The Operation of Macroprudential Policy Measures: The Case of Korea in the 2000s

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This paper draws implications for the effective operation of an MaPP framework based on the experiences during the 2000s of Korea. Korea had in fact operated several MaPP measures, but could not shield itself from the impacts of the global financial crisis in 2008 because of a new type of financial imbalance accumulated in the 2000s. The implications are summarized with respect to the objectives, scopes, and other elements of the MaPP framework; that the objectives of MaPP measures should be set in the macroprudential dimension rather than from a microprudential perspective; that the MaPP measures should be devised in ways that reduce the possibility of regulatory arbitrage or minimizes the boundary problems; that MaPP measures in the forms of ratio regulations may need to be supplemented, with for example caps on borrowings or debts; that when revising MaPP measures it will be very important to maintain their initially intended purposes; that MaPP measures need to be flexible to incorporate structural changes in the financial and real sectors preemptively; that, in the case where several MaPP measures are applied simultaneously, consideration should be given to the issue of their coordination and the interrelationships among them.

Keywords: Macroprudential policy; Financial regulation; Liquidity ratio regulation; Loan-to-value limits; Debt-to-income limits; Financial imbalances

JEL Classification: E44, E58, G01, G18

I. Introduction

The 2008 global financial crisis highlighted the need for adopting a macroprudential approach to financial stability, beyond micro-prudential regulation and supervision. Macroprudential policy (MaPP) refers to a policy framework for addressing the stability of the financial system as a whole, rather than its individual components such as financial institutions or financial markets. At the international level, consensus has formed in favor of applying MaPP frameworks (FSB et al. 2011).

In reality, however, it would not be easy for a country to adopt a full-scale MaPP framework¹⁾ for various reasons including the lack of clear identification of the ultimate target of MaPP²⁾ and the need for developing instruments and tools of MaPP. While MaPP measures refer in general to prudential regulations applied from a system-wide perspective on individual financial institutions, they can in a broad sense be extended to include the authority's policy activities such as monitoring and addressing of systemic risks in a preemptive manner and preventing risks from becoming systemic. Attempting to overcome such the difficulties in developing MaPP measures, a few scholars and practitioners have recently begun to devote attention to MaPP instruments. To date a variety of MaPP instruments have been suggested, but verification of their effectiveness is needed if they are to be applied in the real world (Caruana 2010, Galetti and Moessner 2011).

Many papers evaluating the usefulness of MaPP measures have already appeared. For example, BOE (2011) illustrates various kinds of instruments and discusses each of their pros and cons. Goodhart et al. (2011) analyze the effects of MaPP instruments in a general equilibrium model. Hanson et al. (2011) evaluate MaPP tools on a conceptual basis. Lim et al. (2011) gather 49 countries' experiences and try to generalize on how to improve MaPP tool effectiveness. However, none of these papers provide detailed know-how concerning the design and operation of these instruments.

In this regard, this paper intends to report the experiences during the 2000s of Korea, which operated several MaPP instruments prior to the stressful events of

1) Among a few documents which deal with the MaPP framework, the IMF (2011) provides a well-organized discussion of a variety of issues related to the means of setting up such a framework.

2) For a variety of definitions and concepts of financial stability, see Ingves (2011).

2008. The instruments were not based on the concepts currently discussed, but did take forms similar to those proposed in present days. The Korean MaPP scheme seems to have been systematic, in the sense that it covered the whole financial sector; from as early as 1997 Korea applied several types of liquidity ratio regulations designed to cure potential weaknesses seen in domestic banking and foreign currency (FX) transactions. And then later, with a housing boom becoming apparent, the Korean authorities introduced a loan-to-value (LTV) ratio and, later on, a debt-to-income (DTI) ratio³⁾, in order to stabilize housing prices.⁴⁾

Notwithstanding these measures, another round of crisis-like events hit Korea in 2008. In fact, Korea had accumulated a new type of financial imbalance, in domestic banking as well as FX transactions and associated in part with the housing market boom. The banks had raised funds through non-core liabilities and expanded their lending to households in line with the strength of housing prices. To meet the growing demand for FX derivatives transactions, meanwhile, they had at the same time begun to rely more and more on short-term foreign borrowings.

The Korean case in the 2000s will provide a basis for evaluating several MaPP measures from various viewpoints. For the setting up of a well-defined MaPP framework, the objectives, scope and other policy elements need to be specified (FSB et al. 2011, IMF 2011, and others). The choices of operational alternatives such as single versus multiple measures, broad-based versus targeted risks, fixed versus time-varying application, and others can also affect MaPP effectiveness (Lim et al. 2011). The Korean case can serve as a good sample to ask what went wrong with the operations of the MaPP measures with respect to these factors.

This paper's approach differs from those of others that have tried to analyze the Korean case. For example, Igan and Kang (2011) analyze the effects of the LTV and DTI regulations, but focus only on the MaPP measures for one sector. Hahm et al. (2012) discuss the effects of the MaPP measures introduced in recent years since the 2008 event from a retrospective viewpoint, by evaluating their effects on the key

3) These two types of measures can be matched with the MaPP types of Funding Liquidity Standards and Collateral Arrangements, respectively, considered by Galetti and Moessner (2011) in classifying MaPP measures into 10 categories (refer to Galetti and Moessner (2011), p. 10).

4) The primary objective of the Korean LTV and DTI regulations in the 2000s seemed to be "stopping booms," rather than "building buffers." This issue will be discussed later in detail.

factors considered to have triggered that event. This paper, however, dealing simultaneously with the several major MaPP measures adopted before the 2008 crisis, is able to analyze the effectiveness of the measures in combination with other measures and from a preemptive perspective. In addition, this paper will try to discuss various aspects of MaPP operation.

This paper will begin with a brief history of the MaPP measures applied in Korea in the 2000s. It will subsequently focus on the process of accumulation of the financial imbalances which became channels for spillover of the 2008 global liquidity contraction. Combining its consideration of these financial imbalances and of the MaPP measure operation, this paper will discuss what went wrong with the operations of the measures, and what the limitations of these tools were. Finally it will conclude with a summary of the discussion, and derive some implications for MaPP use in the future.

II. The MaPP Measures in the 2000s

The 1997 currency crisis paved the way for stronger financial regulation, which it was believed would help prevent the recurrence of financial crisis. Among the regulations, several can be regarded as among the MaPP instruments suggested in recent years. This section will describe several regulations that can be regarded as MaPP measures.⁵⁾

1. Prudential Measures Related to FX Transactions

A. Foreign Currency (FX) Liquidity Ratio Regulation

This was intended to strengthen banks' abilities to pay off their short-term foreign debts. It was based on the notion that a certain amount of liquid assets maintained by a bank can be immediately used for covering short-term debts, and that by holding of liquid assets above a certain level the bank may ensure its liquidity.

⁵⁾ Korea has employed several other tools that can be regarded as MaPP measures, such as the BIS capital adequacy ratio, reserve requirements on deposits, and restrictions on lending (especially FX lending) to certain borrowers. This paper however excludes such measures from discussion.

According to the formula initially employed, banks' FX assets with outstanding maturities of less than 3 months should be maintained at above 70% of their foreign debts with outstanding maturities less than 3 months:

$$\text{FX liquidity Ratio} = \frac{\text{Liquid Assets with maturity of 3 months or less}}{\text{Liquid Liabilities with maturity of 3 months or less}} \times 100 \geq 70\%$$

This was similar to the Foreign Currency Liquidity Coverage Ratio (LCR) under Basel III (BCBS 2010b and 2010c), but without risk-factor adjustment.⁶⁾ It in addition differed from the BCBS's LCR in that the standard maturity was set at 3 months, while the BCBS's LCR has a 1-month maturity.

This ratio was used as a basic regulation to ensure Korean banks' FX liquidity. It was introduced in July 1997, just before outbreak of the 1997 currency crisis. It was applied initially to general banks only, but was extended to also cover special banks in July 1998. In June 2000, the guideline for the ratio was adjusted upward from 70% to 80%, in response to signs of a resurgence of banks' short-term borrowings as their FX transaction activities returned to normal with the improved creditworthiness of the Korean banking sector in the international financial markets. The guideline was raised further to 85% in 2004, when banks' short-term foreign borrowing began to accelerate.

B. Maturity Mismatch Ratio

To effectively tackle a variety of risks accompanying FX transactions, the maturities were broken down into seven ranges⁷⁾ and different liquidity ratios applied. The regulation tried to limit the gap between the amount of FX assets and debts at each maturity range above a certain ratio. For example, it was required that the ratio for the maturity range of less than 7 days be more than 0% (meaning that the amount of assets with maturities of less than 7 days should match or exceed that of debts with

6) In 2009, Korea revised the formula to incorporate the risk factors for various assets (FSC and FSS 2009).

7) From 0 to 7 days, from 8 days to 1 month, from 1 month to 3 months, from 3 to 6 months, from 6 months to 1 year, from 1 to 3 years, and exceeding 3 years.

the same maturity), while that for maturities of less than 1 month had to be more than -10%.

This requirement was introduced in January 1999 in line with the recommendation of the IMF. Since then, the regulation has been partly amended several times, for instance to include forward FX transactions in the coverage, and the amendments have tended to strengthen it.

C. Ratio of Long-term Foreign Borrowings

This was introduced to restrain the practice of setting the maturities for FX lending as long as possible in the early period of capital liberalization, that is, in 1991. In the early 1990s, just after the capital account had begun to be liberalized, companies favored long-term FX debt as a stable source of funding. As the banks began to extend the maturities of their FX loans, their maturity mismatches were in consequence aggravated, and the authorities introduced this measure to deal with that problem. According to the initial regulation, more than 70% of FX loans with maturities above 3 years had to be funded with foreign debts with maturities greater than 3 years.

This ratio was however eased in April 1993 (70%→50%), as it was difficult to comply with and was considered somewhat superfluous. It was difficult to comply with because it was in practice impossible for Korean banks to borrow long-term loans in the international financial markets, due to their low credibility. It was also considered as a sort of regulation subject to financial liberalization, and its elimination was recommended by the Financial Deregulation Taskforce Committee of that time.

The problem with regulation compliance persisted in the 2000s. Korean banks with low external credibility had to pay additional premiums for longer-term borrowings. They thus tried to evade the regulation by adding clauses in their loan contracts specifying early redemption.⁸⁾ In consideration of these problems, the criterion for the ratio was lowered from maturities of more than 3 years to those of more than 1 year in September 2001, in view of the reality that most of Korean banks' foreign debts had 1-year maturities.

8) The loan contracts set the maturity at more than 3 years, but contained put option clauses giving the borrowers the right to ask for early redemption, so that the actual maturity would be shortened to 1-2 years.

This regulation is similar to the Net Stable Funding Ratio (NSFR) under Basel III (BCBS 2010b), but with the following differences; that it was applied to FX transactions while the NSFR is for domestic banking, and that the NSFR is based on numerical risk factors in addition to maturity while it was based on maturity only.

2. Measures for Domestic Banking

A. DC Liquidity Ratio Regulation

Starting in January 1999, right after the currency crisis, the authorities began to specify a domestic currency (DC) liquidity ratio as one of the major guidelines for banks' risk management. Similar to the FX liquidity ratio, this ratio is denoted by dividing liquid assets by liquid debts of maturities set at 3 months or less:

$$\text{DC Liquidity Ratio} = \frac{\text{Liquid Assets with maturity of 3 months or less}}{\text{Liquid Liabilities with maturity of 3 months or less}} \times 100$$

Before the 1997 currency crisis, this was operated as the ratio of DC liquid assets to total DC deposits, and the guideline figure was set at more than 30%. The formula was then revised to its current type, however, in order to manage liquidity risks from both the asset and the liability sides and to make it consistent with international standards.

Assets and liabilities for computation of the liquidity ratio include all types of credits and debts with the exception of those in trust accounts. These liquid assets and liabilities should reflect the actual maturity, and the reality that assets and debts are in practice actually payable or receivable at the due date. In this sense marketable securities are recognized as liquid assets, with no consideration given to their outstanding maturities. Non-investment grade securities and pledged securities are in contrast excluded from liquid assets.

In March 2002, the DC liquidity ratio guideline was strengthened. As the liquidity ratios of financial institutions had fallen below 100% on average since around 2001, the rule was revised to send warning signals to banks whose liquidity ratios were below the precautionary level, specifically 105%, and to order them to submit plans for improving their financial statuses. The early 2000s can be viewed as the

time when banks began to expand their loans just after the completion of banking sector restructuring following the 1997 currency crisis.

However, the scheme was then eased significantly in August 2006. First of all, the precautionary ratio level was abolished. In addition, the authorities allowed banks to include reserve requirements at the central bank and CDs held by banks in the class of liquid assets. Further, credit card receivables and other type of receivables were also included in the liquid assets. This revision of the scheme meant in practice a lower guideline (down from 105% to 100%) for the liquidity ratio, and much more capacity to lend domestic currency funds.

The reasons behind this easing of the liquidity ratio are unclear. The authorities said that they had done it to keep pace with the developed countries, as the ratios had improved significantly (FSC 2006). According to media reports at that time, however, financial institutions appeared to have strongly requested easing of the regulation, arguing that it led to short-term lending to business firms (*E-Daily*, 20th June 2006). In any case the revision of this regulation in 2006, toward deregulation or easing, was clearly a background factor behind the rapid expansion in bank lending. In this regard, it should be pointed to as a type of mistake in MaPP measure operation, since banks' over-lending then caused liquidity problems in the wake of the 2008 financial turmoil. This issue will be discussed in detail later.

B. Loan-to-Deposit Ratio Regulation

In the 1990s, the loan-to-deposit (LTD) ratio was one of the major management guidelines. At that time the ratio of core disposable funds (disposable deposits + domestic currency debentures + capital) to loans had to be less than 100%, to preclude any shortage of liquidity. The regulation was abolished in January 1999, however, after introduction of the DC liquidity ratio regulation, as part of the regulatory easing efforts (FSC 1998).

3. Measures for Real Estate Market

In September 2002, the authority introduced a LTV regulation to stabilize real estate prices after housing prices had soared around 2001. The authority did not

declare clearly the objective of its introduction of LTV regulation at that time, although it was announced that the LTV regulation had been included in the list of measures adopted for limiting the rises in housing prices (MOFE et al. 2002). In this regard, the primary objective of LTV regulation in Korea can be interpreted as “stopping booms” in housing prices.⁹⁾ This is quite different from the objectives suggested in the recent discussions on the MaPP framework, such as improving the loss-enduring capacities of banks, stopping credit booms, or limiting the leverage of households.

The LTV ratio was first set at 60%, and has since then been strengthened to as low as 40% in some regions:

$$\text{LTV} = \frac{\text{Mortgage Loans} + \text{Senior Lending on Houses} + \text{Rent Security Received}}{\text{House Price}}$$

In August 2005, a DTI regulation was additionally implemented, as real estate prices continued to rise despite the variety of measures taken in response including the LTV ratio requirement. The DTI ratio has been strengthened since its introduction, and the target group for its application expanded:

$$\text{DTI} = \frac{\text{Annual Mortgage and Other Loan Payments}}{\text{Annual Income}}$$

The DTI regulation seemed to be intended to prevent or reduce the speculative holding of houses. With the wide spreading of expectations of housing price rises in the mid-2000s, many families were trying to purchase multiple houses. Because of an implicit restriction on the number of houses owned by an individual, the newly bought houses were registered under the names of the owners’ family members, rather than of the owners/heads of the households. The DTI regulation was targeted at restricting this kind of house purchase by family members not earning money by their own work. The DTI regulation was implemented to reduce speculation on houses through restricting house purchases by persons unable to verify their incomes.

9) The authority later mentioned the soundness of financial institutions as an indirect objective of LTV regulation when it amended the regulation.

The LTV and DTI regulations were implemented in combination with a variety of other policies. In calculating the BIS capital adequacy ratio, the risk weighting for mortgage loans was increased. From a short-term perspective, the authorities adopted various measures to deter real estate demand; the rates of taxation for real estate ownership and transactions were raised; the administrative procedures were strengthened; and a new tax was levied on real estate development profits. Longer-term policies to expand housing supply, such as new town development plans, have also been pursued.¹⁰⁾

The LTV and DTI regulations are characterized by the fact that they can target very specified areas or groups. In the early 2000s, real estate prices had begun to rise mainly in certain parts of Seoul, and the regulations were applied first to these areas. Even after the housing price boom had spread to other regions, the regulations were applied only to some regions designated as “speculative zones,¹¹⁾” rather than on a nationwide basis. The regulations could also be differentiated in accordance with the types of financial institutions they concerned, and thereby be customized to the characteristics of individual financial institutions and users. Their flexibility was another advantage of these regulations. While real estate market conditions have changed continuously, the authorities have been able to change the targets of regulation flexibly.

The LTV and DTI regulations have some drawbacks as well, however. They were implemented in Korea in a reactive manner, rather than from a proactive or pre-emptive perspective. In other words, they were applied after real estate prices had already gone up, which was one of the reasons for their ineffectiveness in stabilizing housing prices.

10) Real estate policy and monetary policy were implemented separately during this time (BOK 2003).

11) An area was designated as a speculative zone in the case where its monthly nominal house price index (HPI) had risen by more than 1.3 times the nationwide inflation rate (CPI) during the previous month (cited from Igan and Kang (2011)). In the most extreme cases “excessively speculative zones” were designated, in which certain specified types of transactions were prohibited.

III. Financial Imbalances in the 2000s, and Effects of US Financial Crisis

1. Financial Imbalances

In the 2000s the Korean economy showed signs of escaping the 1997 currency crisis and moved onto a stable path of growth. Although the economic growth rate was lower than before, it maintained a sound momentum of 5%. Inflation, measured by the consumer price index, fell to around 2% - far more stable than the annual average of 6% seen in the 1990s. In addition, the current account ran continued surpluses with the help of the strong competitiveness of the manufacturing sector. Furthermore, during the 2000s up until the global financial crisis, the fiscal balance had maintained continuous surpluses all the way to 2008. To summarize the overall economic situation in the 2000s, the economy maintained sound and stable economic growth momentum following the successful structural adjustment efforts following the 1997 currency crisis.

While the Korean economy enjoyed stable growth in the 2000s, there were big structural changes occurring in its financial sector - in domestic banking as well as in capital transactions. Prices in the asset markets surged in parallel with this, and in the process financial imbalances accumulated. Korea was unable to resolve this problem before outbreak of the US financial crisis, and was as a result hit very hard by the crisis impacts. In the section below, the process of financial imbalance accumulation in Korea in the 2000s will be reviewed in respect of three sectors; domestic banking, the real estate market, and external capital transactions.

A. Domestic Banking

One of the most remarkable aspects of the domestic financial sector in the 2000s was the gap in growth between the deposits and loans of commercial banks. In the past deposits and loans had moved in parallel¹²⁾, but beginning in around 2002 this

12) Except during the period of the currency crisis, when deposits at NBFIs were relocated to the banking sector and lending declined significantly due to economic recession.

pattern of parallel deposit and loan movements broke down. The rate of increase in loans greatly exceeded that of deposits, and this trend continued until right before outbreak of the US financial crisis (Figure 1-a).

Figure 1: Banking Sector Activities

Note: Rates of change on y-o-y basis

Source: BOK, ECOS

As a result of this phenomenon, loan-to-deposit (LTD) ratios increased rapidly as shown in Figure 1-b. The ratio, which was at around the 80% level during the 1997 currency crisis, soared to 142% in August 2008 just before Lehman Brothers filed for bankruptcy.

The rapid rise in the LTD ratio was made possible by the increase in issuance of non-core liabilities such as debentures and certificates of deposit (CDs). As shown in Figure 2, from the time when the gap between deposit and loan growth began, i.e. 2002, the issuance of bank debentures expanded and the LTD ratio began to rise:

Figure 2: Sources of Loanable Funds
(Deposit-taking Institutions)

Note: Funds include CMAs, MMFs, Beneficiary Certificates, and others

Source: BOK, ECOS

Of course, the structural changes observed in domestic banking might have been due to the changes in individuals' asset management practices (Khatri 2008). Individual depositors preferred investment in marketable financial instruments over deposits at that time, in line with the lower interest rates paid on deposits. This meant limitations for banks in expanding their funding through deposits to meet the growing loan demand. Banks could as a result not help but rely on non-core liability issuance to raise funds to lend.

Korean banks that had issued debentures faced numerous difficulties as market liquidity conditions worsened when the effects of the 2008 financial crisis materialized while these debentures approached their maturity dates. The heavy reliance of Korean banks on non-core liabilities was pointed to as an issue by Shin (2010), from the perspective that their funding possibilities then suddenly shrank with the global liquidity contraction. Banks' activities at that time may also be criticized from another point of view, that a bank's fund raising should be matched with its lending in respect of maturity (Berger and Bouwman 2009). In reality, Korean banks had

raised funds through liquid liabilities and then lent them out in the form of illiquid loans such as mortgage loans, which consequently increased the extent of their maturity mismatches. From the Berger and Bouwman perspective we can interpret Korean banks to have been actively involved in excessive liquidity creation.

B. Real Estate Market

Following the 1997 currency crisis, the major users of bank loans changed from corporations to households. Business firms, after having experienced great difficulties during the crisis due to their high reliance on outside borrowings, began to optimize their borrowings to improve their financial soundness post-crisis. Household debt in contrast began to increase significantly right after the crisis. The rate of increase in household borrowings substantially surpassed that in corporate loans, and this trend continued until right before the global financial crisis hit (Figure 3-a). As a result, the share in total bank loans of loans to households soared from a mere 28% in 1998 to 50% shortly before the global crisis hit as shown in Figure 3-b:

Figure 3: Bank Loans

Note: Loans to corporates include those to public entities

Source: BOK, ECOS

The expansion of bank loans in the 2000s, especially mortgage loans to households, was directly related to the asset market boom accompanying the increase in

real estate prices. Real estate prices began to soar from around 2002, coincident with the beginning of banks' expansions in their mortgage loans. Housing prices had been stable since the early 1990s, and had in fact fallen during the currency crisis. They then gained rising momentum after the crisis, and during 2002 posted a greater than 17% increase (Figure 4-a). From that time housing prices remained on a continuous rise, albeit with some fluctuations, until right before outbreak of the global financial crisis. The real estate market was driven by housing prices in certain regions, specifically the three “Kangnam” districts in the southeastern part of Seoul (Figure 4-b), whose residential infrastructures were relatively well-developed with smooth traffic, high quality schools and numerous cultural facilities as well as convenience for commuting to offices in downtown Seoul. The rise in housing prices in these regions led to subsequent real estate price increases in neighboring areas:

Figure 4: Housing Prices

Source: Kookmin Bank

Several other factors might of course also have been related to the expansion in bank lending to households; the liberalization of the housing loan markets¹³⁾, the profit maximization behaviors of banks, the severe competition among banks, the preferred treatment of household loans in BIS capital adequacy ratio calculation, and others. But it should be stressed that the continuous and substantial increases in

13) Korea Housing Bank, a specialized bank that had been in exclusive charge of housing finance, was converted to a commercial bank in 1996, and from that time other commercial banks were also allowed to deal in mortgage loans after having previously focused mainly on corporate finance.

housing prices had to be the fundamental factor leading to the expansion in banks' household loans.

C. Foreign Exchange and Capital Transactions

The 1997 currency crisis was a critical opportunity giving Koreans an awareness of the importance of proper foreign debt management. Following the lessons of the crisis, Korea began to pay careful attention to this matter. Focused efforts were devoted in particular to reducing short-term debt while maintaining the country's net creditor position. External assets began to exceed external debts from 2000, as Korea moved thereby to a net creditor position, and the net external credit amount grew every year thereafter until 2004. Foreign assets were held mainly in short-term instruments (Figure 5-a), with the aim of ensuring FX liquidity. At least in the early years of the 2000s, Korea managed its external debt without a hitch.

In the middle part of the 2000s, however, changes in the net external credit composition appeared. Beginning from 2005, short-term net foreign assets (NFAs) of the private sector turned negative, and the scale of their negative balance grew ever larger until right before the global financial crisis (Figure 5-b). Although the central bank's foreign reserve holdings rose continuously, the short-term NFAs of the private sector declined rapidly enough to offset this.

Figure 5: Foreign Assets & Liabilities

Source: BOK, ECOS (Foreign Debt)

The decline in short-term NFAs of the private sector was a result of the lending and borrowing activities of financial institutions. Net lending (lending minus borrowing) began to decline rapidly from 2005 (Figure 6-a). Further, this decline in net lending was caused mainly by an increase in short-term borrowings by financial institutions.

Figure 6: Net Lending and Short-term NFAs

6-a Short-term Loans and Borrowings

6-b Short-term NFAs by Banks

Source: BOK, ECOS (Foreign Debt)

Both domestic banks and the branches of foreign banks (FBBs) played roles in this decline in short-term NFAs. Comparing the amounts of their negative short-term NFAs, however, those of FBBs overwhelmingly exceeded those of domestic banks. Short-term net debts of the former expanded from \$20 billion at the end of 2004 to \$114 billion in Q3 2008 (Figure 6-b). Those of domestic banks were in contrast a mere \$20 billion at that time. It should be noted, however, that the short-term net position of domestic banks had turned negative in 2005, and the negative position size had gradually expanded from that time.

The jump in foreign borrowings by financial institutions was related to a sudden expansion in forward FX contracts (IMF 2008). Major exporters including ship-builders¹⁴⁾ were selling their expected future incomes in foreign currencies in the

14) In addition, overseas portfolio investment by domestic investors increased rapidly from 2006. Those investors too sold forward contracts, in order to hedge their investments to avoid foreign exchange risk.

form of forward contracts with domestic banks and FBBs. And the financial institutions buying these forward contracts then needed to borrow dollars abroad to balance their FX positions.

2. Spillovers from US Crisis

As mentioned earlier, Korea came close to suffering another currency crisis in 2008. Market Pressure Index (EMPI) was calculated to analyze the situation of the Korean foreign exchange market in light of this history, in accordance with the methods of Kaminsky and Reinhart (1999). The exchange rate and foreign reserves are based on monthly average data¹⁵⁾, and when the index exceeds more than twice its standard deviation the case is considered as a currency crisis. As shown in Figure 7, the EMPI surpassed this upper bound in November and December of 1997 and in October of 2008, indicating the occurrences of currency crisis at those times.

Figure 7: EMPI

15) The monthly data during the period of April 1990 through March 2012 were used for the calculation, because the government allowed the exchange rate to be freely determined in the market from March 1990.

The hit by the global financial contraction in 2008 seems to have been unavoidable, considering the wide openness of the Korean economy. For example, Korea had come to face newly heightened external vulnerability with a reversal of current account to deficit in early 2008, when crude oil prices rose sharply amid the sub-prime mortgage debacle in the US. In fact, Korea relies for its oil consumption entirely on imported oil. Its (net) imports of oil inflated from \$72 billion in 2007 to \$104 billion in 2008, leading to a shrinkage of the current account surplus from \$22 billion to a mere \$3 billion at that time.

This paper emphasizes that the impacts on the Korean economy of the 2008 financial crisis were more severe than those on other Asian countries. Korea was hit much harder in terms of exchange rate volatility, the jump in its CDS premium, and so on. For example, Figure 8 shows that the CDS premium on Korean government bonds, after having been at a level similar to those in China, Malaysia and Thailand, rose to become much higher - similar to those of Indonesia and the Philippines:

Figure 8: Comparison of CDS Premiums

Source: Bloomberg

The severe hit by the 2008 global financial crisis was due largely to domestic factors, specifically the financial imbalances accumulated during the 2000s. In the wake of the 2008 global financial turmoil, the domestic financial markets encountered liquidity freezes in several financial instruments such as bank debentures. The aggravated domestic market situation exacerbated the spillover effects on the Korean foreign exchange market from abroad.

The initial cause of the exchange rate surge in 2008 was the direct exposures of financial institutions to FX liquidity risks caused by the increases in their short-term foreign debts. In particular, FBBs had to repay their short-term borrowings from their headquarters offices in line with the liquidity shortages faced by their mother banks in advanced countries during the crisis. Domestic banks, meanwhile, which had also expanded their short-term borrowings, faced similar difficulties repaying them. The ratio of short-term foreign debt rollover fell rapidly during the global financial crisis (Table 1), over and above the rising cost of attracting foreign capital, measured by the spread on Korean government bonds as mentioned in the paragraph above:

Table 1: Roll-over Ratio¹⁾

2008					2009				
H1	Q3	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May
97.6	99.8	39.9	52.9	60.7	92.6	89.1	100.6	111.3	97.3

Note: 1) Of general banks' foreign borrowings with maturities of 1 year or less

Sources: FSS, *Financial Supervision Information*, 2009-26 (No. 529) (2009.6.26.~7.2), and various press releases

The FX liquidity crunch faced by domestic banks was further aggravated by the potential weaknesses of domestic banking. First of all, the domestic financial market situation was almost analogous to that in the US - mortgage loans had been extended to households and housing prices had surged. Many people thus raised suspicions of a housing price bubble, and the risk of declines in housing prices leading to non-performing loans at banks. In addition, Korean financial institutions had raised the funds for their lending through wholesale financial instruments such CDs, debentures, etc., a situation which also seemed similar to the advanced country case.

In the process of spillover of the global financial crisis into the Korean financial markets, an acute debate on the level of Korean banks' LTD ratios occurred. Foreign investors (e.g., Merrill Lynch 2008) and foreign media (e.g., Wang 2008, *The Economist* 2009, and others) raised questions about the high LTD ratio of Korean banks. Korean banks and the authorities tried to counter by stressing the differences between Korean debentures and CDs and those in foreign countries, since

in Korea they were issued to individual rather than institutional investors, and by asserting that Korean banks' LTD ratio was not so high if these debentures and CDs were included in deposits. At any rate, the debate on the LTD ratio level served as momentum sounding alarms that Korean banks might have difficulties in securing liquidity.¹⁶⁾

Symptoms of a liquidity crunch with respect to securities appeared. The spreads of debenture and CD interest rates over government bond yields jumped to unprecedented levels (Figure 9). Bank debenture and CD yields had previously moved in patterns similar to that on 1-year treasury bonds, but after the Lehman Brothers incident rose to levels 2% points higher than treasury bond yields. As a consequence, the share of debentures in financial institutions' funding sources declined greatly from October 2008, due to their difficulties in issuing them (Table 2):

Figure 9: Spreads

Source: BOK, ECOS

Table 2: Composition of FI Debt and Capital

	Dec. 2005	Dec. 2007	Aug. 2008	Dec. 2008	Dec. 2009	Dec. 2010
Deposits	63.6	55.3	54.1	57.0	59.6	64.0
CDs	2.6	4.2	4.8	4.5	4.5	1.7
Debentures	9.9	11.4	11.3	10.7	8.9	8.4
Funds	14.2	16.6	17.3	15.2	13.8	11.9
Money in Trust	2.2	3.9	4.0	3.6	3.8	3.5
Others	1.4	2.8	2.6	2.2	2.6	4.1
Capital	6.1	5.9	5.9	6.8	6.8	6.6
Total	100	100	100	100	100	100

In addition, given the economy's growing sluggishness the possibility arose of a worsening of mortgage loan and SME loan performance. If the liquidity crunch in the domestic financial markets had tightened further, and financial institutions refrained from lending, then the domestic financial sector would have experienced

16) The suspicions about Korean banks might also have been aggravated by memories of the 1997 currency crisis.

a financial contraction through deleveraging, which might eventually have led to outbreak of a financial crisis.

The Figure 10 is a diagram of the process of spillover of the US financial crisis to the Korean economy. It shows the entire process of spread of the US financial crisis to the domestic Korean financial markets, and how a variety of domestic issues combined to aggravate the impacts from abroad, worsening the domestic liquidity situation and thereby giving rise finally to another round of currency crisis. The diagram stresses the fact that liquidity contractions occurred in both the domestic financial and FX markets. In addition, attention should be paid to the mutual interaction between foreign exchange market instability and the liquidity strains in the domestic financial market.

Figure 10: 2008 Currency Turbulence in Korea

3. Response to the Spillovers

Against this backdrop the Korean authorities adopted a series of emergency measures (Table 3), such as supplying FX liquidity directly to financial institutions and providing guarantees on banks' foreign liabilities to foreign debtors, although none of them were very effective (Baba and Shim 2011). Korea did also manage to conclude a bilateral currency swap agreement with the Federal Reserve, however, which helped to soothe market sentiment.

Emergency liquidity was also provided to the domestic financial markets. The authorities sought various ways of providing liquidity to SMEs, which were suffering difficulties due the sharply increased exchange rate, the economic recession and huge losses on FX derivatives transactions. The Bank of Korea opened a rediscount window to securities companies as the inter-bank markets froze. It also expanded the range of collateral eligible for use in its open market operations (OMOs), to include bonds and debentures issued by public enterprises and banks. Apart from these liquidity provision measures the BOK cut its policy rate rapidly, from 5.25% to 3% in just two months from October through December 2008. The authorities meanwhile created a 10 trillion-won Bond Market Stabilization Fund, and proposed a Bank Recapitalization Fund with the aim of improving financial institutions' credibility. The supervisory authority revised the DC liquidity ratio formula by reducing the maturity for calculation of the ratio from 3 months or less to 1 month or less (FSC 2008).

Table 3: Crisis Management in Korea after Lehman Brothers Bankruptcy

Date	Actions and Measures	Note
Oct. 9	BOK cut of policy rate	5.25% → 5%
Oct. 13	Government and BOK release of a plan for providing FX liquidity for international trade by SMEs	\$16 Bil
Oct. 19	Government provision of guarantees of banks' foreign currency-denominated debts	up to \$100 Bil
Oct. 27	BOK cut of policy rate	5% → 4.25%
Oct. 27	BOK inclusion of bank debentures and public entity bonds as OMO collateral	
Oct. 27	BOK introduction of auction scheme to provide FX liquidity to banks	
Oct. 30	BOK signing of currency swap agreement with FRB	\$30 Bil
Oct. 31	FSC change of DC liquidity ratio rule	3-month → 1-month
Nov. 7	BOK cut of policy rate	4.25% → 4.0%
Nov. 24	BOK provision of liquidity to banks participating in Bond Market Stabilization Fund	₩5 Tril
Dec. 3	BOK payment of interest on banks' reserves at BOK	2.3% p.a.
Dec. 11	BOK cut of policy rate	4.0% → 3.0%
Dec. 11	BOK inclusion of securities companies among counter- parties for BOK RP transactions	
Dec. 12	BOK signing of currency swap agreement with PBOC ¹⁾	\$30 Bil
	BOK expansion of currency swap agreement with BOJ ¹⁾	\$3Bil → 20Bil
Dec. 16	Launch of Bond Market Stabilization Fund	₩10 Tril
Dec. 18	FSC release of plan for establishment of Bank Recapitalization Fund	₩20 Tril

Note: 1) Agreement made in addition to swaps through CMI (Chiangmai Initiative)

IV. Effects of MaPP Measures

1. Overall Evaluation

In evaluating the effectiveness of the MaPP measures employed in Korea, this paper will look at whether the measures ensured their ultimate purpose, i.e. financial stability. The existing studies, such as BCBS (2010a), Lim et al. (2011), and Claessens and Gosh (2012), consider the extents to which these measures contributed

to reducing the possibility of financial crisis (or systemic risk), or to reducing the vulnerability of financial institutions, and tend to evaluate the measures' effectiveness positively if they made even small contributions to these ends. This paper will in contrast evaluate MaPP measure effectiveness based on judgment of whether they were effective in preventing the occurrence of "systemic events." This perspective seems more reasonable in the sense that the ultimate purpose of MaPP is to preemptively prevent financial imbalances in the financial sector that might in the end lead to systemic events.

As mentioned earlier, Korea adopted several MaPP measures in the 2000s. A de facto financial crisis did however occur afterward, and we can thus assess the Korean MaPP measures to have not been fully effective, given that they were unable to achieve their ultimate goal of "preventing systemic events."

We cannot of course deny that these policy measures had effects to some degree, relative to the case of nothing having been done. It should be noted as well that the effects of individual policies can be examined from various perspectives and dimensions. In addition, it is well known that the MaPP measures in Korea were not implemented under the more integrated conceptual framework of the recent years, in any pursuit of the objectives that have been the basis of the current discussions.

Taking these points sufficiently into account, this paper will look into the limitations and problems of the MaPP measures used in Korea in the 2000s, and some mistakes in their operation, in order to derive lessons from Korea's experience for establishment of a more efficient MaPP framework. The focus will be given to the major instruments, specifically the liquidity ratio regulations and the LTV/DTI regulations.

2. Limitations and Problems of FX Liquidity Ratio

The biggest problem of this regulation was that the FBBs were not made subject to it. There was a predominating perception that their parent banks in advanced countries could inject FX liquidity into their branches at any time (Khatri 2008). However, when major banks in advanced countries were hit by the global financial crisis it became impossible for them to inject liquidity into their Korean branches. FBBs, which had increased their short-term borrowings in order to buy forward exchange, then had to redeem their borrowings at maturity, leading domestic foreign

exchange conditions to deteriorate.

Since introduction of the FX liquidity ratio regulation, meanwhile, domestic banks had remained in compliance with it (Figure 11). And this fact indicates as well that, even if the FX liquidity ratio is met there are limitations in its prevention of systemic event occurrence. It is therefore important to examine why a FX liquidity shortage occurred even though the ratio had been met.

Figure 11: FX Liquidity Ratio

Source: FSC, Data Base

Primarily, given that the indicative guideline for the ratio was 85%, doubts about that level might be raised. And since banks actually maintained their FX liquidity ratios above 100%, much higher than the guideline, exactly what the appropriate level for this guideline is can also be a major topic of study going forward. However, I would like here to instead emphasize the limitations of the liquidity regulations, as shown in the ratios of assets and debts.

The fact that a liquidity shortage occurred even though the FX liquidity ratio had been met implies that the liquidity secured through foreign currency assets was unable to meet the obligations incurred through foreign currency debts. Since it is not easy to accurately measure the liquidities of assets and liabilities, I would like to examine their volatilities first. Looking at the quarter-on-quarter changes in assets and debts with outstanding maturities of less than 3 months, we find the volatility of FX debts measured by their standard deviation (std) to have been much higher than

that of FX assets before the crisis¹⁷⁾ (Table 4). In other words, the foreign debts fluctuated with relatively wider margins even during the normal period, hence further suggesting differences in liquidity between foreign assets and liabilities:

Table 4: Volatilities, FX Assets vs. Debts

(%)

	Whole Period 2003Ⅳ-2011Ⅳ		Before-Crisis 2003Ⅳ-2008Ⅲ		During Crisis 2008Ⅳ-2010Ⅰ		After-Crisis 2010Ⅱ-2011Ⅳ	
	mean	std	mean	std	mean	std	mean	std
Assets	2.5	15.7	3.4	16.0	-2.3	12.6	3.8	20.2
Liabilities	2.4	19.6	4.5	20.7	-3.8	9.5	1.7	25.9

There may be a shortcoming in the examination of differences in liquidity on the basis of assets and liabilities outstanding. Outstanding assets and liabilities represent stocks at a certain point in time, after adjustment of excesses or shortages in total liquidity. To measure excesses or shortages in total liquidity, however, we need to examine the volatility in terms of flows.

To examine the fact that assets and debts, two components of the FX liquidity ratio, have different volatilities in terms of their flows, I investigated the relevant statistics from the capital account of the balance of payments. I used the 12-month moving sum of capital flows, based on the methodology of Rothenberg and Warnock (2006), who defined it as a crisis when statistical indicators increase beyond a certain range (for example, exceeding more than twice their standard deviations):

$$C_t = \sum_{i=0}^{11} P_{t-i}$$

$$\Delta C_t = C_t - C_{t-12}$$

C : 12-month moving sum of capital flows

P : monthly capital flows

ΔC : annual change

17) However, the standard deviation of their quarter-on-quarter changes was relatively smaller during the crisis period, presumably because the range of fluctuation in debt narrowed due to the unfavorable debt financing conditions.

Calculation of financial institution lending and borrowing flows shows that borrowing went up by more than two standard deviations in 2008, with the accumulated outflows over 12 months so great as to exceed \$80 billion (Figure 12-a). Lending meanwhile did not show wide fluctuations, but rather remained almost stable within a certain range. In terms of cashable assets and debts including cash and deposits, both assets and liabilities showed wide fluctuations (Figure 12-b). In terms of the ranges of their fluctuations, however, cash and deposit liabilities exhibited sharper outflows than the inflows of assets, with the accumulated outflows over 12 months amounting to \$40 billion. The inflows of cash and deposit assets also grew sharply during the crisis, but by much less than the increase in debt outflows at around \$15 billion¹⁸⁾. In sum, examination of the flows of foreign assets and liabilities confirms the volatilities of foreign debts to be larger than those of foreign assets.¹⁹⁾

Figure 12: Volatility

Source: BOK, ECOS

In conclusion, the disparity in liquidity between assets and liabilities is the limitation of the FX liquidity ratio regulation. The possibility of short-term liquid asset

18) Meanwhile, the time that it took for the cash and deposit assets of domestic financial institutions to exceed two standard deviations was significantly earlier than what it took for debt outflows. This may be a new basis to devise a crisis forecasting index.

19) In the case of Korea in 2008, the rapid reduction in foreign borrowings was attributable mainly to foreigners. In this sense, the event could be categorized as a "sudden stop" instead of sudden flight (refer to Rothenberg and Warnock (2006) for detailed discussion of this issue).

liquidation, in other words market liquidity, could decline drastically during a crisis, and funding liquidity could also fall sharply. In cases of emergency, therefore, a situation could arise in which banks are forced to redeem their total liquid liabilities without being able to liquidate their liquid assets.²⁰⁾

Another problem of the liquidity ratio regulation is that the gap between liquid assets and liabilities could widen. With the liquidity ratio regulation in place, the actual ratio is not likely to change dramatically, but to hover at around the regulatory level. Even with such an unchanging liquidity ratio, however, the gap between liquid assets and liabilities in terms of their absolute values could widen (Figure 13-a). This is because the scale of liquid assets and liabilities with maturities less than 3-month could increase. In addition, the gap between liquid assets and liabilities could increase compared to nominal GDP, and as shown in Figure 13-b below this trend has been verified in Korea. The widening gap between liquid assets and liabilities may have great impact on the financial market, given the mismatch between market and funding liquidities. The ratio regulation, which expresses the relationship between liquid assets and liabilities in terms of ratios, could therefore lose its effectiveness as time passes, given an expansion in financial transactions.

Figure 13: Liquidity GAP

Source: FSS Data Base and BOK, ECOS

20) Recently, a way of numerically reflecting the possibility of liquidation has been considered. However, it is possible that liquidity might not be ensured as much as expected in this case either, if many financial institutions try to liquidate assets at the same time.

3. Limitations and Problems of DC Liquidity Ratio

The DC liquidity ratio regulation is similar to the FX liquidity ratio in terms of its limitations and problems, in that it too is based on ratios expressing the relationship between assets and liabilities. Similarly, while there have been no commercial banks whose ratios have gone below the guideline²¹⁾ (Figure 14) a liquidity crunch in the domestic financial market nevertheless did occur in 2008. Therefore, just as in the case of the FX liquidity ratio, it is very interesting to inquire as to why liquidity conditions in the domestic financial markets deteriorated in 2008, even despite commercial banks having all met the DC liquidity ratio guideline.

Figure 14: DC Liquidity Ratio

Source: FSS Data Base

It is doubtful that the DC liquidity ratio represents the liquidity situation of financial institutions in the domestic financial market very well. In other words, the ratio is not closely related to actual liquidity demand in a crisis situation. As liquidity conditions in the domestic financial market deteriorated in 2008, the Bank of Korea provided liquidity. However, the relationship between the scale of this liquidity provision and the liquidity ratio is not clear. Estimation of the correlation from Q4

21) The ratios of the government-owned specialized banks were lower than the guideline, but they did not cause the liquidity shortage in 2008.

2008 to Q3 2009 between the ratio and borrowings from the BOK yields a coefficient of near zero (Figure 15-a). The correlation between changes in borrowing from the BOK and in non-core liabilities was on the other hand relatively distinct, showing a coefficient of -0.32 (Figure 15-b).

Figure 15: Correlation

This implies that, amid the unstable financial market conditions at home and abroad from Q4 2008 to Q3 2009, banks that were able to reduce their non-core liabilities borrowed little from the BOK, while those unable to repay them borrowed substantially from the BOK. This analysis implies further that the sizes of liquid liabilities instead determine financial institutions' liquidity risks. In other words, the *volatility* of funding liquidity demonstrates financial institution liquidity risks well.

It should be pointed out that the DC liquidity ratio regulation was eased in 2006, when the financial authorities de facto decided to lower the guideline. This decision came as a way of supporting the autonomous decision-making of banks, whose DC liquidity ratios had risen greatly thanks to their efforts to consolidate their loans after the credit card distress of 2003 (FSC and FSS 2006). However, the decision did not take macroeconomic conditions into account, while giving priority to bank profitability. At the time the decision was made real estate prices were surging, and bank lending was continually expanding. After that, and up until just before the global financial crisis, the DC liquidity ratio continued to gradually decline, and lending by

banks continued to increase (Figure 16).

Figure 16: DC Liquidity Ratio and Bank Lending

Note: The line along the liquidity ratio presents the trend

Sources: BOK, ECOS, and FSS, Data Base

Analysis shows that the liquidity ratio regulation affects the total lending amount. To grasp the effect of the liquidity ratio on lending, I have estimated a co-integration regression as follows: ²²⁾

$$\log(L_t/P_t) = \alpha_0 + \alpha_1 \log(y_t) + \alpha_2(R_t - \pi_t) + \alpha_3 LR_t + \alpha_4 \log(HP_t/P_t) + \epsilon_t$$

L_t : Bank Lending

P_t : Consumer Price Index

y_t : Real GDP

R_t : Lending Rate (on newly-extended loans)

π_t : Inflation (changes in CPI)

LR_t : DC Liquidity Ratio (3-month maturity basis)

HP_t : Housing Price Index (compiled by Kookmin Bank)

ϵ_t : Errors

22) Co-integration regression techniques of FMOLS (Fully-Modified Ordinary Least Squares Method) and CCR (Canonical Cointegrating Regression) were applied. All level variables have unit roots, and first-differenced variables are stationary. Co-integration test results show the existence of one co-integration relationship.

The estimation, of which results are shown in Table 5, finds that the liquidity ratio is a significant factor determining the amount of bank lending, and based upon these estimation results we can infer that the easing of liquidity ratio regulations in 2006 served as a factor causing the expansion in bank lending in the second half of the 2000s. This regulatory easing appears further to have been part of the background behind financial institutions' expansion in bank debenture issuance at that time.

Table 5: Liquidity Ratio and Bank Lending

Independent Variable	$\log (L_t / P_t)$	
Estimation Method	FMOLS	CCR
Explanatory Variables		
Constant	-4.454 *** (0.908)	-4.342 *** (1.002)
$\log (y_t)$	1.119 *** (0.070)	1.114 *** (0.076)
$R_t - \pi_t$	-0.007 (0.006)	-0.007 (0.002)
LR_t	-0.003 ** (0.001)	-0.004 ** (0.002)
$\log (HP_t / P_t)$	0.845 *** (0.152)	0.865 *** (0.158)
Adjusted R-square	0.987	0.987
Estimation Period	2000.III ~ 2009.III	

Notes: Figures in () refer to standard errors, and ***, ** and * to significance levels of 1%, 5% and 10%, respectively

Interpreting from a retrospective viewpoint based on the analysis above, we can infer that the DC liquidity ratio regulations have been implemented to help ensure the soundness of individual financial institutions, that is, for micro-prudential objectives. On the other hand, macroeconomic financial conditions including total lending seem to have not been kept in mind.

From this we can derive the lesson that, in order to use the liquidity ratio as a MaPP measure, it would be more appropriate to set a target variable representing macroeconomic conditions for the ratio, rather than operating it just for securing individual financial institution soundness.

4. Limitations and Problems of LTV and DTI

There are many precedent studies on the effects of the LTV and DTI regulations related to housing finance. Those discussing the issue from a conceptual perspective tend to view the regulations positively. Discussions related to Korea's case include Chang (2010), Shin (2010), FSB et al. (2011) and Crowe et al. (2011). While there are not many empirical studies on the Korean case, Igan and Kang (2011) did present some results of empirical analysis in a study concluding that the Korean LTV and DTI regulations have not had great influence on housing prices, but have affected the housing transaction volume.

Assessment of the LTV and DTI regulation effects can differ depending upon the perspective and the standard of assessment adopted. I would like to assess them from roughly three perspectives here: a micro-perspective to assess the effects on financial institution soundness, a perspective related to the authority's intention, i.e. to stabilize housing prices, and a perspective regarding the household debt volume or level.

In the Korean case, we can assess the LTV and DTV regulations as having at least helped financial institutions to maintain their soundness. Housing prices fell from the second half of 2009, after the global financial crisis, but the delinquency ratio on household loans remained extremely low (Figure 17). This implies that strict implementation of the LTV ratio prevented delinquencies on household loans even after housing prices fell²³⁾, thus reducing financial institution credit risks despite the dramatic increase in household loans prior to the crisis.²⁴⁾ From this standpoint, the LTV and DTI regulations were helpful in securing financial institution soundness:

23) The lower household loan delinquency ratio in Korea may be due to legal factors. In general, Korean law allows the right of recourse to the creditor, which weakens household incentives for loan default. Fitch Ratings (2010) compactly describes the legal aspects of Korean housing loans.

24) The conclusion of Wong et al. (2011), who reported relatively positive empirical analytical results concerning LTV effects in Hong Kong, is based on this logic.

Figure 17: Delinquency Ratios

Source: BOK, ECOS

Meanwhile, the effects of the two measures in stabilizing housing prices were limited. When the LTV regulation was introduced, and during the several times when it was strengthened, housing prices at first declined but then rose again one or two quarters later (Figure 18-a). In fact, the limited effects of the LTV and the difficulties in strengthening it further led to introduction as well of the DTI regulation in 2005. Even after the DTI regulation was adopted, however, results similar to those with the LTV regulation were observed. Strengthening of the DTI regulation worked at first, but housing prices began to rise again one or two quarters later.

The impacts of the LTV and DTI regulations in limiting household lending seem to have been similar to their impacts on housing prices (Figure 18-b). When stronger LTV and DTI regulations were implemented, financial institutions at first temporarily extended less loans to households. One or two quarters later, however, they increased their household lending again, and this pattern continued until outbreak of the global financial crisis:

Figure 18: LTV and DTI's Impacts

To verify this argument, I estimated a simple regression for the determinants of housing prices and household lending as follows:

$$\log (HP_t / P_t) = \beta_0 + \beta_1 \log (y_t) + \beta_2 (R_t - \pi_t) + \beta_3 \log (L_t / P_t) + \beta_4 LTV_t + \beta_5 DTI_t + \mu_t$$

$$\log (HD_t / P_t) = \gamma_0 + \gamma_1 \log (y_t) + \gamma_2 (R_t - \pi_t) + \gamma_3 \log (HP_t / P_t) + \gamma_4 LTV_t + \gamma_5 DTI_t + v_t$$

HP_t : Housing Price Index (Kookmin Bank)

P_t : Consumer Price Index

y_t : Real GDP

R_t : Lending rate (new contract basis)

π_t : Inflation (changes in CPI)

L_t : Bank lending to households

LTV_t : LTV ratio (minimum)

DTI_t : DTI ratio (minimum)

HD_t : Household debt

μ_t, v_t : Respective error terms

The estimation results in Table 6 and 7 do not support that the LTV and DTI ratios have a close relationship with either housing prices or household debt, as suggested by the lack of robust and significant coefficients on LTV, DTI, or their lags.²⁵⁾

25) In order to obtain concrete statistical evidence of the effects of the LTV and DTI regulations on housing prices and household debt, it may be necessary to apply more detailed econometric estimation techniques that can determine the interrelations among the variables used in the estimation above.

Table 6: LTV and DTI Regulations and Housing Prices

Dependent Variable	$\log (HP_t / P_t)$			
Estimation Method	FMOLS			
Explanatory Variables				
Constant	2.624 (3.685)	-4.921 (4.536)	0.540 (3.521)	-3.243 * (3.895)
$\log (y_t)$	-0.520 (0.387)	0.152 (0.461)	-0.304 (0.370)	-0.008 (0.414)
$R_t - \pi_t$	0.008 (0.008)	0.007 (0.011)	0.004 (0.008)	0.003 (0.011)
$\log (L_t / P_t)$	0.421 *** (0.127)	0.318 ** (0.153)	0.355 *** (0.121)	0.353 ** (0.151)
<i>LTV</i>	-0.002 ** (0.001)			
<i>DTI</i>		0.002 (0.001)		
<i>LTV</i> (-1)			-0.001 (0.001)	
<i>DTI</i> (-1)				0.002 (0.001)
Adjusted R-square	0.859	0.809	0.842	0.823
Sample Periods	2000.III ~ 2009.IV			

Note : Figures in () are standard errors. ***, ** and * imply significance levels of 1%, 5% and 10%, respectively

Table 7: LTV and DTI Regulations and Household Debt

Dependent Variable	$\log (HD_t / P_t)$			
Estimation Method	FMOLS			
Explanatory Variables				
Constant	-14.562 *** (2.241)	-14.243 *** (3.846)	-14.074 *** (2.352)	-13.016 *** (3.174)
$\log (y_t)$	1.910 *** (0.180)	1.888 *** (0.306)	1.871 *** (0.189)	1.791 *** (0.253)
$R_t - \pi_t$	-0.026 *** (0.007)	-0.020 *** (0.010)	-0.024 *** (0.009)	-0.020 *** (0.009)
$\log (HP_t / P_t)$	0.970 *** (0.214)	0.864 *** (0.247)	0.997 *** (0.216)	0.906 *** (0.234)
<i>LTV</i>	0.002 * (0.001)			
<i>DTI</i>		0.000 (0.001)		
<i>LTV</i> (-1)			0.001 * (0.001)	
<i>DTI</i> (-1)				-0.000 (0.000)
Adjusted R-square	0.981	0.978	0.978	0.976
Sample Periods	2000.III ~ 2009.IV			

Note : Figures in () are standard errors. ***, ** and * imply significance levels of 1%, 5% and 10%, respectively

Regression for the determinants of housing prices reveals a coefficient on LTV_t with a 5% level of significance (Table 6). This seems unreliable, however, as it shows a negative sign, different from expectation; it is naturally expected that if the LTV is lowered (the regulation strengthened) housing prices should be squeezed. This estimation result may reflect the ex post property of the LTV regulation, which was only lowered after the jump in housing prices had been observed²⁶⁾. Household debt regression results in Table 7 show that the coefficient on either LTV_t or LTV_{t-1} is significant only at a 10% level but the coefficient on DTI or its lags is insignificant.

The reasons for the limited impacts of the measures in stabilizing house prices and limiting household lending can be found in several factors, including the nature of the housing market at that time and the competition among financial institutions. The decrease in housing supply since the time of the 1997 crisis had resulted in a structural housing supply shortage, leading as a result to widespread expectations of housing price increases. Changes on the demand side were observed as well; in addition to housing quality, buyers considered the residential environment very important. These structural changes in the housing market seemed to make the LTV and DTI regulations ineffective in curbing housing demand, especially for high-end houses. In sum, the regulatory effects will be limited when house prices increase owing to fundamental factors such as a supply-demand mismatch or a pattern shift in housing demand, as happened to Korea in the 2000s.

The expansion in mortgage lending in the 2000s was also linked to the changes in lending strategies of financial institutions. After a series of restructuring process since the 1997 currency crisis, banks began to normalize their businesses from around 2002. As financial institutions regained autonomy and started to manage their businesses with a primary focus on making profits, they began to expand their household loans. Based on the lessons from the currency crisis, companies were at the same time attempting to avoid taking out loans as much as possible, and it was also not easy for financial institutions to expand their corporate lending. It was thus inevitable under these circumstances that they extend more loans to households in order to maximize their profits. Financial institutions were able to reap attractive profits from household loans, most of which were secured by real estate collateral

26) LTV and DTI's characteristic aspect with respect to the timing will be discussed further later.

such as houses and whose risk weights in calculating the BIS ratio were low, while interest rates on household loans were also higher than those on corporate loans. Financial institutions competed vigorously with each other in a lending spree in pursuit of market share expansions or higher asset volume growth. Given these lending strategies, the LTV or DTI regulation could hardly contain this bank lending strategy.

Given these limited effects of the LTV and DTI regulations, the ratio of total household debt to national disposable income has continually risen—from 69% in 2004 to 81% in 2008 and 85% in 2011 (Table 8):

Table 8: Household Debt (relative to disposable income)

(%)

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Household Debt/ Disposable Income	74.2	71.1	68.9	72.7	77.1	78.8	80.7	84.1	83.0	84.8
Bank Loans to Households/ Disposable Income	35.5	38.2	38.4	40.8	44.1	43.1	43.3	44.2	42.3	42.3

Source: BOK, ECOS

5. Lack of Linkages among Sectors

While MaPP measures have been explored for individual sectors such as the housing market, domestic banking and the foreign exchange sector, we should also point out the lack of a comprehensive perspective or tools taking all sectors into account. During the 2008 crisis foreign financial institutions were reluctant to roll over the short-term foreign debts held by Korean banks, due to doubts about Korean bank creditworthiness. It was the LTD ratio that made them suspicious; as mentioned above, an acute debate on the LTD ratio level arose at that time. And while it is not easy to determine how foreign financial institutions reflected the LTD ratios in evaluating Korean banks' financial conditions, the occurrence of this debate did demonstrate the possibility of domestic financial conditions affecting the foreign exchange sector.

To find the correlation between the LTD ratio and financial institutions' short-term FX liquidity, a simple calculation is conducted here. The coefficient of correlation between the previous quarter's LTD ratio and the QoQ changes in short-term

FX liquid liabilities is calculated²⁷⁾. The calculation is conducted for six major commercial banks during the period from Q4 2008 to Q3 2009, and the coefficient of correlation is found to be -0.36 (Figure 19). Based on this result, we can conclude that the LTD ratio did affect the FX funding liquidity of financial institutions.

This finding indicates that the domestic banking and foreign exchange sectors can affect each other. Likewise, what happens in the housing market is also closely linked to the financial sector. It was problematic that Korea nevertheless sought only MaPP measures for application to individual sectors, and not any tools that could reflect the relationships among sectors was adopted. In this regard, when designing MaPP measures it may be necessary to seek ways of reflecting domestic financial conditions in the FX liquidity ratio, and FX funding liquidity conditions in the DC liquidity ratio, as well as simultaneously considering both financial institution activities and real estate market trends.

Figure 19: Correlation, LTD Ratio vs. FX Funding Liquidity

27) Since the liquidity ratio could not reflect the liquidity conditions for banks, as analyzed above, the changes in FX liabilities are selected here as the needed proxy for FX liquidity conditions.

V. Summary and Implications

1. Characteristic Aspects of MaPP Measures in Korea in the 2000s

It seems that the limited effects of the MaPP measures in Korea in the 2000s are attributable to their inherent characteristics. To pave the way for deriving implications for effective future operation of MaPP measures, this paper will discuss some of these characteristics.

First of all, the objectives of the measures were micro- rather than macroprudential. The liquidity ratio regulation in particular was targeted precisely at either strengthening individual banks' abilities to pay their liabilities or securing their soundness. This microprudential viewpoint was of course inevitable in part, since the concept of MaPP did not at the time exist. Another reason may have been the governance of the measures; the authorities handling them were the supervisory authorities, whose responsibility is microprudential regulation. In short, it should be pointed out that the Korean MaPP measures in the 2000s were not operated in targeting macro-level variables or events critical to financial stability.

The Korean MaPP measures in the 2000s also had several features which demonstrate the limitations or shortcomings of regulation. Almost without exemption, no regulation can avoid inherent problems such as boundary problems, loopholes, negative side-effects, and so on. And since all of the MaPP measures took the form of regulation, such problems eroded their effectiveness. A typical example of the boundary problems of the MaPP regulations was the exemption of FBBs from the FX liquidity ratio regulation.

Cases of MaPP regulation loopholes were meanwhile relatively apparent with the LTV and DTI regulations. For example, the authorities' decision to strengthen LTV and DTI regulations in November 2006 was an effort to make up for the regulations' loopholes²⁸⁾. At the same time, the authorities expanded the scope of LTV regulations to NBFIs including savings banks, mutual savings banks and credit companies,

28) Up to that time, an LTV ratio of 40% had been applied to loans for houses priced above 600 million Won with maturities of 10 years or more. On loans for houses of the same value, but with amortized repayment over 10 years with 1-year grace periods, the LTV ratio was meanwhile 60%, as the authorities believed these loans were not motivated by speculative purposes. In fact, however, the latter form of loan came to comprise the majority in those days, with most taken out for the purpose of avoiding the regulation (FSC and FSS 2006).

in an attempt to block opportunities for bridge loans by these NBFIs.

The negative side-effects of the regulations were also not small. Banks endeavored to expand their loans to households, which have longer-term maturities. To meet the liquidity ratio obligation, however, they then also had to reduce the maturities of their loans to business firms. This result was neither ideal nor desirable from the perspective of banks' basic function of maturity transformation, particularly in the Korean situation where viability of the economy depends mainly on active and smooth business firm activities in exporting and transactions.

Another characteristic aspect of the Korean MaPP measures may be examined from the viewpoint of their time dimension, i.e., whether they were applied proactively or reactively. And it is quite clear that the LTV and DTI rules have been applied in the latter manner. The introductions and amendments of these rules have accompanied changes in housing prices, and their time dimension operational characteristics can thus be termed reactive. This aspect is quite contrary to the natural MaPP perspective, under which preemptiveness is called for in preparation against potential risk factors.

The scopes of the MaPP measures may be pointed out as another important characteristic aspect. The Korean MaPP measures were confined to certain areas. In other words, they were operated simultaneously but in separation without any coordination or harmonized adjustments between or among them. In this regard, the operational characteristic aspect of the Korean MaPP measures can be described as an ad hoc approach, which may contrast with the comprehensive viewpoint recommended by the current conceptual framework for MaPP.

To make a final point with regard to the type of the regulation itself, i.e. that its focus is on a ratio, must be pointed out. The liquidity ratio has an inherent inability to catch signals of financial imbalances in advance and prevent their accumulation. In addition, the assets and debts of financial institutions have different properties with regard to financial stability. Reliance on a few ratios, therefore, even though applied from the MaPP perspective, would not be sufficient for securing financial stability.

2. Implications for MaPP Operation

This paper will close with some implications for the effective operations of MaPP,

drawn based on evaluation of the Korean experiences with MaPP measure operation in the 2000s.

A. Objective Setting in Macroprudential Dimension

For the successful implementation of MaPP measures, it is important that their objectives be set from a macro-prudential dimension. It would be ideal to set as objectives indicators reflecting procyclicality, systemic risk or interconnectedness. In reality, however, it is necessary to find alternatives for these macroprudential indicators, as their formulation for use in the real world would not be easy. Better candidates would be lending or borrowing aggregates of certain sectors, for example, whose developments could be monitored, since most financial imbalances usually accumulate in the forms of excessive lending or borrowing (Borio and Shim 2007). The Korean case provides evidence, at least, supporting the argument that micro-prudential objectives should be avoided in the design of MaPP measures.

B. Minimizing Boundary Problems

In Korea, similarly to the US case, the financial imbalances began in areas not subject to regulations. It is therefore quite clear from the Korean experience that MaPP measures should be devised in a way that reduces the possibility of regulatory arbitrage or minimizes the boundary problems of regulations.²⁹⁾

C. Complementing Shortcomings of Ratio-style MaPP Measures

The Korean case illustrates the inherent limitations of liquidity ratio regulation. Even though the risk factor-weighting of liquidity ratios, as considered under BASEL III, may lessen this problem to some degree, it cannot resolve it completely. In this regard, liquidity ratio regulation may need to be supplemented with for example a cap on total borrowing.³⁰⁾

The Korean case also raises the issue of the proper liquidity ratio level. During the 2000s, the liquidity ratios for DC- as well as FX-denominated transactions did not constrain banks' risky activities; almost every bank maintained its liquidity ratio

29) Caprio (2010) argues that the ineffectiveness of Spanish dynamic provisioning has been due to the boundary problem. See Goodhart (2010) for a general discussion of the boundary problem.

30) Regarding this issue, Perotti and Suarez (2011) expressed views similar to those of this paper.

above the guideline level. The appropriate level for the guideline can thus be an important issue related to regulation effectiveness, and it could perhaps be raised to far above 100%.³¹⁾

D. Maintaining Time-Consistency of MaPP

It is natural to expect a situation in which the MaPP measures need amendment or revision as economic and financial circumstances change. Especially, when amending or revising MaPP measures in the direction of deregulation, it will be very important to maintain their initially intended purposes. To this end, it is advisable that the authorities evaluate the impacts of MaPP measure amendment from various perspectives. This is because, as in the Korean case of its 2006 DC liquidity ratio deregulation, the change can be rational from one side but suddenly lead to an imbalance in an unexpected way, which might be very difficult to correct ex post.

E. Incorporating New Risks from Structural Changes

As seen in the history of the MaPP measures in Korea, the tools have been revised frequently and promptly in accordance with changes in market conditions. These frequent revisions have not led to success in achievement of the measures' primary objectives, however. This implies that it might be necessary to adopt new series of regulations to deal with newly emerging potential risks, rather than adjusting existing regulations. For example, banks expanded their short-term borrowings from abroad because of growing exporter demand for new financial techniques such as forward and swap transactions to avoid FX risks, and this needed to be given attention from the MaPP perspective.

F. Harmonizing MaPP Measures for Individual Sub-sectors

While the financial system consists of many sub-sectors, MaPP measures may be designed to target individual sub-sectors. The reality, however, is that these sub-sectors are interconnected. Separate MaPP measures targeting specific sub-sectors will not be able to cope with events occurring across several sub-sectors. From this

31) The Korean authorities (FSC and FSS 2009) have recently announced a plan urging mandatory minimum holdings of safe FX assets, sufficient to cover FX liquidity needs in times of low roll-over ratios as seen during the recent crisis.

viewpoint, it would be recommendable that MaPP measures designed for specific sub-sectors also consider activities in related sectors³²⁾. For example, the Korean case suggests that the FX liquidity ratio scheme needs to also incorporate an indicator for domestic banking activities, such as the LTD ratio.

Along with the design of MaPP measures, their operations as well would work best if harmonized with those of the overall scheme of measures. This issue may be similar to that of coordination between MaPP and monetary policy. The point to be made here is that, in the case where several MaPP measures are applied simultaneously, consideration should be given to the issue of the coordination and interrelationships among them.

G. Overcoming Limitations of Ready-made Rules

As a typical type of regulation, MaPP measures have some inherent limitations, such as their tendencies to lag behind changes in the financial markets and to have loopholes. For the sake of MaPP measure effectiveness they should thus be supplemented with other, non-regulatory measures. Such measures might include the activities of the authorities concerned with regard to financial market and economic monitoring, analysis of potential risks, recommendation of risk avoidance means, and so on. These measures might be articulated as belonging to the realm of “macro-prudential *policy*”, rather than “macro-prudential *regulation*”. From this standpoint, it would be reasonable to operate the MaPP on two tracks; with the macro-prudential regulatory measures supported by the macro-prudential policy activities.

32) The notion here may be similar to the idea of the “look-through” approach suggested by Caruana (2010).

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<Abstract in Korean>

이종규*

본 보고서에서는 거시건전성정책 수단 운용에 관한 2000년대 한국의 경험을 바탕으로 향후 효과적인 거시건전성정책 운용을 위한 시사점을 도출하였다. 한국은 2000년대 몇 가지 거시건전성정책 수단을 운용하였으나 2008년 글로벌 금융위기의 여파를 막지 못하였는데 이는 거시건전성정책에도 불구하고 금융불균형이 누적되었기 때문이었다. 본 보고서는 거시건전성정책 수단의 목표, 적용범위 등과 관련하여 다음과 같은 몇 가지 시사점을 도출하였다. 첫째, 거시건전성정책 수단의 목표는 개별금융기관의 건전성 확보와 같은 미시적 차원의 목표보다는 가급적 거시건전성 차원에서 설정되어야 한다. 둘째, 거시건전성정책이 규제의 형태를 취하는 한 규제 회피 가능성을 줄이고 규제 범위를 잘못 설정함으로써 야기되는 부작용(boundary problem)을 최소화하여야 한다. 셋째, 비율규제 형식의 거시건전성정책 수단은 금융불균형이 누적되는 것을 방지하는 데 그 효과가 제한적인 점을 감안하여 차입 규모에 대한 한도 설정 등과 같은 다른 수단에 의해 보완되는 것이 바람직할 것이다. 넷째, 거시건전성 규제를 고쳐야 하는 경우 애초 목적의 취지를 가급적 살려 일관성을 유지하는 것이 거시건전성정책이 효과를 발휘하는 데 도움이 된다. 다섯째, 거시건전성정책 수단은 금융 및 실물부문의 구조변화로 인한 새로운 유형의 위험에 사전적으로 대응할 수 있도록 신축적으로 강구되어야 한다. 마지막으로 여러 가지 거시건전성정책 수단을 동시에 운용하는 경우 상호간의 영향을 고려하여 조화를 도모할 필요가 있다.

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