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STUDY ON THE RELATIONSHIP AMONG MONEY SUPPLY, AND INFLATION ECONOMIC GROWTH: BASE ON THE STATISTIC DATA 1990-2015 IN CHINA

Abstract: *Relationship among money supply, and inflation economic growth is always a hot topic in academic world. In order to test the new phenomenon in them, Pearson correlation analysis and multiple regression analysis were used to analyze the internal relations among money supply, economic growth and inflation. Money supply and economic growth have high correlation ship, when money supply is high, the economy in China always in period of economic overheating. CPI cannot fully explain inflation in China inflation index should take house price and other elements in to consider.*

Key words: *Relationship, Money supply, Inflation, Economic growth.*

Language: *English*

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Introduction

Since 1990s, China has come into a period with rapid economic growth, which called the second spring of Reform and Opening up. Although the recent economic growth rate is slower than 1990s and 2000s, Chinese economic growth rate is still relatively high compared to the world economy growth. There are many reasons for the rapid growth of Chinese economy, and the money supply is one of the key factors to Chinese economy growth. In the early 1990s, Chinese inflation rate is relatively high than before, but after 1996 Chinese economy achieved soft-landing successfully, Chinese inflation rate became lower and stable until now. However, the amount of Chinese money supply became bigger and bigger with stable inflation rate. These phenomena are deserved to analyze.

Relationship between money supply and economic growth is a hot topic in academic circle. Existing research can be divided into the following aspects: firstly, some researches argue that money supply is affected by economic growth, such as F Takahashi (1971) found the ratio of outside money to the money supply will be influenced by inflation and ultimately the long-run equilibrium values of the real variables in a fully employed economy; secondly, some researches argue that money supply has no significant relationship with economic growth by empirical analysis (Xie, C. et al 2009); some researches argue that influence between cash in circulation and economic growth is not stable, sometimes positive, sometimes negative effect, which means there were interactions between money supply and economic growth in China (Zhou, C. 2013). With regard to Money Supply, Economic Growth and Inflation, Wang (2012) found that there is no cointegration relationship among money supply, inflation, and economic growth, but there is cointegration relationship between money supply and inflation while there is no co-integration relationship between money supply and economic growth. Jiang (2014) studied shocks of economic growth and money supply on inflation use empirical analysis of the United States and China, japan and South Korea, and found that major currency supply shock on inflation is less than that of each country economic growth.

After Chinese economy has entered a new normal, the relationship among money supply, economic growth and inflation appeared new characteristics, so this topic is still need to research and explore.

Materials

China Statistical Yearbook is the most authoritative source of data. Money Supply, economic growth and inflation data can all be found in China Statistical Yearbook, and the data is the complete time series, which can be used conveniently.

Money Supply is the total amount of monetary assets available in an economy at a specific time. The standard measures usually include currency in circulation and demand deposits (depositors' easily accessed assets on the books of financial institutions). In economic research M2 (including currency, demand deposits, and small denomination time deposits) is often used as object of study, so in this paper M2 was used as money supply data. The following tables show the money supply amounts and growth rates from the year 1990-2015.

Table1

The money supply amount from the year 1990-2015.

Year	M2 (CNY)	Year	M2 (CNY)
1990	15293	2003	221223
1991	19350	2004	254107
1992	25402	2005	298756
1993	34880	2006	345578
1994	46924	2007	403442
1995	60751	2008	475167
1996	76095	2009	610225
1997	90995	2010	725852
1998	104499	2011	851591
1999	119898	2012	974149
2000	134610	2013	1106525
2001	158302	2014	1228375
2002	185007	2015	1392278

Table 2

The money supply growth rate in each year from 1990-2015.

Year	M2 growth rate (%)	Year	M2 growth rate (%)
1990	15.7	2003	19.6
1991	26.5	2004	14.7
1992	31.3	2005	17.6
1993	37.3	2006	16.9
1994	34.5	2007	16.7
1995	29.5	2008	17.8
1996	25.3	2009	28.5
1997	17.3	2010	19.7
1998	14.8	2011	13.6
1999	14.7	2012	13.8
2000	12.3	2013	13.6
2001	14.4	2014	12.2
2002	16.8	2015	13.3

From those two table above we can found that the amount of money supply is quite big during the past years, and has several cycles. There are at least 3 cycles during those years, and the year 1993, 2003, 2009 are the peak year respectively in each cycles. Most economists agree that money supply is directly related to inflation (Sims, 1980), so according this kind of viewpoints the inflation would be quite high during the past years, while interestingly the inflation in China is always much lower than money supply and always in controllable range. The following tables show the inflation rates from the year 1990-2015.

Table 3

Inflation rates from the year 1990-2015.

Year	Inflation rate(%)	Year	Inflation rate(%)
1990	3.1	2003	1.2
1991	3.4	2004	3.9
1992	6.4	2005	1.8
1993	14.7	2006	1.5
1994	24.1	2007	4.8
1995	17.1	2008	5.9
1996	8.3	2009	-0.7
1997	2.8	2010	3.3
1998	-0.8	2011	5.4
1999	-1.4	2012	2.6
2000	0.4	2013	2.6
2001	0.7	2014	2.0
2002	-0.8	2015	1.4

From the table above we can found that except the year 1993, 1994, 1995, the inflation rate was relatively high, other years the inflation rates were all lower than 10%, and even the year 1998, 1999, 2002, 2009, the inflation rate is negative. This phenomenon reveal that China retain a reasonable inflation rate. From the year 1992 to 1996 is the most serious overheated economy period in China, and in 1996 Chinese economy has made a soft landing. From the tables below show that Chinese economy has basically achieved high growth with low inflation, which can be called a miracle in world economic history.

Table 4

Chinese GDP from the year 1990-2015.

Year	GDP (CNY)	Year	GDP (CNY)
1990	18872.9	2003	137422.0
1991	22005.6	2004	161840.2
1992	27194.5	2005	187318.9
1993	35673.2	2006	219438.5
1994	48637.5	2007	270232.3
1995	61339.9	2008	319515.5
1996	71813.6	2009	349081.4
1997	79715.0	2010	413030.3
1998	85195.5	2011	489300.6
1999	90564.4	2012	540367.4
2000	100280.1	2013	595244.4
2001	110863.1	2014	643974.0
2002	121717.4	2015	685505.8

Table 5

Chinese GDP growth from the year 1990-2015.

Year	GDP growth rate (%)	Year	GDP growth rate (%)
1990	9.8	2003	12.9
1991	16.6	2004	17.8
1992	23.6	2005	15.7
1993	31.2	2006	17.1
1994	36.3	2007	23.1
1995	26.1	2008	18.2
1996	17.1	2009	9.3
1997	11.0	2010	18.3
1998	6.9	2011	18.5
1999	6.3	2012	10.4
2000	10.7	2013	10.2
2001	10.6	2014	8.2
2002	9.8	2015	6.4

From the table above we can found that China has experienced rapid economic growth for more than 30 years, the GDP in 2015 is 36 times than GDP in 1990, and only six years of growth is below double digits in those 36 years.

Methods

Although from the description of the data money supply, inflation, and economic growth looks like discrepant, their internal relations still need metrical study. Pearson correlation analysis and multiple regression analysis were used to analyze the internal relations among money supply, economic growth and inflation. In statistics, the Pearson correlation coefficient is a measure of the linear correlation between two variables X and Y. It has a value between +1 and −1, where 1 is total positive linear correlation, 0 is no linear correlation, and −1 is total negative linear correlation (Stigler, 1989). It is used to study the correlation ship between money supply and inflation, money supply and economic growth, inflation and economic growth. In addition to Pearson correlation analysis, multiple regression analysis used to discover the causal relationship among money supply, inflation, and economic growth. In statistical modeling, regression analysis is a set of statistical processes for estimating the relationships among variables (Armstrong, 2012).

Results

1. Pearson correlation analysis between each variables

In this part, money supply, inflation, and economic growth were described by M2, CPI and GDP, and they were analysis in pairs.

Table 6

Pearson correlation between money supply and inflation.

Correlations

		M2	CPI
M2	Pearson correlation	1	-.270
	Significance (2-tailed)		.182
	N	26	26
CPI	Pearson correlation	-.270	1
	Significance (2-tailed)	.182	
	N	26	26

The table above indicate that the correlation ship is low between money supply and inflation, and the correlation ship is not significant due to P-Value.

Table 7

Pearson correlation between money supply and economic growth.

Correlations

		M2	GDP
M2	Pearson Correlation	1	.996**
	Sig. (2-tailed)		.000
	N	26	26
GDP	Pearson Correlation	.996**	1
	Sig. (2-tailed)	.000	
	N	26	26

**. Correlation is significant at the 0.01 level (2-tailed).

The table above indicate that the correlation ship is quite high between money supply and GDP, and the correlation ship is significant due to P-Value.

Table 8

Pearson correlation between inflation and economic growth.

Correlations

		CPI	GDP
Inflation	Pearson Correlation	1	-.271
	Sig. (2-tailed)		.180
	N	26	26
GDP	Pearson Correlation	-.271	1
	Sig. (2-tailed)	.180	
	N	26	26

The table above indicate that the correlation ship is low between inflation and economic growth, and the correlation ship is not significant due to P-Value.

2. Multiple regression analysis between each variables

In this part, money supply, inflation, and economic growth were treated as dependent variable respectively to use multiple regression analysis to identify the causal relationship among money supply, inflation, and economic growth.

Table 9

Multiple regression analysis use money supply as dependent variable.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.996[a]	.992	.991	38600.8904

a. Predictors: (Constant), GDP, Inflation

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.232E12	2	2.116E12	1420.061	.000[a]
	Residual	3.427E10	23	1.490E9		
	Total	4.266E12	25			

a. Predictors: (Constant), GDP, Inflation

b. Dependent Variable: M2

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-59564.620	13953.063		-4.269	.000
	CPI	-11.231	1355.887	.000	-.008	.993
	GDP	1.955	.038	.996	51.294	.000

a. Dependent Variable: M2

The tables above indicate that the multiple regression equation is fitting well, since the R squire is almost 1, and the significant level is quite low. The coefficient of GDP is positive, while the CPI is negative. The CPI coefficient is contrary to economic theory.

Table 10

Multiple regression analysis use inflation as dependent variable.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.271[a]	.074	-.007	5.9362

a. Predictors: (Constant), GDP, M2

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	64.312	2	32.156	.913	.416[a]
	Residual	810.488	23	35.239		
	Total	874.800	25			

a. Predictors: (Constant), GDP, M2
b. Dependent Variable: CPI

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	6.083	2.578		2.360	.027
	M2	-2.656E-7	.000	-.019	-.008	.993
	GDP	-7.103E-6	.000	-.253	-.113	.911

a. Dependent Variable: CPI

The tables above indicate that the multiple regression equation is not fitting well, since the R squire is almost 0, and the significant level is big. The coefficients are also meaningless.

Table 11

Multiple regression analysis use economic growth as dependent variable.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.996[a]	.992	.991	19655.8596

a. Predictors: (Constant), CPI, M2

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.098E12	2	5.489E11	1420.849	.000[a]
	Residual	8.886E9	23	3.864E8		
	Total	1.107E12	25			

a. Predictors: (Constant), CPI, M2
b. Dependent Variable: GDP

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	32526.369	6669.379		4.877	.000
	M2	.507	.010	.995	51.294	.000
	CPI	-77.880	690.238	-.002	-.113	.911

a. Dependent Variable: GDP

The tables above indicate that the multiple regression equation is fitting well, since the R squire is almost 1, and the significant level is quite low. The coefficient of M2 is positive, while the CPI is negative. The CPI coefficient is contrary to economic theory, and the M2 coefficient is too low.

Discussions

Pearson correlation between money supply and inflation does not pass the significant test, and the Pearson correlation is low than 0.3, which means there is no significant relationship between them. This phenomenon is not fit the classic economic theory (Chorafas, 2009), and the reason might be the CPI was always received government macro-control restrictions. Pearson correlation between money supply and economic growth is quite high, which means money supply and economic growth is high relevant. The rise in money supply is always accompanied by an overheating economy, and the decline in money circulation is always accompanied by economic contraction. Pearson correlation between inflation and economic growth is also low and cannot pass the significant test, and the problem may still come from CPI, because the calculation of Chinese CPI is selective weighting without lots of important elements like the house price. So the CPI data cannot reveal the real price level in China.

Multiple regression fit use money supply as dependent variable with inflation and economic growth as independent variables has a high fitting degree. The coefficient of GDP is positive, which meet theoretical expectation (Lu, et al. 2017), while the coefficient of CPI is negative, which does not meet theoretical expectation, and the reason might be the same as the discussion of Pearson correlation analysis. Multiple regression fit use inflation as dependent variable does not show good fitting degree, both fitting degree and coefficient are meaningless according the classical theory. Multiple regression fit use economic growth as dependent variable has a good fitting level with bad coefficients, and the reason might be the factors that affect economic growth are numerous. Economic growth could not fully explained by only two elements.

Conclusion

Money supply and economic growth have high correlation ship, when money supply is high, the

economy in China always in period of economic overheating, so money supply adjust can regulate economic overheating or contraction. Economic growth in China is influenced by money supply and other variables, money supply is only one factor of economic growth. CPI cannot fully explain inflation in China, so Pearson correlation and Multiple regression of CPI does not make enough sense, inflation index should take house price and other elements in to consider.

In the future research, new indicator of CPI will be created to do the analysis, more measurement methods will be used to do the test, and panel data formed by sub regional data will be used to promoted accuracy of the analysis.

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