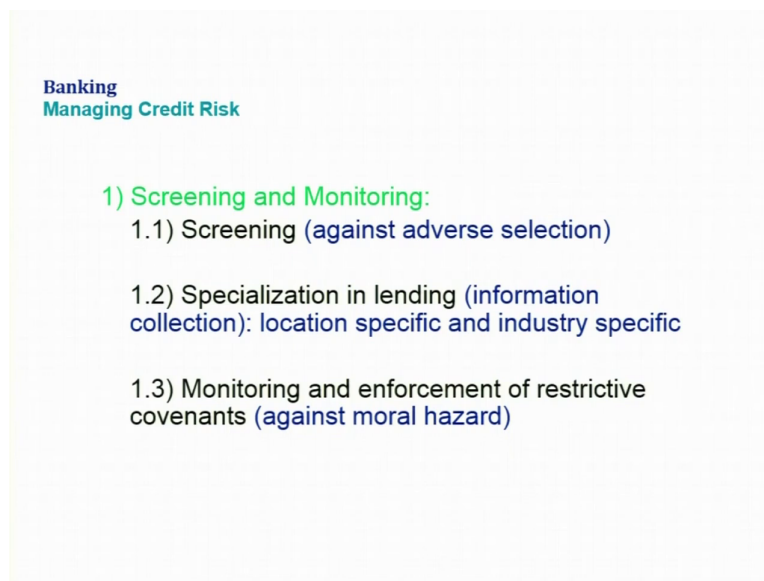


Economics of Banking and Finance Markets
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Lecture - 16
Principles of bank management - II

Welcome to this session. In the previous session, we have discussed some aspects of managing credit risk.

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Banking
Managing Credit Risk

1) Screening and Monitoring:

- 1.1) Screening (against adverse selection)
- 1.2) Specialization in lending (information collection): location specific and industry specific
- 1.3) Monitoring and enforcement of restrictive covenants (against moral hazard)

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Banking
Managing Credit Risk

- **2) Long-term customer relationships**
- If a prospective borrower has had a checking /savings account, or a loan with a bank over a long period of time, a loan officer can look at past activity on the accounts and learn quite a bit about the borrower.
- The balances in the checking and savings accounts tell the banker how liquid the potential borrower is and at what time of year the borrower has a strong need for cash..

One of the issue that we had discussed was screening and monitoring and secondly, we discussed the importance of long term customer relationships.

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Banking:
Managing Credit Risk

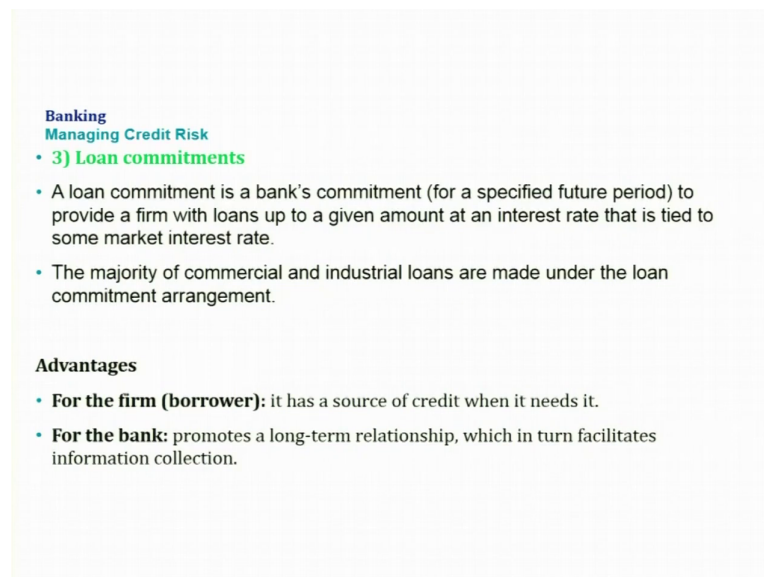
- **2) Long-term customer relationships (Contd...)**
- **Long-term relationships benefit customers & banks**
- **Banks:** long-term customer relationships reduce the costs of information collection and make it easier to screen out bad credit risks.
- The costs of monitoring long-term customers are lower than the costs of monitoring new customers.
- **Customer:** a previous relationship with a bank will find it easier to **obtain a loan from the bank at a low interest rate** because the bank has an easier time determining if the prospective borrower is a good credit risk and therefore incurs fewer costs in monitoring the borrower.

It is actually important developing a long term customer relationship, it benefits the customers; not only the customers, but also the banks as well. So, about the banks, the long term customer relationships reduce the cost of information collection and make it easier to screen out bad risk.

So, the cost of monitoring long term customers is lower than the cost of monitoring new customers, that is one important advantage for the bank. And what about the customers? For the customers, a long term relationship, that is, a previous relationship with a bank will find it easier for a customer to obtain a loan from the bank at a low interest rate.

Because, here, the bank requires less time and efforts in determining if the prospective borrower is a good credit risk and, therefore, incurs fewer cost in monitoring the borrowers, ok. So, this is the advantage for the banks and at the same time we have seen that it is beneficial for the customers as well.

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Banking
Managing Credit Risk

- **3) Loan commitments**

- A loan commitment is a bank's commitment (for a specified future period) to provide a firm with loans up to a given amount at an interest rate that is tied to some market interest rate.
- The majority of commercial and industrial loans are made under the loan commitment arrangement.

Advantages

- **For the firm (borrower):** it has a source of credit when it needs it.
- **For the bank:** promotes a long-term relationship, which in turn facilitates information collection.

Now, coming to third point; that means, a loan commitment. A loan commitment is a commitment for a specified future period to provide a firm with loans up to a given amount at an interest rate that is tied to some market interest rate. The majority of commercial and industrial loans are made under the loan commitment arrangements.

So, the advantage for the firm under this loan commitment is that it has a source of credit, when it needs it. And for the bank it promotes a long term relationship, which in turn facilitates information collection.

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Banking
Managing Credit Risk

- **4) Collateral and compensating balances**
- Collateral, which is property promised to the lender as compensation if the borrower defaults,
- It lessens the consequences of adverse selection because it reduces the lender's losses in the case of a loan default.
- It also reduces moral hazard because the borrower has more to lose from a default.

• **Collateral: Advantages**

- 1) lessens the consequences of adverse selection ✓
- 2) reduces moral hazard ✓

And the third aspects of managing credit risk are the collateral and compensating balances. A collateral is a property promised to the lender as compensation if the borrower defaults. And it lessens the consequences of adverse selection, because it reduces the lenders losses in the case of a loan default.

It also reduces moral hazard, because the borrower has more to lose from a default. So, to summarize, the collateral, the main advantages are that it lessens the consequence of adverse selection and it reduces the moral hazard problems.

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Banking
Managing Credit Risk

- **Compensating balances:** "A firm receiving a loan must keep a required minimum amount of funds in a checking account at the bank."

For example, a business getting a \$10 million loan may be required to keep compensating balances of at least \$1 million in its checking account at the bank. ✓
This \$1 million in compensating balances can then be taken by the bank to make up some of the losses on the loan if the borrower defaults.
In addition to serving as collateral, compensating balances increase the likelihood that a loan will be paid off. ✓
They do this by helping the bank monitor the borrower and consequently reduce moral hazard.

And coming to the compensating balances, a firm receiving a loan must keep a required minimum amount of funds in a checking account at the bank.

So, for example, a business getting 10 million loan may be required to keep compensating balances of at least 1 million in its checking account at the bank. This 1 million a compensating balance can then be taken by the bank to make up some of the losses on the loan if the borrower defaults.

In addition to serving as a collateral, the compensating balances increase the likelihood that a loan will be paid off. They do this by helping the bank monitor the borrower and consequently reducing moral hazard. So, specifically, by requiring the borrower to use a checking account at the bank, the bank can observe the firm's cheque payment practices may yield a great deal of information about the borrowers finance conditions.

So, for example, a sustained drop in the borrower checking account balance may signal that the borrower is having financial trouble or account activity may suggest that a borrower is engaging in risky activities. Perhaps a change in suppliers means that borrower is pursuing a new lines of business.

So, any significant change in the borrower's payment procedures is a signal to the bank that you should make inquiries. Compensating balances, therefore, make easier for banks to monitor borrowers more effectively and are an important credit risk management tool.

The next aspects of tool of managing credit risk is the credit rationing.

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Banking
Managing Credit Risk

- 5) Credit rationing
- Credit rationing takes two forms.
 - 1) when a lender refuses to make a loan *of any amount* to a borrower, even if the borrower is willing to pay a higher interest rate.
 - 2) when a lender is willing to make a loan but restricts the size of the loan to less than the borrower would like.

How does a small loan vs large loan affect moral hazard behaviour?

So, credit rationing takes two in forms: the first occurs when a lender refuses to make a loan of any amount to a borrower, even if the borrower is willing to pay a higher interest rates. The second occurs, when a lender is willing to make a loan, but restricts the size of the loan to less than the borrower would like, ok.

How does a small loan versus large loan affect moral hazard behavior?

Initially, you might be puzzled by the first type of credit rationing; that is, when a lender refuses to make a loan of any amount to a borrower, even if the borrower is willing to pay a higher interest rate. After all, even if the potential borrower is a credit risk, why does not the lender just extend the loan, but at a higher interest rate. The answer is that an adverse selection prevents this from being a wise course of action.

Individuals and firms with the riskiest investment projects are exactly those that are willing to pay the higher interest rates. If a borrower took on a high risk investment and succeeded, the borrower would become extremely rich of course, but a lender would not want to make such a loan precisely because credit risk is very high there. The likely outcome is that borrower will not succeed and the lender will not be paid back.

So, charging a higher interest rate, just makes adverse selection worse for the lender that is it increases the likelihood that lender is lending to a bad credit risk. The lender would therefore, rather not make any loans at a higher interest rate instead it would engage in the first type of

credit rationing and would turn down the loans. Financial institutions engage in the second type of credit rationing to guard against moral hazard. They grant loans to borrowers, but loans that are not as large as the borrowers want.

So, such credit rationing is necessary. If a bank gives you, for example, one thousand dollars as the loan for example, you are likely to take action that enable you to pay it back because you do not want to hurt your credit rating for the future, just for one thousand dollars; however, if the bank lends you a big amount, suppose you have been given a loan of 10 million.

So, you are more likely to fly down to enjoy to celebrate this much money. And, maybe the larger is your loan, greater is your incentive to engage in activities that make it less likely that you will repay the loan, because more borrowers repay their loans if the loan amounts are small. Financial institutions credit ration by providing borrowers with smaller loans than they seek. So, these are all the key aspects of managing credit risk

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Now, let us discuss the various aspects to deal with managing interest rate risk. So, one of the risk that banks often face is the uncertainty in the change in the interest market interest rate. So, the future interest rate, it can either increase or decrease or can keep same (stable) as well.

What if there is an increase in interest rate or what if there is a decrease in interest rates.

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Specific Learning Objective

- Apply gap and duration analysis and identify interest-rate risk.

The specific learning objective of this discussion here is to apply gap and duration analysis to manage the interest rate risk.

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Managing Interest-Rate Risk

First National Bank	
Assets	Liabilities
Rate-sensitive assets \$20 million Variable-rate and short-term loans Short-term securities	Rate-sensitive liabilities \$50 million Variable-rate CDs Money market deposit accounts
Fixed-rate assets \$80 million Reserves Long-term loans Long-term securities	Fixed-rate liabilities \$50 million Checkable deposits Savings deposits Long-term CDs Equity capital

Let us look at the balance sheet of a bank, very simple balance sheet. What we put here? We put the assets and liabilities of this bank into two categories. In the assets itself, what we are

going to do here is that, we are making more rate sensitive assets and fixed rate assets. On the liability side as well, we put more rate sensitive liabilities and fixed rate liabilities.

So, before going further how do you see that whether the assets are rate sensitive or insensitive.

So, in order to identify whether they are rate sensitive or rate insensitive, one tool rule of thumb is that, the small duration securities are more interest rate sensitive than the long term securities. Because for instance, in this case of an increase in the market interest rate, suppose rate of interest is increasing after one month.

So, now thinking about that when the rate of interest is increase. You know for the bank the transaction of the short term securities will be over in a short span of time; that means, within 1 month, then after 1 month they will be transacting with the new interest rate, that at the hiked interest rate.

So, if these are assets, if the assets are more rate sensitive assets then you may know that if suppose that they very short term; that means, when the rate of interest increases in the market they will be able to transact at the new rate of interest in the market. The high rate of interest in the market after one month, right. As I mentioned here the transaction of the short term securities will be over in the short span of time, that is, in the example one month, and can same fund can be reissued or newly issued at the new rate.

But what about the long term securities? Because the long term securities that can be transacted at the new interest rates only after the transaction process are completed; that means, because these are long term. And, suppose these are fixed rate assets, means they are not flexi rate; that means, the agreement is not in a way that when the market rate of interest change, the rate of interest for these assets also change.

But it would not happen in the case of fixed rate assets. So, in the case of fixed rate assets, you can see that they have to wait for the long term; that means, when the agreed period as per the contract is reached. So, because of that we can say that they are rate insensitive assets or we can call it fixed rate assets. So, this is about the asset side and what about on the liability side?

Liabilities means the payment, that the banks make to their liabilities. So, rate sensitive liabilities, you can see here, they are mainly variable rate certificates of deposits and mainly very short money market deposit accounts. And the fixed rate liabilities they are checkable deposits, savings deposits, long term CDs, and equity capital, but based on this classification we cannot infer whether they are really rate sensitive or rate insensitive. These we can discuss in the subsequent session.

In the next couple of minutes, we can discuss what makes an asset and liability sensitive vis a vis insensitive to the rates.

So, from this, let us take a case both; this bank is having 80 million in fixed rate and that means, 80 million in fixed rate assets and the rate sensitive assets is 20 million and total assets 100 million. So, 20 percentages of these assets are rate sensitive assets. Of these liabilities, let us consider that 50 million are rate sensitive liabilities.

So, from this, simply, what you can see that what if the rate of interest increase in the future. So, in this case; obviously, you know that, from the assets this 20 million will be subject to new rate of interest. So, their income, the receipt of income will increase for this 20 million, but you can see from here itself; that means, out of 50 million, for 50 million 50 percentage of the total liabilities are rate sensitive liabilities.

So; that means, the payment to the liabilities that also, will increase; that means, it is fifty million.

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Illustration

Tot assets: 100m ✓
Rate sensitive Assets: 20 million ✓
Rate sensitive Liabilities: 50 million ✓

Scenario 1: Increase in interest rate

Suppose that interest rates rise by 5% points on average, from 10% to 15%.

1) The income on the assets will increase by \$1 million
(=5% * \$20m of rate-sensitive assets = 1 million) ✓

2) The payments on the liabilities will increase by \$2.5m
(=5% * \$50m of rate-sensitive liabilities = 2.5million) ✓

$\Delta NW = (1m) - (2.5m) = (-1.5m)$ ✓

So, taking an illustrative example of this one, total assets 100 million rate sensitive assets is 20 million and rate sensitive liabilities is 50 million. So, in this case, take scenario one; Suppose there is an increase in interest rate by 5 percentage points, from 10 percentages to 15 percentages.

Let us also assume that the interest rate rise is same for both liabilities and assets. So, in this case what is going to happen? You can see from here that the income on the assets will increase by 1 million. You know how, because the rate of interest increased by 5 percentage points. So, 20 million, the 5 percentage of 20 million, then you can see that the bank's return from their assets increase by 1 million, ok.

So, bank is happy from the asset side, but you can also see the payments on the liabilities, but that also will increase by 2.5 million here. So, the 5 percentage of 50 million that you can see that 2.5 million. So, what is the change in the net worth of the bank? So, you can see that the increase in the income of the bank that is 1 million, but the payment on the liabilities also increased by 2.5 million.

So, the net worth of this bank, that is, the changes in the net worth, because of increase in the rate of interest you can see that it is minus 1.5 million. In this case you can see that the banks net worth has decreased. So, in this simple example that you can see that, when this bank is having more rate sensitive liabilities as compared to the rate sensitive assets an increase in rate of interest actually reducing the net worth of this bank.

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Illustration

- Tot assets: 100m
- Rate sensitive Assets: 20 million
- Rate sensitive Liabilities: 50 million

Scenario 1: Decrease in interest rate

· What if the interest rates fall by 5% points on average, from 10% to 5%.

· 1) The income on the assets decreases by \$1 million
(= -5% * \$20m of rate-sensitive assets = (-1 million))

· 2) The payments on the liabilities decreases by \$2.5m
(= -5% * \$50m of rate-sensitive liabilities = (-2.5million))

· $\Delta NW = (-1m) - (-2.5m) = (+1.5m)$

So, let us look at the second scenario, scenario 2 is a decrease in interest rate. So, in this case, what if the interest rates in the market fall by 5 percentage point on average from 10 percentages to 5 percentages. So, if the income on the assets decreases by 1 million, you can see that income declined by 1 million due to decline in the rate of interest.

So, the payments on the liabilities also decrease and is decreased by minus 2.5 million. What of the net worth changes in the net worth of this bank, because of the decline in the rate of interest? You can see that the return on assets declined by 1 million and, but payment on the liabilities also declined, but that declined by 2.5 million. So, you can see the net worth of the bank has increased by 1.5 million.

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If a bank has more rate-sensitive liabilities than assets

- 1) a rise in interest rates will reduce bank profits,
and
- 2) a decline in interest rates will raise bank profits.

So, from this what we can infer that if a bank has more rate sensitive liabilities than assets, a rise in interest rate will reduce bank profits.

And a decline in interest rate will raise bank profits.

These are the two important inferences that we can make from this discussion.

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1) Basic Gap Analysis

- Gap analysis = [Rate sensitive assets - Rate sensitive liabilities] * Δi
- = [20-50] * 5% → +5%
- (-30) * 0.05 = -1.5 million

What we have seen here is very basic analysis from this illustrative example; that means, scenario 1 and scenario 2 and this idea that we can see that in scenario 1 the bank made the

loss of net worth is minus 1.5 million, and in scenario 2 we can see that the net worth was increased by 1.5 million; the same calculation we can get by using basic gap analysis.

How to calculate the basic gap analysis? This is the simple formula. What we have to do here is that we have to put the gap in the rate sensitive assets minus rate sensitive liabilities. So, the gap between rate sensitive assets and rate sensitive liabilities, and times changes in the rate of interest multiplied by changes in the rate of interest. So, in the first cases, we seen that the bank has made the increase in, because of the increase in the rate of interest. So, we are getting increase in the rate of interest rate is 5 percentages, that is plus.

That means you can see here is that the changes in rate of interest was 5 percentage point; in this case we need to calculate the gap. Gap is minus 30, that is rate sensitive asset that is 20 minus rate sensitive liabilities that is 50 times the 5 percentage; that means, 5 percentage means 0.05. So, from here you can see that we are getting the answer that is minus 1.5 million.

In order to understand the credit interest rate risk, bank often use this kind of formula: the basic gap analysis.

However, there are certain limitation what we have mentioned here is that we did not mention the duration of the assets and liabilities, because just to get you the idea simple, we just put this much is rate sensitive assets and this much is rate sensitive liabilities.

However, you know that banks borrow short and lends long; that means, most of its liabilities will be short term and most of its assets will be long term. Moreover, within different types of assets you can see that there will be huge difference in the time, that is, the duration, between short term and long term. So, similarly in the liabilities also there will be short term deposits and the long term borrowing the banks will be making.

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2) Basic Duration Analysis

- **Tot assets: 100m; Tot Liabilities: 90 m & Bank capital 10m**
- Average duration of Assets (the average lifetime of the stream of payments): 3 years
- Average duration of Liabilities: 2 years
- What if the interest rates rise by 5% points from 10% to 15%? **+5%**
- Duration Analysis (also called as income gap analysis) : Percent change in market value of security \approx (- Duration in years) * (% point changes in interest rate)

$$\% \Delta P \approx -DUR \times \frac{\Delta i}{1+i}$$

- 1) Market value of assets falls by 15%: $(= -3 \text{ years} \times 0.05)$ of 100m = $(-0.15 \times 100 = -15 \text{ M})$
- 2) Market value of liabilities falls by 10% $(= -2 \text{ years} \times 0.05)$ of 90m = $(-0.10 \times 90 = -9 \text{ M})$
- $\Delta \text{NW} = (-15\text{M}) - (-9\text{M}) = -6\text{M}$
- Net worth (=mkt value of A - L) declined by -6 million

We can expand this basic gap analysis into basic duration analysis. Here, we are taking an example of a bank with this total asset is 100 million, that 100 million is the total assets and total liabilities is 90 million and bank capital is 10 million.

So, in this case, we need to calculate the average duration of assets, that is the average lifetime of the stream of payment. Suppose the average duration of assets is 3 years. For example, let us take 3 years is the average duration of assets. The average duration of liabilities, let us put it, 2 years. And here what if the interest rates rise by 5 percentage points from 10 percentages to 15 percentages?

In this case, let us see, what will happen to the net worth of this bank? This duration analysis, that we are going to discuss here, is also called as income gap analysis. Here, we calculate the percentage change in market value of security is equal to minus duration in years, times percentage point changes in interest rate.

So, here we calculate, separately for each security; that means, for assets and then we also calculate for the liabilities, and then we calculate difference between return on assets minus the payment on the liabilities. So, this can be expressed by a simple formula that the percentage change in the price of a security.

So, the P means you can use it as either asset and also you can use it for the liabilities as well. So, here in this example, let us plug values in this formula. You can see that the market value

of assets falls by 15 percentages, because that the change is 5 percentage increase in every year.

So, you can see that, for the assets duration: these are 3 years, 3 years is the duration for the assets. So, minus 3 years times 0.05, that is the 5 percentage of 10 million and you can see that the decline in assets is by the changes in assets; that is, 15 million.

The market value of assets falls by 15 percentages. Similarly, the market value of liabilities falls by 10 percentages. That you can see, you are getting minus 9 million. So, the net worth of this bank changes like this, that is, the market value of assets is minus 15 million minus changes in the liabilities is minus 9 million.

So, the net worth of this bank declined by 6 million. This is a simple illustration of basic duration analysis; however, we need to see that it may not be as simple as it looks, because average duration of the asset we just put 3 years and duration also we put 2 years; however, we need to elaborate this analysis using waited duration, which we will cover in the next session.

Thank you.

Key words: interest rate risk, changes in future interest rate, rate sensitive, rate insensitive, assets, liabilities, basic gap analysis, basic duration analysis.