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Abstract

This paper examines how public intervention (prudential policy) in the banking area should be pursued and aims at providing points for discussion in considering what kind of system should be established to promote both the efficiency and stability of banking functions.

The basic thrust of the paper is that it is effective to utilize market mechanisms to improve the efficiency of banking functions and that public intervention is justified in coping with various market failures if optimality is satisfied. Here, market failure is taken to mean (1) information asymmetry between banks and creditors (especially small-lot depositors) and (2) any negative externality that illiquidity and insolvency transmit in a networked way to other banks, leading to the likely emergence of various risks such as: (a) small-lot depositors bearing losses, (b) the collapse of solvent banks due to a liquidity shortage, (c) the spreading by contagion of illiquidity of banks, and (d) the spreading by contagion of insolvency of banks. In examining public intervention to cope with these risks, we conclude that a deposit insurance system with a variable premium and prompt closure action are effective in dealing with risk (a), that the invocation of the central bank's lender of last resort function is effective for risks (b) and (c), and that the introduction of a charge system to internalize externality is effective for risk (d).

Arguments in this paper are conceptual in that they are derived based on certain assumptions with respect to entities related to the banking system, and thus do not exhaustively cover all the factors necessary for deciding actual policies. We hope that our conceptual summary provides grounds for future discussions on more specific system design.

Key words: Prudential policy; Market discipline; Lender of last resort; Deposit insurance; Capital adequacy rule; Systemic risk

JEL classification: D81, G28, L51

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1. Introduction

In any discussion of the various reforms of the banking system, an important consideration is how, and the extent to which, the authorities should intervene, i.e. the design of prudential policy. In this paper, we summarize basic ideas which might serve as guidelines in discussing how to utilize market discipline to maintain sound financial institution management and how to manage the central bank's prudential tools, namely the lender of last resort (LOLR) function and on-site examination.

The motivation for this study stems from a recognition that, in answering various questions concerning prudential policies from the viewpoint of guaranteeing both the efficiency and the stability of the financial system, it is crucial to have a basic idea about the grand design of prudential policy which is shared by all parties concerned. What we especially focus on, based on the current structure of the financial system including regulations reflecting a variety of political factors, is what viewpoint we should take in approaching a desirable system design capable of exercising intrinsic market functions. Therefore, in this paper we adopt a seemingly roundabout way by first clarifying the raison d'être of existing systems and, through specifying cases where these systems are lacking, eventually showing that we need to have a system which realizes "maximum exercise of the market function and minimum public intervention." The discussions presented throughout the paper are not meant to be specific answers to individual questions, but rather to suggest the direction of future discussions among the parties concerned.

In making clear our focus, it is perhaps necessary to indicate where we stand with respect to several points where various approaches are possible. The first of these is

"prudential policy." Since it is difficult, in principle, to differentiate prudential policy from monetary policy when viewed from the long-term perspective of stable financial system management, we focus on a more short-term horizon. The second is our final goal of optimal financial system design. We propose the "maximum exercise of the market function and minimum public intervention" as an ideal, while seeking measures to effectively avoid or contain market failure as a more practical goal. To this end, we seek to recognize existing prudential policy as consisting of "measures to avoid systemic risk by not allowing banks to fail" and explore ways to change such recognition to "measures to avoid and contain systemic risk based on the assumption that banks will fail." Since public intervention consists of mutually entwined tools, it is difficult to extract the central bank function alone separately from other government functions. Thus, we first seek the rationale for public intervention as a whole, and then try to extract implications for central banks. Lastly, with respect to the LOLR issue, we will only propose a basic stance, namely, the utilization of the information obtained through micro-monitoring and enhanced understanding of the macro market mechanism. Other issues, such as the formulation of activation standards in view of possible systemic risk, whether or not to expand Bagehot's principle (lend only to solvent but illiquid banks) in providing liquidity, optimal burden sharing between central bank credit and the injection of public funds from the viewpoint of social welfare, and possible international cooperation in the event of the failure of an international financial institution, are left for future analysis.

The conclusions we obtained can be summarized as follows:

(1) Sound financial institution management should be maintained through market discipline and the strengthening of corporate governance. Public intervention should

be centered on enhancing financial systems conducive to such a mechanism.

(2) In an extreme case where market discipline functions sufficiently among large-lot creditors, a deposit insurance system (with variable premiums according to risk) for the protection of small-lot depositors and also the LOLR function to prevent both failure of solvent banks due to a temporary liquidity shortage (such as a bank run) and systemic risk from materializing, will likely be the two major tools of the authorities in conducting prudential policy.

(3) In the situation where some kind of public intervention to complement the market mechanism is needed, the authorities should prepare intervention measures which can be substituted for market discipline based on economic rationality.[1]

(4) The prudential policy of a central bank should be conducted centering on the exercise of its LOLR function. For this, not only timely and accurate collection of information concerning the solvency of individual banks (net present value and risk) through on-site examination, but also the formulation of accountable and economically rational LOLR management rules based on an appropriate understanding of systemic risk, are required.

This paper is composed as follows. Restating the rationale for public intervention in Section 2, in Section 3 we give possible courses of public intervention referring to the utilization of market discipline as a measure to respond to market failure stemming from information asymmetry. Section 4 discusses desirable approaches for two specific issues central banks now face, namely, revision of BIS capital standards and the construction of a framework for LOLR management. Section 5 summarizes our findings and addresses future work. Since the purpose of this paper is to share views among the parties concerned, our main views are boxed at the beginning of each section.

[1] Similar proposals can be seen in Greenspan [1997].

2. Rationale of Public Intervention

2.1 General Views

In designing prudential policy the objective is to build an optimal system that appropriately combines the market mechanism and public intervention.

Public intervention is justified as a measure to ensure the stability of the system and the equality of distribution when there is a market failure (incompleteness),[2] while utilization of the market mechanism is effective in enhancing system efficiency. Therefore, if public intervention is likely to result in partly impairing or distorting the market mechanism, we need to explore an appropriate balance between efficiency and stability.[3] Hence, given that there is a trade-off between the market mechanism and public intervention, the objective in designing prudential policy is to build an optimal system that appropriately combines the two.

It should be noted that the composition of an optimal system will change as features of the surrounding economic environment, such as increased disclosure occasioned by enhanced information transmission infrastructure and the global trend of financial liberalization, change.[4] Existing systems of public intervention, optimal at the time of establishment, might have become obsolete and it has become all the more important, especially in the current context of a rapidly changing environment, to flexibly review system design.

What is worth noting in setting policy objectives is how to recognize the cost of

[2] For textbooks of public economics, see Laffont [1988] and Stiglitz [1988] for example.
[3] For example, see Suzumura [1990].
[4] See Greenspan [1996].

"failure by the authorities." Bearing in mind the recent experience of international financial crises, this point is an important one which warrants thorough consideration. We will come back to this issue later in the paper.

2.2 Rationale of Public Intervention[5] in the Banking System[6]

Public intervention can be justified only when it aims at coping with market failures stemming from either information asymmetry (market incompleteness) or negative externality.

2.2.1 Information asymmetry (market incompleteness)

For the general creditors (especially small-lot depositors) of a bank, the monitoring cost (i.e. the cost of obtaining and evaluating information on the business conditions of a bank) is not small, and it is still impossible to obtain all internal information (i.e. all the private information that exists) even if creditors spare no effort. There is, of course, a degree of information asymmetry in any industry, although that with respect to the banking industry is substantial, mainly due to the nature of its business, which involves such elements as the quality of portfolios being difficult to gauge by third parties.

It should be noted that, in actuality, there is information asymmetry even among big-lot depositors, which could produce a substantial impediment to the financial system as illustrated by a liquidity decline in Japanese inter-bank market in autumn

[5] For past discussions in Japan, see Iwata and Horiuchi [1985], Bank of Japan [1985], Hayakawa [1988], and Ikeo [1990]. For relatively recent commentary, see Dewatripont and Tirole [1994].

[6] Among various financial institutions, banks stand out because of their central role in deposit acceptance, settlement, and credit creation, the very features focused on in discussing the rationale for public intervention. Bearing this in mind, we use the banking system instead of the financial system as a term which represents the object of prudential policy in order to draw

1997.

2.2.2 Negative externality

When the liquidity crisis or insolvency of an individual bank is transmitted to other banks via the network effect,[7] public functions provided by the banking system, such as the settlement system, will be paralyzed, resulting in massive social losses. There is a negative externality here in that such a possibility has not been taken into account by the management of individual banks. While negative externality exists more or less in any industry, it is of particular significance in the banking industry in two ways[8]: risk is liable to be transmitted, since a bank's balance sheet is highly leveraged both liquidity wise and solvency wise, and the social cost becomes large once such risk is transmitted.

2.3 Four Risks Which Materialize as a Result of Market Failure

If public intervention is not exercised to deal with the above mentioned market failure, four risks are likely to materialize: (a) small-depositors may incur losses due to bank failure, (b) a solvent bank may fail due to a temporary liquidity shortage such as a bank run, (c) the liquidity shortage may be contagious (systemic liquidity risk), and (d) contagious insolvency may arise (systemic solvency risk). Of these, (c) and (d) are significant in that they could impair the stability of the entire banking system.

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due attention to such unique features.

[7] In general, externality (technical externality) refers to a phenomenon, when there is no information asymmetry under perfect competition, where the behavior of an economic entity indirectly affects another's utility. Meanwhile, if the assumption of information asymmetry is satisfied, there will be an externality (pecuniary externality) whereby an economic entity's behavior directly affects the behavior of another entity through prices since prices transmit information. These two externalities should be discussed separately; what we refer to in this paper (network effect) is the former.

[8] See, for example, Yabushita [1995].

The following risks (a)-(d) are likely to materialize without any public intervention to deal with the market failures which are pointed out above.

(a) The burden of small-depositors' losses

Despite it being undesirable to let small-lot depositors, who cannot avoid information asymmetry by themselves, shoulder losses incurred by a bank failure, there is a risk of such a thing happening.

(b) Failure of a solvent bank due to a temporary liquidity shortage such as a bank run

As a result of information asymmetry, there could be a case where a bank run occurs due to rational behavior on the part of creditors thereby forcing a solvent bank into a temporary liquidity shortage. In this case, there is a risk that the bank concerned cannot restore liquidity by itself, resulting in its failure.

(c) Contagious liquidity shortage (systemic liquidity risk)

There is a risk that for some reason, such as a bank run, a bank faces an unexpected liquidity shortage, the impact of which rapidly spreads through the entire banking system within a short period of time through the network effect (though individual banks are not insolvent). If a liquidity shortage is transmitted, we assume that a solvent bank faces quantitative constraints such that it cannot obtain the necessary funding in a timely manner (even at high interest rates) from the market. Such a situation might be induced by two factors: infrastructure may be insufficient, so that a large amount of funding cannot be made instantly due to settlement system constraints; and fund providers cannot effect price sensitive behavior due to information asymmetry.

(d) Contagious insolvency (systemic solvency risk)

There is a risk that the failure of one bank contagiously plunges other banks into

insolvency.[9] One feature of our classification is that we have explicitly separated systemic risk into systemic liquidity risk and systemic solvency risk. Looking at previous studies of systemic risk, there are those which implicitly only deal with the former and those that discuss both without differentiating between them. Since the responses differ in the above two cases[10], we believe our classification is much more effective. If one wants to confine the issue of insolvency to net balance sheet value (liquidation value), its network effect might be relatively small while that of illiquidity is relatively large.

3. The Form of Public Intervention to Deal with the Four Risks

Four public intervention measures in response to the aforementioned four risks:

(a) small depositors losses: deposit insurance and prompt closure action, etc.

(b) failure of a solvent bank due to a temporary liquidity shortage: LOLR

(c) contagious liquidity shortage (systemic liquidity risk): LOLR

(d) contagious insolvency (systemic solvency risk): introduction of a risk charge system.

[9] As mechanisms by which insolvency is transmitted, one focuses on net balance sheet value and another which incorporates franchise value. In considering the former, one can visualize a framework within which the excess debt on the balance sheet of the bank triggering failure is absorbed by the capital (before failure) of the banks subsequently failing. As an example of the latter mechanism, there is a phenomenon of association where the franchise value of other banks of same nationality and business category is reduced resulting in insolvency contagiously materializing.

[10] Looking at academic arguments regarding the exercise of the central bank LOLR function, some assert it should be effected only for solvent but temporarily illiquid banks, while others believe it should be extended to insolvent banks. This paper adopts the former view.

3.1 Responses to Information Asymmetry Existing for Small-Lot Depositors

It is assumed that small-lot depositors cannot undertake monitoring responsibility and hence it becomes necessary to delegate it to a third party. Whether to expand this to include large-lot depositors or limit the range is an important point for discussion, which can basically be summarized as a problem related to degree of information asymmetry (disclosure practices, degree of intrinsic asymmetry). Specific forms of delegated monitoring could be (a) deposit insurance (with fair variable premium) or (b) prompt closure action.[11] In addition, (c) the LOLR function of a central bank could be, conceptually, included as a function which compliments delegated monitoring (explained in detail in 3.1.3), and we can also think of (d) ensuring bank management discipline through enhanced monitoring by large-lot creditors.

3.1.1 Deposit insurance system (fair variable premium)

A deposit insurance system can be an effective monitoring agent if it is possible to set premiums which correctly reflect the state of banks. That is, if a deposit insurance system can routinely monitor solvency (net present value of bank capital <=NPV>) and uncertainty (measurement errors and potential future variability <=risks>), and set insurance premiums according to the monitoring results, the premium will pose the same burden to banks as the interest premium which might be requested by depositors under perfect information in the absence of a deposit insurance system. As a result, depositors would try to avoid the cost of monitoring by delegating it to the deposit insurance system, and the system, in turn, would monitor bank behavior, thereby

[11] This paper uses the term "prompt closure action" to describe action ordering troubled banks to close their business and exit from the market in an appropriate timing. Therefore, we exclude official guidance on how to improve management, which is included in 'prompt corrective action.'

containing moral hazard[12] on the part of banks by curbing their taking of excessive risks[13].

Under a variable premium scheme, the focus of discussion about whether participation in deposit insurance should be made compulsory or optional will differ from that under the existing uniform premium scheme: in the case of a variable premium under a compulsory deposit insurance system, a high premium would be applied to banks judged practically insolvent by the Deposit Insurance Corporation (DIC), which runs the deposit insurance system, resulting in making it very difficult for the bank to remain in business. In this case, the DIC virtually holds the right of approval with respect to banking activity. On the other hand, under an optional deposit insurance system, such a bank would, after having been forced to withdraw from the system, seek depositors' 'approval' as to whether it could continue to collect deposits and conduct banking operations. In this case, depositors or market participants in general would have an opportunity to evaluate the actual condition of bank management. It should be noted that, with respect to participation in and withdrawal from the system, there is a possibility of adverse selection whereby only banks whose premiums are undervalued in light of actual business conditions will remain in the system.

While the possibility of setting a fair premium depends on the extent of private information[14] between banks and the DIC in a strict sense, we can possibly say that, to a certain degree, the DIC is able to grasp asset values (real net capital) and risk amounts (measurement errors and changes in the environment) because of recent technological innovations regarding risk quantification and price assessment. Specific ways to

[12] As for actual moral hazard incidents, see, for example, Dellas, Diba, and Garber [1996].
[13] See, for example, Oda [1999] and Iwamura [1992].
[14] Chan, Yuk-Shee, Greenbaum and Thakor [1992] suggest policy responses from the standpoint

calculate fair premium include setting a premium based on monitoring, for example by government and/or DIC supervision, and applying option pricing theory based on stock price information.[15]

3.1.2 Prompt closure action

A basic function of prompt closure action is to prevent creditors from incurring losses by suspending bank operations before a bank becomes insolvent. A decision on when to suspend operations, including gradual suspension, depends on the results of monitoring by the authority which runs the prompt closure action scheme.

While the prompt closure action scheme overlaps the deposit insurance scheme in that it prevents creditors from incurring losses, if one assumes that the government's monitoring capability is perfect and duly evaluates whether banks are solvent or not, prompt closure action can fully safeguard all creditors and thus might lead to the belief that deposit insurance is unnecessary. Moreover, once creditors accept prompt closure action, deposit insurance, which aims at preventing bank runs, will no longer be necessary. On the other hand, when compared with the deposit insurance system, prompt closure action lacks flexibility in setting closure standards and is accompanied by arbitrariness as to the timing of implementation, and thus, from the viewpoint of economic rationality and accountability, it might be desirable for all deposit protection systems to merge into the deposit insurance system.

What is also common in the deposit insurance system is that, if the monitoring capability of the regulatory authority is perfect, there is a chance that moral hazard might be induced on the part of creditors, not only small-lot depositors but also large-lot creditors, thereby distorting interest rate formation. However, since there are such

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that private information has a substantial impact,.

[15] See Merton [1977] , Merton [1978], Marcus and Shaked [1984], and Ronn and Verma [1986].

risks as measurement errors and changes in the environment, it is difficult to eliminate uncertainty such as that which will be present if insolvency only materializes after liquidation (downward errors in NPV measurement). While the existence of such uncertainty is considered effective in avoiding moral hazard on the part of creditors, since the possibility of a bank run by creditors who are concerned about insolvency remains, it becomes necessary for prompt closure action to be complemented by the deposit insurance system and lender of last resort function.

To compensate for downward errors in NPV measurement, we can think of ensuring conservatism by improving standards for exercising business closure orders (or business restriction orders). However, to implement closure action prior to insolvency could be interpreted as violating property rights and is thus difficult to actually implement. Moreover, from the viewpoint of efficient capital utilization on the part of private financial institutions, it is not appropriate for the authorities to urge the conservative holding of capital. The regulatory authorities should make efforts to improve monitoring capabilities in order to reduce measurement errors and also the need to set appropriate standards in line with the improved measurement accuracy. Since the BIS rule (1988 Basle Accord) was introduced based on the financial environment of ten years ago, one can argue that the current required capital ratio (8%) should be reduced taking into account the improvement in the monitoring capacity of the authorities[16] in the context of evolving advanced information.

3.1.3 Lender of last resort (LOLR) function

In the case of a bank run, while a central bank will provide unlimited liquidity

[16] There is an argument that while risk measurement techniques and others have dramatically improved as a result of technological innovation in the financial industry, the possibility of assessment failure originating from risk measurement errors such as that associated with model

through its LOLR function to banks which it judges to be solvent, it will not do so to those judged insolvent, thus confirming their insolvency to the public. Therefore, the LOLR function eventually allows the central bank, not creditors, to determine solvency and can be regarded as complementing the aforementioned monitoring functions of the authorities such as the deposit insurance system and prompt closure action. However, the LOLR function is not designed to directly protect depositors but rather to contribute to ensuring financial system stability by sustaining solvent banks.

3.1.4 Utilization of market discipline

In order to compensate for the lack of monitoring capability of small-lot depositors, it is necessary to improve the monitoring capability of large-lot creditors by having them thoroughly adopt the principle of self-responsibility. In order to facilitate such an improvement, enhanced information disclosure would be an essential prerequisite. However, given that information asymmetry remains even for large-lot creditors, the role of the central bank's LOLR function remains valid.[17] Rather, the possibility of insolvency at a bank increases through such action as the swift withdrawal of deposits by large-lot creditors which are assumed to have access to certain information, it would lead to more chances for the central bank to exercise the LOLR function (i.e. judgment of a bank's NPV by the central bank) while reducing the burden of its independent monitoring. Therefore, it would be possible to improve monitoring efficiency through large-lot creditors and the central bank complementing each other.

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risk cannot be ignored.

[17] This paper does not consider either large-lot creditors (or market participants) or the authorities (or the central bank) to have an absolute advantage in terms of holding information with respect to bank conditions. Rather, this paper considers that the former have an advantage in being able to promptly obtain market information whereas the latter have an advantage in that they have a right to directly access insider information (supervision and on-site/off-site monitoring), both are thus mutually complementary.

With respect to the possibility of measures to protect creditors such as prompt closure action and the deposit insurance system generating moral hazard, we can think of a situation where a system design could contain moral hazard by keeping the monitoring capacity of the regulatory authorities uncertain. In other words, once the authorities' monitoring capacity is considered perfect, creditors would forget their monitoring efforts, thus generating moral hazard. However, if, by taking into account that there is a certain limit to the monitoring capability of the agency, creditors recognize that a bank's default might result in a loss to them even when there is a safety net, creditors would have an incentive to initiate monitoring themselves. This is a situation in which a safety net and market discipline co-exist.

In Section 3-1, we have assumed that small-lot depositors are not required to be self-responsible, although, in the real world, this assumption is an important issue.[18] Intuitively, it is difficult to believe that all small-lot depositors are capable of duly evaluating the business condition of banks. This situation remains the same whatever the degree of disclosure. Consequently, it is inappropriate to require self-responsibility to apply all at once, but it might be worth considering gradually requesting limited self-responsibility. However, as long as information asymmetry is not completely eliminated, it is necessary that the function of delegate monitoring continue to some degree. Bearing this in mind, the issue is about the appropriate allocation of monitoring costs among related parties, that is, whether an increase in the monitoring burden on the part of small-lot depositors (increase in social cost) will balance reduced

[18] A New Zealand approach reported at the November 1997 BOE research conference "Financial Regulations and Incentives" would be a good specific example. See Mayes [1997].

dependence on delegate monitoring (decrease in social cost).

If we are to require certain responsibility on the part of small-lot depositors, there is a possibility that information intermediaries such as rating agencies start to play the role of delegate monitoring on behalf of small-lot depositors (in such a case, further issues such as whether to impose regulations on rating agencies would have to be considered). While rating agencies are considered to have similar functions as large-lot creditors and professional investors, it should be noted that the risk of bank runs remains, given that information asymmetry will not be completely eliminated even for large-lot creditors.

3.2 Responses to the Possible Failure of Solvent but Temporarily Illiquid Banks

As a framework to rescue a solvent bank (not a plan to rescue depositors) which faces temporary liquidity problems due to such factors as a bank run, the LOLR function of a central bank is effective. Specifically, we can think of building a system where, to remove information asymmetry between creditors and a bank, the central bank implements delegate monitoring and, based on the results, extends unlimited liquidity to banks in need. If a central bank announces such a stance and obtains credibility in the eyes of creditors, then it might not have to actually provide massive liquidity but simply make an announcement to achieve the same effect, resulting in reducing LOLR costs.

3.3 Responses to Systemic Liquidity Risk

In order to prevent systemic liquidity risk from materializing, it becomes necessary to properly cope with information asymmetry and settlement system

limitations. In addition, as a related issue, there is the possibility of externality[19] of network effects causing a liquidity shortage.

With respect to information asymmetry, delegate monitoring by a third party is effective. A central bank with the LOLR function would be a strong candidate for conducting such delegate monitoring. The rationale would be that there is a necessity to provide both liquidity aiming at stemming systemic liquidity risk and also liquidity as a monetary operation measure in a consistent manner. In addition, even in the case where an institution other than a central bank (for example the government) could provide liquidity solely to avert systemic liquidity risk, if the amount determined necessary differed from that decided by the central bank, the eventual amount of liquidity provided would be subject to the central bank's judgment, since it could sterilize liquidity provided by other institutions.

The limitation of settlement systems would be resolved, in theory, by having an infrastructure within a central bank settlement network system which enabled banks judged solvent by a central bank to have immediate access to uncollateralized overdrafts when necessary.

As for responses to contagion effects, one idea is to establish a charge system in order to prevent contagion, that is, to internalize the externality (for example, setting a penalty interest rate on LOLR funds[20]). However, at the moment it is difficult to propose a specific system since we lack an appropriate proxy variable for a liquidity situation (the possibility that illiquidity will occur) which is necessary for deciding a

[19] See Loretan [1996].
[20] It can be argued that a penalty rate should be applied flexibly according to whether the emergence of a bank's liquidity crisis is the bank's fault (for example, insufficient disclosure, failure in fund management, etc.) or not (for example, a widespread bank run not attributable to an individual bank).

specific charge level. While it is possible to prevent risk from materializing even without a charge system through utilizing the LOLR function and settlement system, from the perspective of minimizing the social cost (emergence of moral hazard), it would be necessary to examine the issue of burden sharing between the central bank and market participants by setting certain rules for internalization.

3.4 Responses to Systemic Solvency Risk

A systemic solvency risk is rooted in insolvency contagion. Some kind of action is necessary if the contagion effect might have a serious impact on the financial system as a whole. Specifically, creating a charge system to internalize contagion, which is a negative externality, could be considered.

We consider two types of charge rule possible: the macro approach and the micro approach. The former strictly limits the total amount of risk and introduces market transactions in the allocation process (similar to the trading of pollution rights in environmental policy), while the latter individually estimates and imposes charges corresponding to risks.

In adopting the macro approach, one problem is that systemic risk is not simply the sum of micro risks. If systemic risk and micro risks are in a linear relationship, it would be sufficient to control the total amount of risk and thus the creation of a trading market would be easy, while if the relationship were nonlinear, it would be technically difficult to deal with. Also, with respect to the micro approach, how to estimate charges at the micro level would be a problem. From the viewpoint of an individual bank management, the difficulty in predicting systemic solvency risk becomes a problem. To cope with this problem, the possibility of responding (for example) by

utilizing private insurance would be worth examining.

If insolvency is separated from illiquidity and can be defined based on net balance sheet value (liquidation value), one may consider that the possibility of pure systemic solvency risk emerging is quite low and that, even if it does emerge, the impact on the overall system is not significant. In such a case, one might argue that the necessity for examining the creation of a charge system is not that high. However, at present, we cannot disregard the possibility that a specific bank failure will induce a decline in the franchise value of other banks of the same nationality and engaged in the same business area, thereby resulting in insolvency contagion. We need to analyze such a mechanism and examine how it could be reflected in the charge rule.

4. The Capital Adequacy Rule and the Criteria for Activating the LOLR

Based on previous discussions, this section considers two prudential policy issues which bear a close relationship to the function of a central bank. In 4.1 we summarize implications based on theoretical analysis as to how the current capital adequacy rule should evolve in the future, followed by points to be taken into account in utilizing the LOLR function, an intrinsic function of a central bank, in 4.2.

4.1 Direction of Revising the Capital Adequacy Rule

The capital adequacy rule can be interpreted as one form of prompt closure action. In this case, we can accept its raison d'être as providing a transitional system to complement market discipline. However, the required ratio should be lowered in accordance with improved measurement accuracy (of both capital and risk) and enhanced market discipline. In other words, it is desirable that, while gradually lowering the capital adequacy ratio and allowing market discipline to be strengthened, small-lot depositors should be protected by applying the deposit insurance scheme.

As for likely responses, for the time being, in order to have an environment that encourages large-lot depositors to adopt the self-responsibility principle (including a change in creditor's recognition, improvement in banks' attitude toward disclosure, etc.) it would be appropriate to gradually lower required capital to a level not exceeding the economic capital ratio[21] which is necessary for running the business. Eventually, it will be deemed desirable to consider the complete abolition of prompt closure action. In a situation where market discipline on the part of large-lot creditors is functioning properly, both the deposit insurance system designed to protect small-lot depositors and the LOLR function of the central bank in avoiding failure or systemic liquidity risk at solvent banks due to a liquidity shortage will be the two main tools of prudential policies. But, as a premise, the delegate monitoring function of both the deposit insurance system and LOLR must be sufficiently accurate. If accurate monitoring is judged as not being possible because of significant information asymmetry between banks and the central bank/deposit insurance corporation, it would be justifiable to continue prompt closure action as a complementary measure. Therefore, whether prompt closure action is justified or not depends on the monitoring capability of the authorities.

While this paper interprets the capital adequacy rule as a form of prompt closure action (delegate monitoring), from a different point of view it can be understood as a measure to improve the soundness of bank management. The latter, in other words, justifies the capital adequacy rule as a measure to cope with systemic solvency risk, but this paper does not take this view. The reason is, as we have described in Section 3, that systemic solvency risk is rooted in insolvency contagion. In order to avoid such contagion, we believe that establishing a charge system which internalizes the cost of externality will have a more direct effect[22] in avoiding systemic risk than it will in t

[21] With respect to economic capital, see Merton and Perold [1994] and Estrella [1995].
[22] As a preventive measure against possible systemic risk, it is theoretically effective to introduce a charge system, but it should be noted that it would be accompanied by not a few difficult issues in terms of actual implementation, such as the problem of deciding how to set the charge. However, such difficulties also exist in the case of the current capital adequacy ratio, for example there is the problem of defining bank capital including Tier 2 and of constructing the rationale behind the ratio (8%).

improving the soundness of management at individual banks.

A pre-commitment approach[23] (or, more generally, an incentive compatible approach), which is oft-considered as a substitute tool for the capital adequacy rule, can be classified as a "micro approach" of the charge system[24]. However, in this approach we should note that the risk which the charges are based on is not the systemic risk (trigger and contagion) which ought to be used, but a proxy using the expected negative capital base of an individual bank. Such treatment is different from the ideal where the level of charges should be determined with reference to external diseconomies (which are related to the required confidence interval in calculating the charges), and efforts to fill the gap are a future task. If one thinks the "macro approach" is appropriate for the charge rule (a view that systemic risk should never be generated), not only the raison d'être of the capital adequacy rule but also that underlying the pre-commitment approach would be rejected.

In addition, when examining the capital adequacy rule, the continuation of the international level playing field is also an important factor. In other words, when we consider the difference in the development of market discipline and situations of information infrastructure in each country or market, it is not an easy task to review the regulatory design while maintaining a framework of "international standards." It thus becomes necessary to discuss the framework that will replace "international standards" and which can meet requirements posed by both the progress of internationalization and difference between the markets and between the banks.

While these are the views derived from discussion in this paper, it would be useful to consider the following six scenarios where the preconditions are changed from ours (but we will not discuss in this paper).

(1) A standpoint which considers it impossible to set an fair deposit insurance

[23] A pre-commitment approach does not calculate regulatory required bank capital based on a certain rule, but allows banks to report loss amounts on a self-assessment basis and imposes a penalty if the actual loss exceeds it, thereby trying to make the incentive for a bank to undertake its own risk management compatible with the regulatory requirement. For details, see Kupiec and O'Brien [1995,1997].

[24] This paper recognize the raison d'être of the pre-commitment approach as not that it lets a bank determine the capital adequacy ratio for improving soundness but that it allows a bank to internalize the penalty which takes into account externalities according to each bank's utility.

premium (including operational methods).

(2) A standpoint which considers that setting a fair deposit insurance premium has a pro-cyclical effect on the business cycle (a position which views, in determining the premium, not only the default probability of individual banks but also measures to mitigate macro shocks).

(3) A standpoint which claims that it is impossible to establish an effective charging system.

(4) A standpoint which claims that the cost of accurate risk monitoring in prompt closure action is excessive.

(5) A standpoint which claims that the network effect of insolvency cannot be ignored since systemic solvency risk cannot be distinguished from systemic liquidity risk.

(6) A standpoint which claims that small-lot depositors should also bear self-responsibility (a view which claims that not only large-lot creditors should bear responsibility).

4.2 Prudential Policy Management Centering on the Lender of Last Resort Function

Timely and accurate information of a bank's solvency is indispensable in deciding the activation of the lender of last resort (LOLR) function. Such an operational requirement should be taken into consideration in examining bank supervision and the establishment of an off-site monitoring system. Arranging a system that enables the timely provision of liquidity is also essential for the settlement system. For an appropriate assessment of the possibility that systemic risk might materialize as a requirement for the activation of LOLR, it is necessary to be able to objectively assess the possibility of a micro-level liquidity crisis leading to a macro-level systemic risk. It is also necessary to work toward establishing accountable and economically rational rules for LOLR management based on due judgment of such micro and macro conditions.

One conclusion obtained in this paper is that a central bank should operate its prudential policy with the LOLR function at the core. Various theories exist as to requirements for activating the LOLR function. By assuming that, as a requirement for activating the LOLR function, liquidity support should be provided to solvent banks but not to insolvent banks in principle, an implication may be derived that it is important to frequently assess bank capital and risks. Timely and accurate information on net present value is indispensable in deciding the activation of the LOLR function, and it is similarly essential that a central bank should, when deciding on bank supervision and the establishment of an off-site monitoring system, consider such LOLR operational requirements.

There may exist the idea that a condition for activation of the LOLR function should be that it will be occur "only when there exists possibility of systemic risk emerging" (for example, the views currently expressed by the Bank of Japan are based on this concept). To strictly abide by this concept, it is necessary to be able to assess the possibility of a micro-level liquidity crisis leading to a macro-level systemic risk.[25] However, this assessment is by no means easy since the emergence of systemic risk may largely depend not only on the contagion effect but also on an abstruse mechanism such as market imperfection.

One solution to this difficult problem may be to establish a rule to activate the LOLR function whenever "a solvent bank faces a liquidity crisis caused by factors such as a bank run." This may be based on an understanding that the occurrence of such a situation is evidence that market imperfection exists, and that there is thus a high possibility that systemic risk may materialize in due course. However, the opposite

[25] Refer to George [1998].

logic may not necessarily be true. Different criteria will be needed to decide the activation of the LOLR function when "a bank whose solvency is questioned faces a liquidity crisis" since concerns of the emergence of systemic risk may not be ruled out in such a case.

On the other hand, there is a view that a central bank should always activate its LOLR function when an individual solvent bank faces a micro-level liquidity crisis, even though it may not be certain that the crisis will lead to macro systemic risk. However, in this case, it should be kept in mind that the central bank is assumed to be capable of monitoring the solvency of individual banks accurately and in a timely manner.

As discussed above, it is considered essential for a central bank to continue efforts to complementarily improve its ability to (1) monitor the solvency of banks at a micro-level, and (2) assess the possibility of the emergence of systemic risk. At the same time, it goes without saying that economic rationality and accountability are required for the framework of policy activation based on these decisions, just as in the case of other public intervention measures.

5. Concluding Remarks

Recognizing that the purpose of prudential policy design is to achieve an efficient and stable banking system, this paper has discussed issues related to the basic stance of the authorities (including central banks) in considering responses to cope with specific policy issues, and can be summed up as follows:

(1) The maintenance of sound financial institution management should be effected through market discipline and strengthened corporate governance, with the authorities mainly participating in organizing a system which enhances the working of such mechanisms. Once there is an environment where market discipline functions sufficiently, two principal means of the authorities' prudential policy would be the deposit insurance system for safeguarding depositors, and the LOLR function for preventing both a solvent bank from going bankrupt due to a liquidity shortage and systemic risks from materializing. If some kind of regulations are required to complement the market mechanism during a transitional period, intervention measures which could be substituted for market discipline, i.e. which have economic rationality, should be used.

(2) The prudential policy management of a central bank should be carried out centering on activation of the LOLR function. For this purpose, it is necessary to improve the central bank's micro level monitoring capability utilizing on-site examination and off-site monitoring, understand macro market functions such as the mechanism whereby systemic risk emerges, and establish management rules that take into account such micro and macro factors and which are accountable and economically rational.

Based on such a basic stance, it is not desirable to regard capital adequacy as a measure to improve bank soundness and to insist that the higher the rate the better. Rather, we should pay attention to whether a bank has attained the economically required capital adequacy ratio, and a bank which falls short should be urged to leave the market. Hence, the rate complements the market mechanism. In order to

measure economically necessary bank capital, it is necessary to further enhance measurement accuracy so as to reflect technological innovation in the market. Similarly, with respect to the LOLR management framework, based on the fundamental idea of organizing a system which enables the prompt provision of liquidity to solvent banks, we need to consider examination and monitoring and the management of payment and settlement systems should be, as well as to continue complementary research on systemic risks.

As further research topics, we list the following three:

(1) Criteria for activating the LOLR function

The core of prudential policy which a central bank independently exercises is the management of its LOLR function, and the most crucial issue here is the criteria according to which the LOLR function is activated. Specifically, we can point out such issues as: (a) improving the micro aspect of NPV and monitoring capability regarding related uncertainty, and linking monitoring results with activation of the LOLR function; (b) objectively setting LOLR activation criteria which duly take account of the possibility of the emergence of systemic risk at the macro level; (c) optimal burden sharing between central bank credit and capital injection using public funds from the viewpoint of social costs; (d) the practicability of Bagehot's principle (provision only to solvent but illiquid banks) regarding which banks should be provided liquidity; and (e) the possibility of international cooperation in the event of the collapse of an international financial institution.

(2) Method of implementing a fair deposit insurance premium and prompt closure

standards

It is necessary to consider how to set a premium which is consistent with the actual condition of bank capital and risks. Theoretically, option-pricing theory has often been used to calculate the expected burden on deposit insurance, yet we must verify the validity of doing so in the context of using data for Japan. Once information disclosure has become more widespread, it is highly likely that a method using stock market information (such as stock price and implied volatility) would work more effectively. However, in a situation where disclosure is insufficient and information asymmetry between financial institutions and their creditors considerable, we might have no choice but to rely on individual research and evaluation by a third party such as the Deposit Insurance Corporation. Moreover, it is also necessary to consider a complementary relationship between the deposit insurance system and prompt closure standards.

(3) Specific approach to systemic risks

It is desirable to pursue research on the mechanisms through which systemic risks emerge such as the failure of one bank leading to insolvency contagion by way of reducing the franchise value of other banks, and also to examine the possibility of establishing a charge system (micro and macro approach) that adjusts externality. It would also be beneficial to utilize the incentive compatible approach and consider the possibility of combining various systems such as banks being asked to report private information they have in setting the deposit insurance premium.

As we mentioned at the beginning, it should be noted that blueprints of future financial system designs indicated in this paper are optimal only under certain conditions. In the process of developing specific system designs, we need to assume a kind of game theoretical framework which takes account of incentives and the behavior of public intervention entities (the regulatory and supervisory authorities and safety net providers). While we have assumed that the government, central bank, and other entities all have a certain level of monitoring capability, we have not evaluated the capability of each. What is needed is to ascertain the possibility of this assumption turning real.

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