The Limits of Market Discipline in Reducing Banks' Risk Taking*

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Abstract

This paper analyzes the influence of market discipline on the risk-taking incentives of banks. It is shown that market discipline reduces risk if banks can credibly commit to a given level of risk before the interest rate on deposits is set. If, however, the bank can readjust the level of risk after the deposit rate is contracted, market discipline leads to an increase in risk. The reason is that rational depositors anticipate the banks' behavior and therefore ask for a higher risk premium ex ante. Facing a higher interest burden, the banks in turn have an even greater incentive to increase risk because the option to go bankrupt is more valuable.

Keywords: Market discipline, banks, risk taking, deposit insurance.

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1 Introduction

Since the recent financial turbulence following the crises in Russia and East Asia, there has been a lively debate on improving 'financial architecture'. Most of the proposals brought forth feature two main ideas, (i) to strengthen market discipline, and (ii) to reduce the existing safety nets for financial institutions. These two recommendations are based on the idea that the current structure of financial markets encourages imprudent behavior by market participants. It is pointed out that depositors who are protected by deposit insurance or by state guarantees lack any incentives to monitor their banks' behavior. In particular, depositors are indifferent about the riskiness of their banks. This absence of any restraint allows the banks to engage in socially wasteful excessive risk taking. It is argued that if deposit insurance and any state guarantees were abolished or banks were required to hold subordinated (uninsured) debt, the costs of debt finance would reflect the banks' riskiness and hence banks would have an incentive to keep risks within reasonable limits.

As obvious as it may appear at first sight, the outlined story is squarely at odds with well-known results in the theory of incentives concerning debt finance. An essential point in the market discipline story is the assumption that a bank which chooses a higher risk is facing higher financing costs. Therefore, the bank is assumed to have an incentive to reduce its risk in order to keep the costs of debt low. From the literature on asymmetric information and debt contracts[1], however, we know that an agent facing a higher debt burden has a greater incentive to incur larger risks. In the light of this conclusion we would not expect a decrease but rather an *increase* in risk resulting from heightened market discipline.

In this paper, the risk-taking incentives of a bank are analyzed under different assumptions about the degree of market discipline and under different safety nets. The main conclusion is that the effect of market discipline on bank behavior depends crucially on the timing of events. If the bank first sets its level of risk and the deposit rate is contracted after depositors observe the chosen level of risk, market discipline

[1] See, for instance, Stiglitz and Weiss (1981).

indeed helps to reduce banks' riskiness. By choosing a low level of risk, banks can reduce the risk premium required by depositors and hence keep interest rates on deposits low. If, however, the deposit rate is contracted first and then the bank chooses the level of risk, market discipline leads to banks taking even higher risks than under full deposit insurance. This inefficient outcome results because a bank cannot credibly commit to a low level of risk. Once the deposit rate – based on a low promised level of risk – is set, the bank has an incentive to increase risk. Rational depositors will anticipate this incentive and will therefore ask for a higher interest rate in the first place. A bank facing higher interest payments in turn has a greater incentive to increase risk, because the option to go bankrupt becomes more valuable. In equilibrium banks incur a higher risk than in the absence of market discipline. This argument carries over to the case where the level of risk and the interest rate on deposits are set simultaneously: banks take higher risks than without market discipline.

While the presence of deposit insurance may reduce banks' risk-taking incentives, a safety net in the form of a 'too-big-to-fail' policy unambiguously increases banks' risk appetite. This is because under deposit insurance, only depositors are protected but not the bank itself. Thus, when the bank becomes insolvent, it loses its charter and incurs bankruptcy costs. In order to reduce the probability of incurring those losses, the bank has a self-interest to avoid unreasonably high risks. This risk-reducing effect completely disappears if the bank is bailed out whenever it would become insolvent.

The disciplining role of depositors on banks has been analyzed before, most notably in the seminal paper by Calomiris and Kahn (1991). The existing literature focuses on the fact that deposits are very short term, demandable debt. It is argued that depositors can punish banks by withdrawing their funds whenever they do not approve of the bank's behavior. Usually this means that depositors withdraw their money *after* problems or losses become apparent [for more recent papers with this feature, see Allen and Gale (1999) and Chen (1999), for example]. Put differently, monitoring by depositors occurs only interim or ex post. In this paper monitoring by depositors takes place ex ante, i.e., before any uncertainty about investments is resolved. Furthermore, the bank's risk choice is modelled explicitly.

The literature on optimal deposit insurance is also closely related to the present paper. The most important conclusion from that literature is that insured banks paying unfair insurance premia tend to incur higher risks than uninsured banks. As Saunders (2000) notes in his textbook treatment of deposit insurance, 'mispriced deposit insurance, when risk taking is not actuarially fairly priced in insurance premiums, adds to the incentives of bank stockholders to take additional risk'(p. 411). In contrast to that conclusion the results in this paper indicate that precisely the opposite is possible. Even though fair insurance premia are feasible, they lead to a higher level of risk than premia that imply a subsidy to banks.

The paper is organized as follows. In section 2 the model is presented. The first-best solution is then compared with the decision problem of an individual bank – with and without deposit insurance. In section 3 the bank's risk choice is analyzed both under market discipline, and under a policy of bailouts. Section 4 contains some concluding remarks.

2 The Model

I consider a single, risk-neutral bank that invests its available funds for one period. The amount of equity W is assumed to be exogenously given. The demand for deposits is either $D > 0$ if the expected return to risk-neutral depositors is equal to the riskfree rate of return, $r_f \geq 1$, or zero if the expected return is below the riskfree rate. The contracted (gross) deposit rate is denoted by r_D, so the bank's total costs of deposits at the end of the period are $r_D D$.

At the beginning of the period, the bank can choose the risk-return characteristics of its portfolio. I abstract from any incentive problems within the bank and assume that bank managers maximize expected shareholder value. As in Blum (1999), I assume a two-point distribution of the gross rate of return $\tilde{r}$ of the portfolio, with the lower realization normalized to zero:

$$\tilde{r} = \begin{cases} X & \text{with probability} \quad p(X) \\ 0 & \text{with probability } 1 - p(X) \end{cases},$$

for $X \geq r_f$, with $p'(X) < 0$, $p''(X) \leq 0$ and $p(r_f) = 1$. In order for the expected return to be increasing in X at r_f, I further assume that $p'(r_f) > -1/r_f$. The unique level of risk that maximizes expected return is denoted by $\overline{X}$. These assumptions imply that the expected return function $E[\tilde{r}|X] = p(X)X$ is strictly concave as illustrated in Figure 1. Since the risky portfolio (weakly) dominates the safe asset, all the funds are invested in the risky portfolio. Hence, the probability of default is $1 - p(X)$ for every given X. Finally, the level of risk chosen by the bank can be observed costlessly by everyone, but it is not verifiable, i.e., contracts specifying a certain level of risk cannot be enforced.

[**INSERT FIGURE 1 HERE**]

If at the end of the period the available funds are not sufficient to cover the costs of deposits, the bank defaults. Due to limited liability bank owners cannot be forced to pay any additional amount to cover unfulfilled claims. However, owners of the bank still incur fixed bankruptcy costs of C_B. These costs include the loss of the bank's charter, and the loss of any private benefits and of reputation. In addition to that, there are further bankruptcy costs of C_S. These costs are not borne by owners or managers but rather represent social costs, such as the costs of a disruption of the payments system or the expected costs of a banking panic, which may be triggered by the default of one bank.

2.1 First Best

In order to have a benchmark by which to gauge the effect of different institutional arrangements, I now derive the first-best solution of the model. A risk-neutral social planner chooses that level of risk that maximizes total expected surplus

$$p(X)X(D + W) - (1 - p(X)) [C_B + C_S] - r_f D. \tag{1}$$

Assuming an interior solution exists, the necessary and sufficient first-order condition to this problem is

$$[p'(X^*)X^* + p(X^*)] (D + W) = -p'(X^*) [C_B + C_S] . \tag{2}$$

Since the expected return function is strictly concave and $p'(.)$ is negative, the first-best level of risk is smaller than the level of risk that maximizes the expected return, $X^* < \overline{X}$. Intuitively, a reduction of risk at the maximum of the expected return function has a first-order effect of zero on the expected return, but a positive effect on the expected bankruptcy costs, $(1 - p(X)) [C_B + C_S]$. At the social optimum the marginal expected return is equal to the marginal cost of increasing the level of risk (left-hand side and right-hand side of equation 2, respectively).

An observation that will be useful in the following analysis is that the higher the term in square brackets on the right-hand side of (2), the lower the optimal level of risk. In other words, the higher the costs in the event of bankruptcy, the greater is the value of avoiding default.

2.2 The Bank's Problem

I now consider the generic decision problem of the bank. For the time being, I take the promised interest rate on deposits r_D as given. Later I will endogenize this variable under different institutional arrangements. Given r_D, the bank solves

$$\max_X p(X) [X(D + W) - r_D D] - (1 - p(X)) [C_B + \max \{0, -r_D D\}] . \tag{3}$$

Two differences between (1) and (3) are worth pointing out. First, since the social costs C_S are not borne by bank owners, they neglect these costs in their choice of risk. They only care about the bankruptcy costs C_B, which they have to bear themselves. The second remark concerns the last term in (3), $\max \{0, -r_D D\}$. This term is a consequence of the bank owners' limited liability. Since they cannot be forced to pay any additional money after the bank goes bankrupt, they always receive a payoff of at least zero. In particular, they do not have to cover the costs of deposits in case of insolvency. The bank only takes the costs of deposits into account in the event that the investment is successful. Simplifying, we can rewrite (3) as

$$\max_X p(X) [X(D + W) - r_D D] - (1 - p(X))C_B. \tag{4}$$

The optimality condition is

$$\left[p'(\hat{X})\hat{X} + p(\hat{X})\right](D+W) = -p'(\hat{X})\left[C_B - r_D D\right]. \tag{5}$$

Comparing (2) and (5), it is apparent that the costs of bankruptcy are smaller for the bank than for a social planner, since $[C_B - r_D D] < [C_B + C_S]$. In fact, going bankrupt does not only represent a cost to the bank, C_B, but also a benefit, $-r_D D$. The bank benefits from insolvency because – due to limited liability – the interest on deposits (including principal) does not have to be paid. Ceteris paribus the bank has a preference for higher risk, since a higher probability of default reduces the *expected* cost of deposits, $p(X)r_D D$. Therefore, a bank chooses a risk higher than first best, $\hat{X} > X^*$, irrespective of the costs of deposits $r_D D$.

2.3 Deposit Insurance

If depositors are fully insured, they don't have any incentive to monitor their bank and are willing to accept a promised return on their deposits of r_f. I assume that the insurance premium cannot be made contingent on the bank's risk. And for simplicity, the flat rate is set equal to zero. In this scenario the bank's first-order condition becomes

$$\left[p'(\underline{X})\underline{X} + p(\underline{X})\right](D+W) = -p'(\underline{X})\left(C_B - r_f D\right). \tag{6}$$

As in the last section, the level of risk chosen by the bank is larger than first best, $\underline{X} > X^*$. The expected cost of deposits to the bank are only $p(X)r_f D < r_f D$, since they only have to pay depositors if the investment is successful. The expected cost to the deposit insurance fund is $[1 - p(X)]\, r_f D$. This benefit to the bank is often referred to as the '(put) option value of deposit insurance'.

Under full deposit insurance, the level of risk chosen by the bank is too high and the costs of deposits faced by the bank are too low. As described in the introduction, many people expect an improvement along both dimensions if the protection of depositors is reduced and as a consequence banks are subject to increased market discipline.

Whether and under what circumstances this presumption is correct will be analyzed in the next section.

3 Market Discipline

To illustrate the influence of market discipline on the bank's risk-taking incentives I now consider the case where no safety net exists at all. I make the extreme, possibly unrealistic assumption that the government can credibly commit not to protect depositors ex post. In that setup depositors care about the bank's risk, since the level of risk directly influences the expected return they receive from depositing money in the bank.

First I consider the case where the bank chooses its level of risk *before* the rate of return on deposits is fixed. Since depositors can costlessly observe the precise level of risk, they ask for an interest rate that guarantees them an expected return equal to the riskfree return. The higher the bank's risk, the higher the premium they require in the event the investment is successful. For every level of risk X that the bank chooses, depositors require a promised return r_D that satisfies

$$p(X) r_D D = r_f D,$$

or,

$$r_D(X) = \frac{r_f}{p(X)}. \tag{7}$$

As is apparent from (7), the bank has to promise a higher interest rate the higher the chosen level of risk, $r_D'(X) > 0$. This effect has to be taken into account by the bank when determining the optimal level of risk. The bank therefore solves

$$\max_X p(X)\left[X(D+W) - r_D D\right] - (1-p(X))C_B$$
$$s.t. \quad r_D = \frac{r_f}{p(X)}$$

Inserting the constraint into the objective function yields

$$\max_X p(X)X(D+W) - (1-p(X))C_B - r_f D. \tag{8}$$

The solution of the bank's problem satisfies

$$\left[p'(\dot{X})\dot{X} + p(\dot{X})\right](D+W) = -p'(\dot{X})C_B. \tag{9}$$

A comparison of (6) and (9) immediately yields the following result:

Result 1 *If the bank sets its level of risk before the deposit rate is contracted under market discipline, the level of risk is lower than under deposit insurance, $\dot{X} < \underline{X}$.*

In this case market discipline indeed reduces the bank's risk-taking incentives. The costs of deposits are fully internalized and borne by the bank. Market pressure cannot solve the problem of excessive risk taking completely, however, since the externality that arises through the bank's ignoring the social bankruptcy costs is not internalized.

The above mechanism is probably what most people have in mind when they promote heightened market discipline. Crucial for the argument is the requirement that banks have to commit to a level of risk before depositors decide whether and under what terms to give the bank their money. To demonstrate the importance of that assumption, I now look at the opposite case where the bank sets its level of risk *after* the rate of return on deposits is contracted.[2] This sequence of events is for instance implied in the various subordinated debt proposals.[3] Even if the bank and its subordinated debt holders agree on a level of risk initially, the bank can always readjust its risk afterwards. This is possible because risk is at best observable but not verifiable, and the bank's investments are highly 'flexible', i.e., by selling and buying assets and with the additional use of derivatives a bank can change its risk profile very quickly and substantially. In other words, an investment in safe assets does not represent a credible commitment to adhere to a safe investment strategy in the future.

Rational depositors know the bank's incentives and opportunities, and they can perfectly anticipate the bank's risk choice at stage two for every possible deposit rate

[2] This case is equivalent to both the deposit rate and the risk being set simultaneously, or if the bank can readjust the level of risk after the deposit rate is contracted in the previous scenario. But for expositional convenience, I concentrate only on the following sequential interpretation of events.

[3] For an example of a subordinated debt proposal, see Calomiris (1999). For a survey of various proposals, see Board of Governors (1999).

agreed upon at stage one. Therefore depositors require a promised rate of return $\breve{r}_D$ that will yield them an expected payoff of $r_f D$, given that the bank will optimally set its level of risk $\breve{X}$ in reaction to the required rate of return. In a Nash equilibrium $(\breve{r}_D, \breve{X})$ the following two conditions have to hold simultaneously:

$$p(\breve{X})\breve{r}_D = r_f, \tag{10}$$

and,

$$\left[p'(\breve{X})\breve{X} + p(\breve{X})\right](D + W) = -p'(\breve{X})\left(C_B - \breve{r}_D D\right). \tag{11}$$

The first condition (10) is the requirement that depositors receive an expected return equal to the riskfree rate in equilibrium. The second condition (11) is the first-order condition of the bank's profit maximization problem (3). These two conditions imply upward sloping reaction functions, i.e., the rate of interest required by depositors and the level of risk set by the bank are strategic complements.

Two cases are possible, as illustrated in Figure 2. First, if the probability of default increases very quickly with the level of risk, the bank's reaction function always lies below the reaction function of depositors, and no equilibrium exists (see panel A). Second, if the default probability does not increase too quickly, there are two equilibria in pure strategies (see panel B).[4] The equilibrium with the lower level of risk always yields a higher payoff to the bank, since the expected costs of deposits are identical in both equilibria, but the expected return is higher with the lower level of risk.

[INSERT FIGURE 2 HERE]

If an equilibrium exists, condition (10) can be inserted into (11), which yields

$$\left[p'(\breve{X})\breve{X} + p(\breve{X})\right](D + W) = -p'(\breve{X})\left(C_B - \frac{r_f}{p(\breve{X})}D\right). \tag{12}$$

Since $p(X) < 1$,

$$\breve{r}_D = \frac{r_f}{p(\breve{X})} > r_f.$$

[4] For instance, if $r_f = D = 1$, $W = C_B = C_S = 0$, and $p(X) = 1 + a - aX$, no equilibrium exists, if $a > 0.17$. If $a < 0.17$, there are two equilibria (in pure strategies).

Using this fact and comparing (6) and (12) leads to the following result:

Result 2 *If the bank sets its level of risk after the deposit rate is contracted under market discipline and if an equilibrium exists, the level of risk is higher than under subsidized deposit insurance,* $\breve{X} > \underline{X}$.

Thus, due to market discipline banks are induced to choose a *higher* level of risk than if depositors are protected by deposit insurance and do not monitor banks. It is true that any subsidy through deposit insurance is eliminated.[5] But since banks incur higher risks, the expected social costs of bank failure, $[1 - p(X)]\, C_S$, increase, and with the opportunity cost of deposits being constant, overall social surplus unambiguously decreases. Note that the result only holds if deposit insurance is not actuarially fair. If the insurance premia perfectly reflect the bank's riskiness, the outcome would be identical to the case of market discipline.

Here a subsidy of banks in the form of deposit insurance helps to reduce banks' risk-taking incentives and increases welfare. This is in contrast to most of the literature where deposit insurance is not seen as a remedy but as a cause for excessive risk taking by banks. By reducing the debt burden, (subsidized) deposit insurance here reduces the option value of bankruptcy, thereby mitigating the moral hazard problem of debt finance.[6] On the basis of this argument public deposit insurance would be preferable to a private insurance fund. While a privately owned insurance fund has to require fair insurance premia in order to break even and to avoid default itself, the government can finance the (efficient) deficits of the insurance fund because of its ability to raise taxes.

It is often argued that the implementation of a subordinated debt proposal would lead to an increase in banks' costs. While some people fear that this would be harmful to banks and could lead to a significant reduction in intermediation, others argue that

[5] Here the bank's expected costs of deposits are equal to the opportunity costs of funds, $r_f D$. In contrast under deposit insurance the expected costs to the bank are only $p(X) r_f D$. The difference in costs corresponds to the 'subsidy' of deposit insurance, which amounts to $[1 - p(X)] r_f D$.

[6] In a dynamic framework Chan, Greenbaum, and Thakor (1992) also conclude that subsidized deposit insurance can reduce moral hazard. In their setup, the subsidies create future rents, which lead banks to reduce risk today in order to receive those rents tomorrow with a higher probability. Similarly, Hellmann, Murdock, and Stiglitz (2000) find that deposit rate ceilings may be beneficial. In their model, deposit-rate controls facilitate prudent investment by increasing franchise values.

any increase in financing costs of banks would not only be tolerable, but in fact would be desirable. An increase in the cost of deposits would internalize part of the externality created by the subsidized deposit insurance, shifting the effective costs of risk taking from society to the banks. So, even though the banks may be hurt by increased market discipline, social welfare rises. In the light of the current model, however, the presumption that an increase in costs of banks is accompanied by a reduction in social costs may not be justified. Here, the higher costs actually lead to a *decrease* in social welfare.

It is important to emphasize that the failure of market discipline to effectively reduce risk is neither due to depositors being badly informed about the bank's risk, nor to any free-rider problems between small, dispersed depositors.[7] In this model, depositors are completely rational and are fully informed about the bank's risk choice. The problem only stems from the fact that the level of risk cannot be contracted, or rather, that any contract specifying risk cannot be enforced. This illustrates that transparency by itself does not solve the problem of 'misbehavior' of banks. While the lack of transparency may lead to the exploitation of uninformed depositors, the more fundamental problem of excessive risk-taking incentives cannot be mitigated.

3.1 Bailouts

In the last section it was shown that a safety net in the form of deposit insurance can help to reduce banks' riskiness. I now briefly consider the case where the safety net consists of a full state guarantee, i.e., banks are perfectly protected against bad outcomes of their investments. If we assume banks are always bailed out if their investments fail, this implies that $C_B = 0$ and $r_D = r_f$.[8] Hence the condition for optimality is

$$[p'(X)X + p(X)]\,(D + W) = -p'(X)\,(-r_f D)\,. \tag{13}$$

[7] For that view, see Dewatripont and Tirole (1994).

[8] Alternatively, banks could always be bailed out, but whenever a bailout occurs, the current management and owners are replaced. The outcome in this model would then be identical with the case of full deposit insurance considered above.

Not surprisingly, since bailing out eliminates the private bankruptcy costs of bank owners, bank owners choose a higher level of risk than when they are not bailed out. This implies that while the (subsidized) protection of depositors may be efficient, the protection of whole banks is counterproductive. By stepping in whenever a problem occurs, almost any incentives to avoid high risks are destroyed.

4 Conclusion

This paper argues that at the heart of the problem of excessive risk taking by banks lies not the lack of market discipline, but rather the moral hazard problem inherent in all debt relationships. The bank (i.e., the debtor) has an incentive to take higher risks than the depositors (i.e., the creditors) would because all the gains of an increase in risk accrue to the debtor while the losses are primarily borne by the creditors. Hence, if the level of risk cannot be contracted, a socially efficient outcome is not possible. Moreover, rational depositors asking for a risk premium in the form of higher deposit rates aggravate the problem of excessive risk taking because a higher debt burden increases the value of the bank's option to default. In this setting, a deposit insurance can mitigate the problem by subsidizing banks' costs of deposits and hence by reducing the incentive to go bankrupt.

An important remark is in order concerning the relation of the results in this paper with the ones obtained in the literature on the disciplining role of demandable debt. In that literature the threat of withdrawal by depositors can act as an effective disciplining device for banks *ex post*. For instance, the banker can be prevented from absconding by liquidating the bank whenever it becomes obvious that the investment will turn out bad and the banker is likely to abscond (Calomiris and Kahn, 1991). In the context of *ex ante* risk choice, however, the argument is not convincing. At the time problems in a bank become obvious, it is already too late to correct the bank's behavior. In other words, the expectation that depositors will withdraw their money if the bank incurs large losses does not deter the bank from taking excessively high risks ex ante. If the outcome of the risky investment is very low, the bank will be insolvent regardless of what depositors do, and the threat of a run by depositors is completely ineffective. Therefore, while the withdrawal of deposits may provide a mechanism for implementing the optimal stopping time of an ongoing investment, it is not suitable for providing correct incentives concerning (ex ante) risk choice.

The attempt to shift the monitoring responsibility from depositors to subordinated debt holders is also at odds with the withdrawal story. In contrast to deposits, subordinated debt is not short-term. Therefore, subordinated debt holders cannot withdraw their funds quickly once problems in the bank start to emerge. The bank may promise to engage only in low-risk activities. But once the bank has successfully issued the subordinated debt (on the basis of this promise), it can increase its risk. Subordinated debt holders don't have any means to prevent this from happening. In particular, they cannot withdraw their funds. Anticipating the bank's time-inconsistent behavior, they can only require a higher risk premium initially or not give the money to the bank in the first place.

The presented analysis offers some important insights for the discussion about a 'new financial architecture'. It clearly shows the limits of any attempt to delegate more responsibility for monitoring banks to the market. By depending on market forces exclusively, the effect on the safety of banks and the stability of the financial system as a whole could be rather counterproductive.

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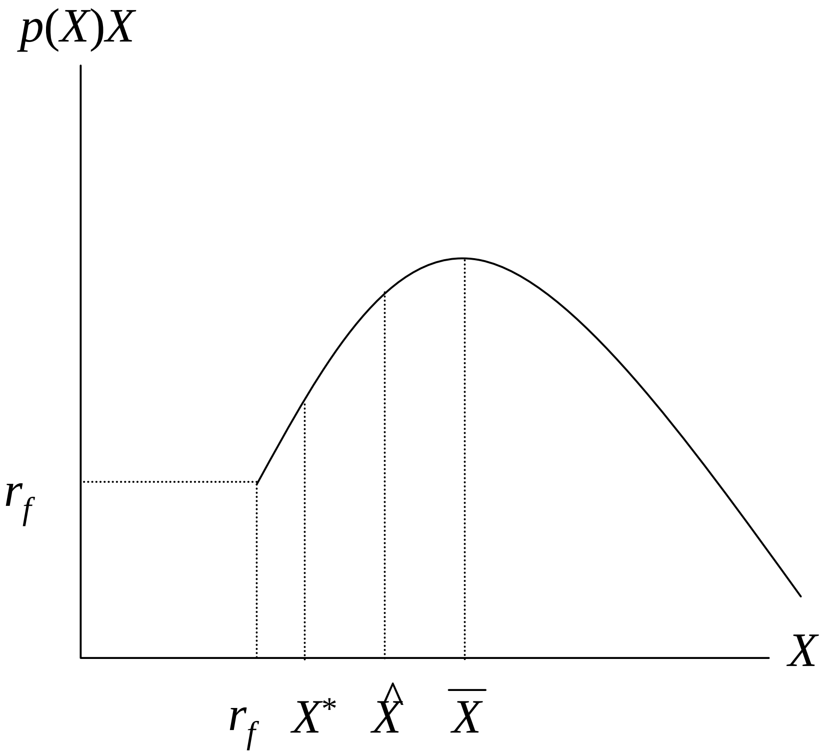

Figure 1

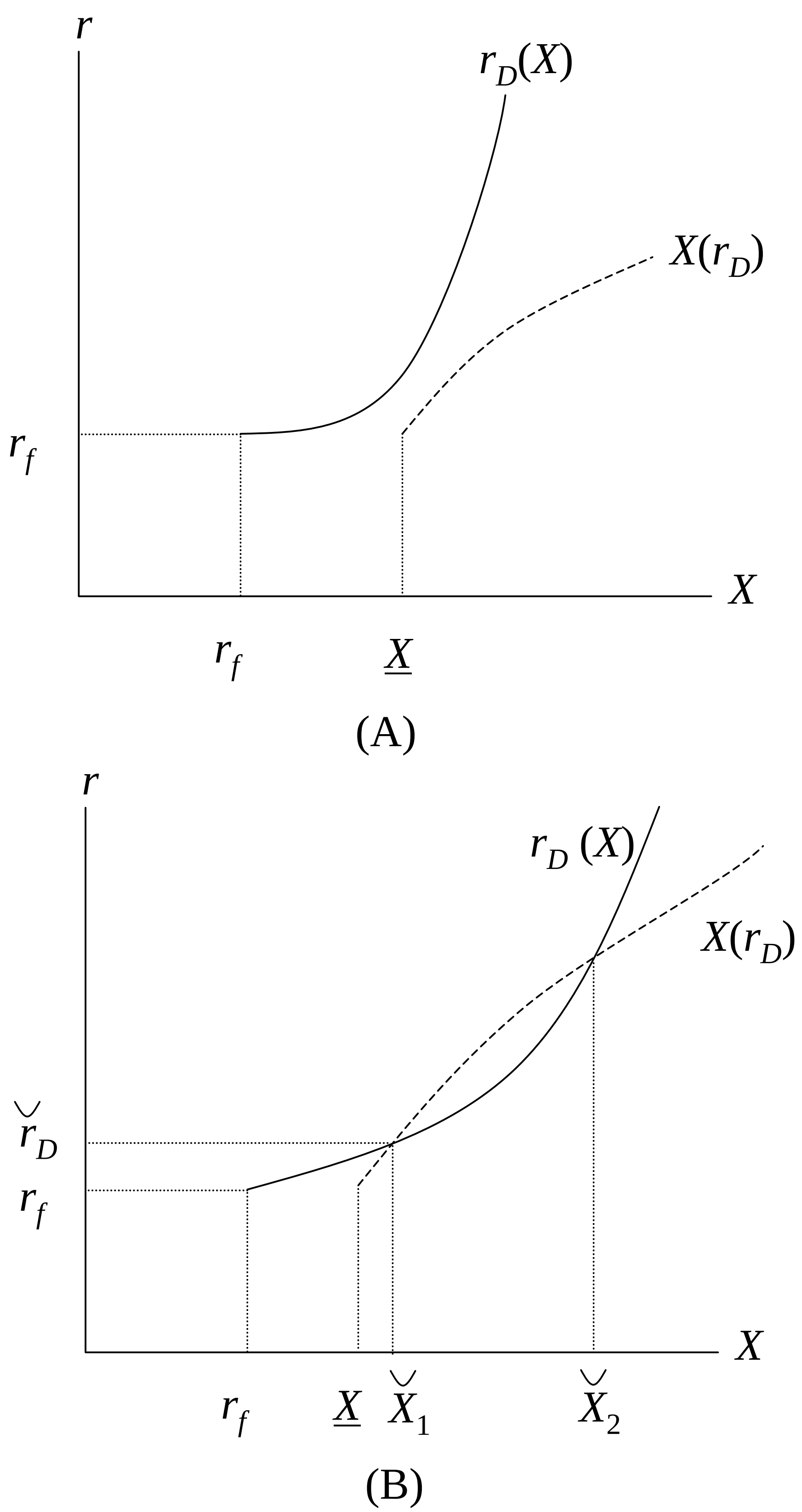

Figure 2