

## The Impact of the USD M2/GDP on Large-scale International Short-term Capital Outflow of NIEs Based on Logit Model

Yi Sun

Shandong University of Technology, Zibo City, Shandong Province, China

Lilianyoyo0809@163.com

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**Abstract:** This paper establishes a binary model, uses the logit model for regression, and gets the conclusion indicating that there will be more obvious capital inflows in the year prior to the outflow of international capital. Then by analyzing the combined effect of capital pre-inflow and M2 / GDP on large-scale international short-term capital outflow, the conclusion can be obtained that when the M2 / GDP of the United States is below 50%, the probability of large-scale International short-term capital outflow in NIEs can increase 9.5% ~ 40.5%.

### 1. Introduction

Due to the change in the expected withdrawal of quantitative easing from the United States, although the M2 / GDP of the United States remains high after 2012, the changes in the international short-term capital flows of NIEs countries are still in line with the expectations of the United States to withdraw from quantitative easing. However, because M2 / GDP is expected to be difficult to quantify, we selected data from 1997 to 2012 of NIEs as the research object and used the logit model to carry out the quantitative analysis. Sample countries include: South Africa, Mexico, Philippines, Indonesia, China, Thailand, Turkey, Malaysia, India and Brazil.

### 2. Index Construction and Variable Selection

#### 2.1 The establishment of a large-scale capital outflow indicator

In order to conduct empirical research on the massive outflow of capital, we first need to construct a reasonable large-scale capital outflow indicator. The previous literature mostly focused on the reversal of capital inflows. The reversal indicator of capital inflows constructed by Rodrik Velasco (1999) and Ozan (2006) is a binary variable. When the ratio of the capital inflow in the previous year to the capital inflow in that year exceeded the certain critical value, a crisis was considered. The value is 1; otherwise, the value is 0. Li Daokui (2009) also used the same method to measure the capital inflow reversal, but he used sample data from 29 developing countries from 1993 to 2005. In addition to the 10 NIEs countries in this article, it also includes Singapore, South Korea, Estonia, Ukraine and other countries. When the M2 / GDP of the United States is below 50%, The probability of reversal in emerging market countries with poor economic fundamentals will increase 12% ~ 30%.

This paper uses the international short-term capital flows proposed by Michaelson (2010) = Increase in foreign exchange reserves - Trade Surplus - trade surplus-Foreign Direct Investment. Because this calculation method is mainly aimed at the international short-term capital flows, and the use of subtraction can effectively eliminate some of the long-term capital situation, and can reflect the flow of many hidden capital. This paper builded the large-scale outflow of international short-term capital dummy variables are as follows:

$$\begin{cases} \text{Reversal} = 1, \text{ if } (K_t - K_{t-1}) / \text{GDP}_{t-1} < -T \\ 0, \text{ other} \end{cases}$$

T is set to ensure that changes in capital inflows exceed a certain threshold. Only when a certain

amount of capital flows out can it have a significant impact on the country's economic activities. This article sets this value to 2% in all regressions. This article does not set conditions for both  $K_t$  and  $K_{t-1}$ . As data analysis shows that international short-term capital flows in India and Philippines have been long-term greater than zero and that in Indonesia and Malaysia have been long-term less than zero.

This paper mainly studies the large-scale outflow of international short-term capital, including the outflow of itself in the previous year. However, capital outflows have occurred this year, and this paper mainly studies the large-scale outflow of international short-term capital, also including the outflow in the previous year with capital outflows occurred this year. In addition, if a capital inflow reversal dummy variable of one year takes a value of 1, the observations of the following two years are missing. Because the capital flows in the last two years are assumed to be caused by the reversal of that year. In this way, a total of 26 capital inflow inversions occurred in 10 sample countries during the 16 years from 1997 to 2012. Including: South Africa (1998, 2007), Brazil (1997, 2010), India (2005, 2008), Indonesia (1997, 2000, 2008, 2011), Mexico (1997, 2000, 2005, 2008), Philippines (1997, 2000, 2004, 2009), Thailand (1997, 2007), Turkey (1997, 2008, 2011), Mainland China (1997, 2005, 2008).

## 2.2 Argument selection and data description

The independent variables selected in this paper include: (1) Variables reflecting the deterioration of their economic fundamentals, such as the current account deficit, domestic credit expansion, real GDP growth rate and real effective exchange rate overvaluation. (2) The variables that may cause financial panic. This article uses short-term foreign debt / foreign exchange reserves. (3) Indicators reflecting the capital inflow in the previous period. This article constructed two different indicators to reflect the level of capital inflows. (4) M2/GDP in the United States.

This is the focus of this study variables. The definition, calculation and data source of each independent variable are shown as follows.

- 1) CA/GDP: Current account balance as a share of GDP.
- 2) REEROVER: Overvalued real effective exchange rate.
- 3) RGDP: Real GDP growth rate.
- 4) DCGDPO: Domestic credit to GDP ratio exceeded the normal level
- 5) STDEBT: The ratio of short-term foreign debt to foreign exchange reserves
- 6) INFLOW11: Pre capital inflows into dummy variables.

Calculation:

According to the method of Ozan (2006). If the following formula holds a value of 1, otherwise 0.

$(K_t - K_{t-k}) / GDP_t > \tau$ ,  $K_t / GDP_t > \mu$ .  $K_t$  is international short-term capital inflow. The first condition identifies the year in which capital inflows have increased substantially from  $t-k$ , taking  $k$  as 3; The second condition requires that the quantity of capital inflows in year  $t$  itself satisfy certain conditions, in order to exclude large capitalization Outflow, while the number of capital inflows in year  $t$  is very low or even a net outflow.  $\tau$  take 1.5%,  $\mu$  take 1%.

- 7) INFLOW22: Capital flows into the proportion of GDP in the past three years.
- 8) M2/GDPO: U.S. M2 deviates from normal GDP levels.

All the data was downloaded from MF's International Financial Statistics, World Bank's World Development Indicator Database, and the Federal Bank.

## 3. Logit Regression Model

This paper mainly uses the logit model to analyze the factors causing large-scale international short-term capital outflow. We consider the following benchmark model:

$$\text{logit}(\text{Outflow} = 1) = F(\alpha_0 + \alpha X_{t-1})$$

Where  $X = (X_1, X_2, \dots, X_n)'$ ,  $\alpha = (\alpha_1, \alpha_2, \dots, \alpha_n)$ . Explanatory variables  $X$  in the benchmark model include economic fundamentals, financial panic variables, capital over inflow variables, and US domestic liquidity variables.

Table 1

Variable	Regression 1	Regression 2	Regression 3	Regression 4	Regression 5	Regression 6	Regression 7
CA/GDP	228** (2.06)	229* (2.043)	214.5** (1.94)	331.1** (2.38)	214.4* (1.815)	191.5** (2.245)	
REERO	0.011 (0.53)						
RGDP <sub>r</sub>	-0.175** (2.05)	-0.18** (-2.05)	-0.22** (-2.05)	-0.13 (-1.42)	-0.23** (-2.54)	-0.09 (-1.6)	
DCGDPO	-2.67** (-2.06)	-2.64** (-2.09)	-3.15** (-2.33)	-2.77** (-2.2)	-2.88** (-2.13)	-1.45** (-2.05)	
STDEBT		1.33 (0.305)					
INFLOW1 1			1.126** (2.165)		1.16** (2.175)		
INFLOW2 2				-120* (1.79)		-64 (-1.47)	
M2/GDPO					-13.8** (-1.74)	-7.2 (-1.534)	-8.6** (-1.99)
LR statistic	26.7	32.4	30.8	37.4	41.2	35.8	42.1
Pseudo R2	0.171	0.211	0.194	0.242	0.282	0.227	0.279

Explanations: By fitting comparison, it is found that INFLOW11 and INFLOW22 lag each other, and the best fitting effect is obtained when other variables are not lagging, while the lag of all independent variables in previous literature is the best. This shows that with the economic globalization, the spread of economic volatility greatly accelerated, more closely linked to each other, the reaction is also more sensitive. The brackets are the z values of the regression coefficients; \*, \*\*, \*\*\* are significant at the level of 10%, 5%, 1%, respectively; the constant terms are removed.

Before adding M2 / GDP variables. Regression 1 is a regression analysis that reflects the country's fundamental variables. Regression 2 is added after the regression caused by financial panic variables, and regression 3,4 are the return to the international short-term capital inflow variables. After adding the initial capital inflow variables, the values of LR and R2 increased significantly, which indicated that the goodness of fit was improved. INFLOW11 is positive and INFLOW22 is negative, indicating that there will be more obvious capital inflows in the year prior to the outflow of international capital. However, in the first three years of INFLOW22 reaction, the international short-term capital inflow variables are negative, Indicating that due to long-term international short-term capital outflows such as Indonesia and Malaysia, and through the chart analysis in Chapter 2, it can also be seen that many countries will have a long-term net outflow of capital after the reversal. INFLOW22 is negative and rejects the null hypothesis at the 10% level of significance, indicating that in the first three years of large-scale capital outflows, the countries themselves will have a net outflow of capital, the economic fundamentals will become fragile and capital outflows will be more prone to occur.

It is worth mentioning that the regression coefficient of current account balance / GDP actually implies the impact of some capital inflows before inflow of dummy variable INFLOW11 without capital addition. When we add capital into INFLOW11, the regression coefficient of current account balance / GDP shows a significant drop both in absolute value and in significant degree.

After adding M2 / GDP variables. Regression 5-Regression 7 is the effect after adding M2 / GDP. From the results, it can be seen that the LR and R2 values increase significantly after joining USD M2 / GDP and the long-term M2 / GDP is negative, which indicates that the decline of M2 / GDP will be aggravated The risk of capital reversal.

As can be seen from the regression 6, after the cumulative capital inflows into the GDP in the past

three years included, the INFLOW22 and M2 / GDP are no longer significant. However, in Chapter 2, we analyze the change of M2 / GDP in the United States in chapter two and we can see that the trend of M2 / GDP in the United States will change about 2-4 years. Therefore, INFLOW22 may include the effect of the last M2 / GDP change. Therefore, after joining INFLOW22, the impact on large-scale international short-term capital outflow is no longer significant, and the M2 / GDP variable is no longer significant.

Regression 7 is the effect of independent variables on international short-term capital flows when M2 / GDP is the only one. Regression 7 is the highest both LR and R2, and the M2 / GDP variable rejects the null hypothesis at the 5% significance level, indicating that the M2 / GDP change has a significant impact on the international short-term capital outflows of NIEs countries.

Taking into account the significance of the coefficients and the fitting effect of the logit regression, we return 5 to the baseline model as follows:

Logit (Reversal = 1) = F (-0.4002 + 214.4CA / GDP-0.23RGDPR-2.88DCGDP0 + 1.16INFLOW11-13.8M2 / GDPO)

Pseudo R2 = 0.282, LR = 41.2

The Combined Effect of Capital Pre-inflow and M2 / GDP on Large-scale International Short-term Capital Outflow.

Table 2

INFLOW11	M2/GDP(-0.05)	M2/GDP(0)	M2/GDP(0.05)
0	34.5%	22%	13%
1	53.5%	38%	25%

The results show that if a large amount of capital flows into the country in the meantime and the domestic liquidity is insufficient in the same period, the probability of a large-scale short-term capital outflow in the future will increase by 19%.

If there is not enough liquidity in the United States, but NIEs countries did not have large-scale capital inflows in the early period, the probability of large-scale international short-term capital outflows will be as high as 34.5%. And through the table, we can also find that despite the excess liquidity in the United States, NIEs countries did not have any large-scale inflow of capital in the early period, and the probability of large-scale short-term capital outflow still remains at 13%. Explain other factors such as domestic economic policies and other external factors also affect the outflow of short-term capital.

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