

# *The Empirical Research on Monetary Neutrality in China*

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**Abstract:** Monetary Neutrality has been a hot topic of economics, which has an important effect on the establishment and implementation of the monetary policy of one country. Based on the related data from 1981 to 2004, this paper makes an empirical analysis of monetary neutrality in China with the method of Unit-Root Test, Co-integration Test and Granger's Cause-and-effect Test, which indicates that the money is neutral and the money supply is endogenous.

## 1. Introduction

Monetary Neutrality means that exogenous changes in money supply prices can only result in changes in the corresponding ratios of nominal variables such as nominal prices and nominal wages, and have no effect on real variables such as real output, real wages and real interest rates.[1] The question of whether the currency is neutral has been one of the hot issues studied by Western economists. The Neoclassical economics, represented by Lucas, Serjeant, Wallace and others, argue for monetary neutrality under the assumptions of rational expectations, market clearing, and the maximization of individual interests, it is believed that once people accurately anticipate the effects of changes in monetary policy, [2] they will adjust nominal prices accordingly, so that only nominal variables change, while actual variables remain unchanged, it is only unexpected monetary policy actions that have an impact on real variables, and it proposes the policy invalidity theory, [3] while Fisher and Taylor, the representatives of new Keynesian economics, argue that monetary non-neutrality, they demonstrate the microscopic base of nominal variables such as wage and price stickiness in terms of market failures such as incomplete markets, staggered price adjustments, and menu costs, it is concluded that changes in money supply cause changes in aggregate demand, which ultimately affect real output and employment, on this basis, the paper puts forward the modern macroeconomic theory of regulating economy by monetary policy and fiscal policy. [4]

From the above, we can see that the "Neutral" or "Non-neutral" problem of currency, its essence is the relationship between monetary finance and economic development, so whether the currency is neutral is of great practical significance for a country to make monetary policy, it will directly affect the formulation and implementation of monetary policy, thus affecting the real economic growth and development. Therefore, this paper will use the latest test method to empirically examine our country's currency neutrality, and judge the long-term relationship between our country's monetary policy and economic growth, thus provides certain basis for the implementation monetary policy development economy.[5]

## 2. Empirical analysis of Chinese currency neutrality

### 2.1 Data and its sources

In order to verify whether money is neutral, this paper, based on the data from 1998 to 2021, chooses M1 to measure money supply, CPI to measure prices, and GDP to measure output. For nominal GDP. For nominal GDP, the 1998-based period is converted into real GDP by the price index. Meanwhile, in order to avoid the drastic fluctuation of the data, the real GDP, M1 and CPI are logarithmically processed and recorded as LNGDP, LNM1 and LNCPI. [6]

### 2.2 Methodology

Because the macroeconomic variables interact with each other, the effects of these variables on the stock market may also cancel each other out. Therefore, this paper analyzes the stock price index and the industrial value-added, money supply, interest rate, savings and price index as a system, the unit root test, co-integration test, Granger cause test and impulse response function were used to analyze the relationship between them.

### 2.3 Results of Empirical Analysis

#### 2.3.1 The Results of Unit Root Test

The stability of the sequence should be checked before the co-integration test. Therefore, the ADF test is used to test the time series LNCPI, LNGDP and LNM1 columns, and the first-order Differential  $d$  (LNCPI),  $d$  (LNGDP),  $D$  (LNM1) to judge the smoothness of the sequence.[9]

The ADF test is selected according to the sequence diagram of the horizontal sequence and the difference sequence, and the proper lag order is determined according to the AIC criterion of the test equation. The results are shown in Table 1.

Table 1: The results of stationary test for each variable.

Variable	ADF test value	Critical value			Is Smooth or not
		1%	5%	10%	
LnCPI	-1.57069	-3.78803	-3.01236	-2.64612	No
LnGDP	0.289053	-3.83151	-3.02997	-2.65519	No
LnM1	0.308883	-3.78803	-3.01236	-2.64612	No
D(LnCPI)	-2.96557	-3.78803	-3.01236	-2.64612 *	Yes
D(LnGDP)	-4.26778	-3.83151#	-3.02997	-2.65519	Yes
D(LnM1)	-3.93858	-3.78803#	-3.01236	-2.64612	Yes

\*Denotes stabilization at the 10% significance level; # denotes stabilization at the 1% significance level

From Table 1, it can be seen that the ADF statistics of LNCPI, LNGDP and LNM1 are all above the critical value of 10% significance level, with unit root, and are not stable, but the ADF statistics of  $d$  (LNCPI) are below the critical value of 10% significance level, the ADF statistic of  $D$  (LNGDP) and  $D$  (LNM1) is less than the critical value of 1% significance level, so  $D$  (LNCPI),  $D$  (LNGDP) and  $D$  (LNM1) have no unit root at the significant level of 10% and 1% respectively, and are stable, that is, LNCPI, LNGDP and LNM1 are all  $I(1)$ . [10]

#### 2.3.2 The results of co-integration test

According to the results of unit root test, LNCPI, LNGDP and LNM1 are all  $I(1)$ , so the Johansen co-integration test can be performed. The results of Johansen co-integration test are shown in tables

2 and 4

Table 2: Co-integration test and co-integration equation Coefficient of LnCPI and LnM1.

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5% Critical Value	Prob.**
None *	0.622743	21.56426	15.49471	0.0054
At most 1	0.050709	1.092849	3.841466	0.2958
Co-integration coefficient				
LnCPI	LnM1		C	
1	-0.143965 (-0.06877)		-4.07224	

Note:\* Denotes Rejection of the original hypothesis at the 5% significance level; figures in parentheses are standard deviations of coefficients;

From Table 2, it can be seen that the trace statistic of the larger eigenvalue is 21.56426, which is greater than the critical value of 5% significance level 15.49471, while the trace statistic of the smaller eigenvalue is 1.092849, which is less than the critical value of 5% significance level 3.841466. Therefore, the first original hypothesis is rejected, and the second assumption is accepted, that there is only one co-integration relationship. Let's write the co-integration relation as a mathematical expression, and let it be Z 1

$$Z1 = \text{LnCPI} - 0.14397\text{LnM1} - 4.07224$$

The Unit Root Test for Z1 is shown in Table 3.

Table 3: The results of stationary test for each variable.

Variable	ADF test value	Critical value			Is Smooth or not
		1%	5%	10%	
Z1	-3.05482	-3.85739	-3.04039 *	-2.66055	Yes

As can be seen from Table 3, the ADF statistic of Z1 is less than the critical value of the 5% significance level, so the null hypothesis is rejected, no unit root, that is, the Z 1 sequence is stable, and the mean of Z1 is 0, fluctuating around 0. Therefore, the co-integration relationship between LNCPI and LNM1 is accurate, and its mathematical expression is:

$$\text{LNCPI} = 0.14397 \text{ LNM1} + 4.07224$$

From above, we can know that there is a long-term stable relationship between LNCPI and LNM1, and it is a positive correlation, that is, the money supply of LNM1 changes 1%, the LNCPI rose 0.143, 965%. [11]

Table 4: Co-integration test and co-integration equation Coefficient of LnGDP and LnM1

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5% Critical Value	Prob.**
None *	0.629755	21.72833	15.49471	0.005
At most 1	0.040258	0.862915	3.841466	0.3529
Co-integration coefficient				
LnGDP	LnM1		C	
1	-0.45115 (-0.01017)		-5.16912	

Note:\* Denotes Rejection of the original hypothesis at the 5% significance level; figures in parentheses are standard deviations of coefficients;

From Table 4, it can be seen that the trace statistic of the larger eigenvalue 21.72833 is greater than the critical value of 5% significance level 15.49471, while the trace statistic of the smaller eigenvalue 0.862915 is less than the critical value of 5% significance level 3.841466. Therefore, the first original hypothesis is rejected, the second assumption is accepted, that there is only one co-integration relationship. Let's write the co-integration relation into a mathematical expression of Z and let it be Z2.

$$Z2 = \text{LnGDP} - 0.45115\text{LnM1} - 5.16912$$

The Unit Root Test for Z2 is shown in Table 5

Table 5: The results of stationary test for each variable.

Variable	ADF test value	Critical value			Is Smooth or not
		1%	5%	10%	
Z2	-4.58025	-3.7696	-3.00486	-2.64224	Yes

As can be seen from Table 5, the ADF statistic of Z2 -4.58027 is less than the critical value of 1% significance level -3.7696, thus rejecting the null hypothesis that there is no unit root, that is, the Z2 sequence is smooth, and the mean of Z2 is 0, fluctuating around 0. Therefore, the co-integration relationship between LNGDP and LNM1 is accurate, and its mathematical expression is:

$$\text{LNGDP} = 0.45115 \text{ LNM1} + 5.16912$$

From the above formula, we can know that there is a long-term stable relationship between LNGDP and LNM1, and it is a positive correlation, that is, the money supply LNM1 changes 1% , the gross domestic product (GDP) was 0.45115% .[12]

### 2.3.3 Granger cause test

The co-integration test shows that there is a long-term stable correlation between the price index and the narrow money supply M1, real GDP and the narrow money supply M1, but it is not clear whether the relationship is statistically cal. Therefore, using group objects with Eviews 5.0 to do granger cause test to test whether there is granger cause between variables. The test results are shown in tables 6 and 7.

Table 6: Results and lags of Granger cause test between LNM1 and LNCPI variables

Lag Period P	Zero Hypothesis:	Sample size T	F Statistic	Probability	1% Critical Value (P,T-2P-1)	5% Critical Value F(P,T-2P-1)
1	LnM1 does not Granger Cause LnCPI	23	0.47423	0.49896	F(1,20)=5.85	F(1,20)=3.49
	LnCPI does not Granger Cause LnM1		1.63492	0.21566		
2	LnM1 does not Granger Cause LnCPI	22	12.0588	0.00055	F(2,17)=6.11	F(2,17)=3.59
	LnCPI does not Granger Cause LnM1		2.73503	0.09336		
3	LnM1 does not Granger Cause LnCPI	21	6.52412	0.00549	F(3,14)=5.56	F(1,20)=3.34
	LnCPI does not Granger Cause LnM1		0.81937	0.5045		
4	LnM1 does not Granger Cause LnCPI	20	3.70098	0.03819	F(4,11)=5.67	F(4,11)=3.36
	LnCPI does not Granger Cause LnM1		0.93482	0.47907		

From Table 6, for the hypothesis that LNM1 is not the Granger cause of LNCPI when the lag periods are stage 2,3, and 4, the F statistic values are 12.0588,6.52412,3.70098 , which are respectively above the critical values  $F(2,17) = 6.11$ ,  $F(3,14) = 5.56$  at 1% significance level and  $F(4,11) = 3.36$  at 5% significance level, and the associated probabilities are 0.00055,0.00549 and 0.03819 respectively, we can reject the hypothesis that LNM1 is not the Granger cause of LNCPI at the confidence levels of 99.9% , 99.5% and 96.2% respectively. That is to say, LNM1 is the granger cause of LNCPI, that is, a change in money supply M1 causes a change in CPI. But for the original hypothesis that LNCPI is not the Granger cause of LNM1, the value of the F statistic in each of the five cases is less than the critical value at the 5% significance level, so the original hypothesis can not

be rejected at least at the 95% confidence level, that LNCPI is not the Granger cause of LNM1. [13]

Table 7: Results and lags of Granger cause test between LNM1 and LNGDP variables

Lag Period P	Zero Hypothesis:	Sample size T	F Statistic	Probability	1% Critical Value (P,T-2P-1)	5% Critical Value F(P,T-2P-1)
1	LnM1 does not Granger Cause LnGDP	23	0.00217	0.96331	F(1,20)=5.85	F(1,20)=3.49
	LnGDP does not Granger Cause LnM1		19.1047	0.0003		
2	LnM1 does not Granger Cause LnGDP	22	2.12464	0.1501	F(2,17)=6.11	F(2,17)=3.59
	LnGDP does not Granger Cause LnM1		7.36076	0.00498		
3	LnM1 does not Granger Cause LnGDP	21	3.32211	0.05089	F(3,14)=5.56	F(1,20)=3.34
	LnGDP does not Granger Cause LnM1		5.82948	0.00843		
4	LnM1 does not Granger Cause LnGDP		1.4355	0.28646	F(4,11)=5.67	F(4,11)=3.36
	LnGDP does not Granger Cause LnM1		5.32071	0.0124		

From Table 7, for the hypothesis that LNGDP is not the Granger cause of LNM1 when the lag periods are 1,2,3 and 4 periods, the F statistic values are 19.1047, 7.36076, 5.82948, 5.32071 respectively, which are above the critical values  $F(1,20) = 5.85$ ,  $F(2,17) = 6.11$ ,  $F(3,14) = 5.56$  at 1% significance level and  $F(4,11) = 3.36$  at 5% significance level, respectively, and the accompanying probabilities are 0.0003, 0.00498, 0.00843, 0.0124 respectively. Therefore, we can reject the hypothesis that LNGDP is not the Granger cause of LNM1 at the confidence levels of 99.9%, 99.5%, 99.2% and 98.76% respectively, in other words, LNGDP is the Granger cause of LNM1, that is, real GDP will cause changes in money supply M1, and the money supply is endogenous. But for the original hypothesis that LNM1 is not the Granger cause of LNGDP, the value of the F statistic in each of the five cases is less than the critical value at the 5% significance level, so at least at the 95% confidence level, the original hypothesis can not be rejected, that is, LNM1 is not the Granger cause of LNGDP, that is, money supply M1 does not cause changes in real GDP, and that money is neutral in the long run. [14]

### 3. Conclusion

Based on the analysis of the theory of money neutrality and its research methods, this paper makes an empirical analysis by using Eviews software, using the relevant data such as the actual output, narrow money supply and price level of our country from 1998 to 2021. We conclude that our currency is neutral in the long run and that changes in the narrow money supply will not affect changes in real GDP, but will affect the price level; there is a long-term equilibrium relationship between the money supply and GDP. The money supply is endogenous, that is, the money supply is not entirely controlled by the Central Bank. It is influenced by real GDP, central Bank independence is weak. Therefore, it is not appropriate to use narrow money supply as an intermediary index of monetary policy. We should use interest rate as an intermediary index to achieve the ultimate goal of monetary policy, which is the stability of currency value and the growth of national economy. [15]

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