

Structure of Money Supply Channels and Monetary Management Policy in Korea*

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Abstracts

This paper attempts to empirically identify the relative importance and structure of the determinants of the money stock in Korea. Impacts of the currency ratio, the reserve ratio, the monetary base, and determinants of the monetary base to changes in the money stock are estimated in the framework of the standard monetary base model.

In comparison with the currency ratio and reserve ratio, the monetary base has been found to exercise the most significant influence on movements of the money stock. Fluctuations in the reserve ratio, mainly due to adjustments of legal reserve requirements, have played a considerable role in the money supply process. In addition, the currency ratio contributions to changes in the money supply, which are beyond the control of the policy authority, have been substantial.

Among the determinants of the monetary base, the foreign sector, central bank loans, and central bank bonds have been dominant in determining the total money stock for a prolonged period. These three determinants have been far more influential than the reserve ratio and currency ratio in terms of their impact on changes in the money stock.

It has been pointed out that Korean monetary authority had managed the monetary base in a way to make its effect on the money supply offset the effect of changes in the reserveratio on the money supply. And it has been found that the excess supply of money had been massively created through either the central bank's rediscount window or from foreign sector contributions on the one hand, and an overwhelming supply of central bank bonds had been issued to mop up excess liquidity on the other hand.

A brief discussion on the negative effects and related policy issues of the monetary management of the Korean monetary authority is included at the end of the paper.

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I. Introduction

The Korean monetary authority has encountered serious difficulty in managing excess money supplies for quite some time. During the 1970s and 1980s, the main channel of excess liquidity was the central bank's rediscount window. During the 1990s, this channel came to be used mainly for inflows of foreign funds, especially as the opening of Korean financial markets rapidly accelerated. In order to mop up the excess liquidity created by the central bank and from abroad, the monetary authority issued large amounts of central bank bonds such as monetary stabilization bonds (MSB).

More specifically, from 1986 to 1997, the average annual monetary base supplied through policy loans and foreign channels by the Korean central bank was 44.4 trillion won. Bonds issued to mop up excess liquidity amounted to an average of 24.0 trillion won, equivalent to 138% of the average actual balance of the monetary base in the same period.

The monetary base supplied and the bonds issued to absorb excess money supplies have increased considerably in recent years. The amount of the monetary base supplied through policy loans and foreign channels amounted to 128.4 and 149.4 trillion won as of the end of 2000 and 2002, respectively. Meanwhile, the total balance of bonds issued to absorb excess money supplies amounted to 79.6 trillion won and 100.1 trillion won. The total actual balance of the monetary base as of the end of 2002 was less than 38 trillion won.¹⁾

This sustained process of money supply involved producing

1) Although large amounts of the monetary base was absorbed, the annual growth rate of the monetary aggregate(M2) was above 20% for the period from 1995 to 2002.

excess amounts of monetary liability by printing more money on one hand and absorbing a large part of it by issuing non-monetary liabilities on the other. The results have had serious negative effects, paralyzing the central bank's monetary management, crowding-out corporate bonds in the bond market, and consistently creating inflationary pressure and asset bubbles which have the potential of causing economic slow down or distortions in output growth.

This paper is focused on the money supply processes in Korea during the period from 1961 to 2002. The relative roles and relationships of major determinants of money supply are empirically identified in this paper. Especially, contributions of determinants of the monetary base and the money multiplier to changes in the total money supply are estimated and examined in the framework of the standard monetary base model.²⁾

A brief discussion on the negative effects and related policy issues of the monetary management of the Korean monetary authority is included at the end of the paper.

II. The Monetary Base Model

According to the standard monetary base model, the total money stock is a multiple of the monetary base and the magnitude of the multiple is determined by both the public's cash preference and the commercial bank's reserve management.

Defining the total money stock (M) as currency in circulation (C) plus total bank deposits (D), and the ratio of currency in

2) There exist previous empirical researches on the relative importance of determinants of money supply (Cagan, 1965 ; Crouch, 1968 ; Black, 1975). They focused on the experiences of developed countries such as the United States and United Kingdom.

circulation to the money stock (C/M) and the ratio of bank reserves to the total bank deposits (R/D) as the currency ratio (c) and reserve ratio (r), respectively, one may derive the following simple relationship between the total money stock and the monetary base or high powered money (B) which is the sum of currency in circulation and bank reserves.³⁾

$$M = \frac{1}{c + r(1 - c)} B \quad (1)$$

Assuming that equation (1) is a polynomial function of time (t) and applying the Taylor series expansion, we can obtain the following formulas which can approximate the separate impacts of the monetary base, the currency ratio, and the reserve ratio to the change in money supply. The procedure for derivation of the formulas is presented in the appendix of this paper. The approximation technique for the decomposition of the rate of change in the money supply employed here is similar to that used by Cagan (1965) and subsequently by Crouch (1968) and Black (1975). It is noted that the method used in this paper might improve the approximation of each factor's impact, allocating the interaction term in possibly a neutral way.

$$\frac{\Delta M_{bt}}{M_{t-1}} = \frac{m_{t-1}}{M_{t-1}} \frac{dB_{t-1}}{dt} + \frac{1}{2M_{t-1}} \frac{dm_{t-1}}{dt} \frac{dB_{t-1}}{dt} \quad (2)$$

$$\frac{\Delta M_{rt}}{M_{t-1}} = \frac{1}{2M_{t-1}} \left[\left(\frac{\partial m}{\partial r} \right)_{c_{t-1}, r_{t-1}} + \left(\frac{\partial m}{\partial r} \right)_{c_t, r_t} \right]$$

3) The relationship of M and B can be simply derived as follows:

$$\frac{M}{B} = \frac{M}{cM + r(M - C)} = \frac{M}{cM + r(M - cM)} = \frac{1}{c + r(1 - c)}$$

$$\text{Hence, } M = \frac{1}{c + r(1 - c)} B$$

$$\left(B_{t-1} + \frac{1}{2} \frac{dB_{t-1}}{dt} \right) \frac{dr_{t-1}}{dt} \quad (3)$$

$$\frac{\Delta M_{ct}}{M_{t-1}} = \frac{1}{2M_{t-1}} \left[\left(\frac{\partial m}{\partial c} \right)_{c_{t-1}, r_{t-1}} + \left(\frac{\partial m}{\partial c} \right)_{c_t, r_t} \right] \left(B_{t-1} + \frac{1}{2} \frac{dB_{t-1}}{dt} \right) \frac{dc_{t-1}}{dt} \quad (4)$$

where m is $\frac{1}{c+r(1-c)}$, i.e., the money multiplier, and t and $t-1$ represents period t and the period that is one period before t , respectively, and $\frac{\Delta M_{bt}}{M_{t-1}}$, $\frac{\Delta M_{ct}}{M_{t-1}}$, and $\frac{\Delta M_{rt}}{M_{t-1}}$ are the separate contributions of changes in B , c , and r , respectively, on the rate of change in M , and $\frac{dB_{t-1}}{dt}$, $\frac{dm_{t-1}}{dt}$, $\frac{dc_{t-1}}{dt}$, and $\frac{dr_{t-1}}{dt}$ are changes in B , m , c , and r occurred for one period, respectively, $\frac{\partial m}{\partial c}$ and $\frac{\partial m}{\partial r}$ are the first derivatives of m with respect to c and r , respectively.

Here it is noted that the sum of $\frac{\Delta M_{bt}}{M_{t-1}}$, $\frac{\Delta M_{rt}}{M_{t-1}}$, and $\frac{\Delta M_{ct}}{M_{t-1}}$ is approximately equal to the rate of change in total money stock (M).

III. Impacts of the Monetary Base, the Currency Ratio, and the Reserve Ratio on Changes in the Money Stock

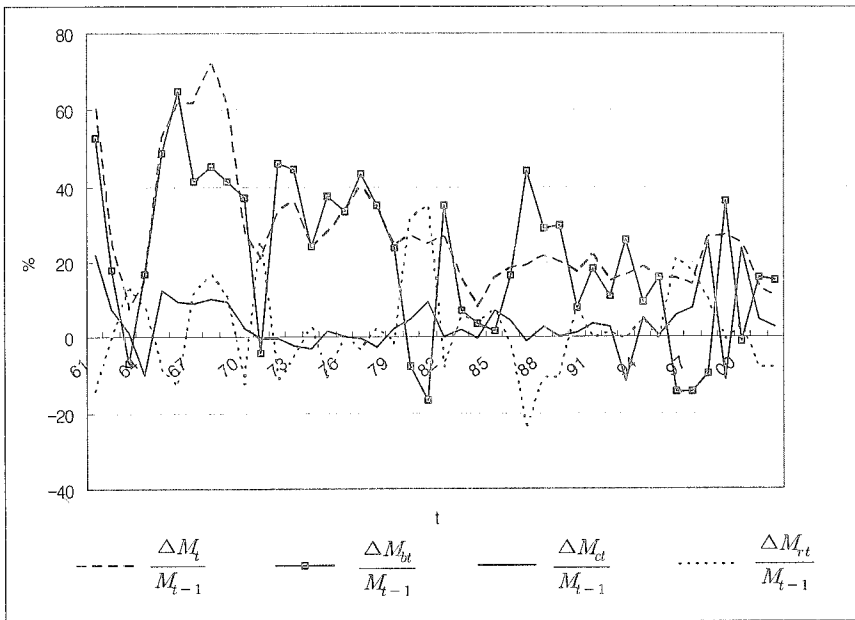
In order to estimate contributions of the monetary base, the currency ratio, and the reserve ratio to changes in the total money

stock, equation (2), (3), and (4) are applied to Korea's annual and quarterly data.

In this study, an indicator for total money stock is confined to M2 (currency in circulation plus commercial bank demand and time deposits) which had been regarded as one of most important monetary aggregates by the Korean monetary authority since 1979.⁴⁾

The results for the estimated contributions of the B , c , and r are presented in Chart 3-1 & Table 3-1.

[Chart 3-1] Contributions of the Monetary Base, the Currency Ratio, and the Reserve Ratio to the annual Rates of Change in the Total Money Stock



4) There exist studies (Ha and Park, 1982; Shin, 1985; Sim, 1987) which have reported empirical results indicating that M2 is superior to other alternative monetary definitions. These results had been mainly based upon empirical analyses of the relationships between various alternative monetary aggregates and some selected variables for economic activity. However, there have also been empirical results (Nam, 1982) which do not support M2. And most recently, the central bank in Korea has emphasized the importance of M3 (M2 + non-bank deposits + debenture issued + commercial bill sold + CD + RP + Cover Bills).

[Table 3-1] Contributions of the Monetary Base, the Currency Ratio, and the Reserve Ratio to the annual Rates of Change in the Total Money Stock

(Unit : %)

	$\frac{\Delta M_t}{M_{t-1}}$	$\frac{\Delta M_{bt}}{M_{t-1}}$	$\frac{\Delta M_{ct}}{M_{t-1}}$	$\frac{\Delta M_{rt}}{M_{t-1}}$
1961	60.70	52.80	22.07	-14.41
1962	24.94	17.89	7.68	-0.61
1963	7.36	-6.84	1.46	12.91
1964	14.80	17.03	-9.94	7.73
1965	52.67	48.77	12.66	-8.79
1966	61.69	64.90	9.63	-12.82
1967	61.66	41.51	9.01	11.49
1968	72.03	45.37	10.35	17.01
1969	61.38	41.48	9.43	10.74
1970	27.42	37.17	2.61	-12.38
1971	20.84	-4.33	-0.16	25.98
1972	33.82	45.97	-0.19	-12.02
1973	36.42	44.48	-2.34	-5.74
1974	24.03	24.16	-2.87	2.77
1975	28.23	37.46	1.72	-10.97
1976	33.49	33.49	0.06	-0.02
1977	39.70	43.42	-0.36	-3.36
1978	34.97	35.22	-2.53	2.29
1979	24.58	23.85	2.40	-1.67
1980	26.90	-7.61	4.68	31.61
1981	25.02	-16.69	9.66	35.20
1982	27.01	35.26	-0.03	-8.24
1983	15.24	7.33	2.17	5.77
1984	7.76	3.81	-0.31	4.20
1985	15.62	1.78	6.95	7.02
1986	18.44	16.31	4.39	-2.26
1987	19.05	43.99	-1.01	-24.56
1988	21.50	29.23	2.84	-10.59
1989	19.82	30.32	0.09	-10.64
1990	17.17	8.08	1.22	7.91
1991	21.89	18.46	3.76	-0.34
1992	14.94	11.14	2.67	1.14
1993	16.58	26.29	-11.52	-0.58
1994	18.68	9.60	5.05	4.87
1995	15.59	16.23	0.43	-1.16
1996	15.83	-14.18	6.06	21.12
1997	14.14	-14.34	7.81	17.83
1998	27.03	-9.61	25.76	9.64
1999	27.38	36.20	-11.03	-0.63
2000	25.43	-0.99	23.72	3.21
2001	13.20	16.04	4.64	-7.91
2002	10.98	15.40	2.81	-7.88

The sum of Columns 3 to 5 of Table 3-1 equals the computed rate of change in *M*. The differences between the actual rate of change in *M* (Column 2 of Table 3-1) and the computed values which are generated by the approximation procedure employed in this analysis are negligibly small in most cases.

According to Table 3-1, in more than 75 percentage of total years, the relative contribution of the monetary base has greater absolute values than that of any other determinants. And for the period from 1961 to 2002, the means of the value of the contribution of the monetary base, the currency ratio and the reserve ratio are calculated as 21.6, 3.8, and 2.0, respectively, as shown in Table 3-2.

And, as presented in Table 3-3, the averages of the absolute value of the relative contribution of the monetary base, the currency ratio and the reserve ratio are estimated as 24.9, 8.9, and 10.6, respectively, based on quarterly data from the 1st quarter of 1961 to the 4th quarter of 2002.

These results illustrate that the monetary base had exercised the most significant influence on changes in the money supply in Korea. This relative importance of the monetary base is consistent with the results of previous studies (Cagan, 1965; Crouch, 1968; Black, 1975) indicating that the monetary base had dominated the money supply in the United States as well as the United Kingdom.⁵⁾

Meanwhile, it is noted that the average magnitude of percentage contribution of the currency ratio has also been considerable. In particular, it was more than half of that of the monetary base

5) As mentioned above, these results are based on the experiences of developed countries such as the United States and the United Kingdom. It is interesting that previous research on the determination of money supply has yielded similar results, despite considerable differences in institutional arrangements and degree of economic development.

since the first half of 1990s. This result implies that the currency ratio, which is determined by the public's asset preference, has played a considerably significant role in Korea's more recent money supply process. The outcome is also consistent with the results of the previous empirical studies indicated above.

In general, the (actual) reserve ratio is presumed to be affected by either a change in excess reserves held by banks, a shift among different deposits, or monetary authority's adjustment of legal reserve requirements.

In Korea, the level of actual reserves has remained relatively the same as that of required reserves as there have been almost no substantial excess reserves throughout most of the period covered.⁶⁾ This has been mainly due to the fact that for a prolonged period, the deposit banks have encountered persistent and strong excess demands for bank loans because, in most cases, the bank loan rates have been well below market rates. Also, the Korean monetary authority has applied uniform required reserve ratios to both demand and time deposits since July 1981. Under the uniform required reserve ratios, any change in public preference with respect to demand and time deposits does not affect the actual reserve ratio.

Considering the above conditions, it appears that the magnitude of contributions of the reserve ratio shown in Table 3-2 and 3-3 has been led mainly by the monetary authority's frequent adjustments of the required reserve ratio.

6) For a detailed explanation of legal reserve requirements and reserve management behavior of the commercial banks in Korea, see the Bank of Korea (1990) and Ha (1983).

【Table 3-2】 Average Values of the Contributions of the Monetary Base, the Currency Ratio and the Reserve Ratio to the Rates of Change in M2

(Unit : %)

Period	$\frac{\Delta M_t}{M_{t-1}}$	$\frac{\Delta M_{bt}}{M_{t-1}}$	$\frac{\Delta M_{ct}}{M_{t-1}}$	$\frac{\Delta M_{rt}}{M_{t-1}}$
1961 - 2002	27.52 (100)	21.57 (78.37)	3.84 (13.97)	1.97 (7.17)
1961 - 1969	46.36 (100)	35.88 (77.16)	8.04 (17.29)	2.59 (5.57)
1970 - 1979	30.35 (100)	32.09 (105.56)	-0.17 (-0.56)	-1.52 (-5.0)
1980 - 1992	19.26 (100)	13.96 (71.26)	2.85 (14.55)	2.79 (14.24)
1993 - 2002	18.48 (100)	8.06 (43.63)	5.37 (29.07)	3.85 (20.84)

【Table 3-2】 Average Absolute Values of Contributions of the Monetary Base, Currency Ratio, and Reserve Ratio to the Rates of Change in M2

(Unit : %)

Period	$\frac{ \Delta M_{bt} }{M_{t-1}}$	$\frac{ \Delta M_{ct} }{M_{t-1}}$	$\frac{ \Delta M_{rt} }{M_{t-1}}$
1961 1/4 - 2002 4/4	24.92	8.92	10.61
1961 1/4 - 1969 4/4	37.95	11.38	11.81
1970 1/4 - 1979 4/4	32.68	12.92	10.06
1980 1/4 - 1992 4/4	17.93	4.09	11.89
1993 1/4 - 2002 4/4	14.52	8.99	8.41

Given that both the central bank's total monetary liability (i.e., the monetary base) and the reserve ratio had been controlled by the monetary authority, the sum of $\frac{\Delta M_{rt}}{M_{t-1}}$ and $\frac{\Delta M_{bt}}{M_{t-1}}$ in Table 3-1 could be regarded as the contributions of the policy actions. In contrast, $\frac{\Delta M_{ct}}{M_{t-1}}$ could be viewed as the contributions of the private decisions.

It is interesting that the sums of $\frac{\Delta M_{rt}}{M_{t-1}}$ and $\frac{\Delta M_{ct}}{M_{t-1}}$ are in

most cases, significantly less than $\frac{\Delta M_{bt}}{M_{t-1}}$, as shown in Table 3-1. The average absolute values of $\frac{\Delta M_{rt}}{M_{t-1}}$ and $\frac{\Delta M_{ct}}{M_{t-1}}$ are calculated as 10.6 and 24.9, respectively.

Based upon these results, one may reason that in order to prevent the total money supply from reaching a excess level, Korean monetary authority had endeavored to manage the monetary base in a way to make its effect on the money supply to offset to a considerable extent the effect of changes in the required reserve ratio on the money supply.

This reasoning seems to be supported by the estimated results of a simple regression equation as follow:

$$\dot{M}_{bt} = -0.3713\dot{M}_{rt} - 0.2253\dot{M}_{ct} + 0.6718\dot{M}_{bt-1} \quad (5)$$

(-3.61) (-1.47) (9.99)

$$\text{where } \dot{M}_{bt} = \frac{\Delta M_{bt}}{M_{t-1}}, \dot{M}_{rt} = \frac{\Delta M_{rt}}{M_{t-1}}, \dot{M}_{ct} = \frac{\Delta M_{ct}}{M_{t-1}},$$

$$\text{and } \dot{M}_{bt-1} = \frac{\Delta M_{bt}}{M_{t-2}}$$

- $R^2 = 0.46$, DW: 1.85
- The estimation period: second quarter, 1961 to forth quarter, 2002
- Values in parentheses are t -values.

The above estimated equation indicates that the Korean central bank had responded to an increase (a decrease) in \dot{M}_{rt} by decreasing (increasing) \dot{M}_{bt} . This implies that when the bank tends to induce a decrease in reserve ratio which leads to an increase in the money stock, she decreases the monetary base so as to avoid

to the excess money supply. Meanwhile, the equation shows that the coefficient of \dot{M}_{ct} is insignificant, which implies that the Korean monetary authority had not responded systematically to a movement in \dot{M}_{ct} . The estimated coefficient of the lagged dependent variable has a positive sign and highly significant; it indicates the central bank had adjusted the monetary base partially over the time.

IV. Determinants of the Monetary Base : Their Relative Importance and Relationship

It is confirmed in the preceding section that changes in the money aggregate (M2) have been led mainly by the monetary base. The object of this section is to look into the role and importance of the key determinants of the monetary base in the money supply process.

Because the monetary base is the sum of monetary liabilities of the monetary authority, it is necessary to look over the account of the monetary authority to illustrate determinants of the monetary base. The account shows transactions between the monetary authority and relevant sectors. Assets of the account are classified by sector and liabilities are classified by degree of liquidity as monetary and non-monetary liabilities.⁷⁾

Through netting non-monetary liabilities and capital accounts to assets in the account of the monetary authority, one may determine the determinants of the monetary base, which is the sum of monetary liabilities of the authority. Table 4-1 lists major

7) For a detail explanation of accounts of the monetary authority and sources and uses of the monetary base, see Appendix II

determinants of the monetary base.

【Table 4-1】 Sources and Uses of the Monetary Base

Government* (net credit)	Monetary Base
Financial Institutions (net credit)	Currency Issued
	Reserve of Financial Institutions
Loans	
Due from Banks in Foreign Currency	
MSB (less)	
MSA (less)	
Due to banks on demand (less)	
Reverse repurchase agreement (less)	
FESFB (less)	
Foreign (net assets)	
Other (net assets)	

* Government includes government agencies and official entities.

** MSB, MSA, and FESFB refer to monetary stabilization bonds, monetary stabilization accounts, and foreign exchange stabilization fund bonds.

In this section, the role of monetary base sources illustrated in Table 4-1 is empirically identified. Consistent data on the determinants of the monetary base is available from the beginning of the 1970s.

Table 4-2 shows that the average sector-specific proportions in the monetary base. In the period from 1970 to 2002, the proportions made up by the financial institutions sector, foreign sector, government sector, and other sectors are 39.7%, 39.6%, 14.2%, and 6.5%, respectively. The Table 4-2 shows that the proportion of the monetary base made up by the foreign sector has increased rapidly since 1980s while that of government sector has decreased substantially.

The average proportions of the major components making up the financial institutions sector portion of the monetary base are shown in Table 4-3. According to this table, the dominant

【Table 4-2】 Average Sector-Specific Proportions of the Monetary Base

(Unit : %)

Period	Government	Financial Institutions	Foreign	Others	Monetary Base
1970 - 2002	14.24	39.70	39.59	6.48	100
1970 - 1979	24.65	59.84	12.62	2.89	100
1980 - 1992	10.17	36.76	46.15	6.92	100
1993 - 2002	9.12	23.38	58.02	9.49	100

components are loans, due from banks in foreign currency, MSB and MSA. For the period of 1970 to 2000, the average proportion of loans to the monetary base is 75.1% and that of bonds (MSB+MSA+reverse RP+FESFB) issued is 116.3%.

【Table 4-3】 Average Component-Specific Proportions of Financial Institution Sector Portion of the Monetary Base

(Unit : %)

B	Period	1970 - 2002	1970-79	1980-92	1993-2002
	Loans		75.06	48.35	119.60
Due from Banks in Foreign Currency		57.25	31.60	52.56	89.00
MSB		-87.19	-6.87	-88.97	-165.19
MSA		-13.84	-3.15	-32.71	0.0
Due to Banks on Demand		-1.57	-0.42	-3.65	0.0
Reverse RP		-6.36	-10.63	-2.67	-6.90
FESFB		-8.83	0.0	-7.64	-19.20

Now, turning to contributions of major determinants of the monetary base to changes in the monetary aggregate. The contributions of the determinants can be estimated using Equation 2 in which the change in the monetary base is replaced with the

change in each determinant of the monetary base.

During the period from 1971 to 2002, the average absolute value of the contribution of the financial institutions sector, the foreign sector, the government sector, and other sectors to the monetary base were 35.1%, 29.0%, 16.5%, and 18.9%, respectively. Table 4-4 shows that the relative importance of the foreign sector contribution has increased significantly since the beginning of 1980s. The role of other sectors has also showed an increase in the 1990s. This is mainly due to the fact that foreign exchange appraisal profits of the central bank has fluctuated greatly. According to Table 4-4, the government sector contributed to the decrease in the total money stock since the beginning of the 1980s while it contributed to an increase the total money stock in the 1970s.

Table 4-5 presents the contributions of components of the financial institutions sector to the rates of changes in the total money stock. According to this table, loans, MSB and due from banks in foreign currency had played the most important roles in the determination of the total money stock.

It is noted that loans and due from banks in foreign currency had contributed to an increase the total money stock, while MSB had contributed a decrease in the money stock. And it is illustrated that central bank loans were the most important factor in the determination of the monetary base and total money stock during the 1970s. At the time, the government had excessively utilized the central bank's rediscount window to provide financial assistance to domestic manufacturing and exporting companies. Since the 1980s, MSB and dues from banks in foreign currency have played a more important role in the determination of the money stock.

It should be noted that the contribution of due from in banks in

foreign currency is included in the contribution of the foreign sector to the monetary base. Due from banks in foreign currency is a type of foreign currency loan to domestic banks. When the central bank acquires the foreign currency to be used as due from banks, it supplies new monetary base.⁸⁾ Therefore it can be said that the total contribution of the foreign sector is sum of due from banks in foreign currency and contributions of the foreign sector of Table 4-4 and 4-5.

〔Table 4-4〕 Value of Contribution of Sectors to the Quarterly Rates of Change in M2

(unit : %)

Sectors	Average Absolute Values				Average Values			
	71.1/4 -02.4/4	71.1/4 -79.4/4	80.1/4 -92.4/4	93.1/4 -02.4/4	71.1/4 -02.4/4	71.1/4 -79.4/4	80.1/4 -92.4/4	93.1/4 -02.4/4
Government	16.47	14.35	19.22	14.76	-0.03	4.66	-2.49	-1.04
Financial Institutions	35.07	23.73	22.78	60.98	-7.85	13.35	3.18	-41.26
Foreign	29.02	11.38	18.65	57.93	24.41	8.39	12.41	54.42
Others	18.88	5.38	15.41	35.21	0.43	0.25	3.65	-3.58

The overall results of this section indicate that the foreign sector, central bank loans, and central bank bonds issued have played overwhelmingly dominant roles in the determination of the money stock. The foreign sector, including due from banks in foreign currency, made the largest contributions, followed by MSB and central bank loans.

It is noted that in most cases contributions of the foreign sector and central bank loans have positive values while those of MSB

8) For detail explanation on due from banks in foreign currency in the central bank accounts, see Appendix II

[Table 4-5] Value of Contribution of Components of Financial Institutions Sector to the Quarterly Rates of Change in M2

(unit : %)

Components of Financial Institution Sector	Average Absolute Values				Average Values			
	71.1/4 -02.4/4	71.1/4 -79.4/4	80.1/4 -92.4/4	93.1/4 -02.4/4	71.1/4 -02.4/4	71.1/4 -79.4/4	80.1/4 -92.4/4	93.1/4 -02.4/4
Loans	21.25	21.35	26.64	14.15	14.06	18.46	23.55	-2.23
Due from Banks In Foreign Currency	27.00	17.30	22.66	41.38	7.07	4.91	18.31	-5.59
MSB	33.41	7.59	50.14	34.89	-21.86	-4.65	-27.00	-30.66
MSA	13.28	6.04	28.51	0	-2.83	-1.44	-5.97	0
Due to Banks on Demand	3.24	7.72	2.62	0	-1.16	-4.43	0.22	0
Reverse RP	4.43	0	0.06	14.09	-0.37	0	-1.89	1.28
FESFB	4.05	0	6.01	5.15	-2.47	0	-3.19	-3.76

has negative values (see Table 4-4 and 4-5). These results may reflect the situation that for extended period Korean monetary authority issued a large amount of central bank bonds to mop up the excess supply of money stock which had been created from the acquisition of foreign asset and through the central bank's rediscount window.

It is worthwhile to examine further the empirical relationship among the major determinants of the money stock in Korea. The findings presented so far indicate that the major determinants in Korean money supply process are the monetary base, reserve ratio and currency ratio. And among the determinants of monetary base, the foreign sector, central bank loans and MSB had been dominant in determining the money supply.

According to these findings and considering the fact that MSB had been the most important short-run policy instrument for the Korean monetary authority, one may specify a simplified form of

the central bank's reaction function in which MSB is a dependent variable and other major determinants of the money supply are independent variables. The estimated results of this kind of a simple reaction function based upon a partial adjustment mechanism are as follow:

$$\begin{aligned} \dot{M}_{it} = & 0.0250 - 0.4165\dot{M}_{ft} - 0.1685\dot{M}_{gt} - 0.6530\dot{M}_{dt} \\ & (0.69) \quad (-5.76) \quad (-1.23) \quad (-6.02) \\ & - 0.3725\dot{M}_{rt} - 0.2978\dot{M}_{ct} + 0.4474M_{it-1} \quad (6) \\ & (-1.86) \quad (-1.01) \quad (5.62) \end{aligned}$$

- $R^2 = 0.77$, DW: 1.85
- Values in parentheses are t -value
- The estimation period: second quarter, 1981 to fourth quarter, 2002

where \dot{M}_{it} , \dot{M}_{ft} , \dot{M}_{gt} , \dot{M}_{dt} , \dot{M}_{rt} and \dot{M}_{ct} are contributions of changes in the MSB, the foreign sector including due from banks in foreign currency, the government sector, central bank loans, reserve ratio and currency ratio, respectively on the rate of change in total money stock(M).

These results illustrate that the Korean central bank had responded to an increase in \dot{M}_{ft} and \dot{M}_{dt} , respectively by increasing MSB, which had led to a decrease in the money stock. And they also show that the bank had not respond systematically to movements in \dot{M}_{gt} and \dot{M}_{ct} . In addition, the above regression results support that the monetary authority had adjusted the balance of MSBs partially over the time.

V. Summary of Findings and Related Policy Issues

This paper attempts to empirically identify the relative importance and structure of the determinants of the money stock in Korea. Impacts of the currency ratio, the reserve ratio, the monetary base, and determinants of the monetary base to changes in the money stock are estimated in the framework of the standard monetary base model.

The findings of the paper are summarized as follow:

In comparison with the currency ratio and reserve ratio, the monetary base exercises the most significant influence on movements of the money stock. Overall, the results are consistent with those of preceding studies on experiences of developed countries such as the United States and the United Kingdom.

Fluctuations in the reserve ratio, mainly due to adjustments of legal reserve requirements, have played a considerable role in the money supply process. And it is noted that the contributions of the reserve ratio and the monetary base - which could be regarded as the results of policy actions - largely offset each other thus producing combined contributions of relatively small size.

In addition, the currency ratio contributions to changes in the money supply, which are beyond the control of the policy authority, are substantial. Therefore, it is demanded that the monetary authority closely monitor the behavior of this ratio and further endeavor to forecast it accurately in order to efficiently implement monetary policy.

Among the determinants of the monetary base, the foreign sector, central bank loans, and central bank bonds have been dominant in determining the total money stock for a prolonged period. These three determinants have been far more influential

than the reserve ratio and currency ratio in terms of their impact on changes in the money stock. And it has been illustrated that for a protracted period, the excess supply of money was created through either the central bank's rediscount window or from foreign sector contributions on the one hand, and an overwhelming supply of central bank bonds were issued to mop up excess liquidity on the other hand.

From the 1970s to the early 1980s, the main channel for excess money supply was the central bank's rediscount window. Since then, however, this channel has been used for the central bank's acquisition of foreign money as the opening of Korean financial markets as rapidly accelerated. Most recently, both the base money supplied and the central bank bonds issued to absorb excess money stock have continuously and dramatically increased (Appendix III carries recent statistics for sources and uses of the monetary base).

The continuation of this behavior of monetary management has resulted in serious negative effects not only on financial institutions and financial markets but also on the real economy. Firstly, the monetary authority has controlled money stock not from the source but by absorbing the excessive liquidity, a pattern of monetary management that has inevitably weakened control mechanisms as well as the credibility of the monetary authority.⁹⁾

9) An informal discussion paper (Bank of Korea, 1992) published in May, 1992, candidly describes the seriousness of the situation regarding Korea's monetary management.

"The central bank bonds issued are amounted to 2.25 trillion won, or 150% of the monetary base, as of the end of 1992. Since the bonds amounted to 0.1 or 0.15 trillion won among them are redeemed every month. It is very difficult for the monetary authority to issue new central bank bonds in order to absorb new base money created by the redemption.

In addition, the amount of monetary stabilization bonds issued is 1.5 trillion won as of the end of 1992. Annual interest payments for the bonds are amounted to 0.18 trillion won. This amount of interest payments leads to a new issue of the same amount of monetary base. Therefore

Therefore it can be argued that the past methods of monetary management and control have significantly contributed to high inflation and inflationary expectations prevailing in Korea for a long time.

As pointed out above, major portions of the monetary base have been supplied through either policy-based lending or the acquisition of foreign assets. The interest revenue of policy loans and foreign assets received by the central bank had been relatively low. Meanwhile, the expenses of issuing MSB to absorb excess liquidity have been high, since MSB interest rates were usually set at market rates. This situation frequently resulted in substantial deficits in the central bank's balance. Of course, these deficits caused new issue of base money to be managed by the central bank. The credibility of the central bank has indeed suffered as a result of the frequent deficits reported since 1982.¹⁰⁾

Secondly, the issuance of large amounts of MSB had the potential to cause serious disturbances in the bond market, such as an excess supply of bonds and crowding-out of private corporate bonds. It is noted that the average proportion of the balance of "Monetary Management Bonds (MMB)"¹¹⁾ issued for monetary control to that of corporate bonds came to 114.8% from the late 1980s to the early 1990s. The average annual growth rate of MMB was 22.0% while that of corporate bonds was 22.5% for the period from 1983 to 2002. In an underdeveloped bond market such as Korea's, the excess supply of bonds had induced decreases in the

considering that present money multiplier is between 5 and 5.5, one may say that the authority faces a serious monetary structure which automatically issues the new monetary base which causes to raise M2 by 1.0 trillion won annually, even though there was no change in other sources of the monetary base."

10) As reported in the Bank of Korea's Annual Reports.

11) The balance of MMB is the sum of the balance of MSB, MSA, FESFB and reverse RP.

prices of bonds and consequently raised the interest rates in most cases.¹²⁾ And most of the newly issued central bank bonds were frequently allotted to deposit banks and other financial institutions. When financial institutions, whose main business was undertaking corporate bonds, were forced to undertake MSB, some private enterprises could not raise sufficient funds by issuing corporate bonds.¹³⁾

Thirdly, it is easily reasoned that the government had frequently made unnecessary interventions on financial institutions and markets through abnormal monetary management, which involved, in particular, an excess supply of central bank policy loans and bonds.

Additionally, it is noted that the authority had, from time to time, imposed high ratio of reserve requirements to the deposit banks in order to decrease high power of the monetary base(or money multiplier). However, this was detrimental to the balance sheets of deposit banks. Consequently, the high reserve requirement ratio tended to force banks to increase loan interest rates, pushing up market rates of interest in the Korean economy.

The monetary authority needs to reform the current structure of money supply as it has had serious negative effects. Above all things, the monetary authority needs to intensify its efforts to reduce the sources of the monetary base. In order to reduce the sources, the authority should restrain the supply of policy-based lending through the central bank's loan window and retire central bank bonds.¹⁴⁾

12) Empirical results (Ha, 1992; Kim, 1993) report that the excessive increase in bond supply had a significant role in raising interest rates in Korea.

13) It is noted that since the late 1990s the Korea central bank has tended to issue MSB through the bond market which has been to some extent deepened.

14) Of course, the monetary authority should attempt to retire some of the bonds by using fiscal funds so as not to create additional liquidity.

In addition, the authority should find a way to cope with the money stock supplied from abroad. Given the open economic system, the Korean government should expand liberalization in the foreign exchange system so as to balance the in-flows and out-flows of foreign exchange and to attract greater holdings and outflows of foreign exchanges by the domestic public, in particular.

The Korean monetary authority has been pressured to devalue the domestic currency with respect to the foreign currencies so as to promote exports and improve business conditions. This type of intervention to induce the devaluation of domestic money has inevitably led to the creation of a greater monetary base. Therefore the authority should refrain as much as possible from intervening in foreign exchange markets if it aims to improve monetary management in Korea.

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Furthermore, rather than recently issued short term MSB, whose maturities are less than 2 years, it is necessary to issue long term MSB. These steps might mitigate inflationary expectations and help nurture the long-term bonds market.

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APPENDIX I

The Contributions of the Monetary Base (B), the Currency Ratio (c), the Reserve Ratio (r) to the Rate of Change in the Money Supply (M)

Assuming that M is a polynomial function of time (t) and applying the Taylor series expansion to it, it may be written that

$$(i) \quad M_t = M_{t-1} + \frac{dM_{t-1}}{dt} + \frac{1}{2!} \frac{d^2 M_{t-1}}{dt^2} + \frac{1}{3!} \frac{d^3 M_{t-1}}{dt^3} + \dots$$

And using the money multiplier relation ($M = mB$, where m is the money multiplier) and supposing that the sum of the first three terms on the right side of equation (i) sufficiently approximates M , one may write the following

$$(ii) \quad M_t = M_{t-1} + \left(B_{t-1} \frac{dm_{t-1}}{dt} + m_{t-1} \frac{dB_{t-1}}{dt} \right) + \frac{1}{2} \left(B_{t-1} \frac{d^2 m_{t-1}}{dt^2} + m_{t-1} \frac{d^2 B_{t-1}}{dt^2} + \frac{2dm_{t-1}dB_{t-1}}{dt^2} \right)$$

Since it is likely that both $\frac{d^2 m_{t-1}}{dt^2}$ and $\frac{d^2 B_{t-1}}{dt^2}$ have very small values, they can be ignored.

Hence the above equation can be specified as below:

$$(iii) \quad M_t - M_{t-1} = B_{t-1} \frac{dm_{t-1}}{dt} + m_{t-1} \frac{dB_{t-1}}{dt} + \frac{dm_{t-1}dB_{t-1}}{dt^2}$$

Dividing both side of equation (iii) by M_{t-1} , we may write:

$$(iv) \frac{M_t - M_{t-1}}{M_{t-1}} = \frac{B_{t-1}}{M_{t-1}} \frac{dm_{t-1}}{dt} + \frac{m_{t-1}}{M_{t-1}} \frac{dB_{t-1}}{dt} + \frac{dm_{t-1}dB_{t-1}}{M_{t-1}dt^2}$$

The first and second term on the right side of equation (iv) are the rate of change in M due to the change in B and that due to the change in m , respectively. The third term is an interaction term.

In this study, however, in order to treat the interaction term in a more neutral fashion, the equation for the rate of change in M due to the change in B (Bc) and the equation for the rate of change in M due to the change in m ($\frac{\Delta M_{mt}}{M_{t-1}}$) are written respectively as follow:

$$(v) \frac{\Delta M_{Bt}}{M_{t-1}} = \frac{m_{t-1}}{M_{t-1}} \frac{dB_{t-1}}{dt} + \frac{1}{2M_{t-1}} \frac{dm_{t-1}}{dt} \frac{dB_{t-1}}{dt}$$

$$(vi) \frac{\Delta M_{mt}}{M_{t-1}} = \frac{B_{t-1}}{M_{t-1}} \frac{dm_{t-1}}{dt} + \frac{1}{2M_{t-1}} \frac{dm_{t-1}}{dt} \frac{dB_{t-1}}{dt}$$

Meanwhile, considering that m is a function of c and r , and assuming that both c and r also are functions of time (t), one may write:

$$(vii) m_t = m_{t-1} \frac{\partial m}{\partial c} \frac{dc_{t-1}}{dt} + \frac{1}{2} \frac{\partial^2 m}{\partial c^2} \left(\frac{dc_{t-1}}{dt} \right)^2 \\ + \frac{1}{2} \frac{\partial^2 m}{\partial c^2} \left(\frac{dc_{t-1}}{dt} \right)^2 + \frac{\partial^2 m}{\partial c \partial r} \frac{dc_{t-1}}{dt} \frac{dr_{t-1}}{dt} + \dots$$

Again, it is presumed that the sum of the first three terms on the right side of equation (vii) is sufficiently approximating m . Accordingly, the above equation may be written as :

$$(viii) \quad m_t = m_{t-1} \frac{\partial m}{\partial c} \frac{dc_{t-1}}{dt} + \frac{\partial m}{\partial r} \frac{dr_{t-1}}{dt}$$

Here it is noted that $\frac{\partial m}{\partial c} = \frac{-(1-r)}{[c+r(1-c)]^2}$ and $\frac{\partial m}{\partial r} = \frac{-(1-c)}{[c+r(1-c)]^2}$ since $m = \frac{1}{c+r(1-c)}$

However, the approximation may be improved by expressing $\frac{\partial m}{\partial c}$ and $\frac{\partial m}{\partial r}$ in terms of its average in two periods. Equation (viii) may be, therefore, modified as follows:

$$(ix) \quad m_t - m_{t-1} = \frac{1}{2} \left[\left(\frac{\partial m}{\partial c} \right)_{c_{t-1}, r_{t-1}} + \left(\frac{\partial m}{\partial c} \right)_{c_t, r_t} \right] \frac{dc_{t-1}}{dt} + \frac{1}{2} \left[\left(\frac{\partial m}{\partial r} \right)_{c_{t-1}, r_{t-1}} + \left(\frac{\partial m}{\partial r} \right)_{c_t, r_t} \right] \frac{dr_{t-1}}{dt}$$

Multiplying both side of the above equation by $\frac{1}{M_{t-1}} \left(B_{t-1} + \frac{1}{2} \frac{dB_{t-1}}{dt} \right)$, one may write:

$$(x) \quad (m_t - m_{t-1}) \frac{1}{M_{t-1}} \left(B_{t-1} + \frac{1}{2} \frac{dB_{t-1}}{dt} \right) = \frac{1}{2M_{t-1}} \left[\left(\frac{\partial m}{\partial c} \right)_{c_{t-1}, r_{t-1}} + \left(\frac{\partial m}{\partial c} \right)_{c_t, r_t} \right] \left(B_{t-1} + \frac{1}{2} \frac{dB_{t-1}}{dt} \right) \frac{dc_{t-1}}{dt} + \frac{1}{2M_{t-1}} \left[\left(\frac{\partial m}{\partial r} \right)_{c_{t-1}, r_{t-1}} + \left(\frac{\partial m}{\partial r} \right)_{c_t, r_t} \right] \left(B_{t-1} + \frac{1}{2} \frac{dB_{t-1}}{dt} \right) \frac{dr_{t-1}}{dt}$$

The value of the left side of equation (x) is $\frac{\Delta M_{mt}}{M_{t-1}}$ defined in equation (vi). Hence, the first and second value on the right side of equation (x) are interpreted as the rate of change in M due to the change in c (i.e., $\frac{\Delta M_{ct}}{M_{t-1}}$) and the rate of change in M due to

change in r (i.e., $\frac{\Delta M_{rt}}{M_{t-1}}$), respectively.

Finally, combining equation (iv) with equation (v), (vi) and (x) leads to

$$\frac{M_t - M_{t-1}}{M_{t-1}} = \frac{\Delta M_{bt}}{M_{t-1}} + \frac{\Delta M_{ct}}{M_{t-1}} + \frac{\Delta M_{rt}}{M_{t-1}}.$$

APPENDIX II

Accounts of the Monetary Authority and Sources and Uses of the Monetary Base

Before 1987, accounts of the monetary authority meant that of the Bank of Korea. As the government's foreign exchange stabilization fund (FESF) was activated, accounts of the FESF were assimilated into that of the monetary authority. Therefore, the account of monetary authority was consolidated from the balance sheets of the Bank of Korea and the FESF.

The FESF had been created to cope with a sharp increase in the monetary base led by trade surplus during the late 1980s under the system of foreign exchange concentration. Unlike other funds of the government, the FESF, which was secured by selling FESF bonds, was deposited to the Bank of Korea so as to absorb excess liquidity. However, in practice, changes in the monetary base were caused mainly by accounts of the Bank of Korea, as the operation of the FESF was not so active.

Total credits of the accounts of the monetary authority consist of credits to government (CG), credits to government agencies (CGA), credits to official entities (COE), credits to financial institutions (CFI), foreign assets (FA), and other assets (OA).

Unlike the others, CG is netting, as government deposits are not regarded as monetary liabilities. Loan to government is less from CG. Transactions between the central bank and the government can be embossed by offsetting the loan against the deposit.

CG consist of claims on government and direct purchase of government bonds. On the other hand, government liability (LG) mainly consists of government deposits, and borrowings from the government. In this paper, COE and CGA are included in CG

because the amounts of CGA and COE are quite small and have not changed much.

CFI are made up of the central bank's loans to financial institutions. One of most important items of CFI are loans to deposit money banks. They contain rediscounts on commercial bills, and loans with collateral of bill. Most of these loans are policy loans designed to provide financial assistance to manufacturing firms.

Due from domestic banks in foreign currency is a type of foreign currency loan to banks. Due from domestic banks is used to support domestic banks' short-term working capital and redemption of external debt, and also to promote corporate investments.

FA consist of due from banks abroad, foreign securities, gold and silver bullion, foreign exchanges, special drawing right (SDR), and subscription to international financial institutions including IMF.

OA contains the Bank of Korea's tangible or non-tangible fixed assets, suspense receivable, current deficit, and so on.

Liabilities of the monetary authority's accounts are classified as monetary or non-monetary.

Monetary liabilities consist of currency issued plus reserve deposits of financial institutions. And non-monetary liabilities consist of liabilities to financial institutions, foreign liabilities, other liabilities and capital.

Liabilities to financial institutions (LFI) contain due to banks on demand, monetary stabilization bonds (MSB), monetary stabilization accounts (MSA), FESF bonds (FESFB), and reverse repurchase agreements (RP). Due to banks on demand is reserve deposits of financial institutions. MSA is a type of due to banks. The balance of the MSB and MSA is maintained to control the monetary base.

FESFB is the balance of FESFB deposited at the Bank of Korea (BOK). Reverse RP is the amount of bonds sold for absorbing excess liquidity in the short run. As a result, MSB, MSA, FSEFB, and reverse RP are used for monetary control.

Foreign liabilities (FL) consist of non-residents' deposits, SDR allocated from IMF, and liabilities to international financial institutions in security.

And lastly, guarantee money received, accrued expenses, reserves for retirement allowances and so forth are included in other liabilities. There are surplus funds in the capital account, which consist of legal reserves, voluntary reserves and undivided earned surplus for the term.

The determinants of the monetary base (the same of sources of monetary liabilities) by sector can be presented through netting non-monetary liabilities and capital accounts to assets in the accounts of the monetary authority. The following table shows this rearrangement of the accounts of the monetary authority.

[Table A1] Accounts of the Monetary Authority and Sources and Uses of the Monetary Base

Accounts of the Monetary Authority		⇒	Sources and uses of the Monetary Base	
Net Credits to Government	Monetary Base		Government (net credit)	Monetary Base
Credits to Government	Currency Issued		Credits to Government	Currency Issued
Less: Liabilities from Government	Reserves of Financial Institutions		Less: Liabilities from Government	Reserves of Financial Institutions
Credits to Financial Institutions	Liabilities from Financial Institutions		Financial Institution (net credit)	
			Credits to Financial Institutions	
			Less: Liabilities from Financial Institutions	
Foreign Assets	Foreign Liabilities		Foreign (net assets)	
			Foreign Assets	
			Less: Foreign Liabilities	
Other Assets	Other Liabilities, Capital		Other (net assets)	
			Other Assets	
			Less: Other Liabilities, Capital	

APPENDIX III

【Table A2】 Recent Statistics of the Monetary Base By Sector

(end of, in billion won)

By Sector	1986-97 (period average)	1998	1999	2000	2001	2002
Government	-6,109.8	-766.0	-3,791.3	-6,377.8	-2,571.0	-6,908.5
Loans to Government	244.5	847.5	787.5	408.5	588.5	948.5
Government Bonds	1,437.0	4,303.2	4,547.4	3,782.9	4,173.3	3,320.7
Less: Due to Government	3,403.4	5,914.9	9,126.3	10,607.3	7,346.6	11,177.7
Government Agency	536.7	370.0	370.0	370.0	370.0	370.0
Official Entities	167.3	8,270.0	2,000.0	2,000.0	2,000.0	2,000.0
Financial Institutions (FI)	6,844.8	-11,571.0	-33,978.6	-62,981.3	-80,602.4	-93,136.9
Loans	11,520.2	13,933.5	8,673.7	7,655.9	10,715.1	7,591.1
Due to Domestic Banks	19,307.0	27,496.8	19,822.1	10,583.2	2,513.8	610.8
Less: MSB	18,817.3	45,673.3	51,489.2	66,377.7	79,121.3	84,277.9
Less: MSA	1,121.4	0.0	0.0	0.0	0.0	0.0
Less: reverse RP	2,520.2	3,423.7	5,442.0	5,478.0	5,135.8	0.0
Less: FESFB	2,696.9	2,917.4	5,317.5	7,725.5	8,689.1	15,849.9
Foreign	13,558.4	38,138.5	73,711.3	110,179.3	131,408.4	141,177.7
Foreign Assets	15,588.8	61,512.2	83,524.1	119,274.0	140,313.7	153,270.9
Less: Foreign Liabilities	2,030.3	23,373.7	9,812.8	9,094.7	8,905.3	12,093.2
Other	-840.0	-13,738.5	-9,824.7	-14,952.1	-17,778.2	-5,514.9
Monetary Base	17,425.3	20,703.0	28,486.7	28,238.1	32,826.8	37,987.4
Currency Issued	10,809.5	15,847.1	22,485.4	21,336.1	22,245.2	24,080.4
Reserve of FI	6,615.8	4,856.0	6,001.4	6,902.0	10,581.6	13,907.0

Source : The Bank of Korea, Money and Banking Statistics, each volume.

한국의 통화공급 경로의 구조와 통화관리정책

하 성 근

논문초록

이 논문은 한국에 있어 통화량 결정요인의 상대적 중요성과 상호관계를 실증적으로 규명하려는 시도에서 쓰여 졌다. 통화량 변화에 영향을 미치는 현금통화비율, 지급준비율, 본원통화 그리고 주요본원통화 결정요인의 영향을 전통적인 표준본원통화 모형을 근거로 추정하였다.

현금통화비율과 지급준비율에 비해, 본원통화는 통화량 변화에 가장 중요한 영향을 미치는 것으로 밝혀졌다. 본원통화 결정요소들 중에서, 해외부문, 중앙은행 대출 그리고 중앙은행 채권이 총통화량을 결정하는데 주도적인 역할을 하였다. 총통화량 변화의 영향에 있어서 이들 세가지 요소가 지급준비율과 현금통화비율보다 훨씬 더 큰 영향을 미쳤다.

그리고 한국에서 통화의 초과공급은 주로 중앙은행의 재할인 창구 또는 해외부문의 통화증발에 의해서 발생되었으며 이러한 과잉유동성은 거액의 중앙은행 발행채권에 의하여 관리되었다. 이 논문의 마지막 부분에서 이러한 통화관리 행태의 문제점과 개선방향이 논의 되었다.

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핵심 주제어 : 통화공급, 통화관리, 기초통화