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What Factors Affect the Cost of Credit Intermediation for Large and Small firms?

Aalok R. Pandey
Trinity College, aalok.pandey@trincoll.edu

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By

Aalok R. Pandey

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ABSTRACT

The financial crisis of the late 2000's has had a devastating effect on the US economy. The economics that explains the amplification of such crises pertains to the financial accelerator model, which states that the supply of and demand for credit depends on interest rates or the credit rationing model, which suggests that credit is always rationed and interest rates have little or no effect on it. In this paper, we look at the factors that affect the cost of credit intermediation for large and small firms on a monthly and a quarterly basis. In addition, we also look at the impact of the current recession on the cost of credit intermediation for small as well as large firms.

To my parents for always being there for me. They are the sole reason for my accomplishments.

Acknowledgments

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INTRODUCTION

New Institutional Theories argue that it is conceptually wrong and misleading from a policy perspective to treat micro variables as constant when analyzing economic relationships at the macro level. For example, many economists assume that the cost of credit intermediation is the same for small firms as well as large firms when analyzing the macro economy. In the credit market, however, there are informational asymmetries between lenders and borrowers. This gives rise to two main problems: moral hazard and adverse selection. The idea of adverse selection deals with the notion that lenders are wary of giving away credit to borrowers because of the high default risk. The idea of moral hazard, on the other hand, deals with the notion that the lenders assume the downside risk of an investment made by a borrower on the amount borrowed.

Because of these problems in the credit market, lenders differentiate between borrowers and disburse most funds to those borrowers who are deemed to be "credit-worthy". There are two theories based on the equilibrium quantity of funds. The financial accelerator model (Bernanke, et al, 1981) contends that the cost of credit is price-based, and that a relatively "credit unworthy" borrower has to pay higher prices to get the same level of credit as compared to a "credit worthy" borrower. The other theory, which is dubbed the Credit Rationing Model (Stiglitz and Weiss, 1981), argues that credit is rationed, and that due to this unworthy [and potentially worthy] borrowers do not get or have minimal access to credit. The theory also contends that the equilibrium interest rate is not at the market-clearing level, but at a level where the return to the lenders is the highest.

The main argument of these two models is that it is easier for big and well-established firms to get access to credit as compared to small firms , i.e. that the cost of credit intermediation is lower for large firms or that large firms aren't rationed whereas small firms are. These models also argue that during a recession, the difference in the price of credit intermediation for large firms and small firms increases and this exacerbates recession. The models also argue that during a recession, the cost of credit intermediation for large and so-called "worthy" borrowers decreases, but it doesn't decrease for "unworthy" or potentially worthy borrowers, i.e. small firms. Since small firms do not get access to credit, these firms are forced to cut back on their investing spending. As a result, we observe the exacerbation of a recession.

A lot of literature has been generated by these two theories. One of the more recent ones, by Walker (2010), tests these two theories. In his paper, "Costs of short-term credit for small and large firms", he explores the factors that affect the cost of credit intermediation for small and large firms in the short-run. He also explores the impact of these factors on the cost of credit intermediation for small firms as well as large firms in the long-run. In addition, he examines the impact of recession on these factors as well as the prices that firms pay for credit.

In our paper, we will follow Walker's (2010) lead, and test the Financial Accelerator Model and Credit Rationing Model. The time period of our analysis will be from 1998 to 2011. We will analyze the cost of credit intermediation for small and large firms, examining what factors are responsible for their changes in the short run as well as the long run. We will also analyze whether changes in the cost of credit intermediation are significantly different during a recession as compared to periods of normalcy. The main goal of this research will be to test if the presence of agency costs, as implied by the Credit Rationing Model and the Financial Accelerator Model, affect small and large firms differently. This line of inquiry leads to another important question, are loanable funds markets for small and large firms segmented or do all firms compete for the same pool of credit? The main variables that will be considered are the cost of credit intermediation for small as well as large firms, and the quantity of credit obtained by these firms.

CHAPTER 1: THEORY REVIEW

1.1 New Institutional Theories of Finance

New Institutional Theories of Finance are based on the market failures inside the financial system. They study the macroeconomic implications of the financial world through the microeconomic behavior of households, firms, financial markets and banks. In the past, Keynesian and New Classical models have ignored the complexities of the interactions at the firm level. To simply assume uniformity at the micro-level when considering the macro-economy leads to the ignoring of crucial macroeconomic implications. (Knoop, 2008)

The Keynesian and New Classical models consider liquidity, but they fail to distinguish credit from liquidity. Liquidity deals with the total amount of funds available to lenders. The change in liquidity occurs when there are changes in the money supply or the level of savings in the economy. Liquidity is usually measured by the money supply. On the other hand, there are difficulties when measuring credit, since it deals with the amount of loanable funds that the financial institutions are willing and able to provide. Another important distinction between liquidity and credit is the idea of perceived default risk. This idea is more important for the provision of credit than the interest rate. With respect to this difference between liquidity and credit, the New Institutional theories of Finance argue that credit may be high when the supply of money is low and vice-versa. (Knoop, 2008)

Another main idea related to the New Institutional Theories of Finance is the idea of information asymmetry. Financial markets are imperfect; hence the idea of informational asymmetry between borrowers and lenders comes into play. This exists because borrowers are more informed about their credit worthiness than the lenders. If the borrower can convince the lender that he is credit worthy, even if he is not, he gets access to credit. On the other hand, if the borrower cannot show he is credit worthy no matter how credit worthy he is, he still fails to get access to credit. (Knoop, 2008)

One of the two main problems that arise from the imperfections of financial markets is the problem of adverse selection. As we know, borrowers with high default risk are more likely to search for loans since they want to take risks with their own funds as well as others' funds. Since lenders are aware of this problem, they are usually not willing to provide credit to everyone who applies for it. (Knoop, 2008)

The second major problem is referred to as moral hazard. Moral hazard deals with the risky behavior by the borrower who gained access to credit. The rationale behind this idea is pretty simple: for the borrower who has been provided credit, the lender assumes part of the downside risk. On the other hand, if the project is successful, the upside benefit is not distributed in the same way. The borrower simply needs to return the amount that he had promised to return, and the remaining profit goes to him. Since there is protection on the downside, and profit in the upside, borrowers are likely to engage in riskier behavior.

These two problems are factors that determine the supply of credit. Due to these problems, the quality of information on the part of the borrower is directly proportional to the amount of credit that the borrower is provided and inversely proportional to the price that the borrower has to pay to get access to credit. Therefore, small or new firms are at a major disadvantage compared to big and established firms. (Stiglitz and Weiss, 1981)

Since the provision of credit depends upon moral hazard and adverse selection, and not necessarily upon the interest rates, the credit market is almost always in disequilibrium: supply for loanable funds rarely equal the demand for loanable funds. (Knoop, 2008)

There are two main models that are derived from the ideas discussed above: the Financial Accelerator Model and the Credit Rationing Model. We will now look at these two models in detail.

1.2 The Financial Accelerator Model

The Financial Accelerator Model examines how the asymmetric information due to imperfection in the financial market exacerbates a financial downturn. Bernanke and Gertler, in their seminal 1996 paper, argue that the cost of credit intermediation of firms, households, and individuals affects the level of credit in the economy. Consequently, small microeconomic changes can have a big impact on the economy. (Bernanke et al, 1996)

According to Bernanke and Gertler, the cost of credit intermediation is partly related to interest rates. The cost of providing information is significant. In this model access to financial information is costly. In addition, the borrowers also have to face monitoring costs as well as the opportunity cost of collaterals in some cases. (Bernanke et al, 1996)

As a result of the costs associated with credit, firms seek to finance their projects internally, via retained earnings. If firms require more finance, they issue debt. If this is not an option for them, they prefer to raise equity. However, raising equity has serious consequences since re-issuance of equity dilutes ownership and might send signals to the public that the stock is overvalued, which is harmful for the firm. (Knoop, 2008)

Bernanke and Gertler argue that the cost of credit intermediation is a function of the financial fundamentals of both borrowers and lenders. They argue that the cost of credit intermediation does not necessarily depend on debt levels as long as the borrowers have assets that can be collaterized. In other words, their net worth (total assets – total liabilities) is what the creditors look at. This determines the financial fundamentals of borrowers. (Bernanke et al, 1996)

To see this, let us assume that we are in a recession, which has hurt a firm's sales. This has a negative impact on the net worth of the firm. Since the net worth of the firm has decreased, lenders would be reluctant to provide this firm with credit. Therefore, the cost of credit for the firm increases, either through an increase in the interest rate, the increase in the collateral that firms have to provide in order to obtain credit, or the increase in the information required for firms to get credit. Let us remember that this occurs when the firms need credit the most. The inaccessibility of credit would lead to a decrease in the consumption and investment of firms. This decrease would, then, worsen the recession. (Knoop, 2008)

Let us consider the Economic Model in Fig 1.1. Now let us assume that a recession has occurred. Due to the recession, the money supply decreases unexpectedly. In addition, there is a decline in expectations, which reduces consumption and investment, and an increase in perceived risk. These three factors lead to the shifting of the aggregate demand. In addition, due to the higher costs of credit intermediation, the aggregate demand falls even more. On the other hand, because of the higher risk factor and the decrease in capacity (due to the fall in investment), the aggregate supply shifts upwards to the left. Thus, the equilibrium output is Y_3 in figure 1.1. (Knoop, 2008)

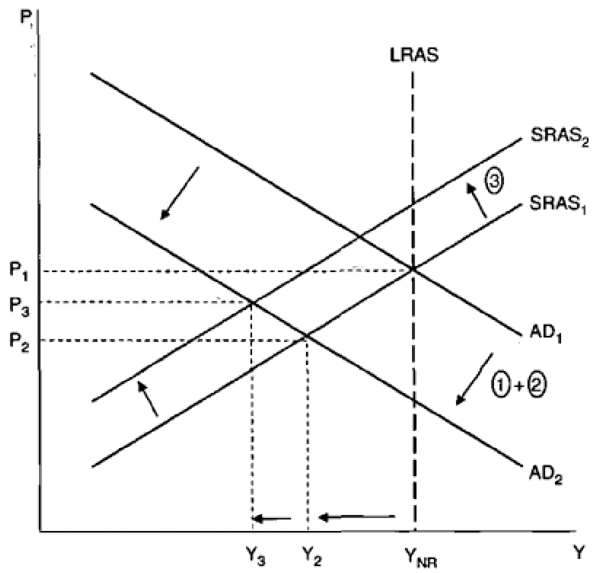

Fig 1.1: Impact of the Financial Accelerator Model on the Economy. (Source: Knoop, 2008)

1.3 The Credit Rationing Model

The Credit Rationing Model suggests that credit is rationed and that access to credit is not affected by the interest rate. (Stiglitz and Weiss, 1981)

Let us see the perspective of the borrower in this model. The borrower defaults on his loan as long as his return from the project and his collateral is less than the amount he has to pay back (which is the loan with interest). Thus, the payoff to the borrower would be the greater of the following: the return from the project minus the loan and interest or the collateral that he will give away if the loan defaults. The return to the bank, on the other hand, will be the smaller of the following: the return of the project and the collateral (if the borrower defaults) or the loan and interest rate (if the borrower pays back). (Stiglitz and Weiss, 1981)

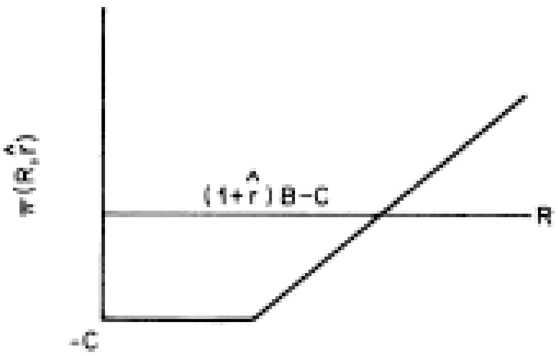

Fig 1.2: Firms' Profit Functions (Source: Stiglitz and Weiss, 1981)

From figure 1.2 and the ideas discussed above, we can see that the borrower has downside protection. Whatever the firm's payoff from the project, the maximum it can lose is the collateral (-C in Figure 1.2). In addition its break-even point will be where the return from the project equals the amount of the loan with interest and the collateral. (R= (1+r)B – C in Figure 1.2). However, as we can see in Figure 1.2, there is no ceiling to the firm's profit. This is why high-risk borrowers are interested in borrowing from the banks. (Stiglitz and Weiss, 1981)

Let us consider the case of an increase in the interest rates. Risk-averse borrowers will borrow only up to a certain interest rate, after which only the high-risk borrowers will borrow. Because of this the profit of the bank will decrease once the risk-averse or the "safe" borrowers pull out. This is shown in figure 1.3. We can see a sudden drop in the bank's profit (ρ) at interest rate r_1. (Stiglitz and Weiss, 1981)

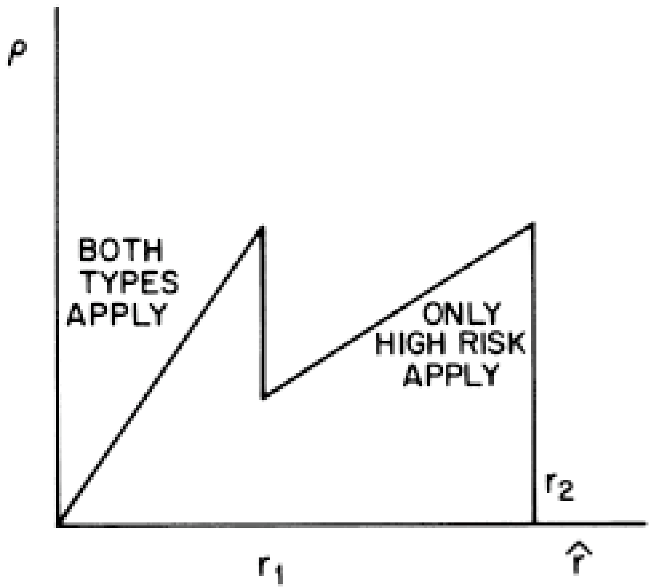

Figure 1.3: Financial institutions' profit function in terms of interest rates. (Source: Stiglitz and Weiss, 1981)

This outcome leads to a theorem derived by Stiglitz and Weiss, which say that the profit function for financial institutions is not a monotonic function of interest rates. There is a particular r*, the interest rate, such that the bank will maximize its returns if it charges its borrowers this interest rate. Therefore, banks will provide credit at the interest rates r*. However, we can see that at this interest rate, there is an excess demand for credit. Therefore we do not reach the market clearing condition for credit. Hence, we can see that credit is rationed, and that all who are in need of credit for do not have access to it. This is shown in figure 1.4. In the figure we can see that the market clearing condition is at the interest rate r_m but the equilibrium is at r^*. At this equilibrium it is evident that there is an excess demand: borrowers are willing and able to borrow more at a higher interest rate. Since it is not profitable for the lender to do so, he will not provide credit at a higher interest rate. It is also evident that the lender maximizes its returns when it provides credit at r^*. (Stiglitz and Weiss, 1981)

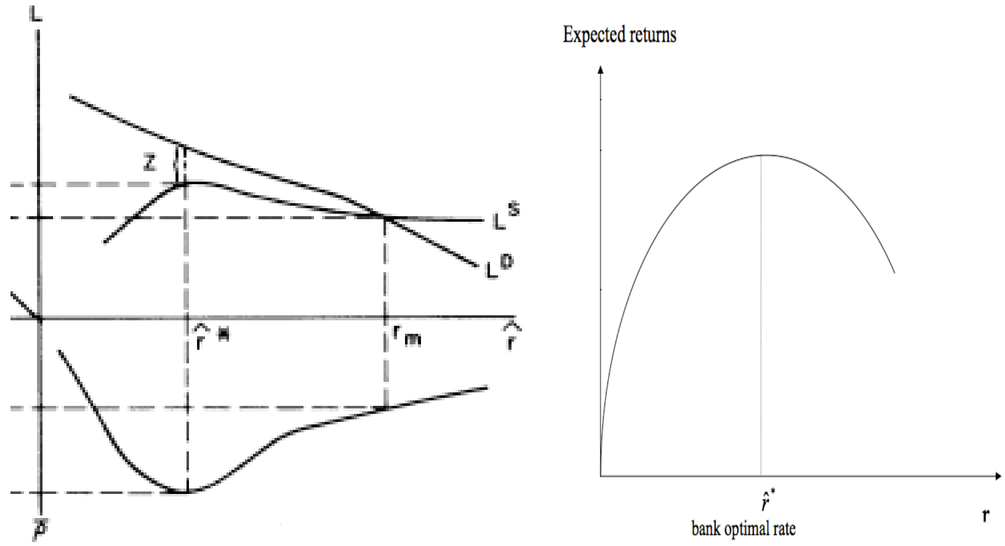

Figure 1.4: The loanable funds market with the lender's profit function. (Source: Stiglitz and Weiss, 1981)

The rationing of credit leads us to an important question: if credit is rationed, how do banks differentiate credit-worthy customers from the ones that are not credit worthy? Large and well-established firms have access to credit, and small firms, which are usually private, might not have access to credit all the time.

The idea of credit limits is important here. Large firms have higher credit limits than small firms (Knoop, 2008). The role of credit limits is very important in the credit-rationing model. According to this model, a small shock to the economy will not have a significant impact on credit as long as the borrowers are well within their credit limits. It is only when the borrowers are near their credit limits that a small shock will lead to a large reduction in credit available to them. During a recession, the credit limits of borrowers are lowered. Thus firms that are in need of credit do not have access to credit. The credit limit is tighter for newer, smaller, and private firms in comparison with well-established, larger, and public firms. (Knoop, 2008) The recession gets escalated in the same way as described in the Financial Accelerator Model.

Chapter 2: Literature Review

As was mentioned in the previous chapter, both the financial accelerator model and the credit-rationing model help explain the exacerbation of economic downturns. However, these models have overlooked some factors related to credit intermediation. This idea will be explored in this chapter.

The financial accelerator model suggests that after an adverse macroeconomic shock, borrowers will have access to a lower amount of credit, and due to this, their economic activity will also decline. This is explained by the presence of agency costs. In a recession, due to the presence of higher agency costs, the borrowers (small-sized firms) face a greater decline in their spending and production, and also their revenue than borrowers (large-sized firms) who do not have such difficulty in obtaining credit. Therefore, the theory predicts that large size firms (who have access to credit) and small size firms who are subject to agency costs are affected differently in an economic downturn. If some firms rely entirely on internal funding and require zero credit, then the financial accelerator model doesn't come into play. (Bernanke et al, 1993)

Ben Bernanke et al (1993) have actually explained this phenomenon and tested the model with quarterly data pertaining to small and large-scale firms in the manufacturing industry. The authors differentiated between large-scale and small-scale firm on the basis of sales. In their paper, "The Financial Accelerator and the Flight to Quality" (1993), they analyzed three variables for these firms: short-term debt, sales, and inventories between the time period of 1979 and 1992. They found substantial differences between these variables pertaining to large firms in comparison with the variables pertaining to smaller firms. (Bernanke et al, 1993) We can observe these differences in the graph below.

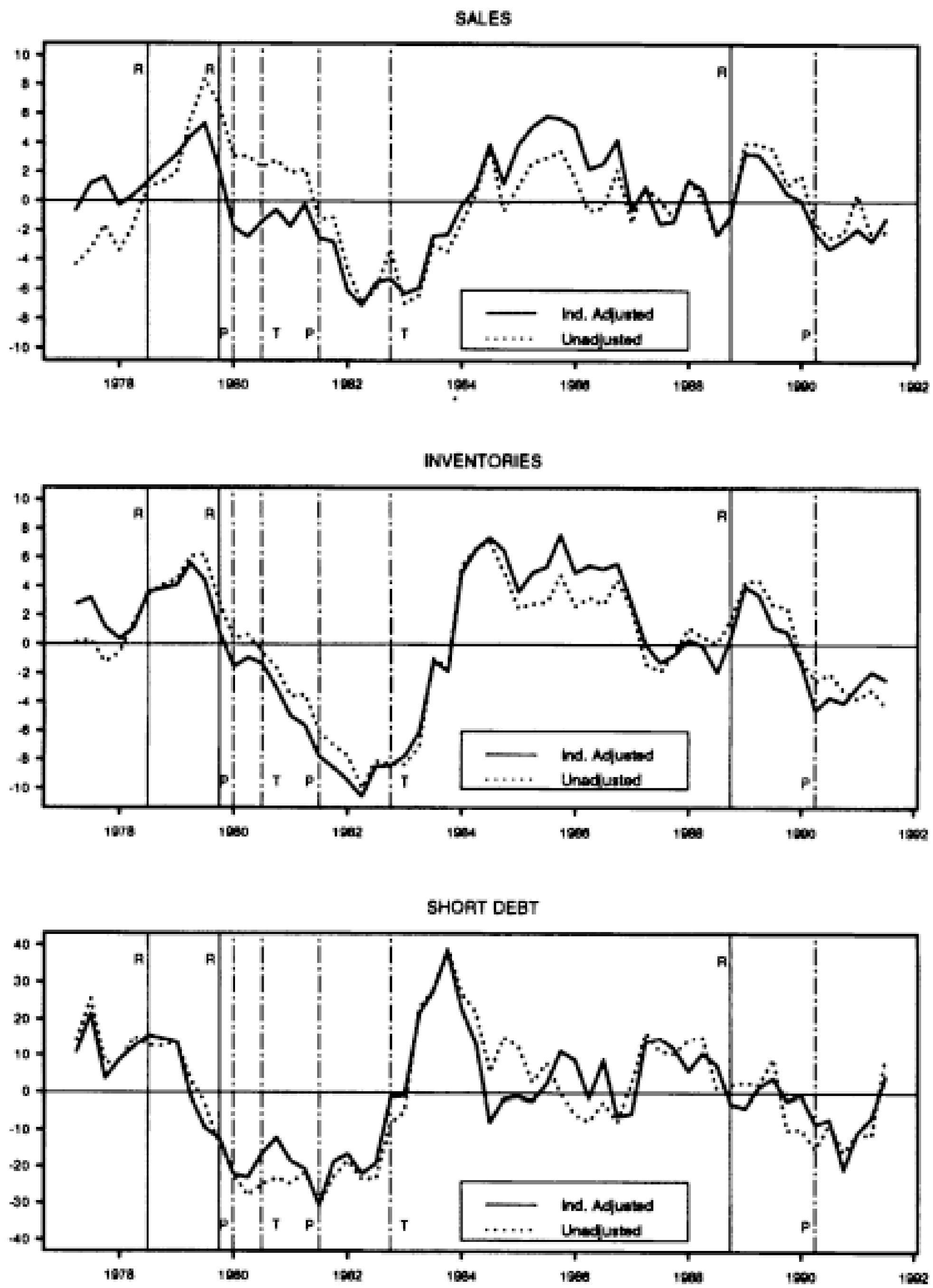

Fig 2.1: The difference between small and large firm cumulative growth rates: a comparison of industry adjusted vs. unadjusted data. (Source: Bernanke, et al 1993)

Bernanke, Gertler, and Glichrist also examined the commercial paper spread. During conditions of tightened money supply and/or access to credit, firms switched from borrowing to issuing commercial paper. When firms are in need of short-term credit they prefer to use commercial paper rather than depend on intermediated credit. However, only high-grade borrowers (large well-established firms) have greater access to commercial paper market and they get funds more easily than low-grade borrowers (small firms). It is the case that small firms cannot use commercial paper to acquire funding and they rely on intermediated credit. Thus, this is consistent with the financial accelerator model. (Bernanke et al, 1993)

The theory also discusses how access to credit changes as a function of the intensity of the recession. When an economy is in a deep recession, the difficulty of obtaining credit for firms is going to be more than in a "not-so-deep recession" and this relationship is not linear. Therefore, deep recessions are amplified more than proportionately than not-so-deep recessions due to the availability of credit.

Although this model generally states how costs of credit intermediation affect large firms and small firms differently in a period of economic downturn, this model doesn't take into consideration the possibility of a deflation independent of an economic downturn. In a period of deflation, we do see the net worth of firms decreasing and this is independent of the change in aggregate output. (Bernanke and Gertler, 1989)

When there is an unanticipated fall in the price level, even if there is no recession, a borrower's net worth decreases. Because of this previously credit-worthy borrowers become "uncredit-worthy." These "uncredit-worthy" borrowers suddenly find themselves without funds to generate their investments. As a result, the total level of investment in the economy decreases, and this has negative effects on the aggregate supply as well as the aggregate demand. Therefore, this phenomenon helps an economy plunge into an economic downturn. The same analysis can be applied to households.

In his analysis of the non-monetary based explanation of the financial crisis during the great depression, Bernanke argues that the reduction in money supply was an unsatisfactory explanation to the fall in output. Furthermore, he argues that during the recession, the banking crises increased the cost of credit intermediation, and that higher costs of credit intermediation had a relationship with the decline in aggregate output. (Bernanke, 1983)

He argues that depositors withdrew their deposits during the crisis fearing runs. This action, along with the financial institutions' desire to have liquid assets led to a "contraction" of their role in credit intermediation. This contraction greatly affected the class of borrowers, which includes households, farmers, unincorporated businesses, and small corporations. In addition, he also mentions that the demand-side of the economy was also affected by the higher costs of credit intermediation. Higher borrowing costs meant that households were forced to decrease their demand for current goods and services. This implies a downward shift of the aggregate demand, resulting in lower output. (Bernanke, 1983)

Craig Hakkiko and Troy Davig have extended this study in an attempt to explore the effect of financial stress on economic activity. In addition to the financial accelerator model, they have also described the "real options theory" as a theory that helps describe the connection between financial stress and economic activity. According to the real options theory, during financial stress, uncertainty is high. Thus, it is profitable to wait until the economy goes to a stage of less uncertainty. Hence, investors prefer to wait than invest in a period of stress. On the contrary, when the economy is in a period of low uncertainty (when it is not under financial stress), extreme outcomes are very unlikely. Thus, there is no point waiting in order to carry out projects. (Davig and Hakkio, 2010)

Hakkiko and Davig test their data using the Regime-Switching model, for two periods, distressed and normal. The variables they used were the Kansas City Federal Reserve's Financial Stress Index (KCFSI) to measure financial stress, and the Chicago Fed National Activity Index (CFNAI) to measure economic activity. They found that there was a negative correlation between KCFSI and CFNAI in both periods, but the correlation was higher, in absolute terms, during the distressed regime. They also noticed that the volatility of both KCFSI and CFNAI were higher in the distressed regime than in the normal regime. (Davig and Hakkio, 2010)

In addition, according to their findings, when the probability of distress regime approaches one, the CFNAI is lower than the KCFSI, and CFNAI is higher than the KCFSI when the probability of distress regime approaches 0. The difference in absolute values in CFNAI and KCFSI is higher when the probability of distress regime approaches 1. (Davig and Hakkio, 2010) This is shown in Fig 2.2

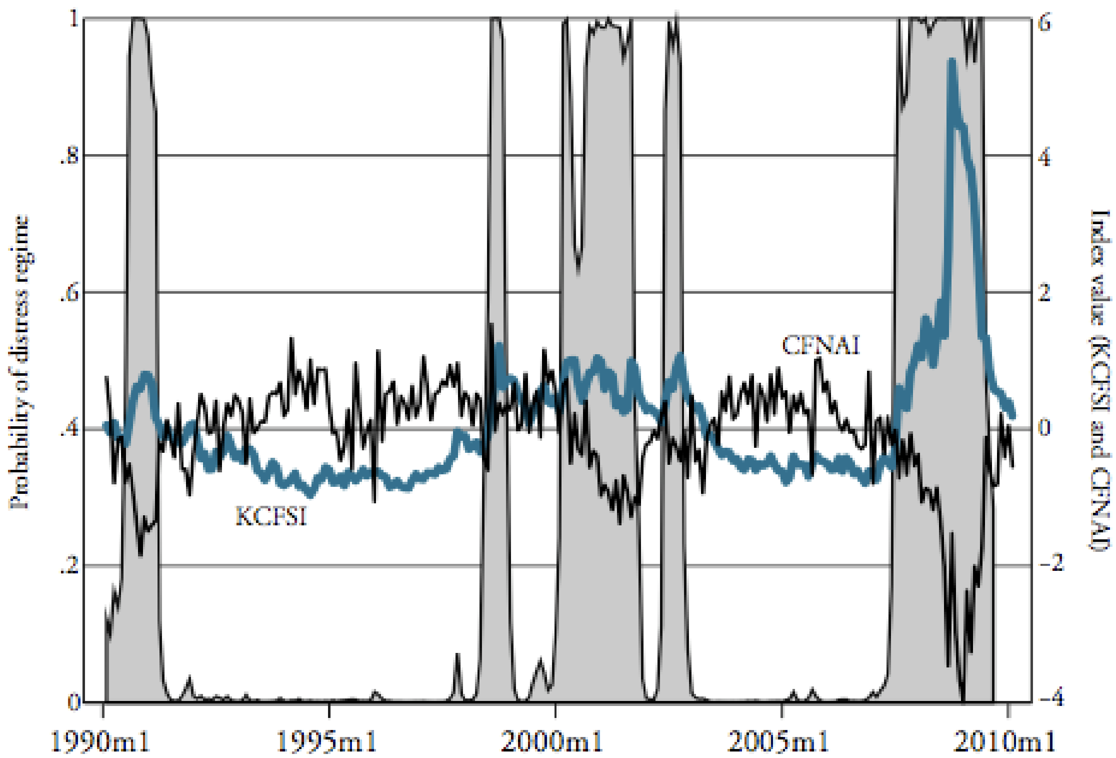

Fig 2.2: Probability that the Economy is in the Distressed Regime
Source: Federal Reserve Bank of Chicago, Federal Reserve Bank of Kansas City, and Troy David and Craig Hakkiko

The credit-rationing model, as has been discussed, states that credit is rationed, and access to credit doesn't depend on the cost of credit intermediation. Stiglitz and Weiss, by proving a number of theorems, have shown that credit is rationed, and the optimal quantity of credit is not at the equilibrium, but rather at a point where the return to the financial institution is the greatest.

Stilgitz and Weiss, by building on the ideas of informational asymmetry, moral hazard, and adverse selection proved the following:

1. "For a given interest rate r*, there is a critical value of t (project) such that a firm will only borrow if and only if the project is greater than the critical value."
2. "As the interest rate increases the critical value of t increases."

3. "The expected return on a loan to a bank is a decreasing function of the riskiness of the loan."
4. If the types of borrowers are different, then the profit function for the financial institution will not be a monotonic function because when groups of borrowers drop out of the market (due to mostly changes in the interest rate), the profit drops.
5. "As the supply of funds increases, the excess demand for funds decreases." However, since this theory entails interest rates being sticky, interest rates do not change as long as there is credit rationing.

Note: For the diagrams explaining this phenomenon, please look at section 1, figures, 1.2, 1.3 and 1.4.

Stilgitz and Weiss also introduce the idea of collateral requirements in their analysis. When the demand for credit increases, financial institutions might not necessarily increase their collateral requirements, thus reducing their rate of default because this action may not necessarily mean that these institutions will experience an increase in their returns. This is because smaller firms have small projects that have a high probability of failure. If the financial institutions increase the collateral requirements, smaller firms may still be able to meet those requirements and gain access to credit. However, since these projects have a higher probability of failure, increasing the collateral requirement may lead to an increase in the riskiness of the loans.

Stiglitz and Weiss' seminal paper is primarily a theoretical contribution and in it they do not test their theories empirically. Although it is a formidable task to test whether credit rationing occurs or not (since financial institutions seldom give out information about their credit policies), many economists have tried to address this issue. In their paper "Do Firms Get the Financing They Want?", Alec R. Leveson and Kristen L. Willard test whether credit rationing really exists.

In their paper, they test their hypothesis that credit rationing does not exist. They tackle the ambiguity associated with credit rationing. They refute the notion that firms that were discouraged from applying due to the fear that their application will get rejected do not belong to the firms that are credit-rationed. Furthermore, they introduce the idea of time in terms of credit rationing, which had been ignored by Stiglitz and Weiss in their analysis. Furthermore, Leveson and Willard argue that firms that did not gain access to credit in the time they wanted to but got the required funds eventually cannot be characterized as credit-rationed firms.

In their analysis, Willard and Leveson found out that 6.36 percent of the U.S. small businesses during the period of 1987-88 had an “unfulfilled desire for credit”. But these firms only accounted for 3.22 percent of the total sales and 3.46 percent of the total employment among all firms that were included in the study. Of the 6.36 percent of the firms that were rationed, only about a third of these firms were denied credit. The remaining either didn’t apply or got the funds eventually. This result along with the negative correlation between firm size and credit denial suggests that the credit-rationing model may not work in real life. (Levenson and Willard, 2009)

The two theories also discuss how the bank lending is being reduced either through the credit-rationing mechanism or the rise in interest rates during economic downturns. However, it is imperative for us to take into account why there exists a decline in bank lending during recessions. In a study done by Jim Wilkinson and Jon Christensson of the Kansas City Federal Reserve in 2011, there was evidence that changes in bank capital and problem assets affected the amount of bank lending during the recent “Great” recession. The study observed that raising the bank capital requirement would be effective as a policy instrument. If there is a rise in bank capital, however, it might still not be the case that small businesses will get access to credit.

Although the financial accelerator model and the credit rationing models imply that small firms find it difficult and costly to get access to credit during times of economic downturn, both of these theories fail to consider the possibility that there is a weak demand for credit from qualified small business owners. It might be the case that the small firms do not want access to credit, under any cost, because they fear weak sales and poor prospects. Therefore, they plan to cut back their operations rather than expand them. According to the survey by the National Federation of Independent Businesses, twenty-seven percent of the firms were concerned about bad sales, whereas only three percent were worried about not being able to get access to credit. In addition, although recessions "are likely" to decrease the firms' internal finance, it might be the case that firms, at least in a particular area, had no access to credit markets not just only during recessions, but all the time. (Wilkinson and Christensson, 2011)

Some economists have also argued that there is a relationship between the debt capacity of a firm and cost of asset sales, and debt capacity deteriorates during a recession. They attribute the notion of asset illiquidity to this problem. Shleifer and Vishny (1992) argue that in an economic downturn, small firms have trouble meeting debt payments and their assets are usually liquidated and sold. The highest valuation potential buyers of these assets are usually competitor firms. During financial distress, the competitor firms are unlikely to raise enough capital to purchase the other firms' assets. As a result, assets would be sold to industry-outsiders who do not manage these assets as well as the firms that are in the industry. Due to this reason, the industry-outsiders would have to hire specialists to operate those assets. They also wouldn't know the actual value for the asset. Thus they fear paying higher costs in regard to buying and operating the assets. As a result, they buy the assets in a price below what could have been the price paid if the asset were to be used inside the industry. This increases costs for the already credit-constrained firms, reduces their net worth, and decreases their debt capacity. As a result, they will face higher costs of credit intermediation and this amplifies the downturn. (Shleifer and Vishny, 1992)

Kitoyaki and Moore (1997) explain this idea through what they call the predator-prey model. They describe the debt levels of a firm as the predator and its landholdings as the prey. They argue that given a rise in a firm's landholdings, it's net worth increases, which allows it to borrow more. On the other hand, higher debt levels decrease the funds that are available to the firm and might imply liquidation and forced selling of the land. Kiyotaki and Moore also take into consideration the price of land, which causes the economy to react more to a shock. (Kiyotaki and More, 1997)

The idea of the economy falling into pieces after a financial crisis is also explored by Hall (2010). In his paper, Hall introduces the idea of "financial friction", which deals with a cost to one side of the transaction which is not a benefit to the other side of the transaction. He also argues that financial friction has the same effect on the economy as a property tax on capital. In addition, he claims that the events in September 2008 led to an increase in credit spreads, which is consistent with the financial accelerator model. Furthermore, he argues that a critical component of the credit spread is financial friction. He also underscores the idea that the rise in credit spread led to the widespread of credit rationing, and this resulted in the diminishment of the firms' ability to finance the "acquisition of capital goods", which in turn resulted in the cutback of all types of investment in the economy. Thus, the recession persisted.

Until this point, we have been discussing economic downturns under the assumption that the financial institutions themselves are not adversely affected by the downturn. In those recessions, as we have discussed above, financial institutions did give out credit to businesses even if the credit was either rationed or there were higher costs of credit intermediation. The reason for this was that investors withdrew their wealth from securities and deposited it in banks. But what if financial institutions are at the center of an economic downturn? In a recent study done by the Kansas City Federal Reserve Bank, it is suggested that during financial institutions-centered financial crises, the financial institutions that supply credit found it “harder to attract deposits”. In addition, it is believed that depositors looked for safer ways to invest, such as the US Treasury Bonds. This is consistent with the theory of “flight to safety”. Therefore the level of credit supplied in such recessions will be less than the level of credit supplied in other recessions. This implies that in such recessions, the financial accelerator model tends to exacerbate the economic downturn even more. (Mora, 2010)

Furthermore, it is imperative for us to take into account why there was a decline in bank lending during recent recessions. Changes in both bank capital and problem assets appeared to play a role in the decline in bank lending during the recent “Great” recession. In a test done by Wilkinson and Christensson, they have shown that during the recent recession and financial crisis, business lending by community banks had decreased by sixteen percent. During this period, problem loans and loan loss provisions increased as well. (Wilkinson and Christensson, 2011)

CHAPTER 4: DATA AND METHODOLOGY

As discussed in the previous chapters, the cost of credit is different for large firms and small firms. The primary motive of this paper is to examine whether the difference in cost of credit intermediation between small and large firms is significant in periods of recession as well as other periods.

It is also a formidable task to obtain data pertaining to the cost of credit intermediation for small as well as large firms. Therefore, proxies have been used to represent cost of credit intermediation for the firms. In order to search for suitable proxies, it must be evident that they are highly correlated with the cost of credit intermediation for large as well as small-sized firms. (Walker, 2009) It has been argued in this paper that large firms are usually credit worthy, and credit worthy borrowers usually borrow at the prime rate. Therefore the Prime Rate has been used as a proxy for the cost of credit intermediation for large firms. The Prime Rate is used as a proxy for the analysis of both monthly variables as well as quarterly variables (PRIMONTH and PRIQ, respectively). In addition, it has also been argued that cost of credit intermediation is higher for smaller firms. The cost of credit intermediation for small and independent firms is a mixture of the interest rate they pay on short-term interest rates and the interest rate they pay on credit card. According to the National Federation of Independent Businesses, 92 percent of small businesses/firms use one or more credit cards. Thus, the interest rate on credit cards (CREDCARDQ), released by the Federal Reserve, has been used as a proxy for the cost of credit intermediation for small firms. However, these rates are only generated by the Federal Reserve on a quarterly basis (Feb, May, Aug, and Nov of every year). In order to compare the cost differentials on a monthly basis, the paper uses actual monthly interest rate paid by small businesses on short term loans (INTRM), generated by the National Federation of Independent Businesses. (Walker, 2009) The time period for the analysis is from January 1998 to December 2011. These variables are endogenous, whereas the other variables, which are discussed in this chapter, will be tested for weak exogeneity.

Before specifying the model, it was imperative that the data be tested for non-stationarity. This needed to be done because:

a. When we deal with a non-stationary time series, it is possible for us to study its behavior only for a particular period under consideration since each period will be a different episode, which cannot be generalized for other periods. Therefore, a non-stationary time series will not be of much use for forecasting purposes.
b. If we are dealing with two or more time series and run Ordinary Least Squares Regression, it might lead to spurious regressions. Spurious regressions occur when we get a very high R-squared and significant t-statistics for the regression coefficients. However, these results are not reliable since OLS assumes that the time series are stationary. (Gujarati, 2011)

One of the methods of testing for non-stationarity is the unit root test. The Augmented-Dickey Fuller Test is used to detect whether the time series in question are non-stationary or not.

The series, PRIMONTH, PRIQ, INTRM, and CREDCARDQ will be tested for non-stationarity. The three equations used to test for non-stationarity are given below:

1. $\Delta Y_t = \beta_1 + \beta_2 t + \beta_3 Y_{t-1} + \beta_4 \Delta Y_{t-1} + \beta_5 \Delta Y_{t-2} + \ldots + \beta_{n+2} \Delta Y_{t-n} + \varepsilon_t$ (to test for random walk with drift around a deterministic trend)

2. $\Delta Y_t = \beta_1 + \beta_3 Y_{t-1} + \beta_4 \Delta Y_{t-1} + \beta_5 \Delta Y_{t-2} + \ldots + \beta_{n+2} \Delta Y_{t-n} + \varepsilon_t$ (to test for a random walk with drift)
3. $\Delta Y_t = \beta_3 Y_{t-1} + \beta_4 \Delta Y_{t-1} + \beta_5 \Delta Y_{t-2} + \ldots + \beta_{n+2} \Delta Y_{t-n} + \varepsilon_t$ (to test for a random walk)

Where Y = PRIMONTH, PRIQ, INTRM, and CREDCARDQ.

If the null hypothesis of non-stationarity cannot be rejected in equation 1, and the trend is not significant, then the second equation will be used. If the null hypothesis of non-stationarity cannot be rejected and the intercept is not significant, the third equation would be used. If null hypothesis of non-stationarity cannot still be rejected, it will be concluded that the time series is a pure random walk.

The first differences of the time series will then be taken into consideration. If the time series becomes stationary (i.e. the null hypothesis of non-stationarity can be rejected), the time series is said to be difference stationary or integrated of order one. If it has to be differenced twice to make it stationary, it is said to be integrated of order two.

Once the time series are tested for non-stationarity, the two sets of time series, monthly and quarterly, were tested for co-integration. Two variables are co-integrated if they have a long-term relationship. Therefore any probability of spurious regressions between cointegrated variables is 0. The variables were also tested for cointegration in order to determine whether an error correction term would be needed in the later regressions or not, i.e., a model which reconciles both the short run and long-run behavior of these variables.

Cointegration between two variables can be tested by using the Engle-Granger test. It should be noticed that this test can only be used if there are only two variables in question. For more than two variables, the Johannsen test must be used. Since this is a test to find if there are cointegrating relationship between INTRM and PRIM and PRIQ and CREDCARDQ, it is suitable to use the Engle-Granger Test. In the Engel-Granger test, one of the two variables is regressed against the other. The residual from this regression is, then, tested for unit root. If the residual is stationary, it is concluded that the two variables are cointegrated, and the null hypothesis of no cointegration is rejected.

However, the Engel-Granger test may give contradictory results at times. As stated above, the Johannsen Test is another method of finding whether the two time series in question are cointegrated. Under this test, the null hypothesis is that there is no cointegration between the time series in question. When we are dealing with n variables, the test results indicate if we can/cannot reject the null hypotheses of 1,2,..,(n-1) cointegrating equations.

After the data have been tested twice for cointegration, using different tests, it could be concluded whether the time series are cointegrated or not.

If either the PRIMONTH and INTRM or PRIQ and CREDCARDQ are found to be cointegrated, an Error Correction Model should be used to correct the disequilibrium that arises between the short and long run behavior of the included variables. The Error Correction term is used to connect the short run behavior of a variable to its long-run value.

The next thing will be to analyze what factors affects PRIMONTH, INTRM, PRIQ and CREDCARDQ. Depending on whether or not these variables are stationary or not, the variables will be taken in either their level terms or their first differences. However, if they are cointegrated, the VECM model will be used, which takes into account the differences and not the level terms.

The variables that might explain the changes in PRIMONTH and INTRM have been chosen following Walker's (2010) lead. These variables are the Federal Funds Rate Monthly (FFM), INDEXM (the Business Borrowing Index Monthly released by the NFIB), and QBORSM (percentage of firms borrowing at least once every quarter, released by NFIB). These variables are either in their level values or differenced values. A unit root test will determine whether these variables are stationary or not. If they are stationary, their level values will be taken; otherwise, their differenced values will be used to set up the model, given that they are difference-stationary.

The next step would be to use a VAR/VEC model to analyze the relationship between the dependent variables, PRIMONTH and INTRM and the exogenous variables FFM, INDEXM, and QBORSM. However, it needs to be established that the explanatory variables are exogenous. This can be done using the Block Granger Causality test. If at least one of these variables turns out to be endogenous, a co-integration test must be performed using the variables that are endogenous, PRIMONTH and INTRM. Since there would be more than two variables that need to be tested for co-integration, the Johansen test must be performed.

The VAR model is similar to a system of simultaneous equations. The only difference is that, in the VAR model, the current values of the dependent variable are not present in the right hand side of the equation. The model doesn't differentiate between exogenous and endogenous variables; therefore each system of equations will have the same number of regressors. The number of lagged terms will be the same throughout all systems of equations. Another important reason for using the VAR model in this analysis is that with the use of this model, the impact of a variable can be determined as well as simultaneous impact multipliers.

A critical requirement of the VAR model is that all the time series variables are stationary. If the variables mentioned above are not stationary or difference stationary, then the VAR model cannot be applied to this analysis.

The system of VAR model will be as follows:

$$\begin{pmatrix} \Delta PRIMONTH_t \\ \Delta\ INTRM_t \end{pmatrix} = \begin{bmatrix} \beta_{1L} \\ \beta_{1S} \end{bmatrix} + \sum_{k=1}^{n} \begin{pmatrix} \beta_{kLL} & \beta_{kLS} \\ \beta_{kSL} & \beta_{kSS} \end{pmatrix} \begin{pmatrix} \Delta PRIMONTH_{t-k} \\ \Delta INTRM_{t-k} \end{pmatrix} + \sum_{k=1}^{n} \begin{bmatrix} \alpha_{1S} \\ \alpha_{2S} \end{bmatrix} \begin{bmatrix} X_t \end{bmatrix}$$

$$+ \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \end{bmatrix}$$

,where X is not an endogenous variable. As we have discussed before these variables, including PRIMONTH and INTRM are either in their level values or differences depending on whether they are stationary or not.

Similarly, the system of VAREC equation would be:

$$\begin{pmatrix} \Delta PRIMONTH_t \\ \Delta INTRM_t \end{pmatrix} = \begin{bmatrix} \beta_{1L} \\ \beta_{1S} \end{bmatrix} + \sum_{k=1}^{n} \begin{pmatrix} \beta_{kLL} & \beta_{kLS} \\ \beta_{kSL} & \beta_{kSS} \end{pmatrix} \begin{pmatrix} \Delta PRIMONTH_{t-k} \\ \Delta\ INTRM_{t-k} \end{pmatrix} + \sum_{k=1}^{n} \begin{bmatrix} \alpha_{1S} \\ \alpha_{2S} \end{bmatrix} \begin{bmatrix} X_t \end{bmatrix}$$

$$+ \begin{pmatrix} \mu_1 \\ \mu_2 \end{pmatrix} EC_{t-1} + \begin{pmatrix} \varepsilon_1 \\ \varepsilon_2 \end{pmatrix}$$

where EC is the Errror Correction term. $EC_{t-1} = PRIM_t + \alpha_0 + \alpha_1 INTRM_t$

The same analysis is going to be applied to the quarterly data, the monthly variables being transformed into quarterly variables with the exception of some variables. The proxy variable for the quantity of funds obtained by small firms on a quarterly basis is QCARDQ, which is the total credit card borrowing and is the sum of the revolving and non-revolving credit obtained. The data is released by the Federal Reserve. This replaces QBORSM.

The next step will be to verify the long term relationship or the impact multipliers. To analyze the long term relationship between variables, all the lagged terms and the present terms must be equated. For instance, to see the long term relationship in the monthly data, the level terms of FFM, QBORSM, and INDEXM will be used. A restriction, $PRIMONTH_t = PRIMONTH_{t-1} = PRIMONTH_{t-1}$ and so on, will also be used to determine the long-run impact. (or $\Delta PRIMONTH_t = \Delta PRIMONTH_{t-1} = \Delta PRIMONTH_{t-1}$ if PRIMONTH is non-stationary. The same procedure will be undertaken for INTRM and CREDCARDQ and PRIQ.

Once the long-run values are calculated, the next step in the analysis would be to compare the data in periods of recession and periods of normalcy or growth. For this reason, a new binary variable RECESSIONB is obtained, which has values of 1 during a recession and values of 0 during periods of normalcy or growth. The data is obtained through NBER.

The same analysis will be done, but now a dummy variable for the intercept would be used as well as the slope dummy variable. The values of the binary variable have been determined with respect to the data released by NBER identification of 2001 and 2007. The new binary variable, R, has a value of 1 during a recession and a 0 when there was no recession. The new variables will be R, R*QBORSM, R*INDEXM, and R*FFM for the monthly data, and R, R*QCARDQ, R*FFQ, and R*INDEXQ. The significance of these variables is going to be tested. Depending on whether these variables are significant, we can determine whether the cost of credit intermediation during a recession is different between small and large firms as well as it being different in periods of normalcy versus periods of recession.

CHAPTER 4: RESULTS

4.1 Unit root tests

As we are discussing the factors that affect the cost of credit intermediation for small and large firms, we need to check whether the proxy variables are stationary or not. We have used the Augmented-Dickey fuller test and followed the Doldado et al (1990) procedure and the results are follows:

1. Variable: PRIMONTH

Null Hypothesis (H_0) = PRIMONTH has a unit root.

A. Test for Unit root using trend and intercept

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-1.809054	0.6961

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.087017	0.057785	1.505882	0.1340
@TREND(1998M01)	-0.000322	0.000286	-1.124132	0.2626

Here, it can be observed that the null hypothesis of unit root cannot be rejected; however the intercept and trend coefficients are not significant as well.

B. Test for Unit root for intercept

		t-Statistic		Prob.*
Augmented Dickey-Fuller test statistic		-1.416687		0.5731
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.032477	0.031413	1.033894	0.3027

Again, the null hypothesis of unit root cannot be rejected; however the intercept is not significant.

C. Test for Unit root without intercept and trend

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-1.302243	0.1776

The null hypothesis of a unit root can still be not rejected, and it can be observed that this time series is a pure random walk.

D. Test for difference-stationarity

For this test, the null hypothesis is that ΔPRIMONTH has a unit root.

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-5.265297	0.0000

Therefore, the null hypothesis can be rejected and it can be concluded that the PRIMONTH is difference-stationary, and that PRIMONTH is integrated of order 1, or I(1).

2. Variable: INTRM

Null Hypothesis(H_0): INTRM has a unit root.

A. Test for Unit root using trend and intercept

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-2.573689	0.2930

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.489220	0.207229	2.360767	0.0195

@TREND(1998M01)	-0.000923	0.000659	-1.400372	0.1634

Here, the null hypothesis of non-stationarity cannot be rejected, but it can be observed that the intercept is significant at the 5% level.

B. Test for Unit root using the intercept

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-1.200990	0.6736

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.123607	0.131669	0.938771	0.3492

The null hypothesis of non-stationarity can still not be rejected, and the intercept is not significant anymore.

C. Test for Unit root without trend and intercept

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-1.479160	0.1298

Again, it can be observed that the null hypothesis for non-stationarity cannot be rejected. Therefore, it can be concluded that INTRM is non-stationary. The next step is to check whether INTRM is difference-stationary or not.

D. Test for difference-stationarity

For this test, the null hypothesis is that ΔINTRM has a unit root.

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-18.50543	0.0000

Therefore, the null hypothesis can be rejected and it can be concluded that INTRM is difference-stationary, and that INTRM is integrated of order 1, or I(1).

3. Variable: PRIQ

Null Hypothesis(H_0): PRIQ has a unit root.

A. Test for Unit root using trend and intercept

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-2.460392	0.3474

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.203792	0.095657	2.130435	0.0347
@TREND(1998M01)	-0.000701	0.000471	-1.487400	0.1389

Here, the null hypothesis of non-stationarity cannot be rejected, but it can be observed that the intercept is significant at the 5% level.

B. Test for Unit root using the intercept

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-1.954350	0.3069

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.084167	0.051985	1.619042	0.1074

The null hypothesis of non-stationarity can still not be rejected, and the intercept is not significant anymore.

C. Test for Unit root without trend and intercept

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-1.263481	0.1895

Again, it can be observed that the null hypothesis for non-stationarity cannot be rejected. Therefore, it can be concluded that PRIQ is non-stationary. The next step is to check whether PRIQ is difference-stationary or not.

D. Test for difference-stationarity

For this test, the null hypothesis is that ΔPRIQ has a unit root.

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-3.331908	0.0000

Therefore, the null hypothesis can be rejected and it can be concluded that PRIQ is difference-stationary, and that PRIQ is integrated of order 1, or I(1).

4. Variable: CREDCARDQ

Null Hypothesis (H_0): CREDCARDQ has a unit root.

A. Test for Unit root using trend and intercept

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-1.588209	0.7938

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.406507	0.279276	1.455574	0.1474
@TREND(1998M01)	-0.000338	0.000473	-0.713723	0.4764

Here, the null hypothesis of non-stationarity cannot be rejected, and neither the intercept nor the trend is significant at the 1, 5, or 10 percent level.

B. Test for Unit root using the intercept

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-1.200990	0.6736

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.123607	0.131669	0.938771	0.3492

The null hypothesis of non-stationarity can still not be rejected, and the intercept is not significant.

C. Test for Unit root without trend and intercept

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-1.308892	0.1756

Again, it can be observed that the null hypothesis for non-stationarity cannot be rejected. Therefore, it can be concluded that CREDCARDQ is non-stationary. The next step is to check whether CREDCARDQ is difference-stationary or not.

D. Test for difference-stationarity

For this test, the null hypothesis is that ΔCREDCARDQ has a unit root.

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-12.80625	0.0000

Therefore, the null hypothesis can be rejected and it can be concluded that CREDCARDQ is difference-stationary, and that CREDCARDQ is integrated of order 1, or I(1).

4.2 Tests for Cointegration

4.2.1 Test for Cointegration between INTRM and PRIMONTH

Since both INTRM and PRIMONTH are non-stationary, we need to check if they are cointegrated. As mentioned in the previous chapter, this needs to be done to check whether the VAR or the VEC model should be used in the analysis involving these two variables. Since there are only two variables that are in question, the Engel-Granger test is used. As mentioned in the previous chapter, PRIMONTH is be regressed on INTRM and the residuals are saved. In this analysis, the residuals are stored as EC. EC is then tested for non-stationarity. Under the unit root test, the Null Hypothesis is that EC is non-stationary.

A. Test for Unit root using trend and intercept

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-2.297345	0.4326

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.045964	0.062522	0.735159	0.4633
@TREND(1998M01)	-0.000535	0.000640	-0.835403	0.4048

Here, the null hypothesis of non-stationarity cannot be rejected; however the coefficients of the trend variable and intercept are not significant.

B. Test for Unit root using the intercept

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-2.218388	0.2006

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000172	0.030045	0.005715	0.9954

The null hypothesis of non-stationarity can still not be rejected; however, the intercept is not significant.

C. Test for Unit root without trend and intercept

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-2.225729	0.0255

Again, it can be observed that the null hypothesis for non-stationarity can be rejected at the 5% level. Therefore, it can be concluded that EC is stationary. Hence, INTRM and PRIMONTH are cointegrated. Therefore, the VEC model should be used to analyze the factors that affect the changes in INTRM and PRIMONTH.

In order to confirm this result, the Johansen procedure (1988-91) is performed. The number of lags used for this test is 1. The results are summarized below:

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.151361	29.56054	15.49471	0.0002
At most 1	0.013857	2.316294	3.841466	0.1280

This test is used to examine the number of cointegrating equations. We can reject the null hypothesis of no cointegrating equation between PRIMONTH and INTRM at the 0.1% level; however we cannot reject the null hypothesis of at most one cointegrating equation between PRIMONTH and INTRM at the 10% level. Therefore, INTRM and PRIMONTH are uniquely cointegrated.

4.2.2 Test for Cointegration between PRIQ and CREDCARDQ

Since both PRIQ and CREDCARDQ are non-stationary, we need to check if they are cointegrated. As mentioned in the previous chapter, this needs to be done to check whether the VAR or the VEC model should be used in the analysis involving these two variables. Since there are only two variables that are in question, the Engel-Granger test is used. As mentioned in the previous chapter, PRIQ is regressed on CREDCARDQ and the residuals are saved. In this analysis, the residuals are stored as ECQ. ECQ is then tested for non-stationarity.

A. Test for Unit root using trend and intercept

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-1.253599	0.8953

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.022121	0.050167	0.440952	0.6598
@TREND(1998M01)	-0.000374	0.000521	-0.717112	0.4743

Here, the null hypothesis of non-stationarity cannot be rejected; however the coefficients of the trend variable and intercept are not significant.

B. Test for Unit root using the intercept

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-1.101650	0.7147

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.009463	0.023983	-0.394575	0.6937

The null hypothesis of non-stationarity can still not be rejected, and the intercept is not significant.

C. Test for Unit root without trend and intercept

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-1.106302	0.2431

Again, it can be observed that the null hypothesis for non-stationarity cannot be rejected. Therefore, the residuals are not stationary. It can be concluded that CREDCARDQ and PRIQ are not cointegrated. In order to confirm this result, the Johansen procedure (1988-91) is performed. The number of lags used for this test is 1. The results are summarized below:

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.019042	3.881462	15.49471	0.9129

The null hypothesis of no cointegrating equation cannot be rejected. Therefore at the 5% level, there is no cointegration between PRIQ and CREDCARDQ

4.3 TESTS FOR EXOGENEITY

We have to perform a test for exogeneity to ensure the exogeneity of FFM, QBORSM, and INDEXM for monthly data and FFQ, QCARDQ, and INDEXQ for quarterly data.

4.3.1 Tests for exogeneity of the monthly variables

A Block Granger Causality test for exogeneity was performed and the results of the test are as follows:

a. Variable: FFM

Dependent variable: D(PRIMONTH)			
Excluded	Chi-sq	df	Prob.
D(FFM)	33.13260	2	0.0000
D(INTRM)	2.178612	2	0.3364
All	34.27836	4	0.0000
Dependent variable: D(FFM)			
Excluded	Chi-sq	df	Prob.
D(PRIMONTH)	2.010149	2	0.3660
D(INTRM)	1.251031	2	0.5350
All	3.238653	4	0.5187
Dependent variable: D(INTRM)			
Excluded	Chi-sq	df	Prob.
D(PRIMONTH)	13.51886	2	0.0012
D(FFM)	1.774424	2	0.4118
All	67.06046	4	0.0000

Here, we can see the null hypothesis of ΔFFM not causing ΔPRIMONTH can be rejected at a very significant level, but the null hypothesis of ΔPRIMONTH not causing ΔFFM cannot be rejected. Therefore, there is only a one-way relationship between ΔPRIMONTH and ΔFFM. In the case of ΔINTRM and ΔFFM, we cannot reject the null hypothesis of ΔINTRM not causing ΔFFM and ΔFFM not causing ΔINTRM. Hence we can conclude that ΔFFM is not endogenous.

b. Variable: QBORSM

Dependent variable: D(PRIMONTH)			
Excluded	Chi-sq	df	Prob.
D(QBORSM)	0.459151	2	0.7949
D(INTRM)	1.029635	2	0.5976
All	1.409052	4	0.8426
Dependent variable: D(QBORSM)			
Excluded	Chi-sq	df	Prob.
D(PRIMONTH)	4.079816	2	0.1300
D(INTRM)	1.178268	2	0.5548
All	4.625865	4	0.3279
Dependent variable: D(INTRM)			
Excluded	Chi-sq	df	Prob.
D(PRIMONTH)	65.65220	2	0.0000
D(QBORSM)	1.343829	2	0.5107
All	66.45391	4	0.0000

Here, we can see the null hypothesis of ΔQBORSM not causing ΔPRIMONTH, as well as the null hypothesis of ΔPRIMONTH not causing ΔQBORSM cannot be rejected . Therefore, there is no relationship between ΔPRIMONTH and ΔQBORSM. In the case of ΔINTRM and ΔQBORSM, we can observe similar results. We cannot reject the null hypothesis of ΔINTRM not causing ΔQBORSM and ΔQBORSM not causing ΔINTRM. We can conclude that ΔQBORSM is not endogenous.

c. Variable: INDEXM

Dependent variable: D(PRIMONTH)			
Excluded	Chi-sq	df	Prob.
D(INDEXM)	2.118170	2	0.3468
D(INTRM)	1.248083	2	0.5358
All	3.078016	4	0.5449
Dependent variable: D(INDEXM)			
Excluded	Chi-sq	df	Prob.
D(PRIMONTH)	9.825101	2	0.0074
D(INTRM)	6.207281	2	0.0449
All	16.71681	4	0.0022
Dependent variable: D(INTRM)			

Excluded	Chi-sq	df	Prob.
D(PRIMONTH)	67.09858	2	0.0000
D(INDEXM)	2.786025	2	0.2483
All	68.48541	4	0.0000

Here, we can observe that the null hypothesis of ΔINDEXM not causing ΔPRIMONTH cannot be rejected; however, the null hypothesis of ΔPRIMONTH not causing ΔINDEXM can be rejected at a very significant level. Therefore, there is a one-way relationship between ΔINDEXM and ΔPRIMONTH. We can also observe that the null hypothesis of ΔINTRM not causing ΔINDEXM can be rejected at the 5% level. However, the null hypothesis that ΔINDEXM not causing ΔINTRM cannot be rejected. Therefore, there is a one-way relationship between ΔINDEXM and ΔINTRM. We can conclude that ΔINDEXM is weakly exogenous.

The test results indicate that all of the variables that we are concerned about (QBORSM, INDEXM, and FFM) are not endogenous.

4.3.2 Tests for exogeneity for the quarterly variables.

Variable: FFQ

Dependent variable: D(PRIQ)			
Excluded	Chi-sq	Df	Prob.
D(CREDCARDQ)	0.013579	2	0.9932
D(FFQ)	0.000151	2	0.9999
All	0.014068	4	1.0000
Dependent variable: D(CREDCARDQ)			
Excluded	Chi-sq	Df	Prob.
D(PRIQ)	0.000628	2	0.9997
D(FFQ)	0.000107	2	0.9999
All	0.018871	4	1.0000
Dependent variable: D(FFQ)			
Excluded	Chi-sq	Df	Prob.

D(PRIQ)	0.000878	2	0.9996
D(CREDCARDQ)	0.013509	2	0.9933
All	0.014402	4	1.0000

The results indicate that we cannot reject the null hypotheses of ΔCREDCARDQ not causing ΔFFQ, ΔFFQ not causing ΔCREDCARDQ, ΔPRIQ not causing ΔFFQ, and ΔFFQ not causing ΔPRIQ. Hence we can conclude that ΔFFQ is not endogenous.

Variable: QCARDQ

Dependent variable: D(PRIQ)

Excluded	Chi-sq	df	Prob.
D(CREDCARDQ)	0.016341	2	0.9919
D(QCARDQ)	0.663591	2	0.7176
All	0.677567	4	0.9541

Dependent variable: D(CREDCARDQ)

Excluded	Chi-sq	df	Prob.
D(PRIQ)	0.032764	2	0.9838
D(QCARDQ)	0.471352	2	0.7900
All	0.490172	4	0.9745

Dependent variable: D(QCARDQ)

Excluded	Chi-sq	df	Prob.
D(PRIQ)	0.633331	2	0.7286
D(CREDCARDQ)	0.224366	2	0.8939
All	0.681696	4	0.9536

The results are similar to those of ΔFFQ. We cannot reject the null hypotheses of ΔQCARDQ not causing ΔPRIQ, ΔPRIQ not causing ΔQCARDQ, ΔQCARDQ not causing ΔCREDCARDQ and ΔCREDCARDQ not causing ΔQCARDQ. Therefore, we can conclude that ΔQCARDQ is not endogenous.

Variable: INDEXQ

Dependent variable: D(PRIQ)

Excluded	Chi-sq	df	Prob.
D(CREDCARDQ)	0.011273	2	0.9944
D(INDEXQ)	0.009720	2	0.9952

All	0.023638	4	0.9999
Dependent variable: D(CREDCARDQ)			
Excluded	Chi-sq	df	Prob.
D(PRIQ)	0.023127	2	0.9885
D(INDEXQ)	0.006912	2	0.9965
All	0.025677	4	0.9999
Dependent variable: D(INDEXQ)			
Excluded	Chi-sq	df	Prob.
D(PRIQ)	0.002468	2	0.9988
D(CREDCARDQ)	0.000856	2	0.9996
All	0.004918	4	1.0000

Again, the results are very similar to the results obtained above. We cannot reject the null hypotheses of ΔINDEXQ not causing ΔPRIQ, ΔPRIQ not causing ΔINDEXQ, ΔINDEXQ not causing ΔCREDCARDQ and ΔCREDCARDQ not causing ΔINDEXQ. Therefore, we cannot conclude that ΔINDEXQ is exogenous even though we can conclude that ΔINDEXQ is not endogenous.

4.4 THE MODEL

A critical requirement of the VAR/VAREC model is that all time series in question be stationary. Therefore the next step is to check whether the variables that might affect (the exogenous variable are stationary.

4.4.1 Tests for stationarity of Monthly Variables

As mentioned in the previous chapters, Walker's (2009) lead is followed. The variables are ΔFFM, ΔQBORSM, and ΔINDEXM. We also need to check the stationarity of the level values of these variables in order to construct the impact multiplier model. In order to check the stationarity of variables, the ADF-test for unit root, following the Doldado et al (1990) procedure. is performed. The test results are discussed below:

a. Variable: FFM

1. Test for unit root using trend and intercept

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-1.800233	0.7005

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.054383	0.041939	1.296719	0.1966
@TREND(1998M01)	-0.000350	0.000298	-1.173104	0.2425

2. Test for unit root using intercept

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-1.363982	0.5988

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.010109	0.018311	0.552098	0.5816

3. Test for unit root without trend and intercept

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-1.527638	0.1185

The results indicate that the null hypothesis of non-stationarity cannot be rejected in all three tests. The trend was not significant in the first test and the intercept was not significant in the first as well as the second test. The p-value of the ADF test statistic in the third test is almost significant at the 10% level. This compelled us to perform other tests for stationarity. The DF-GLS test was performed and the results are given below:

		t-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-3.466794
Test critical values:	1% level	-3.508000
	5% level	-2.970000
	10% level	-2.680000

The results of the DF-GLS test indicate that the null hypothesis of a unit root can be rejected. Thus, we can conclude that FFM is stationary.

For our short run model, we need to determine whether ΔFFM is stationary or not. The ADF Test for stationarity was run again and the results are shown below:

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-5.40704	0.0000

As the result shows, the null hypothesis of a unit root can be rejected at a very significant level. Therefore, ΔFFM is stationary.

b. Variable: INDEXM

1. Test for Unit root using trend and intercept

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-3.624057	0.0308

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	14.04378	3.883052	3.616687	0.0004
@TREND(1998M01)	0.010669	0.004275	2.495673	0.0136

The results indicate that the null hypothesis of non-stationarity can be rejected at the 5% level. The results also show that the constant as well as the trend are significant. Thus, we conclude that INDEXM is stationary.

For our short run model, we need to determine whether ΔINDEXM is stationary or not. The ADF Test for stationarity was run again and the results are shown below:

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-9.931625	0.0000

The results indicate that the null hypothesis of non-stationarity can be rejected. Hence, ΔINDEXM is stationary.

c. Variable: QBORSM

1. Test for Unit root using trend and intercept

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-5.060611	0.0003

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	14.69186	2.910157	5.048476	0.0000
@TREND(1998M01)	-0.009747	0.003994	-2.440516	0.0157

The results indicate that the null hypothesis of non-stationarity can be rejected at the 5% level. The results also show that the constant as well as the trend are significant at the 5% level. Thus, we conclude that QBORSM is stationary.

For our short run model, we need to determine whether ΔQBORSM is stationary or not. The ADF Test for stationarity was run again and the results are shown below:

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-14.56497	0.0000

Again the test result shows that the null hypothesis of a unit root can be rejected at a very significant level. Therefore, ΔQBORSM is stationary.

4.4.2 TESTS FOR STATIONARITY OF QUARTERLY VARIABLES

The variables for the quarterly data analysis are ΔFFQ, ΔQCARDQ, and ΔINDEXQ. The Engle-Granger test is performed to test the stationarity of the quarterly variables. The results from the test are discussed below:

a. FFQ

1. Test for unit root using trend and intercept

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-2.159381	0.5086

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.12460	0.077215	1.613676	0.1086
@TREND(1998M01)	-0.000743	0.000545	-1.362767	0.1749

2. Test for unit root using intercept

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-1.670836	0.4442

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.029806	0.033610	0.886817	0.3765

3. Test for unit root without trend and intercept

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-1.601402	0.1028

The results indicate that the null hypothesis of non-stationarity cannot be rejected in all three tests. The trend was not significant in the first test and the intercept was not significant in the first as well as the second test. The p-value of the ADF test statistic in the third test is almost significant at the 10% level. This compelled us to perform other tests for stationarity. The DF-GLS test and the KPSS test were performed and the results are given below:

		t-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-1.227099
Test critical values:	1% level	-2.579404
	5% level	-1.942818
	10% level	-1.615392

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.713283
Asymptotic critical values*:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000

The results of the DF-GLS test indicate that the null hypothesis of a unit root cannot be rejected, even at the 10% level. The results of the KPSS test show that the null hypothesis of stationarity can be rejected at the 5% level. Thus, we can conclude that FFQ is not stationary.

For our short run model, we need to determine whether ΔFFQ is stationary or not. The ADF Test for stationarity was run again and the results are shown below:

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-3.894196	0.0001

As the result shows, the null hypothesis of a unit root can be rejected at a very significant level. Therefore, ΔFFQ is stationary.

b. ΔINDEXQ

1. Test for unit root using trend and intercept

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-2.805761	0.1975

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	17.99574	6.403492	2.810300	0.0056
@TREND(1998M01)	0.012594	0.005993	2.101246	0.0373

The results from the ADF test indicate that the null hypothesis of non-stationarity cannot be rejected. The trend and the intercept are significant at the 5% level.

For our short run model, we need to determine whether ΔINDEXQ is stationary or not. The ADF Test for stationarity was run again and the results are shown below:

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-12.84523	0.0000

As the result shows, the null hypothesis of a unit root can be rejected at a very significant level. Therefore, ΔINDEXQ is stationary.

c. QCARDQ

1. Test for unit root using trend and intercept

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-3.077464	0.1154

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	39903.27	12363.02	3.227632	0.0016
@TREND(1998M01)	233.4228	79.73325	2.927546	0.0040

The results from the ADF test (where the intercept and the trend are highly significant) indicate that the null hypothesis of a unit root cannot be rejected at the 10% level. However the p-value of the test statistic is very close to 10. This compelled us to perform stronger tests of non-stationarity to confirm the results given by the ADF test. The Phillips-Perron test and the KPSS test were performed. The results from these tests are given and discussed below:

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.765794	0.3965
Test critical values:	1% level	-3.469691	
	5% level	-2.878723	
	10% level	-2.576010	

		LM Stat
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.255670
Asymptotic critical values*:	1% level	0.216000

The results from the Phillips-Perron test show that we cannot reject the null hypopthesis of non-stationarity, whereas the results from the KPSS test indicate that we can reject the null hypothesis of stationarity at 1% significance. Hence, we can conclude that QCARDQ is not stationary.

For the analysis of the short-run effects, we need to determine whether ΔQCARDQ is stationary or not. The ADF test was used to test for stationarity. The results are given below:

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-1.144033	0.2294

Here, the null hypothesis of non-stationarity cannot be rejected, even at the 20% significance. This result is surprising, given that all other variables were difference stationary. This compels us to perform stronger tests for non-stationarity. The Phillips-Perron test and the KPSS test are applied to test whether the result shown by the ADF unit root test is reliable. The results from these two tests are discussed below:

1. The Phillips-Perron Test Result

	Adj. t-Statistic	Prob.*
Phillips-Perron test statistic	-13.52452	0.0000

The Phillips-Perron test clearly shows that the null hypothesis of a unit root can be rejected. The adjusted t-stat is highly significant.

2. The KPSS Test Result

			LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic			0.323012
Asymptotic critical values*:	1% level	0.739000	
	5% level	0.463000	
	10% level	0.347000	

The KPSS test result is very consistent with the Phillips-Perron test. The null hypothesis of stationarity cannot be rejected at the 10% level. Therefore, we can conclude that ΔQCARDQ is stationary, and using the ADF test results would have led to a type II error.

4.4.3 VEC MONTHLY MODEL

A. Short Run Model

Now that the requirements for the VEC model are satisfied in terms of the exogenous variables, the model can be set up. As discussed in the previous chapter, the model is:

$$\begin{pmatrix} \Delta\, PRIMONTH_t \\ \Delta\, INTRM_t \end{pmatrix} = \begin{pmatrix} \beta_{1L} \\ \beta_{1S} \end{pmatrix} + \begin{pmatrix} \beta_{2LL} & \beta_{2LS} \\ \beta_{2SL} & \beta_{2SS} \end{pmatrix} \begin{pmatrix} \Delta PRIMONTH_{t-1} \\ \Delta\, INTRM_{t-1} \end{pmatrix} + \begin{pmatrix} \alpha_{1L} \\ \alpha_{2S} \end{pmatrix} \begin{pmatrix} \Delta FFM_t \end{pmatrix} + \begin{pmatrix} \alpha_{2L} \\ \alpha_{2S} \end{pmatrix} \begin{pmatrix} \Delta QBORSM_t \end{pmatrix}$$

$$+ \begin{pmatrix} \alpha_{3L} \\ \alpha_{3S} \end{pmatrix} \begin{pmatrix} \Delta INDEXM_t \end{pmatrix} + \begin{pmatrix} \mu_1 \\ \mu_2 \end{pmatrix} \begin{pmatrix} EC_{t-1} \end{pmatrix} + \begin{pmatrix} \varepsilon_1 \\ \varepsilon_2 \end{pmatrix}$$

For this model, we have only used one lagged value of the dependent variable because the AIC/SBC criterion suggested it. The results of this model are shown and discussed below:

The cointegrating equation is: $EC_{t-1} = PRIM_{t-1} - 5.173 + \underset{(-24.22)}{1.433} INTRM_{t-1}$

	D(PRIMONTH)	D(INTRM)
D(PRIMONTH(-1))	0.176182	0.034765
	(0.03549)	(0.15998)
	[4.96425]	[0.21731]
D(INTRM(-1))	-0.004802	-0.319304
	(0.01553)	(0.07001)
	[-0.30918]	[-4.56085]
C	0.000155	-0.018980
	(0.00477)	(0.02151)
	[0.03238]	[-0.88235]
D(FFM)	0.807552	0.338442
	(0.03135)	(0.14130)
	[25.7619]	[2.39522]
D(INDEXM)	0.001120	0.005567
	(0.00228)	(0.01026)
	[0.49211]	[0.54270]
D(QBORSM)	-0.002569	0.006897
	(0.00174)	(0.00784)
	[-1.47659]	[0.87945]

Table 4.1: Results of the VECM Monthly Model

Interpretations of the model:

a. ΔPRIMONTH has a significant positive autoregressive relationship with its own lagged value, whereas ΔINTRM has a significant negative autoregressive relationship with its own lagged value.

b. ΔPRIMONTH and ΔINTRM both do not have significant autoregressive relationships with each other's lagged values.

c. ΔPRIMONTH and ΔINTRM both have significant positive relationship with ΔFFM. The coefficient of ΔFFM in the model concerning ΔPRIMONTH is almost 2.5 times the coefficient of ΔFFM in the model concerting ΔINTRM.

d. The intercept is insignificant in both models.

e. ΔPRIMONTH does not have a significant relationship with either ΔQBORSM or ΔINDEXM. Similarly, ΔINTRM does not have a significant relationship with either ΔQBORSM or ΔINDEXM. Therefore, there is no significant relationship between price and quantity in terms of monthly data.

B. Impact multipliers and Long run equilibrium

For the long run equilibrium values, we assume that $\Delta PRIMONTH_{t-1} = \Delta PRIMONTH_t = \Delta PRIMONTH$. Similarly we also assume that $\Delta INTRM_{t-1} = \Delta INTRM_{t.} = \Delta INTRM$. The long run equilibrium coefficients are given below. In order to measure the long-run impact, we have taken level values of the exogenous variables as compared to taking the differenced values for the short-run analysis. Since INDEXM, QBORSM, as well as FFM are stationary time series, we were able to use the level values for the analysis.

	ΔPRIMONTH	ΔINTRM
INDEXM	0.0009116	0.0030699
QBORSM	-0.0071857	0.0040791
FFM	0.8055881	0.1101336

Table 4.2: The monthly impact multipliers

Interpretations of the Monthly Impact Multipliers:

Since INDEXM is a proxy for the quantity of funds borrowed by big firms, and QBORSM is a proxy for the quantity of funds borrowed by small firms, it can be observed (table 4.2) that both small and large firms are paying higher prices for larger quantity of funds; however, the cost of credit intermediation is higher for the small firms relative to large firms. The cross quantity elasticity coefficient is negative in the PRIMONTH model, whereas it is positive in the INTRM model. This suggests that the larger quantity small firms borrow, the lesser the cost of credit intermediation for large firms. On the other hand, these results also suggest that the larger quantity big firms borrow, the larger the cost of credit intermediation for small firms. An increase in FFM increases the cost of credit intermediation for small firms as well as big firms.

4.4.3 VAR QUARTERLY MODEL

The requirements for a VAR Quarterly Model are met in terms of the exogenous variables. Therefore, the model can be set up. As we have discussed in the last chapter, the VAR model is as follows:

$$\begin{pmatrix} \Delta PRIQ_t \\ \Delta\ CREDCARD_t \end{pmatrix} = \begin{bmatrix} \beta_{1L} \\ \beta_{1S} \end{bmatrix} + \begin{pmatrix} \beta_{2LL} & \beta_{2LS} \\ \beta_{2SL} & \beta_{2SS} \end{pmatrix} \begin{pmatrix} \Delta PRIQ_{t-1} \\ \Delta CREDCARDQ_{t-1} \end{pmatrix} + \begin{bmatrix} \alpha_{1L} \\ \alpha_{1S} \end{bmatrix} \begin{bmatrix} \Delta FFQ_t \end{bmatrix} +$$

$$\begin{bmatrix} \alpha_{2L} \\ \alpha_{2S} \end{bmatrix} \begin{pmatrix} \Delta QCARDQ_t \end{pmatrix} + \begin{bmatrix} \alpha_{3L} \\ \alpha_{3S} \end{bmatrix} \begin{pmatrix} \Delta INDEXQ_t \end{pmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \end{bmatrix}$$

In order to get consistent and comparable results with the monthly data, a lag length of one is taken. The VAR output is given on the next page.

	D(PRIQ)	D(CREDCARDQ)
D(PRIQ(-1))	-0.001814	0.003488
	(0.01912)	(0.05656)
	[-0.09488]	[0.06166]
D(CREDCARDQ(-1))	-0.001710	0.003288
	(0.02549)	(0.07541)
	[-0.06708]	[0.04359]
C	-0.006098	0.011727
	(0.00571)	(0.01688)
	[-1.06882]	[0.69463]
D(QCARDQ)	1.12E-06	-6.06E-06
	(5.5E-07)	(1.6E-06)
	[2.04198]	[-3.75210]
D(INDEXQ)	0.007741	-0.009009
	(0.00204)	(0.00605)
	[3.78791]	[-1.48978]
D(FFQ)	0.931686	0.239644
	(0.01758)	(0.05203)
	[52.9837]	[4.60570]

Table 4.3 Results from the VAR Quarterly Model

Model Interpretations :

a. ΔPRIQ and ΔCREDCARDQ both do not have significant autoregressive relationships with their own lagged values.

b. ΔPRIQ and ΔCREDCARDQ both do not have significant autoregressive relationships with each other’s lagged values.

c. ΔPRIQ and ΔCREDCARDQ both have significant positive relationship with ΔFFQ. The coefficient of ΔFFQ in the model concerning ΔPRIQ is almost 4 times the coefficient of ΔFFQ in the model concerting ΔCREDCARDQ.

d. The intercept is insignificant in both models.

e. ΔPRIMONTH has a significant positive relationship with ΔINDEXQ as well as ΔQCARDQ. On the other hand, ΔCREDCARDQ has a significant negative relationship with ΔQCARDQ but has an insignificant relationship with ΔINDEXQ. Therefore, we can conclude that the market for funds for small and big firms is not segmented.

B. Impact multipliers and Long run equilibrium

For the long run equilibrium values, we assume that $\Delta PRIQ_{t-1} = \Delta PRIQ_t = \Delta PRIQ$. Similarly we also assume that $\Delta CREDCARDQ_{t-1} = \Delta CREDCARDQ_{t.} = \Delta CREDCARDQ$. The long run equilibrium coefficients are given below. We could not take the level values to measure the long-run impact of the quarterly exogenous variables on the changes of cost of credit because these variables were not stationary.

	ΔPRIQ	ΔCREDCARDQ
ΔFFQ	0.9300	0.2405
ΔQCARDQ	1.1179E-6	-6.0812E-6
ΔINDEXQ	0.0074	-0.0090

Table 4.4 The Quarterly Impact Multipliers

Interpretations of the Quarterly Impact Multipliers:

Since INDEXQ is a proxy for the quantity of funds borrowed by big firms, and QCARDQ is a proxy for the quantity of funds borrowed by small firms, it can be observed that large firms are paying a higher price for a larger amount of funds, whereas small firms are paying lower price for a larger amount of funds. The cross quantity elasticity coefficient is positive in the PRIQ model, whereas it is negative in the CREDCARDQ model. This suggests that the more quantity small firms borrow, the higher the cost of credit intermediation for large firms. On the other hand, the larger the amount of funds borrowed by the larger firms are, the lesser the small firms have to pay for a certain amount of funds. An increase in FFM increases the cost of credit intermediation for small firms as well as big firms; however the change in prices for large firms is about 3 times the change in prices for small firms, which is consistent with the monthly variable analysis. These results do contradict the financial accelerator hypothesis, but it also must be noted that we used the differences rather than level values to estimate the impact multipliers.

4.4 IMPACT OF RECESSION ON THE MODEL

As we have discussed in previous chapters, the cost of credit intermediation increases for small-sized firms. This idea is consistent with the idea of the financial accelerator and the credit rationing model, which state that an economic downturn gets amplified due to the increase in cost of credit intermediation. Therefore, it is of great interest to determine whether the cost of credit intermediation does increase during a recession, and whether the difference between the cost of credit intermediation for small firms and big firms is going to rise. As discussed in the previous chapter, the same analysis was repeated with the use of the dummy variable. The t-statistics of the tests mentioned in the last chapter are noted below.

4.4.1 Effects of Recession on Monthly Data

	Intercept		Card Rate Equation		Prime Rate Equation	
	Δ(PRIMONTH)	Δ(INTRM)	Δ(PRIMONTH)	Δ(INTRM)	Δ(PRIMONTH)	Δ(INTRM)
R	-3.11	-0.36				
R* ΔINDEXM	-3.06	-0.37			1.34	-0.17
R* ΔQBORSM	-3.30	-0.42	-1.59	-0.44		
R* Both	-3.24	-0.21			1.20	-0.21

Note: The t-statistics are rounded off to 2 decimal places
Table 4.5: T-statistics for recessionary monthly binary model

For the monthly model, wherever the t-statistics are significant, the credit prices are lower during the recession. The t-statistics of the intercept model are significant at the 1% level for ΔPRIMONTH. Therefore, the credit prices for large firms decrease during a recession. On the other hand, the credit prices for ΔINTRM do not change since none of the recession coefficients for ΔINTRM are significant even at the 10% level. The other recession coefficients for ΔPRIMONTH are not significant at the 10% level. Thus, it can be concluded that in a recession, the credit prices for large firms decrease and they stay the same for small firms, hence widening the difference in their cost of credit intermediation.

4.4.1 Effects of Recession on Quarterly Data

	Intercept		Card Rate Equation		Prime Rate Equation	
	ΔPRIQ	ΔCREDCARDQ	ΔPRIQ	ΔCREDCARDQ	ΔPRIQ	ΔCREDCARDQ
R	-6.48	-0.43				
R* ΔINDEXQ	-6.13	-1.09			2.00	-4.04
R* ΔQCARDQ	-6.42	0.45	0.38	0.45		
R* Both	-6.07	-1.06	0.43	0.36	2.00	-4.02

Note: The t-statistics are rounded off to 2 decimal places
Table 4.6: t-statistics for recessionary binary quarterly model

For the quarterly model, the credit prices show mixed responses to recession. The t-statistics of the intercept model are negative and are significant at the 1% level for ΔPRIQ. Therefore, the credit prices for large firms decrease during a recession. In the quarterly prime rate models, on the other hand, the t-statistics for ΔPRIQ are positive and significant, which implies that credit prices increase for large firms in a recession. This is not a matter of concern for us since the t-statistics for ΔPRIQ in the intercept model are greater, in absolute terms, than the t-statistics of ΔPRIQ in the prime rate equation. Thus, the net effect is going to be negative. On the other hand, the t-statistics for ΔCREDCARDQ are negative and significant at the 1% level. However, the R-Squared values of these models were so low (0.002 and 0.096,), as compared to the PRIQ model that we can ignore the effect of the recession on the prices for credit for small firms. As a result we conclude that the credit prices for large firms decrease and stay constant for small firms, hence widening the difference in their cost of credit intermediation during a recession. These results are consistent with the theory discussed in Chapter 2.

CONCLUSION

By and large, both the monthly and quarterly results reported in this thesis are consistent with the theories described in the earlier chapters. In both cases, the cost of credit intermediation for small firms and large firms responded to the same economic and financial factors. In addition, the reported estimates also suggest that the impact of economic recession on the cost of credit intermediation was significant. The results suggest that the cost of credit intermediation decrease in a recession; however the decrease appears to be larger in the case of big firms as compared to that of small firms.

The changes in the cost of credit intermediation for small firms as well as large firms were affected by changes in the federal funds rate; however, the reported estimates suggest that the positive change in the federal funds induces a bigger increase in the price of credit for large firms as compared to the price of credit for small firms. In the analysis for the monthly data, the estimates suggest that the price of credit, for both small and large firms, did not respond to the changes in the quantity of credit borrowed in the short-run. As a result, it was not possible to refute the null hypothesis that the market for credit intermediation is not segmented between small and large firms.

To determine which variables affected the cost of credit intermediation for the monthly data in the long-run, this study considered the level values of the variables. The results from the analysis indicate that the quantity borrowed by large firms had a positive impact on the cost of credit intermediation for both types of firms, and the impact was greater for the small firms as compared to the larger firms. In addition, the results suggest that an increase in the quantity borrowed by smaller firms resulted in a decrease in the cost of credit intermediation for larger firms, but led to an increase in the cost of credit for small firms. This result is consistent with the financial accelerator model and the credit rationing model. It also clearly suggests that the credit markets for small firms and large firms are not segmented in the long run.

For the quarterly data, the cost of credit intermediation for large and small firms responded to similar economic and financial factors in the short-run. The cost of credit intermediation for both types of firms had a significant positive relationship with changes in the Federal Funds Quarterly Rate. However, a positive change in the Federal Funds Rate induced a greater rise in the cost of credit intermediation for large firms as compared to the cost of credit intermediation for small firms. This result is consistent with those obtained from the monthly data analysis.

In terms of the cost of credit intermediation responding to changes in the quantity borrowed for the quarterly data, it was shown that a positive change in the quantity borrowed by large firms increases their cost of credit intermediation. In addition, changes in the cost of credit for small firms had a negative relationship with changes in the quantity borrowed by small firms but a positive relationship with the quantity borrowed by large firms. These results are puzzling. The theories argue that it should be the opposite because of the imperfections in the credit market.

The long-run impact multipliers reported for the quarterly data could not be estimated because the variables associated with the quantity borrowed were not stationary. Therefore, the differenced values were taken into consideration, and the results obtained are consistent with the results obtained for the short-run for the quarterly data.

The introduction of the effects of economic recession into the model generated results that were, by and large, consistent with the theories discussed in this paper. For the monthly data, the estimates suggest that a recession decreases the price of credit for large firms, but did not change the cost of credit intermediation for the small firms. Therefore, the reported estimates suggest that during a recession the gap between the prices of credit for small firms and large firms widened.

The results obtained from the impact of economic recession for the quarterly data were very similar to those obtained for the monthly data; however, there were some anomalies in the reported estimates. In general, they suggest that the cost of credit intermediation decrease during a recession. The decrease appears to be greater in the case of the cost of credit intermediation for large firms. Therefore, the results are still consistent with the theories discussed in this thesis.

REFERENCES

Bernanke, Ben Gertler, Mark, and Gilchrist, Simon. (1996). The Financial Accelerator and the Flight to Quality. *National Bureau of Economic Research.*

Stiglitz, Joseph E., Weiss, Andrew.(1981). Credit Rationing in Markets with Imperfect Information.

Levenson, Alec R., and Willard, Kristen L.(1999) Do Firms Get the Financing They Want? Measuring Credit Rationing Experienced by Small Businesses in the US.

Gertler, Mark, and Bernanke, Ben.(1989) Agency Costs, Net Worth, and Business Fluctuations.

Mora, Nada. (2010). Can Banks Provide Liquidity in a Financial Crisis?

Bernanke, Ben. (1983). Non-monetary Effects of the Financial Crisis in the Propagation of the Great Depression

Wilkinson, Jim and Christensson, Jon (2011). Can the Supply of Small Business Loans be Increased?

John Moore and Nobuhiro Kiytaki. (1997). Credit Cycles

Andrei Shleifer and Robert Vishny. (1992). Liquidation Values and Debt Capacity: A Market Equilibrium Approach

Davig, Troy and Hakkio, Craig (2010). What is the Effect of Financial Stress on Economic Activity?

Hall, Rober E. (2010). Why Does the Economy Fall to Pieces after a Financial Crisis

Walker, David A. (2010). Cost of Short-term Credit for Small and Large Firms

Gujarati, Damodar. (2011). Econometrics by Example. Macmillan Publisher