

# Empirical Study on the Basic Reason of Current Inflation

Jun-jun Chen<sup>\*1</sup>, Yu-xiang Han<sup>2</sup>

<sup>1\*</sup> Jun-jun Chen, college of management, university of shanghai for science and technology, Shanghai, China.

<sup>2</sup> Yu-xiang Han, college of management, university of shanghai for science and technology, Shanghai, China.

Email: [junjunchan@126.com](mailto:junjunchan@126.com)

**Abstract** –This paper attempts to study the relationship between China's current money supply and inflation. We do an empirical study by establishing a stable money demand model in long-term during the period from the first quarter of 2000 to the first quarter of 2011. The results show that there exists a cointegration relationship among the variables of money supply, price index and gross domestic product, interest rates, where money supply is highly correlated with CPI, the oversupply of money could lead to the decline of interest rates with the subsequent phenomenon of excess liquidity, and the excess liquidity contributes greatly to China's current inflation in turn.

**Keywords** –Abusing publication of currency; Excess liquidity; Inflation; VAR

## 1. Introduction

In response to the negative impact of the 2007-2008 global financial crisis on the real economy in China, Chinese government implemented a proactive fiscal policy and moderately loose monetary policy during the period of 2008 to 2010, and until 2011, the government began to implement a proactive fiscal policy and a prudent monetary policy. With the use of easing, China's strong economic growth momentum has been consolidated. However, it is facing new challenges of the excess liquidity both at home and abroad, and the pressure of growing inflation. Since November 2009, the Consumer Price Index (CPI) has been keeping rising, soaring to a new height of 5.4 percent on March 2011. If we define 3% as the inflation cordon, we can see that since the end of the second quarter of 2010, China has been experiencing a serious challenge of inflation. Some scholars believe that the abusing publication of currency leads to the excess liquidity, which resulted in the rise of current and expected inflation rates. Sebastian Becker (2007) put forward that, if the money supply expansion continued exceeding the GDP growth, then excess liquidity will appear. A number of empirical studies also had been done to study the relationship between inflation and money supply. Bachmeier & Swan-son (2005) did the empirical study with the data of United States, and the results show that when add the money supply variable into the VAR model, it will significantly improve its predict ability compared to that only with the inflation variable to predict the inflation rate for more than a year, at the same time, the results also indicate that there exists a Granger causal relationship between the money supply and the inflation. Helge Bergeretal (2008) did the study by adopting Bayesian vector autoregression approach with the related quarterly data of EU, the results also show that there is a Granger causal relationship between the money supply and inflation. Liu Zhuanshi and Li Dan (2008) studied the relationship between inflation and money supply by applying the cointegration analysis and

ECM methods with the data of China from the third quarter of 1994 to the third quarter of 2007, and they found that in the long term every 1% increase of liquidity will lead to 0.79% increase of inflation, however, in the short-term, liquidity has a very limited impact on inflation. Zuo Xiaolei (2011) come up that the biggest threat of inflation comes from the liquidity. The liquidity management in China, should be achieved by raising interest rates and deposit reserve ratio, as well as a positive return for open market operations, so that strictly control the liquidity in the economic operation within the policy objectives, and to maintain the growth rate of money supply just a few percentages higher than the sum of economy's growth rate plus CPI. In this paper we define the excess liquidity as: the amount of money in an economy beyond the amount it needs for its normal economic operation.

## 2. The theoretical analysis and hypotheses

### 2.1. Inflation and excess liquidity

American economist Mankiw put forward that when the government issues too much money, the price rises. In China, the money supply is divided into three levels:  $M_0$ ,  $M_1$  and  $M_2$ .  $M_0$  is currency(coins and bills),  $M_1$  is  $M_0$  plus demand deposits (such as checking accounts), which reflects the direct purchasing power of economies, and  $M_2$  is  $M_1$  plus savings accounts, time deposits, and other institutional accounts, which reflects the direct purchasing power and potential purchasing power of economies. Generally, the central bank implements the loose monetary policy by increasing the money supply and the size of the loan, reducing the deposit reserve ratio and the interest rate, using open market operation, which will first cause the rapid growth of the  $M_2$ , and the growth rate of the  $M_2$  often higher than that of  $M_1$ . However,  $M_1$  will grow rapidly after a delay, and the excess of  $M_1$  will lead to higher inflation. Based on the analysis above, we put forward the following hypothesis:

**Hypothesis 1:** The oversupply of money leads to the rise of price, then inflation occurs.

## 2.2. The missing currency

$M_2$ /GDP is commonly used to measure the degree of currency of a country's economic indicators, along with the deepening of financial reform. Since China's reform and opening up,  $M_2$  / GDP has been keeping increasing. The ratio was only 0.28 in 1978, but it reached 2.59 in the third quarter of 2010. With such a high ratio of  $M_2$ / GDP, a serious inflation will be expected to occur in other countries. However, in China, except for the double-digit rates of vicious inflations occurred during 1988-1989 and 1993-1995, there was no double-digit inflation in any other year. We are sure that there must be a part of the issued currencies were missing: First, since the reform and opening up, China has been encouraging the export-oriented industrial development, bring in a large amount of foreign capital, accumulated the massive foreign exchange reserves, which accordingly needs to issue the same amount of money. Second, China's high savings and investment, as well as the bad assets of state-owned enterprises and financial system, all make it necessary to issue more money. Third, the marketization of commodities, resources and securities needs to issue more money. Based on the analysis of "missing currency", we use the growth rate of  $M_2$  to measure the money growth rate, put forward the following hypothesis:

**Hypothesis 2:** With the deepening marketization, China's GDP is growing rapidly, which calls for  $M_2$  to grow correspondingly.

## 2.3. Interest rate and excess liquidity

The interest rates will fall when the money supply increases, and will increase when the it reduces. When the interest rate falls below a certain level, people would think that it won't fall any more, and therefore securities' prices won't rise but only to fall, so people are willing to hold money in hands no matter how much they have, as a result excess liquidity appears. Generally speaking, when the excess liquidity appears, the government could tighten money supply to raise interest rate, thus slow the growth rate of economy. Base on the analysis above, we put forward the following hypothesis:

**Hypothesis 3:** Too much money supply will lead to the decline of interest rates, and cause the excess liquidity.

## 3. Empirical study

### 3.1. Main variables and definitions

#### 3.1.1. Consumer price index (CPI)

As a major means to measure inflation, CPI comprehensively reflects the trend and degree of changes in prices of consumer goods and services purchased by urban and rural households during a given period. It is closely related to the national daily life, and is the most concerned index of the government and the public. What's more, the data is easily accessible and relatively accurate.

#### 3.1.2. Gross domestic product (GDP)

GDP refers to the market value of all officially recognized final goods and services produced within a country in a given period. It is often considered as the best indicator of a country's economic conditions. The growth of nominal GDP is not only influenced by real output, but also influenced by price. When the economy is in a recession, the government will take expansionary policies. Expanding the money supply will promote the actual GDP output in a certain extent, and at the same time, prices rise accordingly.

#### 3.1.3. Interest rates (R)

When the money supply of an economy is expanding, then the interest rates usually will fall. Conversely, when the central bank raises interest rates, it will not only influence the financial asset prices, consumption and investment activities, but also will reduce the currency create multiplier, leading to the contraction of liquidity, therefore reduce the money supply.

#### 3.1.4. Money supply ( $M_2$ )

$M_2$  does not only reflect a country's direct purchasing power, but also reflect the potential purchasing power. When studying the liquidity, we should take all into account, including currency, current deposit, time deposit, savings deposit, securities, and so on.  $M_2$  is relatively an appropriate index to measure potential purchasing power.

### 3.2. Sample selection and data sources

In this paper, the sample period is from the first quarter of 2000 to the first quarter of 2011, and we choose the quarterly data of the CPI, M2 and GDP, as well as China's 91-120 days interbank lending weighted average interest rate (R) announced by the central bank. There are totally 45 sample data. As shown in table 1.

**Table 1.** The sample data from 2000 Q1 to 2011 Q1  
(Unit:CNY bn)

Quarter	CPI	$M_2$	GDP	R (%)	Quarter	CPI	$M_2$	GDP	R (%)
2000Q1	99.8	12258.07	2064.70	5.64	2005Q4	101.6	29875.57	5783.30	3.89
2000Q2	100.5	12660.53	2310.12	5.83	2006Q1	100.8	31049.07	4441.98	2.40

2000Q3	100.5	13047.38	2433.93	5.40	2006Q2	101.5	32275.64	4919.18	2.72
2000Q4	101.5	13461.03	3112.75	5.29	2006Q3	101.5	33186.54	5098.50	3.30
2001Q1	100.8	13874.45	2329.95	4.94	2006Q4	102.8	34560.36	6735.39	3.25
2001Q2	101.4	14780.97	2565.14	5.01	2007Q1	103.3	36409.34	5135.39	3.80
2001Q3	99.9	15182.26	2686.73	4.26	2007Q2	104.4	37783.22	5755.92	3.05
2001Q4	99.7	15830.19	3386.38	2.86	2007Q3	106.2	39309.89	6014.84	3.49
2002Q1	99.2	16406.46	2537.57	2.88	2007Q4	106.5	40340.13	8046.84	6.00
2002Q2	99.3	16960.12	2796.53	4.01	2008Q1	108.3	42305.45	6149.06	4.57
2002Q3	99.3	17698.24	2917.57	2.45	2008Q2	107.1	44314.10	6912.84	4.51
2002Q4	99.3	18500.73	3727.63	3.89	2008Q3	104.6	45289.87	7101.20	4.43
2003Q1	100.9	19447.83	2886.18	2.90	2008Q4	101.2	47516.66	9264.50	3.94
2003Q2	100.3	20493.14	3100.71	3.28	2009Q1	98.8	53062.67	6981.69	2.08
2003Q3	101.1	21356.71	3346.04	3.55	2009Q2	98.3	56891.62	7838.67	1.38
2003Q4	103.2	22122.28	4249.37	4.51	2009Q3	99.2	58540.53	8309.97	1.82
2004Q1	103.2	23165.46	3342.06	3.92	2009Q4	101.9	60622.50	10959.60	1.92
2004Q2	105.0	23842.75	3698.53	3.89	2010Q1	102.4	64994.75	8187.70	2.08
2004Q3	105.2	24375.69	3956.17	3.37	2010Q2	102.9	67392.17	9172.80	3.51
2004Q4	102.4	25410.70	4991.04	3.64	2010Q3	103.6	69647.15	9661.90	3.00
2005Q1	102.7	25410.70	3884.86	3.99	2010Q4	104.6	72585.18	12749.90	3.43
2005Q2	101.6	27578.55	4257.39	2.50	2011Q1	105.4	75812.99	9631.10	4.85
2005Q3	100.9	28743.83	4456.24	2.25					

Sources: The People's Bank of China, the National Bureau of Statistics of China, and China economic information network

### 3.3. Research methods and model design

#### 3.3.1 Model Setup

According to the impact mechanism of excess liquidity on inflation, this paper does a regression analysis on the money supply ( $M_2$ ), consumer price index (CPI), nominal gross domestic product (GDP), interbank lending weighted average interest rate (R), and sets the regression equation as follows:

$$\ln m_{2t} = \beta_0 + \beta_1 \ln cpi_t + \beta_2 \ln gdp_t + \beta_3 r_t + u_t \quad (1)$$

This equation works out the actual amount of money that an entity economy needs to achieve its long-term equilibrium.

#### 3.3.2. Model estimation and adjustment

In this paper we adopt the eviews 5.0 software to deal with the data showed in Table 2, then do the regression after the log processing, at last, we get the following results:

Table 2. China's CPI and PPI increase since October 2009

Month	CPI %	PPI %	Month	CPI %	PPI %
2009 • 10	-0.5	-0.58	2010 • 12	4.6	5.9
2009 • 11	0.6	-2.1	2011 • 01	4.9	6.6
2009 • 12	1.9	1.7	2011 • 02	4.9	6.6
2010 • 01	1.5	4.3	2011 • 03	5.4	7.3
2010 • 02	2.7	5.4	2011 • 04	5.3	6.8
2010 • 03	2.4	5.9	2011 • 05	5.5	6.8
2010 • 04	2.8	6.8	2011 • 06	6.4	7.1

2010 • 05	3.1	7.1	2011 • 07	6.5	7.5
2010 • 06	2.9	6.4	2011 • 08	6.2	7.3
2010 • 07	3.3	4.8	2011 • 09	6.1	6.5
2010 • 08	3.5	4.3	2011 • 10	5.5	5
2010 • 09	3.6	4.3	2011 • 11	4.2	2.7
2010 • 10	4.4	5.0	2011 • 12	4.1	1.7
2010 • 11	5.1	6.1	2012 • 01	4.5	0.7

Sources: National Bureau of Statistics of China

Table 3. Regression results of real money balances demand equation

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-7.332810	4.721467	-1.553079	0.1281
LNX1	2.089711	1.103038	1.894504	0.0652
LNX2	0.976553	0.053485	-18.258470	0.0000
X3	-0.072740	0.022059	-3.297605	0.0020
R-squared	0.949641	Mean dependent var	12.58420	
Adjusted R-squared	0.945957	S.D. dependent var	0.54363	
S.E. of regression	0.126380	Akaike info criterion	-1.21436	
Sum squared resid	0.654848	Schwarz criterion	-1.05377	
Log likelihood	31.32311	F-statistic.	257.72030	
Durbin-Watson stat	2.242176	Prob(F-statistic)	0.00000	
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The sample estimate regression equation:  
 $lnm_2 = -7.3328 + 2.0897incpi + 0.9766lngdp_t - 0.0728r_t$  (2)  
 $t = (-1.553079) \quad (1.894504)$   
 $(18.25847) \quad (-3.297605)$

$R_2 = 0.9496 \quad \bar{R}_2 = 0.9459$   
 $F = 257.7203 \quad DW = 2.2422$

We can see that F and t tests both are significant, there is no autocorrelation, and the coefficient of determination is relatively high. Based on the model above, in the long term, the money supply after the log processing, the consumer price index after the log processing, and the gross domestic product (GDP) after the log processing are positively correlated, while money supply after the log processing and the interest rate are

negatively correlated. It also proves the reasonableness of the three hypotheses presented above in this paper.

### 3.4. Analysis of Empirical results

#### 3.4.1. Cointegration test

In order to avoid spurious regression, for non-stationary time series, there should be a cointegration relationship among variables in this regression model. Using the ADF method to do the unit root test of  $lnm_2$ ,  $incpi$ ,  $lngdp$  and  $r$  sequence, and do stationarity test on the regression residuals  $e_t$ , the test results are shown in Table 3 and Table 4.

Table 4.  $lnm_2$   $incpi$   $lngdp$ ,  $r$  unit root test

Variables	Results of level test				Results of first order difference test			
	ADF-t value	Critical values at 1%、5%、10% significance level			ADF-t value	Critical values at 1%、5%、10% significance level		
$lnm_2$	1.297	-3.597	-2.933	-2.605	-3.922	-3.601	-2.935	-2.606
$incpi$	-2.46	-3.597	-2.933	-2.605	3.193	-3.601	-2.935	-2.606
$lngdp$	-0.302	-3.597	-2.933	-2.605	-52.753	-3.601	-2.935	-2.606
$r$	-2.584	-3.597	-2.933	-2.605	-3.36	-3.601	-2.935	-2.606

The results showed in Table 3 indicate that at the 5% significance level, ADF test values of all sequences are greater than the critical value, means all are non-stationary variables. However, the ADF test

values of first order difference sequences were less than the critical value. Therefore, the tested variables are integrated of order 1 sequences, satisfying the conditions of cointegration relationship test.

**Table 5.** Stationarity test on the residuals sequence

	t-Statistic	Prob.
Augmented Dickey-fuller test statistic	-6.2141113	0.0000
Test critical values:		
1% level	-2.624057	
5% level	-1.949319	
10% level	-1.611711	

The results showed in Table 4 indicate that at 5% significance level, the test value of the residuals is less than its corresponding critical value, and there is no unit root, which indicates that it is a stationary sequence. So there is a cointegration relationship and long-term equilibrium relationship among the money supply, CPI, GDP and R.

### 3.4.2 Empirical results

According to the results of the regression equation, we can draw the following conclusions: First, after the log processing, the money supply and the CPI are correlated and the correlation coefficient is 2.0897, which is very sensitive, means when there are too much money supply, the price will increase sharply; Second, the money supply after the log processing and the GDP after the log processing are correlated and the correlation coefficient is 0.9766, which is relatively sensitive, and means that the money supply's moderate growth and the economic growth will promote each other; Third, the money supply after the log processing and the market interest rates are negatively correlated, and the correlation coefficient is -0.0728, which is not sensitive, indicates that when the money supply is too much, the interest rates will decline, but the decline trend is not so obvious. Therefore, there will be no significant results to regulate the money supply in China by increasing interest rates.

## 4. Conclusions and policy suggestions

The current strong economic growth in China, naturally requires corresponding growth of money supply. Based on the empirical study above, we can draw the conclusion that the current inflation is caused by the abusing publication of currency which have led to excess liquidity.

At present, inflation has become the most important issue of China's economy. To control inflation, we should moderately slowdown the pace of economic growth, take a prudent fiscal policy and tight monetary policy, moderately inhibit the aggregate demand, slowdown the speed of government investment, particularly slowdown the approval rate of the country's railways, highways, airports, nuclear power, hydropower and other projects, which are in construction or to be constructed. Gradually withdraw and reduce the liquidity of the economy, control the current inflation, thereby control the expected inflation.

China should continue to further the reform of interest rate marketization. On the one hand, the interest rate still cannot play the function of price signals. On the other hand, the interest rate also cannot play a role in deployment of funds, let alone to play a role in macro-control. As the price of capital market products, interest rate makes monetary policy more effective through its price signal functions, thus play the basic role of price signals in allocating resources. Market interest rates affect the rate of return of all assets. It takes the initiative to allocate the asset of the economic entities, and have a tremendous impact on consumer and investment behavior. In a perfect market, when excess liquidity and inflation occurred, the central bank will implement a tight monetary policy, such as raise the deposit reserve ratio, open market operations, raise interest rates, and so on, make the quantity and price tools work at the same time. Our method can be used in various fields [16-23].

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