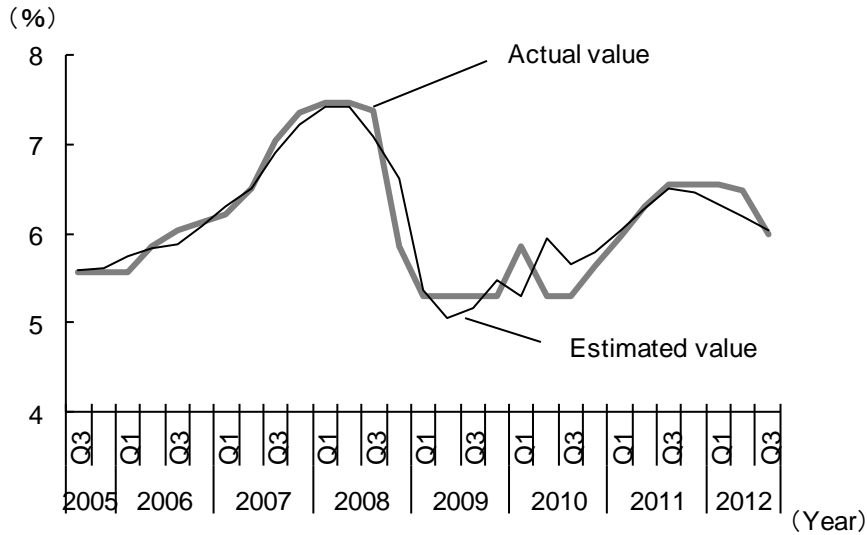
Regarding the Taylor rule as a policy reaction function, we explain how Chinese authorities adjust the policy interest rate to macroeconomic conditions by estimating a regression equation with the economic growth rate and inflation rate as explanatory variables.

Specifically, we use the one-year base lending rate of Chinese financial institutions as the benchmark for the policy interest rate, the explained variable in the regression analysis. For the explanatory variables, we use the CPI rate on a year-on-year basis as the measure of the inflation rate and the economic growth rate as a proxy for the GDP gap, which China does not officially publish.<sup>2</sup> In addition, the base lending rate for the previous quarter is added as a third explanatory variable to account for the inertia of monetary policy.<sup>3</sup> The estimated coefficients from this regression suggest that Chinese monetary authorities adjust the policy rate by only 0.11 percentage points for each one-percentage point change in the inflation rate and by 0.06 percentage points for each one-percentage point change in the growth rate (Figure 8).

According to the Taylor principle, in order to stabilize the economy, the authorities should adjust the policy interest rate by more than the change in the inflation rate, but our regression estimate (0.11) suggests that Chinese authorities do not adjust the policy rate to this extent. Hence, China’s real interest rate is inversely correlated with the inflation rate and it is evident that interest rate policy has not played its expected role as an instrument to stabilize China’s economy (Figure 9).<sup>4</sup>

Figure 8: Changes in the One-Year Base Lending Rate

— Actual versus Predicted Values —



Note: The predicted value is based on the following regression equation.

Base lending rate =

$$1.68 + 0.11 \times \text{inflation rate} + 0.06 \times \text{economic growth rate} + 0.57 \times \text{base lending rate lagged one quarter}$$

(3.70)

(2.43)

(5.66)

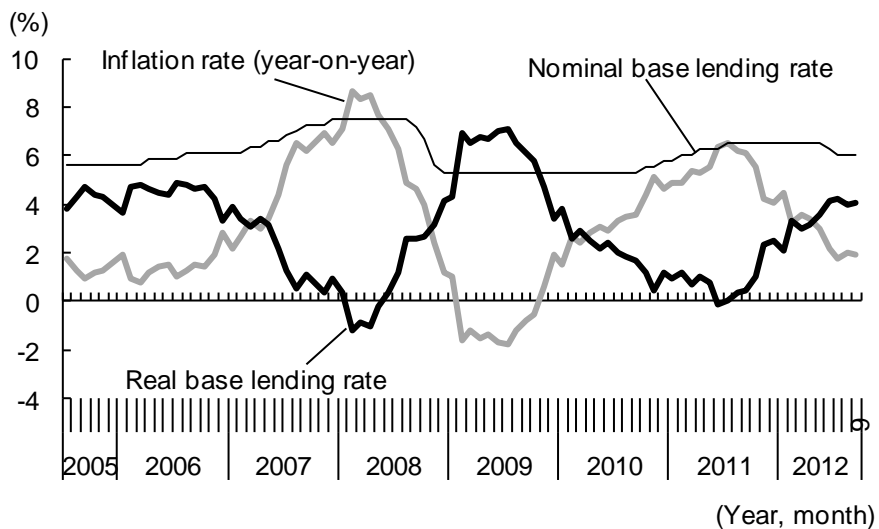
Figures in parentheses are t-values.  $\bar{R}^2 = 0.84$

The base lending rate has a one-year maturity.

Estimation period: Q3 2005 to Q3 2012

Source: Compiled by Nomura Institute of Capital Markets Research based on CEIC database.

Figure 9: Real Base Lending Rate Inversely Correlated with the Inflation Rate



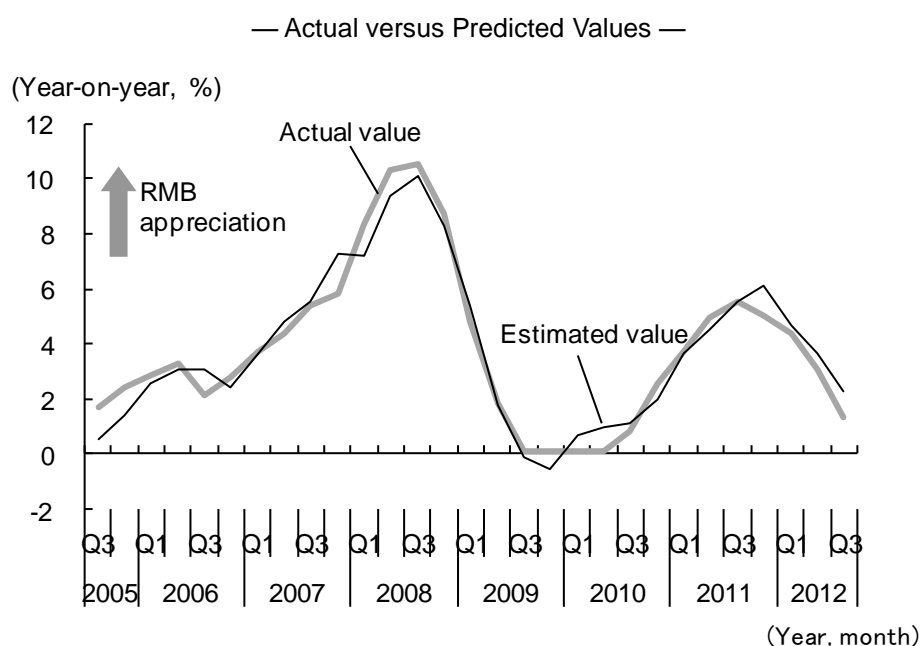
Note: The base lending rate has a one-year maturity. Real base lending rate = Nominal base lending rate - inflation rate (year-on-year)

Source: Compiled by Nomura Institute of Capital Markets Research based on CEIC database.

### 3) Determinants of the RMB exchange rate

Next, we apply the Taylor rule to analyze the determination of the RMB exchange rate by estimating a regression with the exchange rate of the renminbi against the U.S. dollar (USD/RMB) as the explained variable, and CPI inflation and economic growth rates as explanatory variables. All variables are year-on-year changes. To account for time lags and exchange rate inertia, we used the inflation rate for the preceding quarter rather than for the current quarter, and we added the renminbi-dollar exchange rate for the preceding quarter as an explanatory variable. Our estimation shows that the RMB exchange rate adjusts by 0.53% to a one-percentage point change in the prior-quarter's inflation rate and by 0.29% to a one-percentage point change in the economic growth rate (Figure 10).

Figure 10: Changes in RMB Exchange Rate against the U.S. Dollar (USD/ RMB)



Note: The predicted value is based on the following regression.

$$\begin{aligned} \text{USD per RMB} = & -3.30 + 0.53 \times \text{inflation rate lagged one quarter} + 0.29 \times \text{economic growth rate} \\ & (7.23) \qquad \qquad \qquad (4.53) \\ & + 0.62 \times \text{USD per RMB lagged one quarter} \\ & (9.47) \end{aligned}$$

Figures in parentheses are t-values.  $\bar{R}^2 = 0.93$

Figures for the RMB rate are based on period averages.

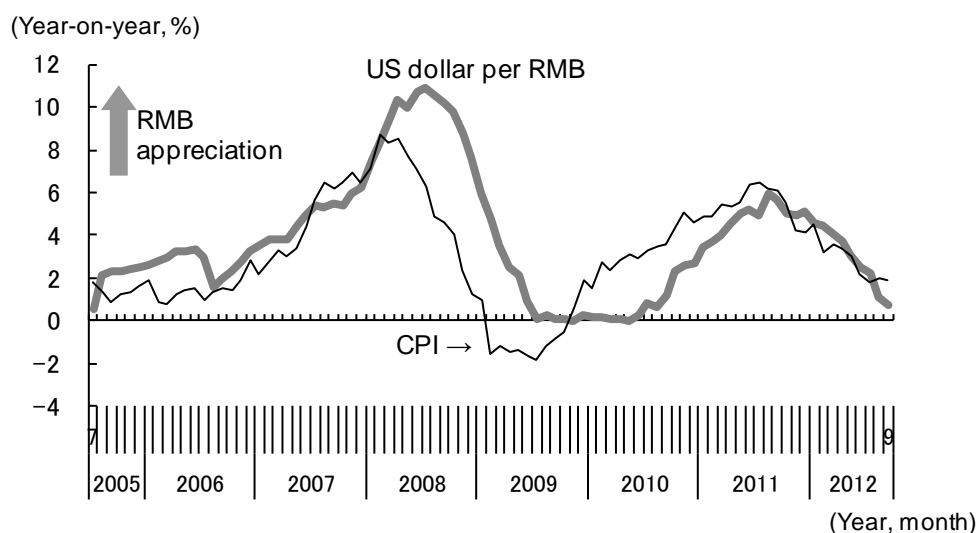
Estimation period: Q3 2005 to Q3 2012

Source: Compiled by Nomura Institute of Capital Markets Research based on CEIC database.

Comparing changes in the RMB exchange rate and the inflation rate since the third

quarter of 2005, we can see that the higher the inflation rate, the more the renminbi appreciates against the dollar (Figure 11). This is contrary to the market principle and suggests that China is using the exchange rate as a tool to maintain price stability.

Figure 11: Rate of RMB Appreciation Moving in Tandem with the Inflation Rate



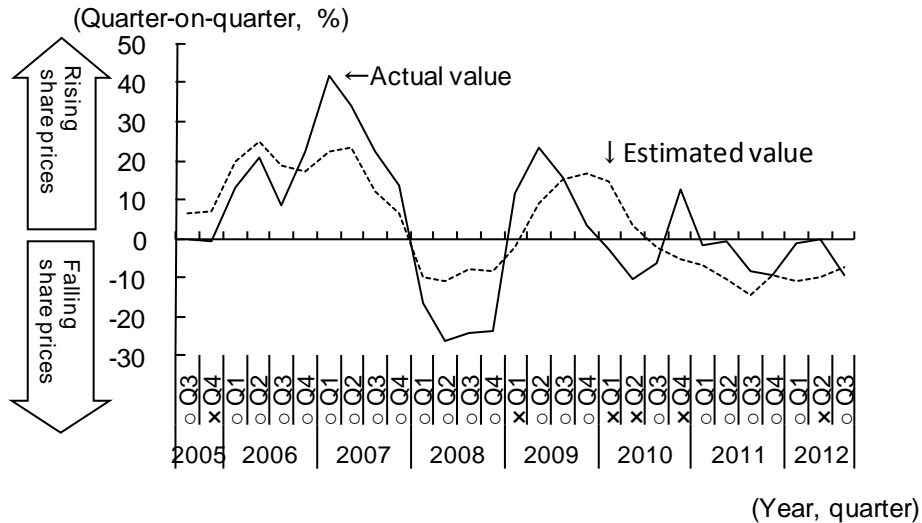
Note: Monthly average of the RMB exchange rate (U.S. dollars per renminbi).  
 Source: Compiled by Nomura Institute of Capital Markets Research based on data from the National Bureau of Statistics and the State Administration of Foreign Exchange (SAFE) of China.

#### 4) Determinants of stock prices

Finally, we apply the Taylor rule to analyze the determination of stock prices in China by estimating a regression equation with the quarter-on-quarter change in the Shanghai Stock Exchange (SSE) Composite Index as the explained variable and the year-on-year economic growth and inflation rates as the explanatory variables. Our estimation shows that the SSE Composite Index responds by 4.91% to a one percentage point change in the economic growth rate, and by  $-3.52\%$  to a one percentage point change in the inflation rate (Figure 12). Predicted changes in the SSE Composite Index calculated from the estimated regression move in the same direction as the actual values in 23 out of the 29 quarters with inconsistent movements observed only in the remaining six quarters.

Figure 12: Changes in the SSE Composite Index

— Actual versus Predicted Values —



Notes: The predicted value is based on the following regression.

Shanghai Composite Index (QoQ) =

$$-36.90 + 4.91 \times \text{economic growth rate (YoY)} - 3.52 \times \text{inflation rate (YoY)}$$

(4.98) (-4.01)

Figures in parentheses are t-values.  $\bar{R}^2 = 0.53$

Figures for Shanghai Composite Index are based on period averages.

Estimation period: Q3 2005 to Q3 2012

○ indicates the predicted value rises or falls with the actual value.

× indicates the predicted value moves in the opposite direction from the actual value.

Source: Compiled by Nomura Institute of Capital Markets Research based on CEIC Database.

## 6. Short-term economic outlook

The Chinese economy is likely to pick up in 2012 on the back of more expansionary fiscal and monetary policies pursued by the government. A large-scale stimulus comparable to the four-trillion yuan package implemented after the Lehman crisis, however, is unlikely, and the decline in the potential growth rate resulting from the shortage of labor may also limit the pace of recovery.

### 1) Economic growth to pick up

Responding to the recent bout of decelerating growth and falling inflation, the Chinese government has shifted its macroeconomic policy stance from tightening to easing. First, monetary authorities have reduced reserve requirement ratios three times by a total of 1.5 percentage points since December of 2011, and followed by cutting interest rates for two consecutive months in June and July of 2012. Fiscal policy has become more expansionary as the authorities speed up the approval of major investment projects. In the wake of these moves, the economic growth rate is expected to recover starting with

the fourth quarter of 2012, while inflation is unlikely to pick up until the latter half of 2013. In terms of Figure 7, the economy should continue to revolve through the business cycle in a counter clockwise direction from the lower left quadrant.

## **2) Another large-scale stimulus package unlikely**

In contrast to its response following the Lehman crisis, the government has taken relatively weak stimulus measures so far in the current slowdown, as it learned from recent experience that implementing such measures may be very costly.

Although the expansionary fiscal and monetary policies that were quickly implemented after the collapse of Lehman Brothers in September 2008 enabled China's economy to achieve a V-shaped recovery in 2009, distortions brought about by these policies have since gradually come to the fore.

First, the central government financed only 1.18 trillion yuan of the four trillion yuan that were mustered for economic stimulus measures, and local governments had to raise the remaining funds from banks and other sources. As a result, local government debt (including debt raised through financing platforms established to procure funds for infrastructure investments) has been increasing sharply, and it is feared that some local government debt may end up as non-performing bank loans.

Second, following the easing of monetary policy, the money supply (M2) jumped, peaking at 29.7% year-on-year in November 2009. The resulting liquidity expansion gave rise to inflation and to a steep increase in home prices. The year-on-year increase in the consumer price index (CPI) reached 6.5% in July 2011, while the year-on-year increase in home prices in 70 large and medium-sized cities hit 12.8% in April 2010 (Figure 13).

Third, because many investment projects targeted by the economic stimulus measures were unprofitable and/or created excess capacity, the investment efficiency of the overall economy is deteriorating. Reflecting this, while the investment ratio (the ratio of capital formation to GDP) has risen significantly since 2009, the economic growth rate has declined. As a result, the marginal capital coefficient, which is derived by dividing the investment ratio by the economic growth rate, has risen sharply (Figure 14).



Figure 13: Soaring Inflation and Home Prices Following the Sharp Increase in the Money Supply

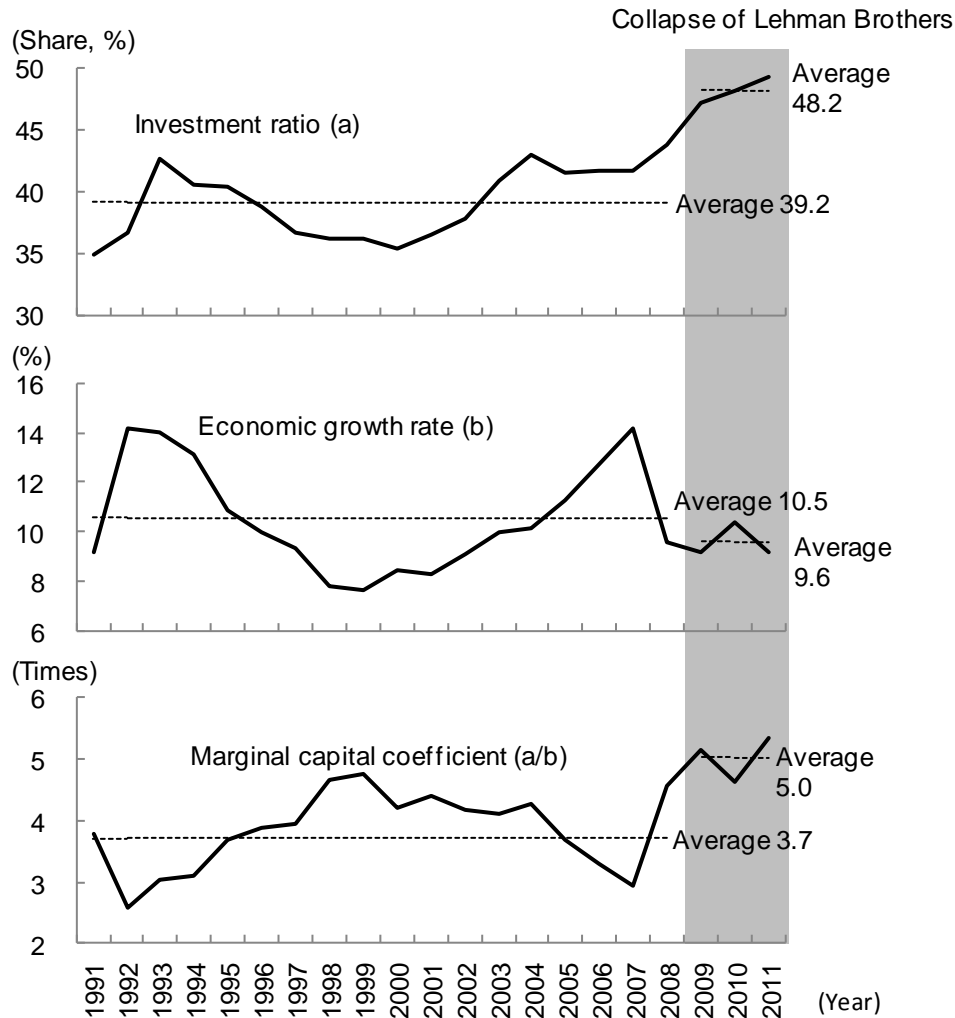
— Situation after the collapse of Lehman Brothers—



Note: Home prices in large and medium-sized cities are based on the sales price indices of residential buildings until December 2010 and on the average sales price indices of newly constructed homes from January 2011.

Source: Compiled by Nomura Institute of Capital Markets Research based on data from the National Bureau of Statistics of China.

Figure 14: Changes in the Investment Ratio, Economic Growth Rate, and Marginal Capital Coefficient



Note: The larger the marginal capital coefficient, the less efficient the investment.  
 Source: Compiled by Nomura Institute of Capital Markets Research based on data from the *China Statistics Abstract 2012* of the National Bureau of Statistics of China.

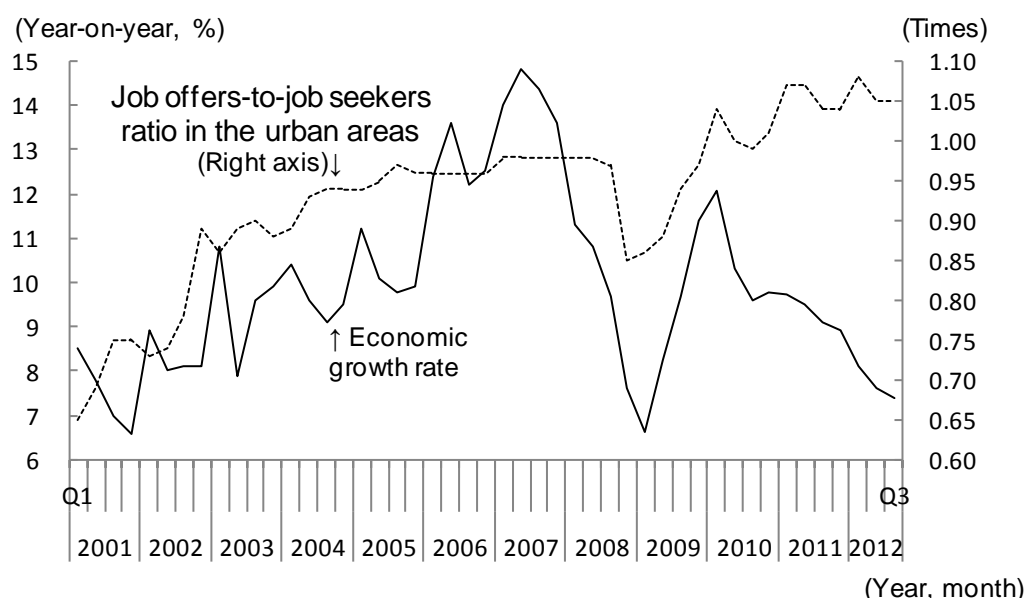
To avoid repeating the same distortions that followed its post-Lehman stimulus, the government is likely to remain cautious when using fiscal and monetary policy to boost the economy in the current downturn.

### 3) Lower potential growth rate

The government should also recognize that, constrained by the supply of labor, China's medium-term potential growth rate might have fallen sharply. There have been clear signs suggesting that China's economy has arrived at the Lewisian turning point—the achievement of full employment in the development process with the drying up of excess

labor in rural areas. Among these signs is the fact that employment conditions have not deteriorated despite the significant fall in the economic growth rate during the recent economic downturn. This situation contrasts sharply with the one that prevailed in the wake of the Lehman Brothers collapse, when demand for labor fell sharply. In the fourth quarter of 2008, for example, the job offers-to-job seekers ratio in urban areas plummeted to 0.85 (Figure 15). This ratio rebounded with the subsequent economic recovery, and has remained at the historically high level of around 1.0 even since the economy started to slow in 2010.

Figure 15: Job Offers-to-Job Seekers Ratio Diverging from the Economic Growth Rate



Note: The job offers-to-job seekers ratio in the urban areas of China is calculated by dividing the number of job offers by the number of job applicants registered in public employment service organizations in approximately 100 cities. It is based on “The Analysis on Supply and Demand of Labor Market in Some Cities” published quarterly by the China Labor Market Information Network Monitoring Center, which operates under the Ministry of Human Resources and Social Security. Sources: Compiled by Nomura Institute of Capital Markets Research based on data from the National Bureau of Statistics of China and the Ministry of Human Resources and Social Security.

Generally speaking, the more the actual GDP growth rate exceeds the potential growth rate, the tighter labor market conditions become and the higher the job offers-to-job-seekers ratio. When the economic growth rate declines, provided that the potential growth rate remains unchanged, labor market conditions should ease, and the job offers-to-job-seekers ratio should move lower. In fact, however, the offers-to-seekers ratio has remained high even though economic growth has fallen substantially. This suggests that China’s potential growth rate has fallen considerably from its past level, constrained by a shortage of labor associated with the arrival of the Lewisian turning

point.

The good news is that the government does not need to worry about unemployment as before, but the bad news is that the era of double-digit growth might have gone for ever. If the government insists on adopting an expansionary policy to maintain high growth, it may inadvertently rekindle inflation and the economic bubble.

## References

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Taylor, John B. (1993), "Discretion versus Policy Rules in Practice", *Carnegie-Rochester Conference Series on Public Policy* 39: 195-214.

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## Notes:

<sup>1</sup> The GDP gap is calculated by subtracting potential GDP from actual GDP. Thus, a larger gap indicates a more overheated economy.

<sup>2</sup> Strictly speaking, the difference between the actual and potential GDP growth rates should be used as the proxy variable for the GDP gap. For simplicity, however, only the actual economic growth rate is included in the estimating equation, assuming that the potential growth rate is constant.

<sup>3</sup> For simplicity, the equilibrium real interest rate and the target inflation rate, which are components of the Taylor rule, are assumed constant and excluded from the estimation equation.

<sup>4</sup> Adjusting statutory reserve ratios, instead of base interest rates, has become the major instrument of monetary policy in China. To curb inflation, authorities raised the statutory reserve ratio applicable to major banks twelve times, from 15.5% to 21.5%, between January 2010 and July 2011. This helped slow the growth of M2 money supply by reducing the credit multiplier.