

# **THE FINANCIAL ACCELERATOR AND FIXED ASSET INVESTMENT**

by

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This manuscript has been read and accepted for the Graduate Faculty in Economics in satisfaction of the dissertation requirement for the degree of Doctor of Philosophy.

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**Abstract**

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The foundation of this paper is the theory of the financial accelerator. The implication of the financial accelerator is that small firms have less access to debt than do large firms, and this difference is greater during recessions. Therefore, smaller firms are at a disadvantage during recessions, and this disadvantage can have significant and long-lasting effects. This paper examines the role of credit and the effect on fixed asset investment over the business cycle. The results confirm that there is a shift in credit from small firms to large firms during recessions, and, more specifically, that banks shift short-term debt from small to large firms. The main contribution of this paper to the work on financial accelerators is the focus on fixed asset investment. The results show that a positive shock to the Federal Funds Rate has no impact on large firms' fixed asset investment; however, a positive shock to the Federal Funds Rate negatively impacts the smallest firms' fixed asset investment five quarters after the shock occurs. During monetary tightening, small firms' fixed asset investments are more negatively impacted than are large firms' fixed asset investments, and this discrepancy is partially explained by access to credit.

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## 1. Introduction

This paper examines the effects of credit constraints on fixed asset investment using the theory of the financial accelerator. According to this theory, information asymmetries and moral hazard make the cost of external financing more expensive than the cost of generating funds internally. It is argued that because large firms have more assets as a percentage of sales available for collateral, it is easier for them to borrow. The advantage that large firms have in borrowing should be most evident during recessions and periods of monetary tightening. If the financial accelerator theory holds, then there should be a shift in bank financing toward large firms and away from small firms during recessions and periods of tight money.

Small firms are identified as having higher agency costs and large firms as having lower agency costs. The idea that large firms have lower agency costs and greater access to debt has been long established (Kimmel, 1939) and is in the literature on financial accelerators (Bernanke, Gertler and Gilchrist, 1996, and Oliner and Rudebusch, 1996). There are several motivations for this assumption. One reason is that many of the largest firms are public companies that publish financial data which is audited. In addition, public firms are investigated by the SEC, sell-side researchers, and multiple credit agencies. Another explanation is that many large companies have been in existence for a long time, and have been able to prove their reliability, thereby establishing relationships with lenders. There are also objective differences in risk and liquidity between small and large firms. For example, small firms are more likely to be in a stage of growth, which holds inherent risks. In addition, small firms have lower profit rates and generate less cash flow than do large firms.

The financial accelerator theory implies that at the beginning of a recession, the borrowers with high agency costs will receive a lower share of total credit and, therefore, those

borrowers will constitute a greater proportion of the decline in real economic activity. I use a panel of small and large manufacturing firms to test several aspects of this theory. First, debt composition is examined to establish differences in access to credit for small versus large firms over expansions and recessions. Second, fixed asset investment is analyzed to determine if there are significant differences between small and large firms over the business cycle. Lastly, the relationship between debt and investments is explored to determine whether changes in credit can explain some of the trends in fixed asset investments.

Section 2 of this paper reviews the literature on the theory of the financial accelerator and presents the empirical studies. The empirical studies cover domestic and international markets, and include these topics: commercial paper, bank loans, trade credit and investments in inventory and land. Section 3 explains the contribution of this paper to the financial accelerator literature and explains how fixed asset investment differs from other investments. Section 4 describes the data sources: the Quarterly Financial Report (QFR), the National Bureau of Economic Research (NBER), the Bureau of Economic Analysis, and the Federal Reserve. Section 5 examines these data and analyzes the results of the tests. Lastly, Section 6 presents and summarizes the findings of this study.

## 2. The Financial Accelerator

### 2.1 Theory

I present a framework for understanding the financial accelerator and its implications. This framework was introduced by Bernanke, Gertler and Gilchrist (1996) and is based loosely on Kiyotaki and Moore (1995) and Hart and Moore (1991).

It starts with the assumption that there are two periods, 0 and 1. Inputs in period 0 produce outputs in period 1, and inputs can either be fixed ( $K$ ) or variable ( $x_t$ ). At the end of period 1, the fixed factor  $K$  can be sold at the market price of  $q_1$  per unit and the variable unit fully depreciates. The output in period  $t$  is defined as  $a_t f(x_t)$ , where  $f(\bullet)$  is increasing and is concave and  $a_t$  is a technology parameter. The debt obligation,  $r_0 b_0$ , is inherited from the past, where  $b_0$  is past borrowing and  $r_0$  is the gross real interest rate on this liability for period 0. The amount borrowed during period 1 is  $b_1$ .

In each period the following accounting identity holds:

$$x_1 = a_0 f(x_0) - r_0 b_0 + b_1 \quad (1)$$

This identity indicates that the variable input in time period 1,  $x_1$ , is limited by the cash flows from the previous period,  $a_0 f(x_0) - r_0 b_0$ , and the amount borrowed in period 1,  $b_1$ . The cash flows from the prior period are defined as output from period 0,  $a_0 f(x_0)$ , minus interest expense on debt from period 0,  $r_0 b_0$ .

Assume the amount the firm can borrow in period 1,  $b_1$ , is limited to the present value of fixed assets that can be used as collateral. The value of the fixed assets at the end of the period,  $q_1 K$ , is divided by  $r_1$  to obtain the present value of fixed assets at the beginning of period 1:

$$b_1 \leq (q_1 / r_1) K \quad (2)$$

Substitute equation (2) into (1), to obtain the following identity:

$$x_1 \leq a_0 f(x_0) - r_0 b_0 + (q_1/r_1)K \quad (3)$$

The amount a firm can spend on the variable input  $x_1$  is limited by the cash flows from the previous period,  $a_0 f(x_0) - r_0 b_0$ , plus net discounted fixed assets  $(q_1/r_1)K$ . This framework can be used to analyze the factors that influence variable inputs and, consequently, output.

Define the firm's net worth as  $[a_0 f(x_0) - r_0 b_0 + (q_1/r_1)K]$ . Suppose there exists an optimal value of  $x_1$  that is greater than the firm's net worth. In this case, equation (3) will be binding and the optimal  $x_1$  will not be attainable. A decline in the firm's net worth can stem from several factors. One possible factor is a decline in gross cash flows,  $a_0 f(x_0)$ . This could arise, for example, from a drop in sales during a recession. A second possibility is a fall in asset prices,  $q_1$ . This could occur as the result of either a recession or monetary tightening, if an asset is priced as the present value of future income streams. Another factor that could lead to a decrease in variable inputs is an increase in the real interest rate,  $r_0$ , on the initial debt obligation  $b_0$ . It is also possible for  $r_1$  to rise, which would lower asset values  $(q_1/r_1)$  and reduce spending by lowering the borrower's assets available for collateral.

This financial accelerator framework can be applied to business cycle fluctuations (Bernanke and Gertler, 1989). Through the factors described above, an adverse exogenous shock, such as a recession or monetary tightening, may reduce investment,  $x_1$ . If investment is reduced, then future cash flows,  $a_1 f(x_1)$ , will be reduced. A reduction in cash flows from period 1,  $a_1 f(x_1)$ , may limit the investment available for the next period,  $x_2$ . Through the financial accelerator mechanism, a shock can propagate via autoregressive movements in output and the real economy will be negatively impacted in future periods.

One implication of this model is that the effects of shocks are asymmetric. The financial accelerator effects are stronger during recessions than in booms. In a boom, internal finance is typically sufficient, and fluctuations in profits have less of an effect on spending. In addition, the deeper the recession, the stronger will be the effects of the financial accelerator. “To the extent that negative shocks to the economy reduce the net worth of borrowers, the spending and production effects of the initial shock will be amplified.” (Bernanke, Gertler and Gilchrist, 1996)

The financial accelerator theory implies that limited access to credit can have large effects on the real economy. However, not all economists agree on the mechanism through which access to credit may be limited. Gertler and Gilchrist (1994) identify two theories. The first theory rests on the role of borrowers and their balance sheets and the second theory relies on the supply of loans and on credit rationing.

According to the first theory, an increase in the interest rate will lower the market value of collateral assets, which in turn will lower the amount a firm can borrow. It will also lower net cash flows since interest expense rises. The decline in cash flows and market asset values lowers the amount of funds available for investment. Since a decline in investment in one period leads to a decline in output in the next period, future investment may also be limited. Hence, the downturn will be propagated. In this way, a shift in monetary policy can have effects that last multiple periods after the original shift has occurred. Research that stresses the role of borrowers’ balance sheet includes Bernanke and Gertler (1989), Calomiris and Hubbard (1989), Gertler (1992), Greenwald and Stiglitz (1993), and Kiyotaki and Moore (1997).

The second approach, called the “credit” view, focuses on the lenders. While the first view rests on the difference between borrowers, the credit view implies that if banks reduce the share of loans in their portfolio, then real economic activity will contract. Banks may reduce

loans for several reasons. For example, fear of a bank run will induce banks to reduce lending. A reduction in bank loans may also occur when the Federal Reserve reduces the volume of reserves, and therefore loans (Bernanke and Blinder, 1992). Kashyap, Stein and Wilcox (1993) find that a tighter monetary policy leads to a decrease in bank loans. All firms will suffer from this.

However, firms that are not dependent on banks will not suffer as much because they can obtain loans from sources other than banks. For example, large firms are able to tap financial markets by issuing commercial paper. On the other hand, many small firms are unable to source loans from non-bank suppliers. Work on the “credit” view has been done by Bernanke and Blinder (1992), Romer and Romer (1990), Kashyap, Stein and Wilcox (1993).

A subset of the credit view relies on the notion of credit rationing. Stiglitz and Weiss (1981) find that credit rationing could occur in the loan market because of asymmetric information which leads to either the adverse selection effect or the incentive effect. It is possible that when interest rates rise, the average riskiness of the firm that is willing to borrow at the higher interest rate increases. The combined effect may actually lower the bank’s profit. It is also feasible that firms change their behavior as interest rates rise. A higher interest rate may induce a firm to forgo a safe, low return project in favor of a project with a lower probability of success, but a higher return if it is successful. Under such circumstances, banks may not be willing to give loans to borrowers, even at higher interest rates.

Despite the differences in these approaches, they all predict that exogenous shocks, such as tightening of monetary policy or recessions, will have a greater impact on borrowers with limited access to capital markets. Further, the borrowers with balance sheet constraints overlap considerably with borrowers who are dependent on banks. While small firms are not necessarily bank-dependent, there is a strong correlation between the size of a firm and access to credit

markets. One reason is that large firms have greater access to alternative sources of credit, such as commercial paper. Commercial paper is virtually non-existent for firms with less than fifty million dollars in assets. In addition, large firms have more fixed assets available as collateral, and are therefore a less risky investment for banks.

Although economists have different theories on the mechanism by which the financial accelerator operates, some results are widely accepted. First, financing raised externally is more expensive than financing that is raised internally. One way to significantly reduce the premium on external financing is to provide collateral. This leads to the second generally accepted concept that the premium on external financing varies inversely with the borrower's net worth. The borrower with a higher net worth has more assets available for collateral, and, therefore, will be able to secure funding at a reduced premium (Bernanke, Gertler, and Gilchrist, 1996).

When a recession or period of monetary tightening occurs, large firms should have greater access to credit than small firms, since large firms have more assets available for collateral. Since large firms can secure more financing than small firms, they ought to have higher investment during downturns. This investment should result in an increase in assets, thus bolstering their balance sheets for future downturns. The financial accelerator effect predicts that large firms have an advantage long after an initial shock occurs.

## **2.2 Empirical Studies**

### **a. Domestic Markets**

#### *The Great Depression*

The theory that access to capital can differ by firm size over the business cycle has been of interest since the Great Depression. For example, Kimmel (1939) provides evidence that large firms had greater access to external finance during the mid-1930s depression. He conducted a

survey of credit availability for manufacturing firms from 1933–1938. His sample was restricted to firms that were normally dependent on bank credit. Kimmel divided firms into groups based on assets, with the smallest firms having under \$50 thousand in capital and the largest firms having over \$1 million in capital. He found that, of the largest firms, only 3.2 percent faced credit restrictions. In contrast, 30.2 percent of the smallest firms faced credit restrictions.

Hunter (1982) also looks at the differences between large and small firms during the Great Depression, specifically the differences in firms' balance sheets. She finds that increases in liquidity were mainly limited to large firms, and that this result was because of their superior access to financial markets. Hunter also finds that the difference in liquidity between small and large firms was especially pronounced during the Great Depression.

Bernanke (1983) adds to the literature on the Great Depression by measuring the effect of limited access to credit. He looks at the period 1930 to 1933, and finds that the breakdown in credit amplified the crisis. He attributes this to two reasons. First, the banking system collapsed and, second, there was a dramatic decline in borrower net worth. Only half of the banks that existed in 1930 were still in existence in 1933, and many of those suffered great losses. This reduced the funds available to those lenders who relied mainly on bank credit. This decline in the availability of credit supports the 'lending' view of the financial accelerator. The decrease in borrower's net worth was brought on by both declining output and by sharp deflation. Therefore, borrowers' balance sheets declined, shrinking their collateral and, thus, limiting their ability to borrow.

The research presented thus far looks at the differences in access to credit and the effects of those differences. Merwin (1942) also analyzes the difference between large and small firms over the Great Depression; but, unlike the other authors who look at the disparity in credit, he

looks at disparity in profits. He notes that the most striking financial difference is that small firms, defined as those with assets under \$250,000, have a lower rate of profit than large firms. Moreover, small firms' profits are more volatile over the business cycle. Merwin observes that the largest group, defined as firms with assets greater than \$50 million, actually showed a net profit in every year of the depression from 1931–1933. Fabricant (1935) finds similar evidence using data from the US Treasury Department for the years 1931 and 1932. He divides firms into size based on total net assets and looks at the difference among these groups in total profits as a percentage of total capital. He finds that the biggest decrease in profits as a percent of total capital was in the smallest size firms, which had less than \$50,000 in assets. Their profit as a percent of total capital was -18.2 and -27.1 in 1931 and 1932, respectively. The largest firms had at least \$50 million in total assets, and were the only group of firms to see an increase in profits as percent of total capital. They had profit rates increases of 2.8 and 1.6 in 1931 and 1932, respectively.

Some of the earliest evidence of the link between financial factors and business fluctuations dates back to before the Great Depression. Calomiris and Hubbard (1989) look at the period pre-World War I to find links between financial markets and real economic activity in their paper “Price Flexibility, Credit Availability, and Economic Fluctuations: Evidence from the United States, 1894–1909.” They gather monthly data from *Historical Statistics of the United States, 1789–1945* and the *Commercial and Financial Chronicle*. Calomiris and Hubbard find that shocks to credit availability contribute significantly to output fluctuations during this period: Output growth is correlated with the commercial paper rate, the real flow of loans and the percentage change in liabilities of business failures.

## *Debt*

In their paper, *Financing Constraints and Corporate Investment*, Fazzari, Hubbard and Petersen (1988) argue that the traditional view of the representative firm is not correct because internal and external financing are not perfect substitutes. They argue that capital market imperfections, such as asymmetric information and moral hazard, require external financiers to evaluate the quality of a firm's investment opportunities. However, gathering information and monitoring firms is very costly for lenders. Fazzari, Hubbard and Petersen document the differences in financing patterns to firms according to the size of the firm. They consider explanations for why internal and external modes of financing are not perfect substitutes.

Fazzari, Hubbard and Petersen use QFR manufacturing data from 1970–1984, and find that differences in debt finance across size groupings are important. Firms with assets of less than \$250 million obtained most of their debt finance from banks, while firms with assets over \$1 billion secured more than 85 percent of their new debt from nonbank sources.

Kashyap, Stein and Wilcox (1993) look at the differences in bank loans and commercial paper after a period of monetary tightening. The authors identify periods of monetary tightening using Romer (1990) dates. They look at movements in commercial paper, bank loans and the combination of these in the year before and three years following each Romer date. They find that over the first year after a Romer date, commercial paper issuance increases sharply. Bank loans are initially static, but fall after two years, and the mix of bank loans to commercial paper declines significantly. Kashyap, Stein and Wilcox take this result as evidence that the loan-supply channel of monetary policy may be significant.

Oliner and Rudebusch (1996) build on the work done by Kashyap, Stein and Wilcox (1993), which examines the relative changes in bank loans and commercial paper after a

monetary shock. Oliner and Rudebusch argue that one drawback with Kashyap, Stein and Wilcox is that it does not differentiate between small and large firms. Only large corporations can issue a significant amount of commercial paper, while small firms rely heavily on banks as their primary source of funding. Since small firms issue so little commercial paper, the ratio of bank debt over bank debt plus commercial paper is almost always one for small firms. The ratio used by Kashyap, Stein and Wilcox does not capture changes in the importance of bank versus non-bank debt for small firms.

Oliner and Rudebusch use all forms of short-term nonbank debt, not just commercial paper. They examine the effects of monetary shocks using Quarterly Financial Report (QFR) data, but unlike many other studies using QFR data, such as Gertler and Gilchrist (1994) and this paper, they define the small firm group as accounting for 15 percent of the total fixed capital in manufacturing. The pattern they observe of the changes in short-term debt between small and large firms after monetary tightening is consistent with that found by Gertler and Gilchrist (1994). For large firms, at first after the monetary contraction short-term debt rises, while small firms' debt decreases. And, the difference in debt growth between small and large firms is statistically significant. Oliner and Rudebusch take this as evidence of a reallocation of short-term credit from small firms to large firms.

These findings are consistent with that of Srinivasan (1986) who finds that internal finance is more volatile over the business cycle for small and medium-sized firms than for large firms. Also, during downturns large firms have greater access to credit. Thus, business recessions and other events that decrease internal cash flow will have a greater negative effect on the growth rates and investment behavior of small firms.

One could argue that the reduction in loans to small firms is a result of lower demand on the part of the small firms. This could happen, for example, if small firms' sales fall more during recessions than large firms' sales. However, Nilsen (2002) finds that during monetary contractions small firms do not voluntarily cut bank loans since they increase a less-desirable alternative, trade credit. He defines trade credit as a loan a supplier provides to its customers in conjunction with product sales. Since trade credit is unattractive, firms would not switch from loans to trade credit unless it is their only alternative.

We would expect small firms to increase their trade credit during periods of monetary tightening. Large firms, on the other hand, have more options of alternative credit sources. For example, large firms can issue commercial paper (Oliner and Rudebusch 1996). Kashyap, Stein, and Wilcox (1993) show that firms issue more commercial paper during monetary contractions. Gertler and Gilchrist (1994) provide evidence that large firms actually accelerate loans from banks during tight monetary policy. Since large firms have access to credit through both bank loans and commercial paper, they are not expected to increase trade credit.

Nilsen tests this hypothesis using data from the QFR, and splits the sample into small and large firms. He finds that both small and large firms increase trade credit during monetary policy contractions. The use of trade credit by large firms at first seems counter to logic: since firms are profit seeking, we would not expect them to use more expensive sources of credit when other sources are available. However, upon deeper inspection, Nilsen finds that only firms with no bond rating increase trade credit. This suggests that some large firms are also credit constrained, and therefore, the largeness of a firm is an imperfect proxy for credit quality.

## *Investment*

Showing that access to credit is asymmetric is only the first step in proving the existence of a financial accelerator. It is also necessary to show that the disparity in access to credit has significant effects on the real economy. Kashyap, Stein and Wilcox (1993) do this by first showing the mix of debt changes following a monetary contraction, and then trying to determine whether the shift in loan supply affects investment while controlling for changes in interest rates and output. They find that the mix of bank loans to commercial paper is a significant determinant of inventories, and that there is a positive correlation between bank loans and inventories. They also find that the mix of debt is important in explaining equipment investment, but less so than in inventory investment. Lastly, they find that mix is not significant for residential investment. The authors conclude that the inventory and investment declines that follow a monetary contraction should be disproportionately concentrated among bank-dependent firms.

This dissertation draws on many of the ideas analyzed in Kashyap, Stein and Wilcox (1993) and builds on those ideas by analyzing data that differentiates between small and large firms. Kashyap, Stein and Wilcox (1993) use bank loan and commercial paper data from the Federal Reserve Board's (1980) flow-of-funds publication and Moody's. Inventory and investment data are from the MPS quarterly-model data base and the National Income and Product Accounts. The use of aggregate data precludes them from differentiating between small and large firms. Since the QFR reports data by asset size, they can be used to make inferences about the differences between small versus large firms over the business cycle.

Gertler and Hubbard (1988) build on the literature by providing evidence of asymmetric effects in financing and investment over the business cycle. They use data on 421 manufacturing firms over 1970–1984 and estimate an investment regression based on Tobin's Q over three

categories of firms: high retention firms (firms with a high income to dividend ratio), medium retention firms and low retention firms. They argue that high retention firms are more constrained since they pay out a relatively lower dividend compared to their income. Indeed, they find that greater retention is associated with a closer link between internal finance and investment, which supports the view that internal and external finance are imperfect substitutes for some firms. In addition, most high retention firms are small and are growing rapidly. This is consistent with the predictions of the asymmetric information theory which highlights the importance of a firm's internal net worth.

More recent literature confirms the existence of the financial accelerator. Vijverberg (2004) uses a multi-equation switching regression model, and finds that due to asymmetric information and credit rationing, a firm's financial status will affect its investment behavior. A credit shock will affect firms' spending on capital and inventory investment. These results support the Financial Accelerator theory that monetary or other shocks may be amplified through the effect of credit on firms, and that changes in balance sheets over the business cycle impact firms' spending.

### *Inventory*

In *Credit Conditions and the Cyclical Behavior of Inventories*, Kashyap, Lamont and Stein (1994) look at US manufacturing firms' inventory during various macroeconomic periods. They find that during the tight monetary periods of 1981–1982 and 1974–1975 inventory investment of firms without access to public bond markets is liquidity-constrained.

They are motivated by the facts that inventory movements play a major role in business cycle fluctuations (Blinder and Mancini, 1991) and that recessions usually follow a period of tight credit (Eckstein and Sinai, 1986).

The paper by Kashyap, Lamont and Stein notes that constraints occur for at least two reasons. The first reason is that some firms are not able to borrow at the observed commercial paper rate, and some may face quantity rationing constraints (Stiglitz and Weiss, 1981; Jaffee and Russell, 1976). The second reason is that some borrowers are “bank-dependent” which means that they need external financing but do not have access to public debt markets.

Kashyap, Lamont and Stein create a variable “mix” that they define as the ratio of corporate bank borrowing to commercial paper borrowing. The intuition is that a decline in the mix variable indicates a contraction in bank loan supply. They then show that tight monetary policy typically leads to a fall in this “mix.” So, tight money reduces bank loan supply to a greater extent than it decreases commercial paper supply.

Next, they use standard inventory models and add this “mix” to the analysis. Kashyap, Lamont and Stein use Compustat data on publicly traded firms. They find that the inventory investment of firms without access to public debt markets is significantly liquidity-constrained.

Gertler and Gilchrist (1994) use QFR data to look at sales, inventories, and short-term debt. For periods of monetary tightening, they use the “Romer dates” identified by Romer and Romer (1989, 1994). The authors use size as a measure of capital market access. They acknowledge that while it may not be a direct determinant, firm size is strongly correlated with the main factors that do matter. For example, younger firms have greater information asymmetry, which leads to higher costs of external financing. They are also less likely to have assets to use as collateral. These firms are also usually smaller. There has been much additional work on the

strong correlation between firm size and external financing. For example, Gertler and Hubbard (1988) show that smaller firms rely more on intermediary credit, while large firms use more direct credit such as equity, public debt, and commercial paper. Fazzari, Hubbard and Peterson (1988) find that smaller firms are more likely to face liquidity constraints.

Gertler and Gilchrist find that the growth rate of sales declines more sharply for small firms after monetary tightening and during recessions. Inventory growth follows a similar decline and this drop is slightly more pronounced than is that in sales growth. Gertler and Gilchrist find that large firms' inventory grows slightly just before a recession, while small firms' inventory growth declines over recessionary periods, and does so at a faster pace than do large firms. Lastly, they look at short-term debt. For small firms, short-term debt consists predominantly of bank loans, whereas for large firms it is mainly commercial paper and bank loans. The pattern for short-term debt is similar to inventory. Before a recession, large firms' short-term debt rises, and then falls as the recession begins. Small firms' short-term debt declines before the recession starts and is steady throughout. They also find that commercial paper issues, which are mostly for large firms, rise after Romer dates and do so at the same general pace as do bank loans from large firms.

Bernanke, Gertler and Gilchrist (1996) build on previous research that used QFR data (Gertler and Gilchrist, 1993, 1994, and Oliner and Rudebusch, 1993) by controlling for industry membership and splitting the sample based on criteria other than size. They follow previous studies that test for the differences between small and large firms in the growth rates of sales, inventories and short-term debt. They use the categorization of small and large firms which correspond to previous studies in order to determine the differences between them, and then use the industry-adjusted differences to see if, and to what extent, the two vary significantly. They

find that the differences between the industry-adjusted and unadjusted series are modest in all cases. This verifies the results of previous studies that only used disaggregated data.

Next, they divide the firms into either 'bank-dependent' or 'not bank-dependent,' and again test for differences in the growth rates of sales, inventories and short-term debt. They define bank-dependent as having no commercial paper and having at least 50% of short-term liabilities in the form of bank loans. The bank-dependent firms are characterized as firms facing high agency costs of borrowing, and having little access to open-market forms of credit. They find this does not change the qualitative nature of the results: The sales of the bank-dependent firms are somewhat less pro-cyclical than are the sales of small firms, but the behavior of bank-dependent firms' inventory and short-term debt is still strongly pro-cyclical. These results support earlier findings that there are significant cross-sectional differences between borrowers that are likely to be subject to agency costs and those that are not.

### *Land*

Kiyotaki and Moore (1997) look at how credit constraints interact with the real economy over the business cycle. They start with the premise that credit constraints arise naturally because lenders cannot force borrowers to repay their debts. To hedge against potential losses, lenders require loans to be secured by some form of collateral such as land, buildings or machinery. In this case, durable assets are both factors of production as well as collateral for loans. The amount of credit available to a borrower will be limited by the value of the assets available for collateral.

The authors go on to consider a temporary shock in which the net worth of borrowers is reduced. If the borrowers' assets available for collateral are reduced, they are unable to borrow more and are forced to cut back on investment expenditure. Thus, in the next period, less revenue

is earned. Accordingly, net worth falls, and as a result they are unable to borrow more and their investment expenditure falls. This repeated effect means that a shock in net worth in one time period is amplified in subsequent time periods. This is referred to as the multiplier effect. On the other hand, a firm with no credit constraints will not suffer any long-term effect from a temporary shock in net worth.

The basic model of Kiyotaki and Moore examines the impact of the multiplier effect resulting from a temporary shock to land prices. They find that the multiplier effect on land prices exceeds that of the static effect by a factor equal to the inverse of the net real interest rate. In addition, the marginal productivity of land for the constrained firms is higher than that for the unconstrained firms.

Kiyotaki and Moore show that asset prices, and shocks to asset prices, reflect future market conditions via the feedback loop captured in the multiplier effect. When the effects of a shock are persistent, the cumulative impact on asset prices, and hence on net worth, can be significant. One weakness of this model is that it does not identify which firms are more likely to become credit constrained.

## *Employment*

Some economists looked to other areas such as employment to prove that credit market frictions exist and that they affect the real economy. In *Financial Market Imperfections, Firm Leverage, and the Cyclicalities of Employment* (1994), Sharpe looks at the effects of the financial markets on the real economy by examining the role of financial leverage as a propagation mechanism in the business cycle. He uses Compustat data to gather annual observations on manufacturing firms from 1959–1985. He employs both instrumental variable and ordinary least squares models, and looks at employment, sales, firm leverage and firm size. He finds that employment at small firms, and at more highly leveraged firms, has greater sales elasticity over the business cycle. This reinforces earlier works (such as Gerlter and Gilchrist, 1993) that show that financial market imperfections, and the constraints to which they give rise, have significant effects on, and implications for, cyclical dynamics. This paper goes further by showing that even after one controls for the greater cyclicalities of sales in small firms, these small firms still have more pro-cyclical employment.

In *Credit Market Frictions and the Allocation of Resources over the Business Cycle* (2002), Barlevy argues that credit market frictions may cause a reallocation of resources from more efficient firms towards less efficient firms. The traditional view is that less productive jobs are cut during recessions. Barlevy introduces credit constraints to the traditional view, and finds the opposite: efficient firms are forced to cut labor during recessions. He tests the hypothesis that the firms that are most vulnerable to credit market frictions are the ones that will reduce labor the most. Barlevy finds evidence that firms with higher output per worker tend to borrow more, and suggests that these groups are more vulnerable to credit constraints. This research offers further evidence that credit market imperfections can affect the real economy over the business cycle.

## **b. International Markets**

Vermeulen (2002) relies on the central theory of the financial accelerator: that real or monetary policy shocks can be amplified by firms with weak balance sheets. He argues that the effect should be stronger in downturns than in booms and also should be greater for small firms than for large firms. This is akin to Gertler and Gilchrist (1993, 1994), who said, “the financial propagation mechanism is likely to be asymmetric over the cycle- more potent in downturns than in booms,” and “the financial propagation mechanism is more applicable to ‘small’ borrowers.”

Using data from the BACH database, Vermeulen looks at the four countries in continental Europe (Germany, France, Italy, and Spain) over the period spanning 1983–1997. BACH, Bank for the Accounts of Companies Harmonized, aggregates the balance sheet and profit and loss accounts of non-financial enterprises for eleven European countries. The contents of BACH cover 13–23 sectors and 3 size classes, and span from the early 1980s to the mid–1990s. Vermeulen uses this database to test three hypotheses. The first tests whether balance sheet positions are significant determinants of firm investment spending. The second hypothesis is that during downturns balance sheet positions are more important in explaining firm investment spending than they are in other times. The third hypothesis is that differences in credit availability influences small and large firms investment spending differently, with small firms influenced more.

The results of these tests provide evidence that the financial accelerator is present in Europe, that is has different strength across size class, and that it has asymmetric effects over the business cycle. More specifically, the effect of weak balance sheets in downturns was stronger in France and Italy than it was in Germany and Spain. Vermeulen also found that small firms seem to be most vulnerable to weak balance sheets, and this vulnerability was consistent across

upturns and downturns. Medium sized firms were not influenced by weaker balance sheets during upturns, but were vulnerable during downturns. Large firms, on the other hand, were relatively immune from the accelerator effect during both upturns and downturns.

Chirinko and Schaller (1995) test whether financial constraints exist and if they are due to information asymmetries. They used a sample of 212 Canadian firms over the period 1973–1986. The data is taken from the Laval and *Financial Post* databases, which are comparable to the CRSP and COMPUSTAT databases. The authors sort firms according to three characteristics that measure the degree of information asymmetry: age, ownership structure, and industrial group.

The first characteristic is age, since mature firms have fewer information problems. This may happen because lenders have more information on firms that have been visible for an extended period, or because mature firms have been able to enter into repeated contracts thereby developing relationships. The second characteristic is the ownership structure of the firm. Canada differs from the United States in that a substantial proportion of publicly traded firms are largely owned or controlled by a single shareholder. The more concentrated the ownership, the more closely managers' interests should be aligned with shareholders. This ought to reduce agency problems and monitoring costs. Nearly all the firms in the sample studied qualified as having concentrated ownership. The last characteristic is membership in an interrelated group of firms. Canada has several major industrial groups that involve ownership or other relationships between many distinct enterprises. By entering into long-term relationships with interrelated firms, a firm can credibly communicate private information about the quality of individual projects with other firms from whom they might secure financing. If a firm is majority-owned or effectively controlled by one of the Canadian industrial groups then it is considered a member.

The authors find that the firms in weak information positions have larger coefficients of liquidity. This indicates that liquidity matters more for firms that find it difficult to “credibly communicate private information,” which implies that financial constraints are significant and that they arise mainly from information asymmetries.

In “Corporate Structure, Liquidity, and Investment: Evidence from Japanese Industrial Groups”, Hoshi, Kashyap and Scharfstein (1991) examine credit availability and liquidity in Japan. The structure of the Japanese economy, in which firms form industrial groups, enables them to divide firms into two sets. The first set maintains close financial ties to large Japanese banks. The second set does not maintain close ties to any major banks. Since the first set has a history of working with banks, they should have fewer information asymmetries. Therefore, the cost of external capital should be lower for them than it would be for the group with no ties to a major bank. Since the cost of external capital is higher for the second set of firms, we should expect those firms to rely more on internally generated capital for investment and expect their sensitivity of investment to firm liquidity should be higher.

Hoshi et al. use panel data of Japanese industrial firms to see if liquidity is more important in determining investment for independent firms with no ties to banks than it is for firms with ties to banks. They find that investment is much less sensitive to liquidity for firms with ties to banks. This supports the financial accelerator theory that capital market imperfections may help to exaggerate business cycle fluctuations.

### **3. Contribution: Debt Composition and Fixed Assets**

Most literature on the financial accelerator has focused on proving the existence of the financial accelerator and illustrating the ways in which it manifests. Some empirical work has focused on the effect of monetary shocks and business cycles on inventory (Gertler and Gilchrist, 1994), employment (Greenwald and Stiglitz, 1993) and land prices (Kiyotaki and Moore, 1997). This paper looks at the effects of business cycles on fixed asset investment by determining whether or not fixed asset investment is different across the business cycle for large firms versus small firms. If it is established that fixed asset investment is different across the business cycle, the next step is to determine how much of the fluctuation is explained by access to bank debt.

There are several factors that make fixed assets investment more complicated than other investments. These factors include inventory and employment. The time when many fixed asset investments are made may be far in advance of their actual use. Evans (1967) finds that fixed asset investment lags the planning period for that investment. Many empirical tests have been conducted to determine the average length of this lag. Meyer (1960) conducted a study of the average lag time of investment decisions in manufacturing firms. In his study, "Plant and Equipment Lead Times," he determined that the average time from the start of construction to completion is about 15 months. This result is corroborated by Department of Commerce data which show a construction period of 13.1 months. The time from a final decision to build to the start of actual construction is six months; so, the sum of time from the final decision to build until completion is approximately 19 months.

Although planning is made before actual investment, modifications to the plan are possible. The flexibility of fixed asset investments is limited, but we should still expect to see a cut-back in spending during recessions. Evans highlights the important distinction in investment

planning between original plans and modifications of these plans. Investment plans may be made a year or more in advance of construction, but modifications of these plans may take place shortly before investment is actually started. Unfortunately, data on original plans and modifications are not publicly available. Nevertheless, we can compare the difference between small and large firm investment to determine whether or not there is a significant difference in investment rates.

Evans notes that because fluctuating sales will lead to fluctuating capital requirements, firms may not have an equilibrium capital-output ratio at any given time when investment plans are made. This misalignment will be especially large when changes in sales are large and unforeseen. This may be the case during periods of monetary tightening and during recessions and other economic shocks. Evans finds that for extremely large firms interest rates are not an important determinant of investment, since large firms have more than enough internally generated funds to finance capital requirements. However, small firms may not have enough internally generated funds, and hence may rely on access to credit.

Our study evaluates the extent to which bank debt explains fixed asset investment, and whether such debt and investment differs between small and large firms over the business cycle. The expectation is that monetary shocks and downturns in business cycles have a larger affect on small firms' investments in fixed assets than on large firms' investments in fixed assets.

## **4. Data**

### **4.1 Quarterly Financial Report**

This paper uses data from the Quarterly Financial Report for Manufacturing Corporations (QFR). The QFR reports quarterly aggregate statistics on real and financial variables for the manufacturing sector, spanning from 1958 to the present. It is compiled by the U.S. Census Bureau, and covers approximately 4,600 large manufacturing corporations and 5,000 selected small and medium sized manufacturing corporations. The sample of firms is updated annually from Federal income tax records. Using the tax data, corporations are selected randomly by industry and asset size. Each quarter, one-eighth of the sample panel is replaced. Corporations that are selected are followed for eight quarters. The time series are divided into eight size classes based on gross nominal assets. These range from under five million dollars in gross assets to over one billion dollars in gross assets.

The QFR is often employed to research the financial accelerator. For example, it has been used by Fazzari, Hubbard and Petersen (1988), Gertler and Gilchrist (1994), Oliner and Rudebusch (1996), Bernanke, Gertler and Gilchrist (1996), and Nilsen (2002). It is also the primary source for current estimates of corporate profits for the Nation's Gross Domestic Income Accounts.

The QFR has two significant advantages compared to Compustat. One is that it provides cross-sectional data at the business cycle frequency. Compustat only provides annual data and, therefore, may be unable to capture the effects of business cycle fluctuations. The second advantage of the QFR data is that it is comprehensive in that it covers both public and private companies. Compustat, on the other hand, covers only public companies.

One of the drawbacks of the QFR is that the data are not firm-level. So, one cannot directly identify which firms have access to various financial markets. In following previous research using this data source, our study uses size as a proxy for access to credit. The second concern in using the QFR data is how to account for inflation, since firm size is measured in nominal terms, and is not adjusted for inflation.

A third drawback is that the QFR only covers the manufacturing sector—a sector which has been in a relative long and steady decline, and is not as important to the U.S. economy as it once was. This underestimates the effects of the financial accelerator on the total economy. For example, the U.S. Department of Commerce reports that in 2002 the share of sales by firms with less than \$100 million in revenue was 22.6% in manufacturing firms, 50.8% in wholesale trade, and 74.2% in construction firms.

#### **4.2 NBER Recession**

The NBER defines a recession as "a significant decline in economic activity spread across the economy, lasting more than a few months, normally visible in real GDP, real income, employment, industrial production, and wholesale-retail sales." Dates of recessions are established by finding the date of the most recent peak in GDP to the most recent trough in GDP. The length of a recession is the interval of the negative trend in GDP. There are several benefits to defining recession by this method. The NBER contends that by measuring a wide range of economic factors, rather than just GDP, they can obtain a more accurate assessment of the health of the economy. For example, the NBER considers not only the product-side estimates like GDP, but also income-side estimates such as the gross domestic income (GDI). Second, by using monthly rather than quarterly economic indicators, the NBER can more precisely measure the

duration of economic expansion and recession. Also, by using a looser definition, they can take into account the depth of decline in economic activity and therefore delineate between recession and stagnation. The recession periods that are relevant for this study are: December 1969–November 1970, November 1973–March 1975, January 1980–July 1980, July 1981–November 1982, July 1990–March 1991, March 2001–November 2001 and December 2007–ongoing.

#### **4.3 Bureau of Economic Analysis: Gross Domestic Product**

Gross Domestic Product (GDP) is reported by the Bureau of Economic Analysis. It is defined as the market value of final goods and services produced by labor and capital within the United States during a given period. GDP is the sum of personal consumption expenditures, gross private domestic investment, exports, imports, and government consumption expenditures and gross investment. Personal consumption expenditures consist of purchases of goods and services by households and by nonprofit institutions serving households. Gross private domestic investment consists of purchases of fixed assets (equipment, software, and structures) by private businesses that contribute to production and have a useful life of more than one year. It also includes purchases of new homes by households, and of private business investment in inventories. Inventory investment includes the value of goods produced during a period but not sold, less sales of goods from inventories that were produced in previous periods. It is measured as ending period less beginning period inventories valued at current prices.

Exports consist of goods and services that are sold or transferred by U.S. residents to residents of the rest of the world. Imports, which is deducted in the calculation of GDP, consists of goods and services that are sold or transferred by the rest of the world to U.S. residents.

Government consumption expenditures represent the value of goods and services provided to the public by governments, such as defense or education. Gross government investment consists of government purchases of equipment, software, and structures to use in producing those goods and services.

The GDP Deflator calculated by the BEA is used to measure changes in the overall level of prices for the goods and services that make up GDP. The BEA reports quarterly estimates in chained dollars. The annual changes in quantities and prices are calculated using a Fisher formula that incorporates weights from two adjacent years. These annual changes are multiplied together to form time series of quantity and price indexes. Quarterly changes in quantities and prices are calculated using a Fisher formula that incorporates weights from two adjacent quarters; quarterly indexes are adjusted for consistency to the annual indexes before percent changes are calculated. The GDP Deflator is used to convert all data series to real variables.

#### **4.4 Federal Reserve: Federal Funds Rate**

The federal funds rate is specified by the Federal Open Market Committee (FOMC) as a short-term objective for open market operations. The federal funds rate is the interest rate at which depository institutions lend balances at the Federal Reserve to other depository institutions overnight. The Federal Reserve's objective for open market operations has varied over the years. During the 1980s, the focus gradually shifted toward attaining a specified level of the federal funds rate, a process that was largely complete by the end of the decade. Beginning in 1994, the FOMC began announcing changes in its policy stance, and in 1995 it began to explicitly state its target level for the federal funds rate.

## **5. Empirical Analysis**

### **5.1 Debt Composition**

Debt composition for the period spanning Q1 1974 through Q2 2010 is divided into two groups: debt composition during recessions and debt composition during expansion. The debt categories used are those reported by the Quarterly Financial Report (QFR). The QFR breaks debt into short-term and long-term debt. Short-term debt includes debt from banks, commercial paper, short-term loans from sources other than banks, and ‘other short-term,’ which includes accounts payable, taxes payable, current portion of long-term debt and other accrued expenses. Long-term debt is broken down into two main categories: long-term loans from banks and ‘other long-term’ loans. These include bonds, other long-term loans and all other non-current liabilities including deferred income taxes, capitalized leases, and minority stockholders’ interest in consolidated domestic corporations.

According to the financial accelerator theory, information asymmetries make the cost of external finance more expensive than the cost of internally generated funds. It has been argued that large firms have more assets available as collateral and hence it is easier for them to borrow. This advantage should be most evident during recessions and periods of tight monetary supply. If the financial accelerator theory holds, then we should see a shift of bank financing toward large firms and away from small firms during recessions and periods of tight money.

Firms are divided into size classes based on total assets under management. Then, the average share of total debt given to each asset class is analyzed to determine if it differs during periods of expansion and periods of recession. If the financial accelerator theory holds, then, during recessions, bank debt should be larger than average for larger asset classes and smaller than average for small asset classes.

Table I lists the distribution of short-term debt and commercial paper by firm size during recessions and expansions from 1974 through 2010. Several trends are observed. First, the share of total short-term bank debt goes down for the two smallest assets classes during recession. For example, firms that have \$25 million or less in total assets would, on average, hold 33.6% of the total short-term bank debt. However, during recessions, that percent decreases by 2.8, so that during those times they only hold 30.8% of total short-term bank debt. The three largest asset classes, 8–10, show increases in their share of short-term bank debt. This illustrates that, on average, during recessions banks shift short-term debt away from small firms and toward large firms. A z-test is conducted to determine whether the difference in the average distributions over recession and expansion are statistically different. The resulting z-score of 31 indicates that the distribution is highly likely to be statistically different during recession versus during expansion.

The figures on commercial paper indicate that small firms have very little access to the commercial bond market. The largest firms, those with \$250 million and more in assets, hold most commercial paper. Interestingly, the largest asset class, firms with \$1 billion and greater in total assets, actually reduce their share of commercial paper during recessions, while the second largest group increases their share. It is possible that lenders shift their preferences toward the asset class with \$250 to \$1,000 million in assets during recessions. However, there are other conceivable explanations. It is possible that the largest firms prefer other sources of financing, perhaps internal, and do not issue commercial paper at this time. If commercial paper rates increase during recessions, then commercial paper becomes less desirable. So, it is possible that the largest firms generate enough cash internally that they can choose to issue less commercial paper during recessions.

Table II shows the distribution of other short-term debt and of current liabilities by firm size during the recessions and expansions from 1974 through 2010. The share of Other Short-term Debt increases significantly for the smallest asset class. It rises 3.4 percent, from 16.4% of the total to 19.8%. This may indicate that small firms are unable to borrow short-term debt from banks, and use other sources instead. The increase in short-term debt could come from accounts payable, taxes payable, current portion of long-term debt or other accrued expenses. The largest asset class also increases its share of Other Short-term Debt, but only by 0.5%. All other asset classes have a decrease in Other Short-term Debt.

The share of total current liabilities increases by 1.1% for the smallest asset class, and decreases by 1.7 % for the largest asset class. All other groups experience almost no change in their share of current liabilities. This indicates that the smallest firms face a greater burden from short-term debt than the largest firms during recessions.

Next, the composition of long-term debt and total debt is analyzed. While long-term debt reflects more than the current environment, it still reflects information on the availability of credit for large and small firms. The results are shown in Table III Distribution of Long-term and Total Debt across Firms.

Table III reveals the distribution of long-term bank debt and total liabilities across firms of different size during the recessions and expansions from 1974 through 2010. The data shows that the share of long-term debt increases for both the smallest and the largest asset classes during recessions. The smallest asset class increases its share by 0.8 % and the largest decreases its share by 0.2 %. This might indicate that the financial accelerator theory applies only to short-term debt, or that it is counteracted by other forces when it comes to long-term debt.

The shift from total liabilities also supports the theory of the financial accelerator. This shows that the smallest firms increase total liabilities by 1.2 %, while the largest firms are able to decrease their share of total liabilities by 1.2 %. So, the largest firms have greater access to short-term bank debt and to commercial paper, and are also able to decrease their total share of debt. Because the smallest firms have a smaller share of short-term bank debt, they are unable to access commercial paper markets, and accrue a greater share of total liabilities. The increased burden on smaller firms is further intensified by the increase in the base amount of total liabilities during a recession. During expansion, the average of the QFR survey of total nominal liabilities for 1974 to 2010 was \$1,866,505. During recessions this increased almost 2% to \$1,899,157. So, small firms carry a relatively larger amount of the total pool of liabilities.

Next, the relationship between short-term debt and total liabilities over both expansions and recessions is analyzed via the following regression:

$$\Delta \text{Short-term Bank Debt} = C + \beta * \Delta \text{Total Liabilities}$$

The results are compared to the relationship between commercial paper and total liabilities across asset sizes during expansion and recession. The relationship between commercial paper and total liabilities is captured by:

$$\Delta \text{Commercial Paper} = C + \beta * \Delta \text{Total Liabilities}$$

All regressions in this paper include constants. The constants are not reported since they are not of economic interest. The results of this regression are listed in Table IV:  $\Delta$  Short-Term Bank Debt and  $\Delta$  Commercial Paper.

The regression results suggest that the relationship between the change in short-term bank debt and total liabilities is not consistent over the asset size classes. For the smallest group, < \$25 million, the relationship is positive during both expansion and recession, but is smaller and less

significant during recessions. So, while total liabilities are decreasing during recession, short-term bank debt is not decreasing as much as other liabilities. For the largest asset group, > \$1 billion, there is a positive relationship during expansion between short-term bank debt and total liabilities, but during a recession there is a negative relationship between short-term bank debt and total liabilities. This difference captures the disparity between small and large firms. During a recession, the change in short-term bank debt is negative for both small and large firms. However, the change in total liabilities is negative for small firms, but positive for large firms. Large firms are able to increase their liabilities during recessions. This could be due to a variety of factors, such as their larger cash flow, their ability to influence customers and suppliers, or their access to other forms of credit.

It is also important to note the difference in magnitude. For small firms, changes in total liabilities explain twelve percent of changes in short-term bank debt during expansion, and six percent during recession. However, for large firms, changes in total liabilities explain less than two percent of changes in short-term bank debt during expansion, and less than three percent during recession.

It is interesting to note that for the smallest firms, total liabilities decreases by 5 percent during recessions. For the largest firms, total liabilities increases by 5 percent during recession. Access to other forms of credit is also limited for small firms. Short-term bank debt as a percent of current liabilities is on average twenty percent for the smallest firms, though it is below three percent on average for large firms.

The relationship between commercial paper and total liabilities cannot be investigated for the smallest asset size because the QFR does not report commercial paper for firms with less than twenty-five million in total assets. In our study, we use asset size that has between twenty-

five and fifty million in total assets as representative of small firms. The evidence shows that small firms have a positive relationship between total liabilities and commercial paper during expansions, and a negative relationship during recessions. However, in both cases, the coefficient is close to zero. Hence, we can conclude that changes in total liabilities explain very little in regards to the changes in commercial paper for small firms.

Large firms behave differently. During expansion, there is a positive relationship between commercial paper and total liabilities, with changes in total liabilities explaining eight percent of changes in commercial paper. The regression results indicate that during recessions, total liabilities rise, while commercial paper falls. Examination of the data shows that for the largest firms total liabilities rise on average during recessions by five percent while commercial paper remains the same, on average, during recession and expansion. The two largest asset classes are similar in that commercial paper remains relatively stable across expansion and recession, with commercial paper decreasing by about one percent on average during recessions. These results may indicate either that there is no market for commercial paper or that the companies themselves do not wish to increase their issued amount of commercial paper.

A comparison of the two regressions shows that during expansion for the smallest asset class, total liabilities is more significant in explaining the change in short-term debt than is the change in commercial paper. This result may be explained by the limited access that small firms have to commercial paper. During recessions, the change in total liabilities is not significant in explaining either relationship.

For the largest asset class during expansion, total liabilities is slightly more significant in explaining the change in commercial paper than in explaining the change in short-term debt, though this change is small in both cases. However, during recession total liabilities are much

more significant in explaining the change in commercial paper than in explaining the change in short-term debt.

## **5.2 Debt Composition and Financial Statements**

The next step in the investigation is to explore the various explanations for why banks, on average, shift short term debt away from small firms and toward large firms during recessions. It has been argued that banks shift loans away from firms with weak balance sheets and toward firms with stronger balance sheets and more collateral. This theory is investigated using the QFR data.

The strength of the balance sheet in determining short-term debt is measured to determine whether it is more significant for large firms than for small firms over expansions and recessions. Net working capital, defined as current assets minus current liabilities, is used as a measure of the strength of a firm's balance sheet. A firm may have assets and may be making a profit, but still may not be able to pay debts. Therefore, positive net working capital is often used as a measure of a firm's ability to repay its short-term debt and satisfy short-term operational expenses. A firm with higher net working capital would be better able to pay debts and, therefore, would be considered a safer bet from the perspective of a lending bank. The data in Table V, Sales and Net Working Capital 1974–2010 Recession versus Expansion, shows the average decrease in both sales and net working capital from expansion to recession.

While sales drop more dramatically for the largest firms, these firms are able to decrease their current liabilities to more than compensate for their fall in current assets. Hence, net working capital does not fall as dramatically for the largest firms as it does for the smallest firms. Since the largest firms retain a greater share of short-term bank debt during recessions, the data in Table V implies that when banks are issuing short-term debt, the amount they issue is more

closely correlated with balance sheet strength than with income statement strength during recessions.

The strength of this theory can be measured by determining the extent to which the balance sheet explains changes in short-term bank loans. Two variables are used to reflect the strength of the balance sheet. The first, net working capital, is defined as current assets minus current liabilities, is used as an indication of the strength of a firm's balance sheet. The following regression is measured:

$$\Delta \text{Short-term Bank Debt} = C + \beta * \text{Net Working Capital}$$

The results of this regression are listed in Table VI:  $\Delta$  Short-Term Bank Debt. It indicates that net working capital is significant in explaining short-term bank debt during expansions for only the smallest firms. Net working capital is not significant during recessions, and this holds for all firms regardless of total assets under management.

The second variable used as an indication of balance sheet strength is fixed assets. It has been argued that banks shift short-term loans from small to large firms because large firms have more assets available for collateral. Table VI:  $\Delta$  Short-Term Bank Debt displays the results of the regression  $\Delta \text{Short-term Bank Debt} = C + \beta * \text{Fixed Assets}$ . The regression results indicate that fixed assets are significant in explaining the shift of short-term bank debt from small to large firms during recessions and expansions.

The ability to access credit has often been attributed to balance sheet strength. However, the role of the income statement may be relevant and ought to be considered. An investigation of the profit margins on the income statements shows a significant difference between the smallest and the largest firms. The data illustrated in Table VII, Profit Margin by Asset Class, reveals that during the expansionary period of 1974 through 2010, the smallest firms averaged a profit rate of

3.5%. This is significantly lower than the profit rate of the largest firms, which showed an average profit rate of 6.6% during expansions. The smallest firms appear to experience less of a decrease in profit rate during recessions, falling 0.8% to 2.7%. While the largest firms have more of a drop in profit rate, 2.0%, they are still operating at 4.6% profit rates, which much higher than the smallest firms.

If banks shift short-term debt toward firms with stronger balance sheets during recessions, then one might also expect them to shift short-term debt toward firms with stronger income statements during recessions. A standard regression would not yield reliable results because short-term bank debt and profit rates are endogenous variables. However, a scatter plot reveals some information on the relationship between the growth of short-term bank debt and the rate of profit. Graphs I and II are scatter plots that depict the relationship between growth in short-term debt and profit rates. Graph I shows this association during recessions and Graph II highlights the relationship during expansions.

Both graphs show that the variability in short-term bank debt is much greater for large firms than it is for small firms. Even when there is a large decrease in the growth of short-term debt, on average, large firms are able to maintain a higher profit rate than are small firms. The ability of large firms to maintain higher profit rates during recession may explain why banks, on average, shift short-term debt away from small firms and toward large firms.

While the graphs do not provide conclusive evidence, they do support the concept of the ‘flight to quality’ (Bernanke, Gertler and Gilchrist, 1996). Banks are more risk averse during recessions. Hence, they seek out firms with strong balance sheets and income statements. Such firms tend to be concentrated in the largest asset group and, therefore, a shift of short-term bank debt during recessions from small firms to large firms can be observed.

### 5.3 Fixed Assets

Graph III (Change in Fixed Assets for Largest Firms, 1974–2010 Recessions) and Graph IV (Change in Fixed Assets for Smallest Firms, 1974–2010 Recessions) plot the change in nominal fixed asset investment for the largest and smallest firms, respectively, during each recessionary period during the time spanning 1974 to 2010. The y-axis measures the change in fixed asset investment, and the x-axis denotes the quarter since the start of the recession.

Graph III shows that while the largest firms, at times, may see a lower rate of investment, this group maintains a consistently positive increase in investment over recessions. During expansions, the largest firms have a decrease in fixed assets eight and a half percent of the time. It appears that, actually, they invest more consistently during recessions than during expansions. This would make economic sense if purchasing prices are lower during recessions. Perhaps large firms are buying property and equipment at a low price during recessions, knowing that they have the financial resources to weather the storm and anticipate the need for these assets when the recession is over.

Graph IV illustrates that, unlike the large firms, the smallest firms experience a mix of increases and decreases in fixed assets over the recessions. On average, the smallest firms decreased their investment in fixed assets during recessions twenty-six percent of the time. This still compares favorably to expansionary periods, where they decrease fixed asset investment thirty-three percent of the time. Perhaps the smallest firms, like the largest, are purchasing property, plant and equipment at low prices during recessions in anticipation of future expansions. However, they are unable to purchase with the same consistency as are large firms.

The frequency of positive investments is greater during recessions for both small and large firms; however, the magnitude of investment for both small and large firms is smaller than it is during times of expansion. For example, the largest firms in the QFR Survey decreased their investment in fixed assets by an average of twenty-one percent during recessions. The smallest firms decreased their investment in fixed assets by an average of twenty-three percent during recessions. Therefore, although firms are investing in fixed assets, they are not investing as much as they would invest during times of expansion.

It is worthwhile to note the difference in fixed assets as a percent of sales. The average fixed asset as a percent of sales for the largest firms' during 1974–2010 was 2.3%, while fixed assets as a percentage of sales for the smallest firms it was only 1.3%. This could be explained by several factors, and it is important to remember that the QFR survey represents only manufacturing firms. One factor is that small firms may outsource the most capital-intensive parts of their business. Another factor is that a small firm may be unable to enter certain industries, such as building airplane parts, without a sufficient level of capital, because those industries naturally have a lower rate of return on capital. An additional factor may be that the largest firms are simply less efficient and have a higher degree of wastage. One or all of these explanations are possible. However, these factors do not detract from our ability to analyze the data.

Both large and small firms decrease fixed assets as a percent of sales during recessions. The average decrease in fixed assets as a percent of sales for the smallest firms is 1.25% during expansion is and 1.11% during recessions. For the largest firms, the average decrease in fixed assets as a percent of sales is 2.33% during expansion and 2.19% during recessions. Both small and large firms experience a decrease of fourteen percent in fixed assets as a percentage of sales

during recessions. From this vantage point, it does not appear that large firms benefit more than small firms during recession. Even though large firms have a greater decrease in sales during recessions, they have the same percent decrease in fixed assets as a percentage of sales as do small firms. The smallest firms see an average decrease in sales during recessions of thirty percent. However, the largest firms see a greater decrease—a decrease of forty-three percent. Since the largest firms have a greater decrease, we would expect them to have a greater decrease in fixed assets, but we do not see that.

Investment in fixed assets as a percent of sales has been changing over the last thirty years. As noted in Table VIII, Fixed Assets as a Percent of Sales, such investments have been increasing consistently and dramatically for the smallest firms, and have decreased considerably over the past twenty years for the largest firms. For example, in the 1970s, the average fixed assets as a percent of sales for all manufacturing firms was 121%, while in the 2000s it rose to 176%. However, for the largest firms there has been a decrease in average fixed assets as a percent of sales: the average in the 1970s was 265%, but in the 2000s this dropped to 198%.

This paper does not delve into the reasons for this change, but does note the importance of this trend. The increase in fixed assets as a percent of sales for the smallest firms suggests that it has been beneficial for these firms to hold more fixed assets. Conversely, the decrease in fixed assets as a percent of sales for the largest firms suggests that it has become less significant for these firms to hold more fixed assets.

If fixed asset investments are financed by debt, then those firms that are dependent on banks for credit may be limited in their investments during recessions. If a firm is not bank dependent, then it will have a powerful advantage. This advantage is especially potent during recessions for two main reasons. The first reason is that the firm that is bank dependent is likely

to have limited access to loans, and may be limited in its ability to invest or even main current capital levels. The second reason is that investments are likely to be less expensive during recessions, and firms will the ability to invest during this period may be able to make lucrative investments at low prices, and enhance their abilities to compete in the future.

To measure the importance of bank debt in fixed asset investment for each class size, as well as during expansions and recessions, the following regression is run:

$$\Delta\text{Fixed Assets} = C + \beta_1 * \Delta\text{Short-term Bank Debt} + \beta_2 * \Delta\text{Long-term Bank Debt}$$

The results Table IX,  $\Delta\text{Fixed Assets}$  related to Short-term and Long-term Debt, show that for the smallest firms, short-term bank debt is important in relation to fixed assets during expansions and recessions, yet this relationship is of greater importance during recessions. This is extremely significant because this correlation occurs at the same time that small firms receive less short-term bank debt, both in terms of total amount and as a percentage of the total loans given. This is especially detrimental for small firms. Long-term bank debt is very significant during expansions, yet it is less significant during recessions.

For the largest firms, the ability to obtain short-term bank debt is not significant in explaining fixed asset investment during expansion or recessions. This may occur because large firms have access to other forms of debt and are also better able to generate more cash internally than are small firms. The evidence that short-term bank debt is less significant for large firms during recessions is meaningful. It may indicate that large firms are not reliant on banks since they can issue commercial paper, get loans from other institutions, or use fund that they have generated through operations. It also indicates that large firms are able to make investments during recessions when prices are low. This gives large firms a great advantage.

For large firms, long-term bank debt is significant in explaining fixed asset investment during periods of expansions, but not during recessions. Long-term bank debt is much less significant for large firms than it is for small firms during expansions, with coefficients of 0.46 for large firms versus 1.92 for small firms. Although the total amount of long-term bank loans decreases during recessions, the share allocated to the largest firms changes negligibly, from 59.7% to 59.5%. Therefore, the largest firms are not unduly hindered from investing because they do not face the financial same challenges as do small firms.

It has been argued that large firms benefit not just from greater access to bank debt during recessions, but also from access to commercial paper. This theory can be assessed by running the regression below for the five largest asset groups:

$$\Delta\text{Fixed Assets} = C + \beta_1*\Delta\text{Short-term Bank Debt} + \beta_2*\Delta\text{Long-term Bank Debt} \\ + \beta_3*\Delta\text{Commercial Paper}$$

The data listed in Table X,  $\Delta\text{Fixed Assets}$  as related to  $\Delta\text{Short-term Bank Debt}$ ,  $\Delta\text{Long-term Bank Debt}$ , and  $\Delta\text{Commercial Paper}$ , reveals that commercial paper is positively correlated with fixed investment for the smaller asset sizes over both expansions and recessions. Although significance varies by asset class for the smaller firms, all firms see an increase in commercial paper concurrent with an increase in fixed investment. For the largest firms, commercial paper most significantly explains the change in fixed assets during expansions. As commercial paper increases, so does fixed investment. During recessions, however, the relationship is positive, but is not significant. The largest firms are able to maintain the same level of commercial paper even though their sales fall by a much greater percent than do these sales of firms with smaller assets.

This might partially explain why during recessions large firms experience less of a drop in fixed asset investment than do firms of smaller asset sizes.

The tests results in Table X shed new light on the role and importance of the financial accelerator. They reveal that, in addition to inventory, employment and land, small firms are at a disadvantage during recessions with respect to fixed asset investments as well. Investment in fixed assets is critical to maintaining sales since current assets depreciate. It is often necessary for growth and expansion. Since many smaller firms are in a growth stage, this is especially important for them. The advantage that large firms have in accessing capital for fixed asset investments can have a significant and long-lasting effect.

It is possible that fixed assets have a dynamic relationship with short-term and long-term bank debt, and that Vector Autoregression (VAR) may be a useful method of capturing their relationship. Lag length criteria indicate that lags are not significant for small firms, but are significant for large firms (Appendix I). So, OLS results are relevant for small firms, but a VAR is appropriate for large firms. A VAR is performed for the largest firms, including nine lags on fixed asset investment, short-term bank debt, long-term bank debt and commercial paper (Appendix II). The regression is over-identified and restrictions must be imposed in order to run impulse response functions. A Cholesky decomposition is applied and the following ordering of variables is used: long-term bank debt, short-term bank debt, commercial paper, fixed assets. An impulse response is then conducted for large firms to track the impact of changes in short-term bank debt, long-term bank debt, and commercial paper on changes in fixed asset investments. The results of all impulse responses are listed in Appendix III.

An impulse response that shows the effect of an exogenous shock in long-term bank debt on fixed assets is shown in Graph V (Response of Fixed Assets to Long-term Bank Debt). It

reveals that an exogenous shock in long-term bank debt will result in an increase in fixed assets during the first, second, third, fifth, sixth, seventh, ninth, and tenth quarters after the shock occurs.

Graph VI (Response of Fixed Assets to Short-term Bank Debt) illustrates the effect of an exogenous shock in short-term bank debt on fixed assets. It shows that a shock in short-term bank debt may lead to an increase in fixed asset investment during the first and third through ninth quarters after the initial shock in short-term bank debt occurs. This supports the dynamic nature of the financial accelerator theory, showing that a shock in one quarter may give rise to changes several quarters later. This advantage may be seen soon after the shock and may last up to two years after the shock takes place.

The impulse response shown in Graph VII (Response of Fixed Assets to Commercial Paper) indicates that when there is an exogenous shock in commercial paper, fixed assets increase in the second, fourth, fifth, sixth, seventh, ninth and tenth quarters after the initial shock in commercial paper. Since small firms do not have access to commercial paper, they are at a significant disadvantage. Commercial paper can generally be issued at a rate below the prime rate. Hence, the cost of borrowing may be less for large firms than for small firms. In addition, commercial paper can serve as an alternative source of credit when bank loans are limited. Hence, large firms benefit from alternative sources of credit not just in the period during which the credit is issued, but in future periods as well.

#### **5.4 Fixed Assets, GDP and the Federal Funds Rate**

The last section of this paper looks at the effects of total GDP and the Federal Funds Rate on fixed asset investment. Data is obtained from the Quarterly Financial Report which

aggregates firm data according to total assets under management. This allows us to observe differences in aggregate firm movements according to size.

The data sets observed are: GDP, fixed assets, inventory, long-term bank debt, short-term bank debt, and federal funds rate. Since the variables are non-stationary, they are tested for optimal lag length. Fixed assets, inventory, long-term bank debt and short-term bank debt are from the Quarterly Financial Report spanning from the first quarter of 1974 to the second quarter of 2010. GDP is from the Bureau of Economic Analysis, and the Federal Funds Rate is from the Federal Reserve Bank. All variables have been weighted by the GDP deflator to reflect real values. Once the optimal lag is determined, a vector autoregression model is employed. A vector autoregression is run for each asset size: <\$25mil, 25-50mil, 50-100mil, 100-250mil, 250-1billion, >\$1billion.

This model is not econometrically identified since there are more exogenous variables than endogenous variables. To identify the effects of exogenous shocks, restrictions are imposed so that the model is exactly identified. We assume that policy shocks do not affect the real economy within the current period (Bernanke and Mihov, 1998). A Cholesky decomposition of the covariance matrix allows for estimation of exogenous shocks. The following order is imposed: GDP, fixed assets, inventory, long-term bank debt, short-term bank debt, and federal funds rate. Impulse response functions can then be calculated.

Results of the impulse response functions are presented in Appendix IV. First, we observe the response of fixed assets to a positive shock in GDP. Next, we look at the response of fixed assets to a positive shock in the Federal Funds Rate. Since the data is aggregated by firm size, it allows for the comparison between large and small firms' response of fixed assets to a positive shock in GDP and the response of fixed assets to a positive shock in the Federal Funds

Rate. Fixed asset investment is implemented several months after its initial plan, 15 months according to Meyer (1960) and 13 months as reported by the U.S. Department of Commerce. Hence, the short-term response of fixed assets to a shock may not be as relevant as the long-term response of fixed assets to a shock.

For every firm size, the response of fixed assets to a positive shock in GDP is not significantly different from zero. However, the response of fixed assets to a positive shock in the federal funds rate differs by firm size. All firms except the smallest do not have a significant response to a positive shock to the federal funds rate. But, the smallest firms, those with less than twenty-five million in total assets, have a statistically significant decrease in fixed assets after a positive shock to the federal funds rate in the fifth quarter after the shock. This corroborates previous research on the financial accelerator theory. For example, Bernanke, Gertler and Gilchrist(1996) find that the response of inventory investment to a shock in monetary policy differs for small versus large firms. Oliner and Rudebusch (1993) find that small and large manufacturing firms' capital investment responds differently to declines in cash flow.

The impulse response graphs indicate that largest firms' fixed asset investment are not significantly affected by a positive shock to either GDP or the Federal Funds Rate. Smaller firms are not significantly affected by a positive shock to GDP; however, the smallest firms' fixed asset investment is negatively affected five quarters after a positive shock to the Federal Funds Rate. This finding supports the hypothesis that monetary shocks differentially affect firms with high versus low access to credit, and that large firms are less negatively affected by monetary shocks than small firms are.

## 6. Conclusion

This paper examines the effects of credit constraints on fixed asset investment using the theory of the financial accelerator. According to the financial accelerator theory, information asymmetries and moral hazard make the cost of external financing more expensive than the cost of generating funds internally. It has been argued that because large firms have more assets as a percentage of sales available for collateral, it is easier for them to borrow. The advantage that large firms have in borrowing should be most evident during recessions and periods of monetary tightening. If the financial accelerator theory holds, then there should be a shift in bank financing toward large firms and away from small firms during recessions and periods of monetary tightening.

This paper confirms the shift of short-term credit from small to large firms during recessions, and confirms the importance of the balance sheet in explaining that shift. Net working capital is significant for the smallest firms in explaining short-term bank debt during expansions, but is not significant for these small firms during recessions. For the largest firms, net working capital is not significant in explaining short-term bank debt during expansions or recessions. The positive relationship between networking capital and short-term bank debt during recessions is significant, and may explain some of the shift of short-term bank debt away from small firms and toward large firms during recessions.

The role of the income statement in explaining the shift of credit from small to large firms is often overlooked and ought to be considered. Since banks shift short-term debt toward firms with stronger balance sheets during recessions, then one might also expect them to shift short-term debt toward firms with stronger income statements during recessions. We find that even when there is a large decrease in the growth of short-term debt, large firms are, on average,

able to maintain a higher profit rate than are small firms. The ability of large firms to maintain higher profit rates during recession may explain why banks, on average, shift short-term debt away from small firms and toward large firms. This result does not provide conclusive evidence that the income statement is significant in explaining credit shifts, but it does support the concept of the ‘flight to quality’ (Bernanke, Gertler and Gilchrist, 1996). Banks are more risk averse during recessions. Hence, they seek out firms with strong balance sheets and income statements.

Another contribution of this paper is in determining the effects of credit markets on small versus large firms’ fixed asset investment. Fixed assets are shown to behave differently for small firms than for large firms during recessions. The evidence shows, first, that small firms are more reliant on debt to fund fixed asset investment than are large firms. Second, it establishes that tightened credit conditions, identified here by NBER recessions, have a greater negative impact on small firms than they do on large firms. Third, it illustrates that long-term debt is more significant for small firms’ fixed asset investment than is short-term debt, though both are significant.

Since small firms are limited in their ability to invest in fixed assets when credit is scarce, their ability to invest in new projects will be limited during these times of recession and monetary tightening, and their ability to sustain current levels of output may also be challenged. This disadvantage is especially harmful to small firms, since it comes at a time when investments may be less expensive, and they cannot benefit from these investments as can large asset firms. During recessions, since large firms are less reliant on credit, they can obtain a greater share of bank-debt and can obtain alternative sources of credit. This gives them an advantage in sustaining current output levels, in investing in new projects, and in securing new investments at lower prices during such periods of recession. The evidence shows that during recessions, small

firms' fixed asset investments are negatively impacted to a greater extent than are large firms' fixed asset investments, and that this discrepancy can be partially explained by access to credit.

The last section of this paper looks at the effects of GDP and the Federal Funds Rate on fixed asset investment for small firms versus these effects on large firms. Results of an impulse response function show that, for all firm sizes, a positive shock to GDP does not have a significant impact on fixed asset investment. However, small and large firms display different responses to a positive shock in the Federal Funds Rate than they do to a positive shock in GDP. The results of an impulse response function show that after a shock to the Federal Funds Rate, the smallest firms with less than \$25 million in total assets exhibit a statistically significant decrease in fixed assets five quarters after the shock.

The implication of the financial accelerator theory is that small firms have less access to debt than do large firms, and this gap in access to credit is greater during recessions than during expansions. Therefore, smaller firms are at a disadvantage during recessions, and this disadvantage can have significant and long-lasting effects. Results confirm that there is a shift in credit from small firms to large firms during recessions. The evidence suggests that both balance sheets and income statements could be relevant in explaining this shift. This dissertation also examines the effect of this shift in credit on fixed asset investment over the business cycle. Impulse response functions show that a shock to the Federal Funds Rate has a differential effect on large firms' fixed assets versus small firms' fixed asset. These results provide evidence that the shift of credit from small to large firms during downturns has significant effects on the real economy.

**Table I: Distribution of Short-term Debt and Commercial Paper (1974–2010)**

	Short-term bank debt during expansion	Short-term bank debt during recession	Commercial Paper during expansion	Commercial Paper during recession
Total Assets				
< \$25 mil	33.6%	30.8%	0.5%	0.6%
25-50	7.4%	6.7%	0.1%	0.1%
50-100	7.2%	7.4%	0.2%	0.2%
100-250	9.1%	9.7%	0.8%	0.7%
250-1 bil	13.2%	13.4%	6.2%	9.1%
> \$1 bil	29.5%	32.1%	92.2%	89.3%
Total	100.0%	100.0%	100.0%	100.0%

Table I pulls data from the Quarterly Financial Report, spanning from the first quarter of 1974 to the second quarter of 2010. It breaks down rows by firm size, which is defined by total assets. So, the top row of the table shows data for all firms in the survey with less than twenty five million in total assets. There are six increments of asset sizes with the last and largest group comprised of all firms in the survey with more than one billion in total assets.

The first column shows the average percent of short-term bank debt allotted to each asset group during expansions. This is obtained by first isolating the quarters of expansion from 1974 through 2010. Next, for each group and for each quarter of expansion, the short-term bank debt is divided by the total amount of short-term bank debt given to all firms during that quarter. Lastly, the average is taken for each asset group over the 118 quarters of expansion.

The same methodology is repeated for short-term bank debt for the periods of recession from 1974 through 2010, and for commercial paper for the periods of expansion and recession from 1974 through 2010.

**Table II: Distribution of Other Short-term Debt and Current Liabilities (1974–2010)**

	Other Short-term Debt during expansion	Other Short-term Debt during recession	Current Liabilities during expansion	Current Liabilities during recession
Total Assets				
< \$25 mil	16.4%	19.8%	11.8%	12.9%
25-50	2.2%	2.1%	2.5%	2.5%
50-100	2.7%	1.9%	2.9%	2.9%
100-250	4.3%	3.7%	4.7%	4.8%
250-1 bil	9.8%	7.5%	10.3%	10.7%
> \$1 bil	64.6%	65.1%	67.9%	66.2%
Total	100.0%	100.0%	100.0%	100.0%

Table II pulls data from the Quarterly Financial Report, spanning from the first quarter of 1974 to the second quarter of 2010. It breaks down rows by firm size, which is defined by total assets. So, the top row of the table shows data for all firms in the survey with less than twenty five million in total assets. There are six increments of asset sizes with the last and largest group comprised of all firms in the survey with more than one billion in total assets.

The first column shows the average percent of other short-term debt allotted to each asset group during expansions. This is obtained by first isolating the quarters of expansion from 1974 through 2010. Next, for each group and for each quarter of expansion, other short-term debt is divided by the total amount of other short-term debt given to all firms during that quarter. Lastly, the average is taken for each asset group over the 118 quarters of expansion.

The same methodology is repeated for other short-term debt for the periods of recession from 1974 through 2010, and for current liabilities for the periods of expansion and recession from 1974 through 2010.

**Table III: Distribution of Long-term and Total Debt across Firms (1974–2010)**

Total Assets	Long-term Bank Debt during expansion	Long-term Bank Debt during recession	Total Liabilities during expansion	Total Liabilities during recession
< \$25 mil	16.4%	17.2%	8.8%	10%
25-50	3.1%	3.0%	2.1%	2%
50-100	3.5%	3.3%	2.6%	3%
100-250	5.5%	5.4%	4.5%	5%
250-1 bil	11.9%	11.7%	10.9%	11%
> \$1 bil	59.7%	59.5%	71.2%	70%
Total	100.0%	100.0%	100.0%	100%

Table III pulls data from the Quarterly Financial Report, spanning from the first quarter of 1974 to the second quarter of 2010. It breaks down rows by firm size, which is defined by total assets. So, the top row of the table shows data for all firms in the survey with less than twenty five million in total assets. There are six increments of asset sizes with the last and largest group comprised of all firms in the survey with more than one billion in total assets.

The first column shows the average percent of long-term bank debt allotted to each asset group during expansions. This is obtained by first isolating the quarters of expansion from 1974 through 2010. Next, for each group and for each quarter of expansion, the long-term bank debt is divided by the total amount of long-term bank debt given to all firms during that quarter. Lastly, the average is taken for each asset group over the 118 quarters of expansion.

The same methodology is repeated for long-term bank debt for the periods of recession from 1974 through 2010, and for total liabilities for the periods of expansion and recession from 1974 through 2010.

**Table IV:  $\Delta$  Short-Term Bank Debt =  $c + \beta \Delta$  Total Liabilities and  
 $\Delta$  Commercial Paper =  $c + \beta \Delta$  Total Liabilities (1974–2010)**

$\Delta$ short-term bank debt = $c + \beta \Delta$ total liabilities			$\Delta$ commercial paper = $c + \beta \Delta$ total liabilities		
	$\beta$ expansion	$\beta$ recession		$\beta$ expansion	$\beta$ recession
<b>&lt; \$25 mil</b>	0.125	0.146	<b>&lt; \$25 mil</b>		
	<i>7.45</i>	<i>3.14</i>			
<b>25-50</b>	0.193	0.012	<b>25-50</b>	0.003	-0.002
	<i>9.43</i>	<i>0.25</i>		<i>2.40</i>	<i>-0.52</i>
<b>50-100</b>	-0.095	0.021	<b>50-100</b>	-0.523	-1.172
	<i>-0.87</i>	<i>0.10</i>		<i>-1.02</i>	<i>-0.62</i>
<b>100-250</b>	0.082	0.136	<b>100-250</b>	0.005	0.000
	<i>4.28</i>	<i>4.18</i>		<i>1.51</i>	<i>-0.01</i>
<b>250-1 bil</b>	0.121	-0.053	<b>250-1 bil</b>	1.236	0.768
	<i>1.34</i>	<i>-0.47</i>		<i>2.50</i>	<i>0.50</i>
<b>&gt; \$1 bil</b>	0.023	-0.013	<b>&gt; \$1 bil</b>	0.088	0.059
	<i>2.99</i>	<i>-0.59</i>		<i>5.27</i>	<i>1.40</i>

(Numbers in italics are t-statistics)

Table IV shows results from twenty-two regressions. All regressions pull data from the Quarterly Financial Report spanning from the first quarter of 1974 to the second quarter of 2010. The smallest group is comprised of all firms in the survey with less than twenty five million in total assets. There are six increments of asset sizes with the last and largest group comprised of all firms in the survey with more than one billion in total assets. All regressions are run with constants, but these values are not reported as they distract from the relevant data, which is the coefficient  $\beta$  and its t-statistic.

Starting from the left, the first column shows the results of a regression with the change in short-term bank debt as the endogenous variable, a constant term, and change in total liabilities as the exogenous variable. This regression is run for each asset size group during expansions. The second column shows the results of this regression for each asset group during recessions.

The third column shows the results of a regression with the change in commercial paper as the endogenous variable, a constant term, and the change in total liabilities as the exogenous variable. This regression is not run for the smallest asset size since the Quarterly Financial Report does not consistently report this variable. This regression is run for each asset size group during expansions. The fourth column shows the results of this regression for each asset group during recessions.

**Table V: Sales and Net Working Capital 1974-2010, Recession versus Expansion**

Total Assets	Net Income during expansion	Net Income during recession	Recession/Expansion	Net Working Capital during expansion	Net Working Capital during recession	Recession/Expansion
< \$25	5,933.86	4,736.97	80%	99,763.64	105,455.68	106%
25-50	1,078.93	801.46	74%	22,449.90	22,625.86	101%
50-100	1,227.97	853.79	70%	25,925.59	25,874.60	100%
100-250	1,862.01	1,368.56	73%	42,298.87	41,238.36	97%
250-1bil	4,163.11	2,725.76	65%	84,245.76	85,665.72	102%
> \$1bil	42,992.54	30,185.09	70%	166,134.17	180,046.38	108%

Table V breaks down rows by firm size, which is defined by total assets. So, the top row of the table shows data for all firms in the survey with less than twenty five million in total assets.

There are six increments of asset sizes with the last and largest group comprised of all firms in the survey with more than one billion in total assets.

The first column on the left shows the average net income over the 118 quarters of expansion in the sample. The second column lists the average income over the 28 quarters of recession in the sample. The third column shows the ratio of the second column divided by the first column, representing the net income during recession as a percent of net income during expansion.

The fourth column from the left shows the average net working capital over the 118 quarters of expansion in the sample. Net working capital is defined as current assets minus current liabilities.

The fifth column lists the average net working capital over the 28 quarters of recession in the sample. The sixth column shows the ratio of the fifth column divided by the fourth column as a percentage, representing net working capital during recessions as a percent of net working capital during expansions.

**Table VI:  $\Delta$  Short-Term Bank Debt (1974–2010)**

$\Delta$ short-term bank debt = $c + \beta \Delta$ net working capital			$\Delta$ short-term bank debt = $c + \beta \Delta$ fixed assets		
	$\beta$ expansion	$\beta$ recession		$\beta$ expansion	$\beta$ recession
<b>&lt; \$25 mil</b>	0.074	0.133	<b>&lt; \$25 mil</b>	0.082	0.137
	<i>2.50</i>	<i>1.48</i>		<i>3.88</i>	<i>2.03</i>
<b>25-50</b>	0.016	-0.091	<b>25-50</b>	0.178	0.087
	<i>0.72</i>	<i>-1.00</i>		<i>7.05</i>	<i>1.17</i>
<b>50-100</b>	-0.015	0.004	<b>50-100</b>	0.004	0.031
	<i>-1.00</i>	<i>0.15</i>		<i>0.38</i>	<i>1.45</i>
<b>100-250</b>	0.011	0.139	<b>100-250</b>	0.084	0.105
	<i>0.36</i>	<i>1.48</i>		<i>3.41</i>	<i>2.33</i>
<b>250-1 bil</b>	-0.027	0.039	<b>250-1 bil</b>	0.003	0.026
	<i>-1.52</i>	<i>1.79</i>		<i>0.32</i>	<i>1.65</i>
<b>&gt; \$1 bil</b>	-0.011	0.073	<b>&gt; \$1 bil</b>	0.038	0.082
	<i>-1.18</i>	<i>1.58</i>		<i>2.13</i>	<i>1.37</i>

(Numbers in italics are t-statistics)

Table VI shows results from twenty-four regressions. All regressions pull data from the Quarterly Financial Report spanning from the first quarter of 1974 to the second quarter of 2010. The first, and smallest, group is comprised of all firms in the survey with less than twenty five million in total assets. There are six increments of asset sizes with the last, and largest, group comprised of all firms in the survey with more than one billion in total assets. All regressions are run with constants, but these values are not reported as they distract from the relevant data, which is the coefficient  $\beta$  and its t-statistic.

Starting from the left, the first column shows the results of a regression with change in short-term bank debt as the endogenous variable, a constant term, and net working capital as the exogenous variable. Net working capital is defined as current assets minus current liabilities. This regression is run for each asset size group during expansions. The second column shows the results of this regression for each asset group during recessions.

The third column shows the results of a regression with change in short-term bank debt as the endogenous variable, a constant term, and fixed assets as the exogenous variable. This regression is run for each asset size group during expansions. The fourth column shows the results of this regression for each asset group during recessions.

**Table VII: Profit Margin by Asset Class, 1974–2010**

Total Assets	Profit Margin during expansion	Profit Margin during recession
< \$25	3.5%	2.7%
25-50	3.4%	2.6%
50-100	3.4%	2.5%
100-250	3.3%	2.5%
250-1bil	3.4%	2.3%
> \$1bil	6.6%	4.6%

Table VII uses data from the Quarterly Financial Report, spanning from the first quarter of 1974 to the second quarter of 2010. It breaks down rows by firm size, which is defined by total assets. So, the top row of the table shows data for all firms in the survey with less than twenty five million in total assets. There are six increments of asset sizes with the last, and largest, group comprised of all firms in the survey with more than one billion in total assets.

The first column shows the average profit margin for each asset group during expansion. The profit margin was obtained for each group by dividing the net income by sales for each quarter during expansions. Next, the average of was taken for each asset size over the 118 quarters of expansion. The second column lists the average profit margin during recessions for each asset size. The same methodology was used to determine the average profit margin for recessions as was used to determine the average profit margin for expansions.

**Table VIII: Fixed Assets as a Percent of Sales (1974–2010)**

	<b>&lt; \$25 mil</b>	<b>&gt; \$1 bil</b>
1970-1979	1.21	2.65
1980-1989	1.30	2.42
1990-1999	1.61	2.56
2000-2009	1.76	1.98

Table VIII uses data from the Quarterly Financial Report, spanning from the first quarter of 1974 to the second quarter of 2010. It breaks down rows by decades, with the first row starting from Q1 1970 through Q4 1979, the second row starting from Q1 1980 through Q4 1989, the third row starting from Q1 1990 through Q4 1999, and the fourth row starting from Q1 2000 through Q4 2009.

The first column shows the average of fixed assets divided by sales for firms with less than twenty-five million in total assets. This ratio was obtained for each decade by dividing the fixed assets by sales for each quarter during the decade. Next, the average was taken of the forty quarters in each decade.

The second column lists the average of fixed assets divided by sales for the largest firms, with more than one billion in total assets. The same methodology was used to determine the average for large firms as was used to determine the average for small firms. Again, the average is reported by decade from the 1970s through 2009.

**Table IX:  $\Delta$ Fixed Assets = C +  $\beta_1$ \* $\Delta$ Short-term Bank Debt +  $\beta_2$ \* $\Delta$ Long-term Bank Debt**

	Expansion			Recession	
	$\beta_1$	$\beta_2$		$\beta_1$	$\beta_2$
<b>&lt; \$25 mil</b>	1.04	1.92	<b>&lt; \$25 mil</b>	0.92	0.64
	<i>3.46</i>	<i>7.45</i>		<i>1.75</i>	<i>0.94</i>
<b>25-50</b>	1.43	0.88	<b>25-50</b>	0.49	1.95
	<i>6.26</i>	<i>4.39</i>		<i>1.62</i>	<i>6.98</i>
<b>50-100</b>	0.79	1.22	<b>50-100</b>	2.66	0.86
	<i>1.11</i>	<i>6.11</i>		<i>1.67</i>	<i>2.40</i>
<b>100-250</b>	1.00	0.46	<b>100-250</b>	0.95	1.18
	<i>3.20</i>	<i>2.61</i>		<i>1.42</i>	<i>3.14</i>
<b>250-1 bil</b>	-0.13	0.96	<b>250-1 bil</b>	2.83	0.77
	<i>-0.16</i>	<i>5.52</i>		<i>1.23</i>	<i>1.55</i>
<b>&gt; \$1 bil</b>	0.67	0.46	<b>&gt; \$1 bil</b>	0.92	0.35
	<i>1.42</i>	<i>2.49</i>		<i>1.50</i>	<i>1.24</i>

(Numbers in italics are t-statistics)

Table IX shows results from twelve regressions. All regressions pull data from the Quarterly Financial Report spanning from the first quarter of 1974 to the second quarter of 2010. The first, and smallest, group is comprised of all firms in the survey with less than twenty five million in total assets. There are six increments of asset sizes with the last, and largest, group comprised of all firms in the survey with more than one billion in total assets. All regressions are run with constants, but these values are not reported as they distract from the relevant data, which is the coefficient  $\beta$  and its t-statistic.

Starting from the left, the first two columns show the results of a regression with change fixed assets as the endogenous variable, a constant term, and change in short-term bank debt and change in long-term bank debt as exogenous variables. The first column shows results for the coefficient of change in short-term bank debt, and the second column shows the results for the coefficient on the change in long-term bank debt. This regression is run for each asset size group during expansions.

The last two columns on the right show the results of this regression for each asset group during recessions. The second column from the right shows results for the coefficient of change in short-term bank debt, and the last column shows the results for the coefficient on the change in long-term bank debt. This regression is run for each asset size group during recessions.

**Table X:  $\Delta$ Fixed Assets = C +  $\beta_1$ \* $\Delta$ Short-term Bank Debt +  $\beta_2$ \* $\Delta$ Long-term Bank Debt +  $\beta_3$ \* $\Delta$ Commercial Paper (1974–2010)**

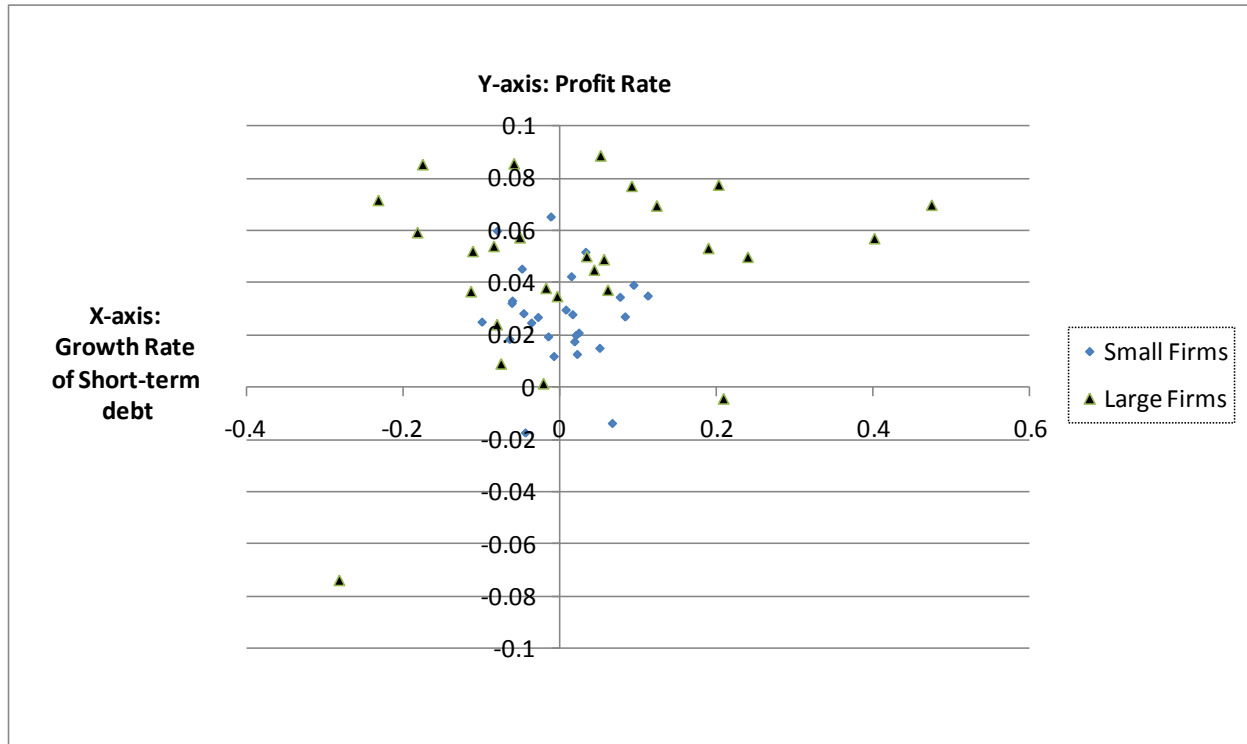
	Expansion				Recession		
	$\beta_1$	$\beta_2$	$\beta_3$		$\beta_1$	$\beta_2$	$\beta_3$
<b>25-50 mil</b>	1.61	0.70	1.97	<b>25-50 mil</b>	0.45	2.02	11.23
	5.59	2.92	0.30		1.35	5.06	1.50
<b>50-100</b>	-0.25	0.80	0.85	<b>50-100</b>	2.92	0.56	0.51
	-0.38	4.33	6.15		2.15	1.76	3.20
<b>100-250</b>	0.96	0.45	0.52	<b>100-250</b>	0.76	1.40	7.27
	2.95	2.50	0.23		1.20	3.80	2.10
<b>250-1 bil</b>	-0.57	0.60	0.96	<b>250-1 bil</b>	1.13	0.77	0.23
	-0.85	4.00	7.68		0.42	1.57	1.19
<b>&gt; \$1 bil</b>	0.35	0.35	0.46	<b>&gt; \$1 bil</b>	0.88	0.30	0.10
	0.70	1.88	2.15		1.35	0.83	0.25

Table X shows results from ten regressions. All regressions pull data from the Quarterly Financial Report spanning from the first quarter of 1974 to the second quarter of 2010. The first, and smallest, group is comprised of all firms in the survey with less than twenty five million in total assets. There are six increments of asset sizes with the last, and largest, group comprised of all firms in the survey with more than one billion in total assets. All regressions are run with constants, but these values are not reported as they distract from the relevant parameters, which are the coefficient  $\beta$  and its t-statistic.

Starting from the left, the first three columns show the results of a regression with change fixed assets as the endogenous variable, a constant term, and change in short-term bank debt, change in long-term bank debt and change in commercial paper as exogenous variables. The first column shows results for the coefficient of change in short-term bank debt, the second column shows the results for the coefficient on the change in long-term bank debt, and the third column shows the results for the coefficient on the change in commercial paper. This regression is run for each asset size group during expansions.

The last three columns on the right show the results of this regression for each asset group during recessions. The third column from the right shows results for the coefficient of change in short-term bank debt, the second column from the right shows the results for the coefficient on the change in long-term bank debt, and the last column shows the results for the coefficient on the change in commercial paper. This regression is run for each asset size group during recessions.

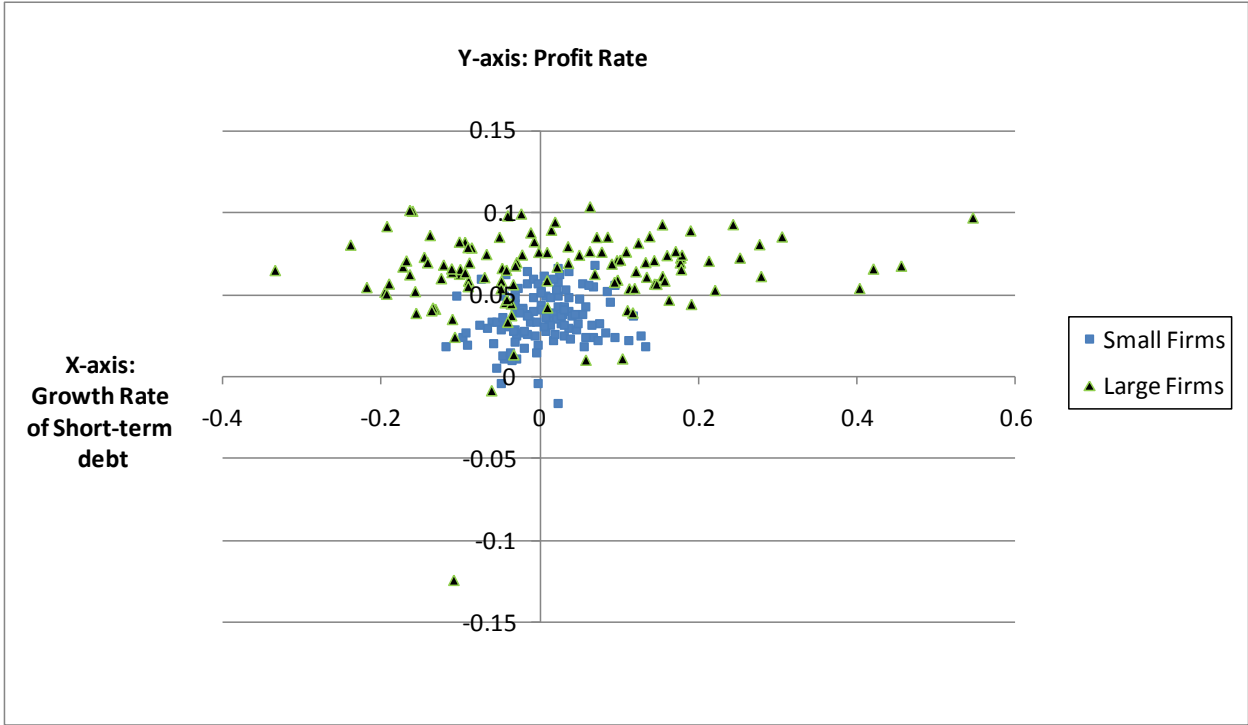
**Graph I: Growth of Short-term Bank Debt and Profit Rate during Recession**



Graph I pulls data from the Quarterly Financial Report published by the Bureau of the Census, and covers all recessions from Q1 1974 through Q2 2010. Recession dates are defined by the National Bureau of Economic Research and start in the quarter during which the peak of a business cycle occurred and end in the quarter during which the trough of the business cycle took place.

The x-axis measures the growth rate of short-term debt which is determined by calculating  $(\text{Quarter 2} - \text{Quarter 1}) / \text{Quarter 1}$ . The y-axis measures the profit rate, which is defined as net income divided by sales. Small firms covers all firms with less than twenty-five million in total assets, and large firms includes all firms with more than one billion in total assets.

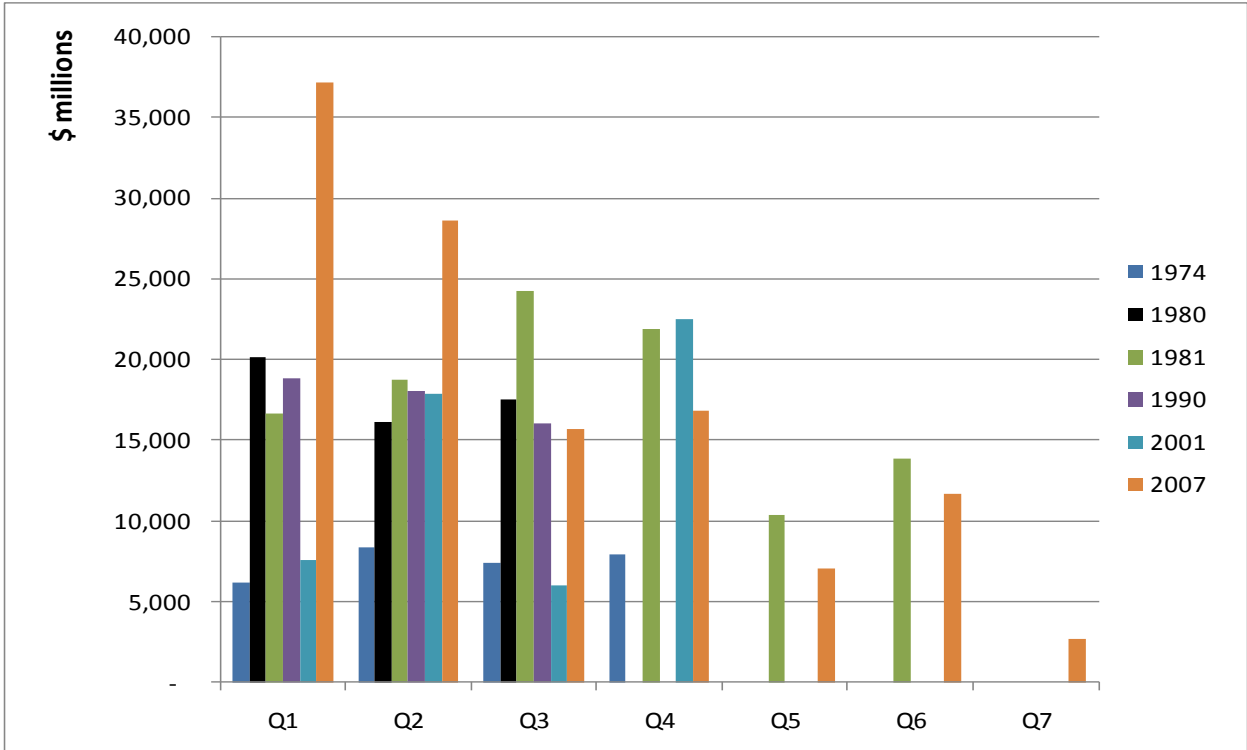
**Graph II: Growth of Short-term Bank Debt and Profit Rate during Expansion**



Graph II pulls data from the Quarterly Financial Report published by the Bureau of the Census, and covers all expansions from Q1 1974 through Q2 2010. Expansion dates are defined by the National Bureau of Economic Research and start in the quarter during which the trough of a business cycle occurred and end in the quarter during which the peak of the business cycle took place.

The x-axis measures the growth rate of short-term debt which is determined by calculating  $(\text{Quarter 2} - \text{Quarter 1}) / \text{Quarter 1}$ . The y-axis measures the profit rate, which is defined as net income divided by sales. Small firms covers all firms with less than twenty-five million in total assets, and large firms includes all firms with more than one billion in total assets.

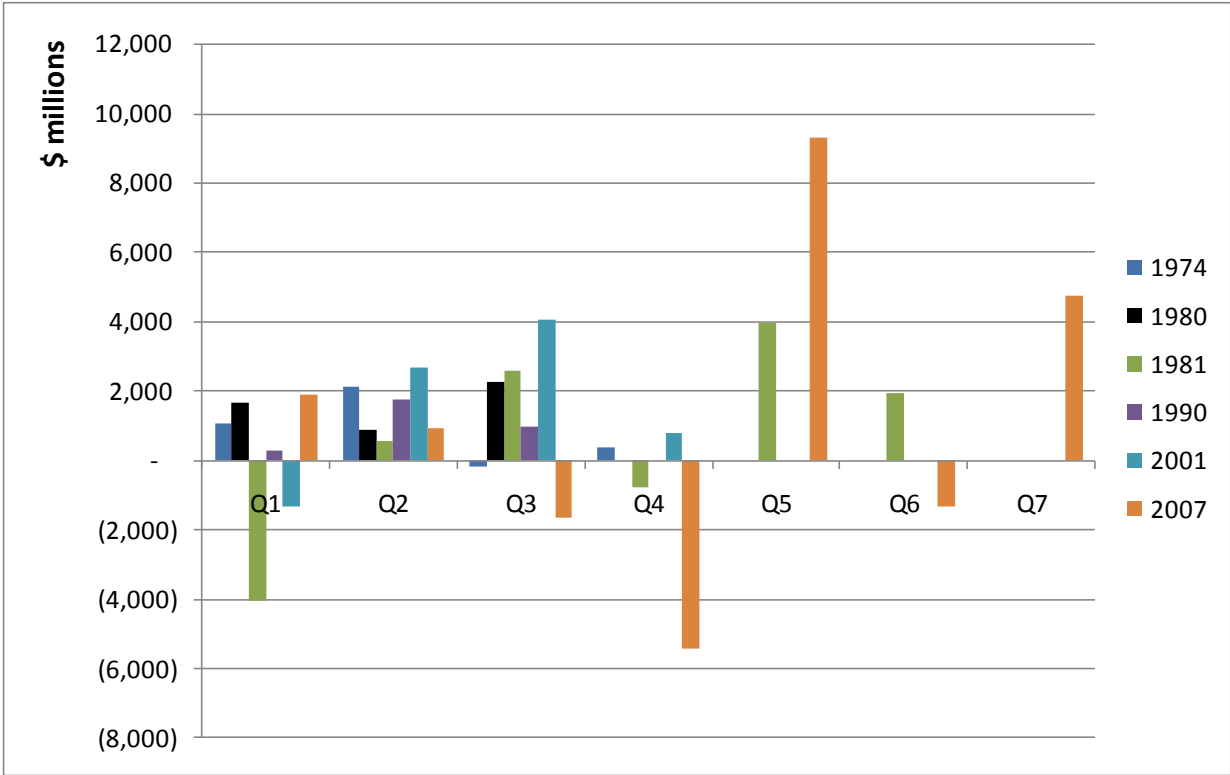
**Graph III: Change in Fixed Assets for Largest Firms, 1974–2010 Recessions**



Graph III uses data from the Quarterly Financial Report published by the Bureau of the Census, and covers all recessions from Q1 1974 through Q2 2010. It covers the largest firms, defined as those firms with more than one billion in total assets. Recession dates are defined by the National Bureau of Economic Research and start in the quarter during which the peak of a business cycle occurred and end in the quarter during which the trough of the business cycle took place.

The x-axis measures in dollars the change in fixed assets quarter-over-quarter. The y-axis shows the number of quarters from the start of the recession. For example, the bars above Q1 show the change in fixed axis during the first quarter of the recessions that started in 1974, 1980, 1981, 1990, 2001 and 2007. The recessions beginning in 1980 and 1990 only lasted three quarters, and hence there is no data for them in Q4, Q5 and Q6.

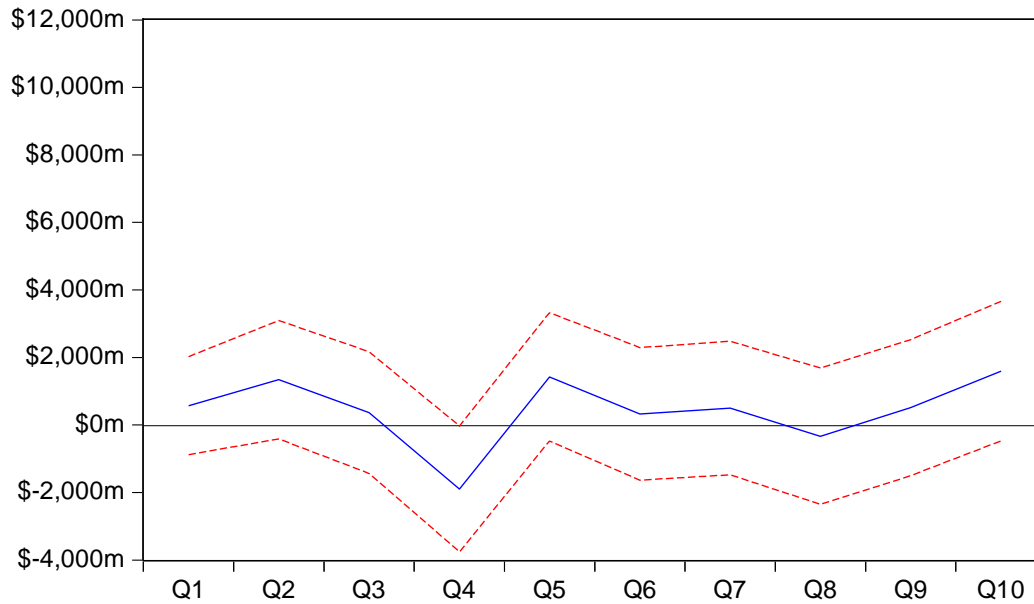
**Graph IV: Change in Fixed Assets for Smallest Firms, 1974–2010 Recessions**



Graph IV presents data from the Quarterly Financial Report published by the Bureau of the Census, and covers all recessions from Q1 1974 through Q2 2010. It covers the smallest firms, defined as those firms with less than twenty-five million in total assets. Recession dates are defined by the National Bureau of Economic Research and start in the quarter during which the peak of a business cycle occurred and end in the quarter during which the trough of the business cycle took place.

The x-axis measures in dollars the change in fixed assets quarter-over-quarter. The y-axis shows the number of quarters from the start of the recession. For example, the bars above Q1 show the change in fixed axis during the first quarter of the recessions that started in 1974, 1980, 1981, 1990, 2001 and 2007. The recessions beginning in 1980 and 1990 only lasted three quarters, and hence there is no data for them in Q4, Q5 and Q6.

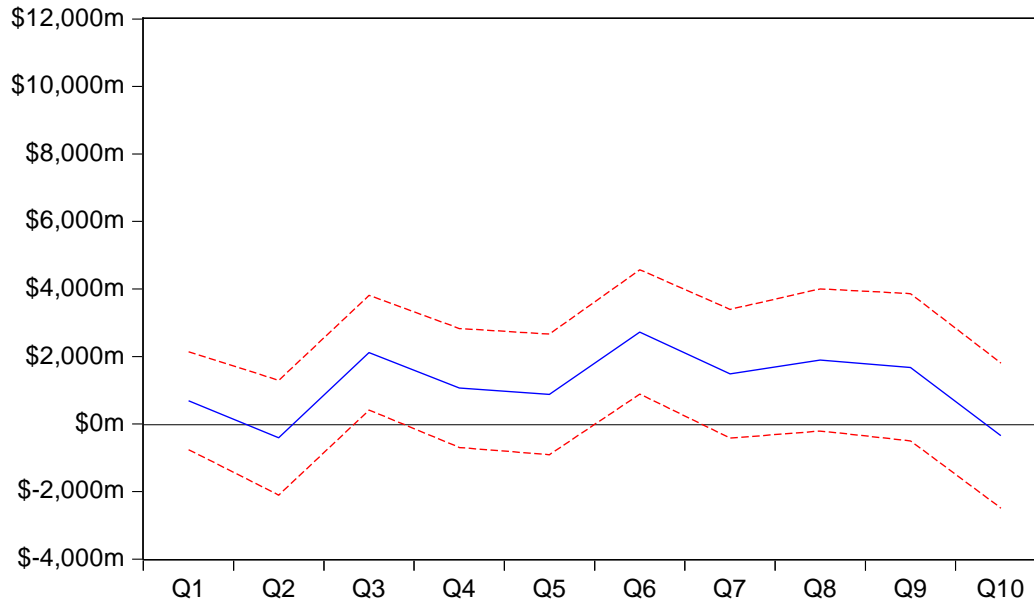
**Graph V: Response of Fixed Assets to Long-term Bank Debt (1974–2010)**



Graph V depicts the impulse response of an exogenous shock in long-term bank debt on fixed assets. Data is from the Quarterly Financial Report published by the Bureau of the Census, and spans Q1 1974 through Q2 2010. It covers the largest firms, defined as those firms with more than one billion in total assets. To obtain the impulse response, first the following regression is run  $\Delta\text{Fixed Assets} = C + \beta_1 \cdot \Delta\text{Short-term Bank Debt} + \beta_2 \cdot \Delta\text{Long-term Bank Debt} + \beta_3 \cdot \Delta\text{Commercial Paper}$  (Appendix II).

The x-axis measures the number of quarters after the shock in long-term bank debt. The y-axis measures, in dollars, the change in fixed assets. So, an exogenous shock in long-term bank debt will result in an increase in fixed assets during the first, second, third, fifth, sixth, seventh, ninth, and tenth quarters after the shock occurs.

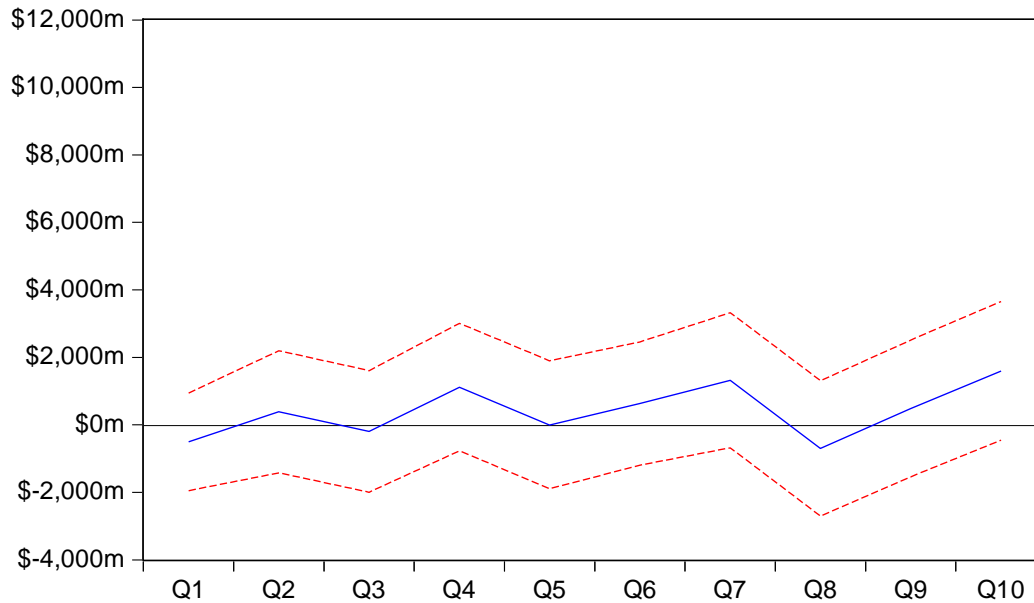
**Graph VI: Response of Fixed Assets to Short-term Bank Debt (1974–2010)**



Graph VI depicts the impulse response of an exogenous shock in short-term bank debt on fixed assets. Data is from the Quarterly Financial Report published by the Bureau of the Census, and spans Q1 1974 through Q2 2010. It covers the largest firms, defined as those firms with more than one billion in total assets. To obtain the impulse response, first the following regression is run  $\Delta\text{Fixed Assets} = C + \beta_1 \cdot \Delta\text{Short-term Bank Debt} + \beta_2 \cdot \Delta\text{Long-term Bank Debt} + \beta_3 \cdot \Delta\text{Commercial Paper}$  (Appendix II).

The x-axis measures the number of quarters after the shock in short-term bank debt. The y-axis measures the change in dollars in fixed assets quarter-over-quarter. So, an exogenous shock in short-term bank debt will result in an increase in fixed assets in the first and third through ninth quarters after the shock occurs.

**Graph VII: Response of Fixed Assets to Commercial Paper (1974–2010)**



Graph VII portrays the impulse response of an exogenous shock in commercial paper on fixed assets. Data is from the Quarterly Financial Report published by the Bureau of the Census, and spans Q1 1974 through Q2 2010. It covers the largest firms, defined as those firms with more than one billion in total assets. To obtain the impulse response, first the following regression is run  $\Delta\text{Fixed Assets} = C + \beta_1 \cdot \Delta\text{Short-term Bank Debt} + \beta_2 \cdot \Delta\text{Long-term Bank Debt} + \beta_3 \cdot \Delta\text{Commercial Paper}$  (Appendix II).

The x-axis measures the number of quarters after the shock in commercial paper occurs. The y-axis measures the change in dollars in fixed assets quarter-over-quarter. So, an exogenous shock in commercial paper will result in an increase in fixed assets in the second, fourth, fifth, sixth, seventh, ninth and tenth quarters after the shock occurs.

## Appendix I

The following data sets from large firms are considered for a vector autoregression:

fixed assets<sub>t</sub>  
 long-term bank debt<sub>t</sub>  
 short-term bank debt<sub>t</sub>  
 commercial paper<sub>t</sub>

The data is tested to determine the probability that it has a unit root using the Augmented Dickey-Fuller (ADF) test. The following table lists the results of the ADF test.

Augmented Dickey-Fuller test statistic  
 Null Hypothesis: Variable has unit root

	t-Statistic	Prob
D(Fixed Assets)	-6.285	0.000
D(Long-term Bank Debt)	-3.175	0.000
D(Short-term Bank Debt)	-12.154	0.000
D(Commercial Paper)	-12.834	0.000

The optimal lag length is determined using the LR test criteria. The test is run for 20 through 1 lag, and for each run the optimal is recorded. The lowest LR criterion occurs when 14 lags are included in the test. It indicates that 12 lags should be included in the VAR.

The following VAR is estimated:

$$y_t = \sum_{i=1}^{12} \beta_i y_{t-i} + e_t$$

$y_t = [\text{long-term bank debt}_t \quad \text{short-term bank debt}_t \quad \text{commercial paper}_t \quad \text{fixed assets}_t]$

VAR results are presented in Appendix II.

This equation is over-identified and restriction must be imposed to run impulse response functions. Cholesky decomposition is used and the following variable order is applied:

long-term bank debt<sub>t</sub>   short-term bank debt<sub>t</sub>   commercial paper<sub>t</sub>   fixed assets<sub>t</sub>

The impulse response functions are shown in Appendix III.

# Appendix II

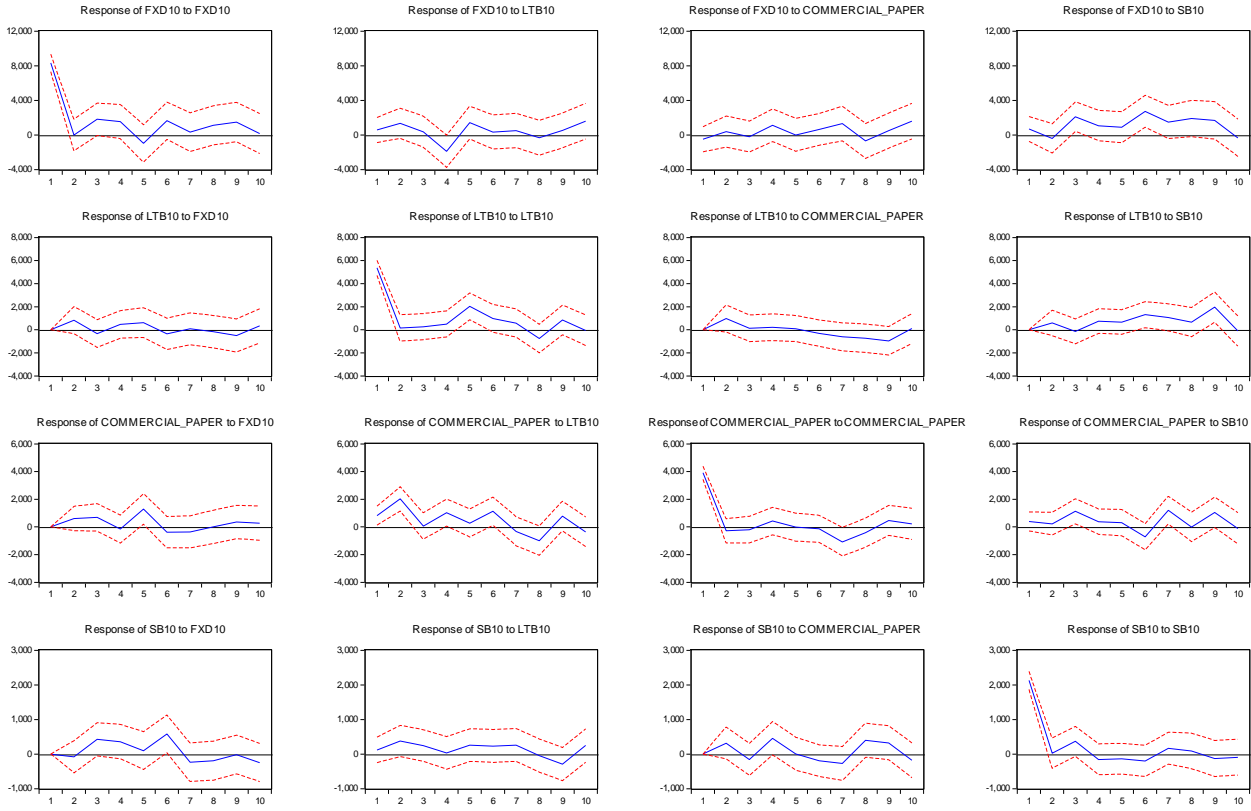
## Vector Autoregression Estimates

t-statistics in [ ]

	Fixed Assets	Long-term Bank Debt	Commercial Paper	Short-term Bank Debt		Fixed Assets	Long-term Bank Debt	Commercial Paper	Short-term Bank Debt		Fixed Assets	Long-term Bank Debt	Commercial Paper	Short-term Bank Debt
Fixed Asset(-1)	-0.003 [-0.02814]	0.099 [1.41313]	0.073 [1.39356]	-0.010 [-0.35200]	Long-term Bank Debt(-1)	0.240 [1.42579]	-0.027 [-0.24731]	0.377 [4.67810]	0.059 [1.37765]	Commercial Paper(-1)	0.098 [0.42360]	0.259 [1.75504]	-0.062 [-0.56059]	0.080 [1.35506]
Fixed Asset(-2)	0.184 [1.64901]	-0.054 [-0.75818]	0.051 [0.94718]	0.040 [1.39895]	Long-term Bank Debt(-2)	0.010 [0.05224]	-0.083 [-0.68441]	0.008 [0.08951]	0.015 [0.32032]	Commercial Paper(-2)	-0.062 [-0.27412]	0.023 [0.16282]	-0.157 [-1.45121]	-0.043 [-0.75023]
Fixed Asset(-3)	0.210 [1.88205]	0.008 [0.10553]	-0.005 [-0.08466]	0.044 [1.55164]	Long-term Bank Debt(-3)	-0.505 [-2.69750]	0.067 [0.55858]	0.170 [1.89274]	-0.019 [-0.39438]	Commercial Paper(-3)	0.206 [0.89980]	0.113 [0.77205]	0.045 [0.41488]	0.102 [1.75181]
Fixed Asset(-4)	-0.159 [-1.29405]	0.048 [0.61169]	0.076 [1.28806]	-0.007 [-0.21518]	Long-term Bank Debt(-4)	0.022 [0.11417]	0.322 [2.56301]	0.005 [0.05718]	-0.024 [-0.48697]	Commercial Paper(-4)	0.105 [0.46906]	-0.063 [-0.44004]	-0.079 [-0.73246]	0.015 [0.26017]
Fixed Asset(-5)	-0.020 [-0.16797]	-0.092 [-1.18484]	-0.088 [-1.51739]	0.025 [0.81355]	Long-term Bank Debt(-5)	0.000 [0.00065]	0.129 [1.03919]	0.131 [1.40749]	0.057 [1.16512]	Commercial Paper(-5)	0.063 [0.31173]	-0.166 [-1.29525]	-0.110 [-1.14538]	-0.098 [-0.96946]
Fixed Asset(-6)	0.083 [0.69269]	-0.024 [-0.30996]	-0.055 [-0.95681]	-0.009 [-0.30354]	Long-term Bank Debt(-6)	-0.093 [-0.50358]	0.113 [0.95327]	-0.046 [-0.51804]	0.042 [0.90175]	Commercial Paper(-6)	0.208 [0.94460]	-0.259 [-1.83685]	-0.300 [-2.83918]	-0.079 [-1.41251]
Fixed Asset(-7)	0.041 [0.33399]	-0.032 [-0.40883]	-0.005 [-0.08990]	-0.025 [-0.80207]	Long-term Bank Debt(-7)	-0.261 [-1.39287]	-0.078 [-0.65019]	-0.109 [-1.21468]	0.001 [0.01768]	Commercial Paper(-7)	-0.077 [-0.33340]	-0.279 [-1.88244]	-0.132 [-1.19361]	0.119 [2.02284]
Fixed Asset(-8)	0.013 [0.11014]	-0.055 [-0.73102]	0.135 [2.37949]	0.002 [0.06307]	Long-term Bank Debt(-8)	0.020 [0.10691]	0.130 [1.07892]	0.070 [0.77483]	-0.080 [-1.66995]	Commercial Paper(-8)	0.111 [0.47229]	-0.258 [-1.72138]	0.297 [2.64408]	0.112 [1.87291]
Fixed Asset(-9)	-0.031 [-0.25091]	0.011 [0.14314]	0.031 [0.53866]	-0.017 [-0.54773]	Long-term Bank Debt(-9)	0.085 [0.45435]	-0.070 [-0.58425]	-0.272 [-3.02156]	0.018 [0.37276]	Commercial Paper(-9)	0.258 [1.02448]	-0.151 [-0.93732]	0.098 [0.81003]	-0.017 [-0.25890]
Fixed Asset(-10)	-0.214 [-1.80739]	0.006 [0.07712]	0.069 [1.22044]	0.056 [1.87031]	Long-term Bank Debt(-10)	0.251 [1.25376]	0.013 [0.10394]	0.046 [0.47937]	0.056 [1.10754]	Commercial Paper(-10)	-0.434 [-1.71363]	-0.129 [-0.79196]	0.054 [0.44194]	0.053 [0.82204]
Fixed Asset(-11)	-0.090 [-0.79760]	0.014 [0.19745]	-0.017 [-0.32158]	-0.048 [-1.69434]	Long-term Bank Debt(-11)	0.020 [0.09431]	-0.122 [-0.91064]	0.028 [0.27577]	-0.141 [-2.64718]	Commercial Paper(-11)	-0.074 [-0.27658]	0.172 [1.00932]	0.092 [0.71843]	0.007 [0.10473]
Fixed Asset(-12)	0.134 [1.14951]	-0.039 [-0.52478]	0.037 [0.67000]	-0.069 [-2.32341]	Long-term Bank Debt(-12)	-0.189 [-0.88101]	-0.222 [-1.61616]	-0.089 [-0.86739]	-0.054 [-0.99028]	Commercial Paper(-12)	0.126 [0.51271]	0.058 [0.37113]	0.103 [0.87932]	0.165 [2.64824]
										Commercial Paper(-12)	0.126 [0.51271]	0.058 [0.37113]	0.103 [0.87932]	0.165 [2.64824]
										Short-term Bank Debt(-12)	0.700 [1.30125]	0.898 [2.60945]	0.318 [1.23425]	0.174 [1.27977]
										C	10,991,600 [2.83388]	2676,334 [1.08854]	-3968,361 [-2.15481]	326,1857 [0.33384]

# Appendix III

Response to Cholesky One S.D. Innovations  $\pm 2$  S.E.



## Appendix IV: VAR

The following data sets are considered for a vector autoregression:

fixed assets<sub>t</sub>

log GDP<sub>t</sub>

log federal funds rate<sub>t</sub>

inventory<sub>t</sub>

short-term bank debt<sub>t</sub>

long-term bank debt<sub>t</sub>

Fixed assets, inventory, long-term bank debt and short-term bank debt are from the Quarterly Financial Report spanning from the first quarter of 1974 to the second quarter of 2010. GDP is from the Bureau of Economic Analysis, and the Federal Funds Rate is from the Federal Reserve Bank.

All variables have been weighted by the GDP deflator to reflect real values. A vector autoregression is run for each asset size: <\$25mil, 25-50mil, 50-100mil, 100-250mil, 250-1billion, >\$1billion. The Augmented Dickey Fuller unit root test results and LR optimal lag length are listed, as well as the number of observations and  $R^2$  for each vector autoregression.

Two impulse response functions are shown for each regression. A Cholesky decomposition is used and the following order is imposed: dlog(GDP) d(fixed assets) d(inventory) d(long-term bank debt) d(short-term bank debt) dlog(Federal Funds Rate). The first graph shows the response of dlog(fixed assets) from an impulse in dlog(GDP). The second graph shows the response of dlog(fixed assets) from an impulse in dlog(Federal Funds Rate).

**Firms with less than \$25 million in total assets**

	<b>t-Statistic</b>	<b>Prob.</b>
d(log GDP)	-7.829	0.00%
d(fixed assets)	-12.238	0.00%
d(inventory)	-10.862	0.00%
d(long-term bank debt)	-13.169	0.00%
d(short-term bank debt)	-15.768	0.00%
d(log Federal Funds Rate)	-3.968	0.21%

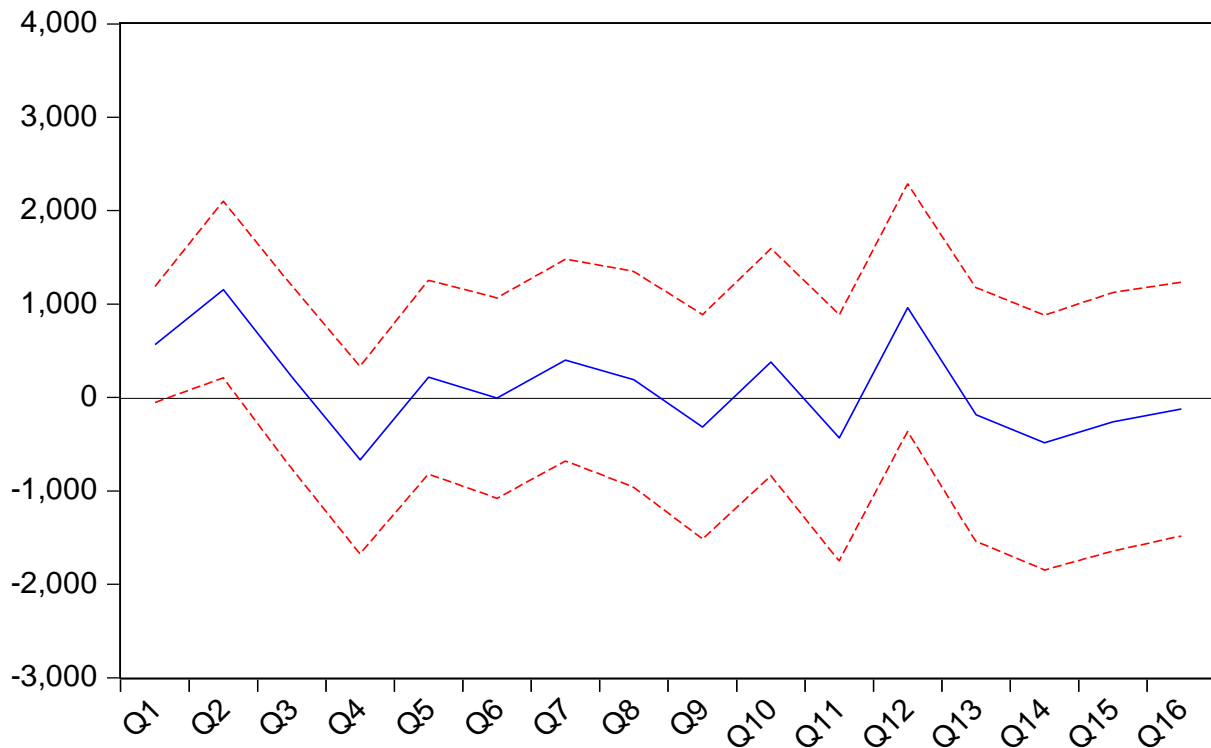
VAR:

Lags = 13

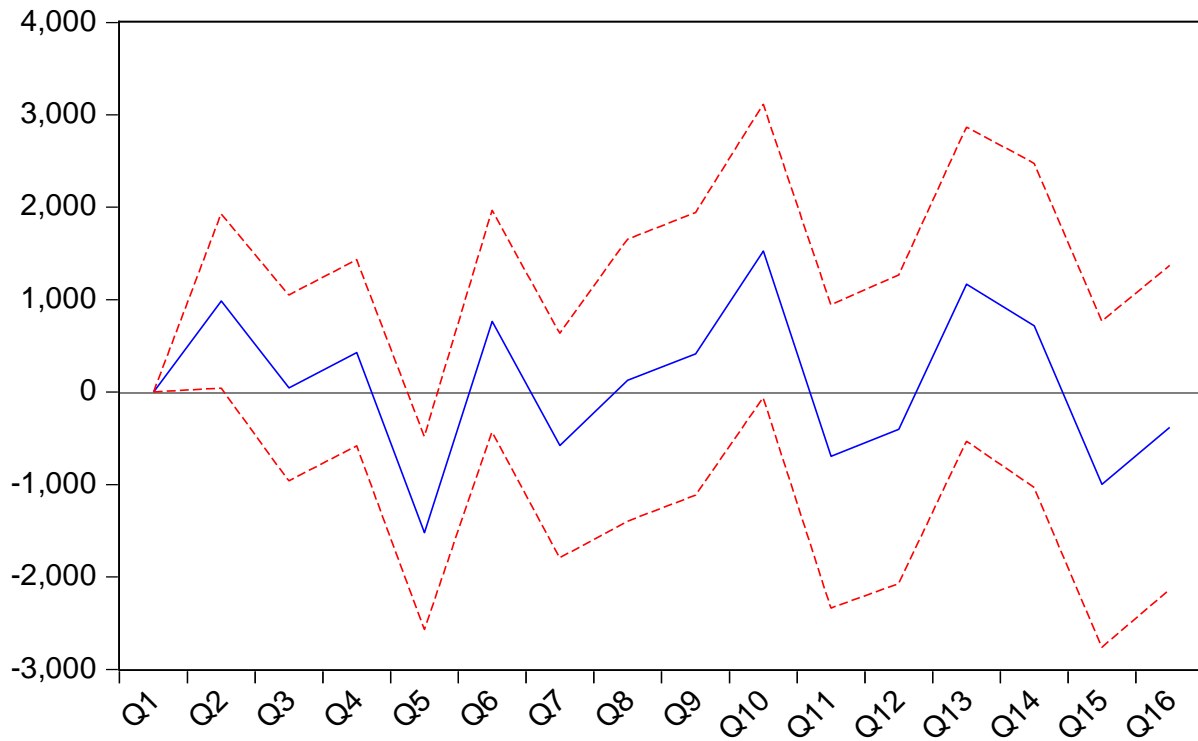
N = 141

R<sup>2</sup> = 0.726

**Firms with less than \$25million in Total Assets:  
Response of d(fixed assets) to dlog(GDP)**



**Firms with less than \$25million in Total Assets:  
Response of  $d(\text{fixed assets})$  to  $d\log(\text{federal funds rate})$**



**Firms with \$25 to \$50 million in total assets**

	t-Statistic	Prob.
d(log GDP)	-7.829	0.00%
d(fixed assets)	-10.645	0.00%
d(inventory)	-13.442	0.00%
d(long-term bank debt)	-15.007	0.00%
d(short-term bank debt)	-11.946	0.00%
d(log Federal Funds Rate)	-3.968	0.21%

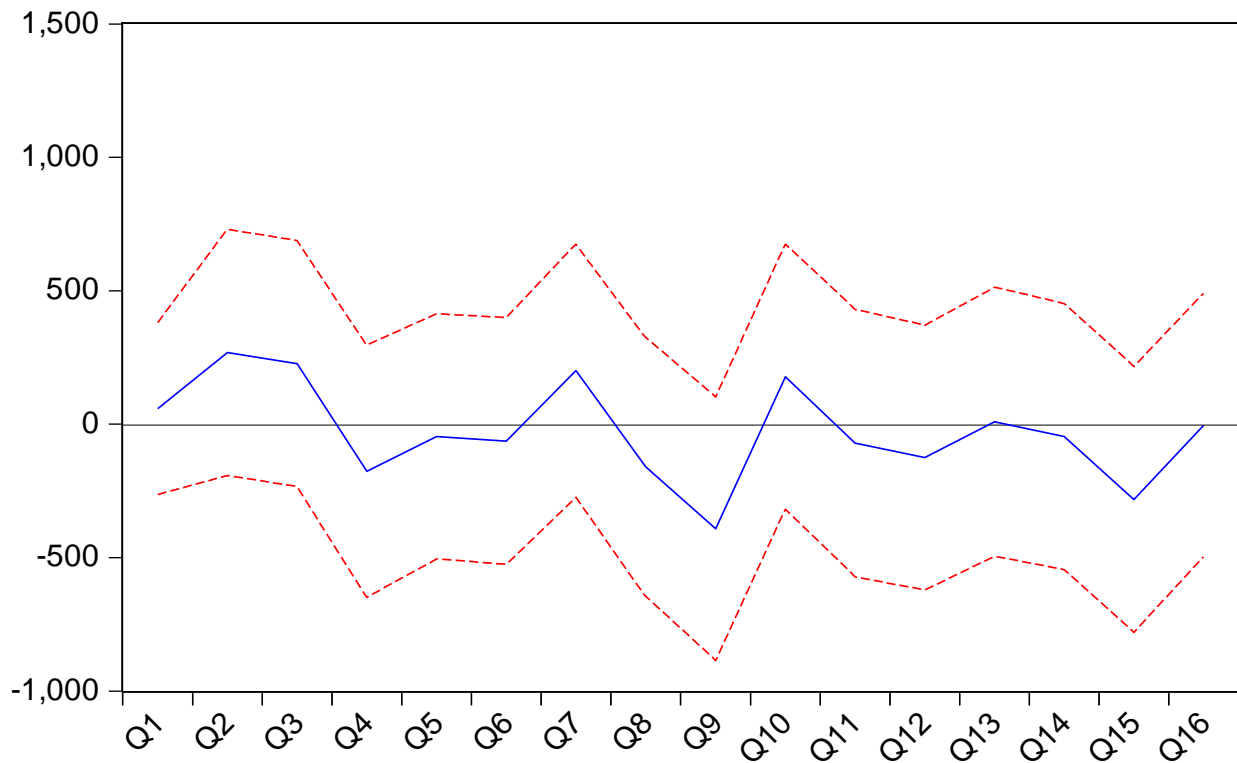
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Lags = 12

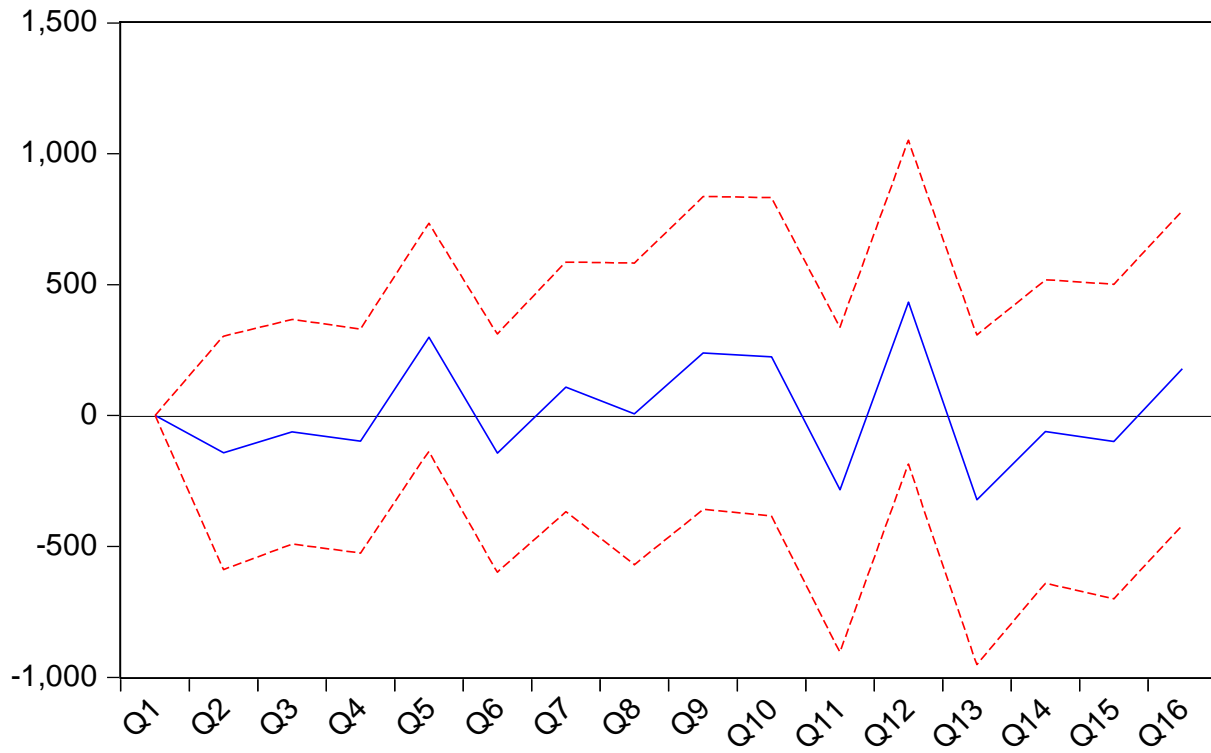
N = 141

R<sup>2</sup> = 0.622

**Firms with \$25 to \$50 million in Total Assets:  
Response of d(fixed assets) to dlog(GDP)**



**Firms with \$25 to \$50 million in Total Assets:  
Response of  $d(\text{fixed assets})$  to  $d\log(\text{federal funds rate})$**



## Firms with \$50 to \$100 million in total assets

	t-Statistic	Prob.
d(log GDP)	-7.829	0.00%
d(fixed assets)	-11.479	0.00%
d(inventory)	-11.209	0.00%
d(long-term bank debt)	-16.443	0.00%
d(short-term bank debt)	-15.937	0.00%
d(log Federal Funds Rate)	-3.968	0.21%

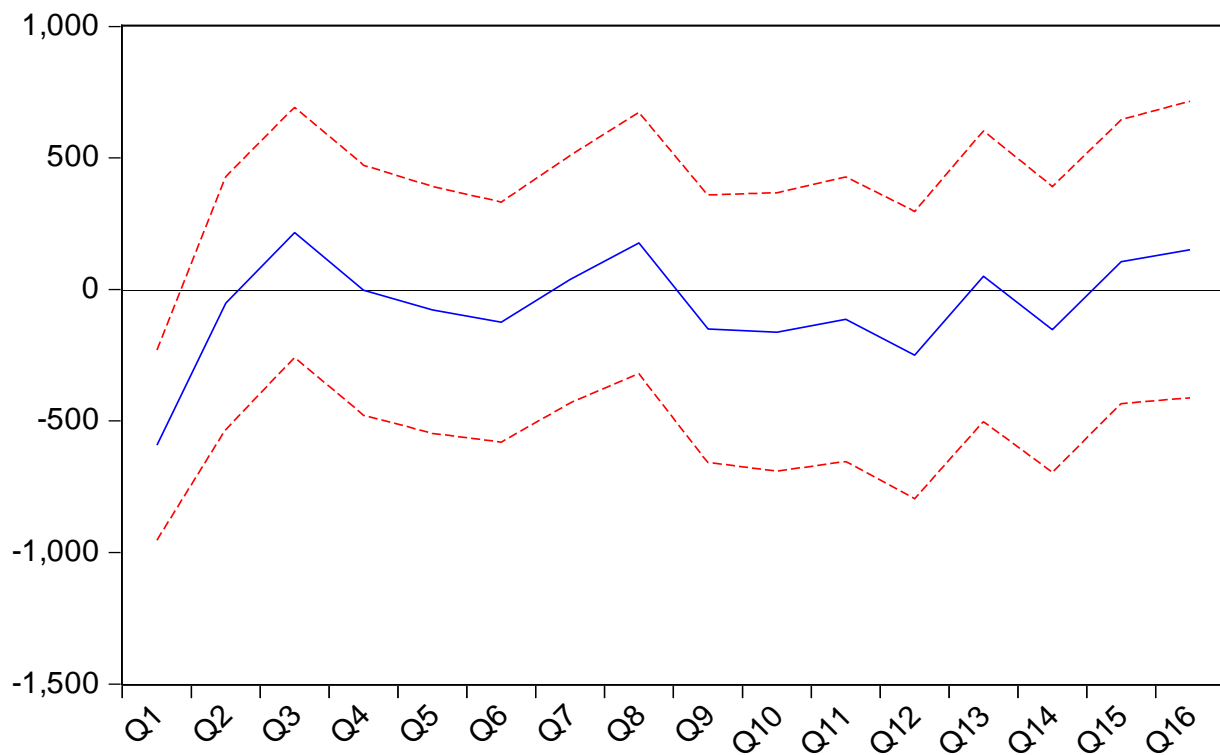
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Lags = 12

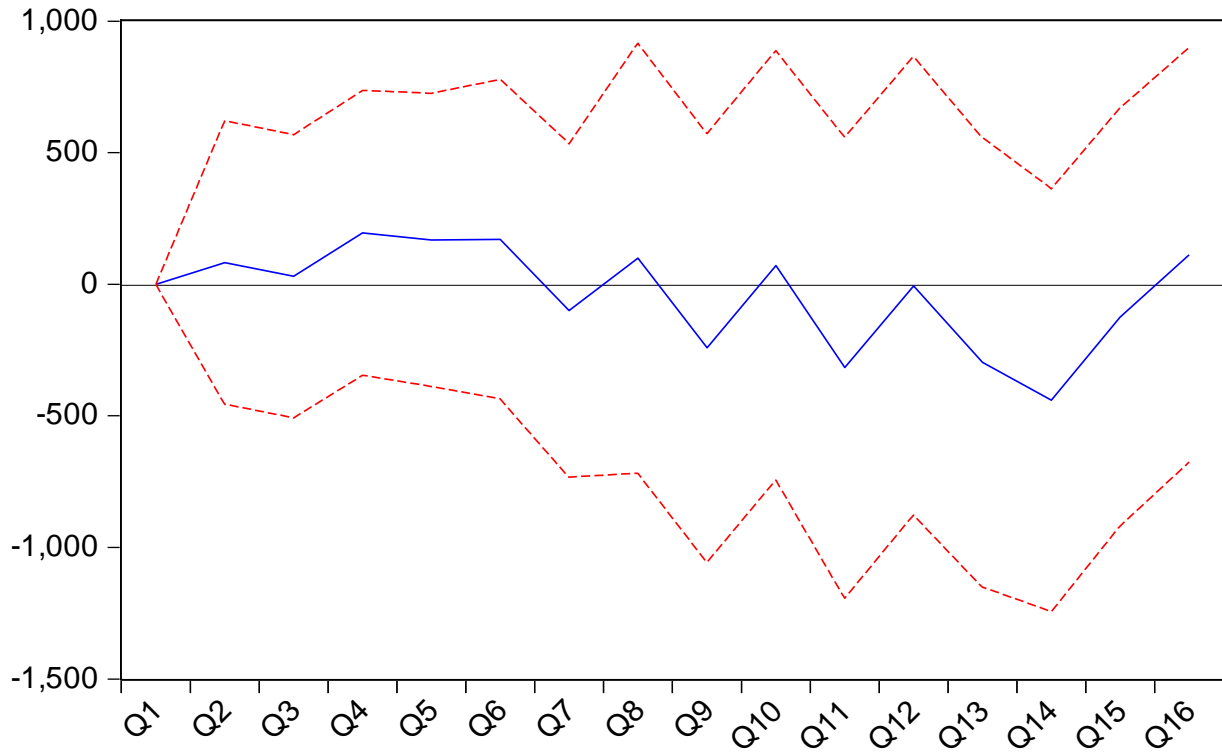
N = 141

$R^2 = 0.734$

### Firms with \$50 to \$100 million in Total Assets: Response of d(fixed assets) to dlog(GDP)



**Firms with \$50 to \$100 million in Total Assets:  
Response of  $d(\text{fixed assets})$  to  $d\log(\text{federal funds rate})$**



**Firms with \$100 to \$250 million in total assets**

	t-Statistic	Prob.
d(log GDP)	-7.829	0.00%
d(fixed assets)	-13.644	0.00%
d(inventory)	-14.882	0.00%
d(long-term bank debt)	-12.282	0.00%
d(short-term bank debt)	-13.297	0.00%
d(log Federal Funds Rate)	-3.968	0.21%

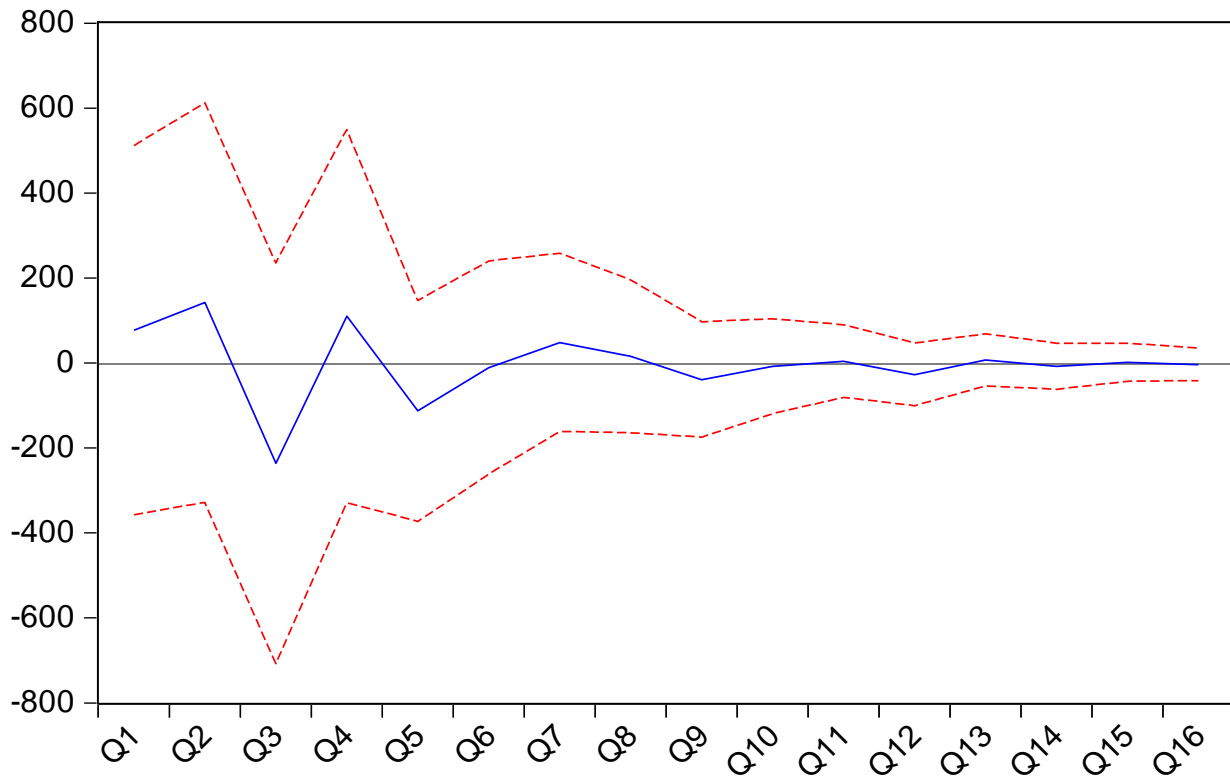
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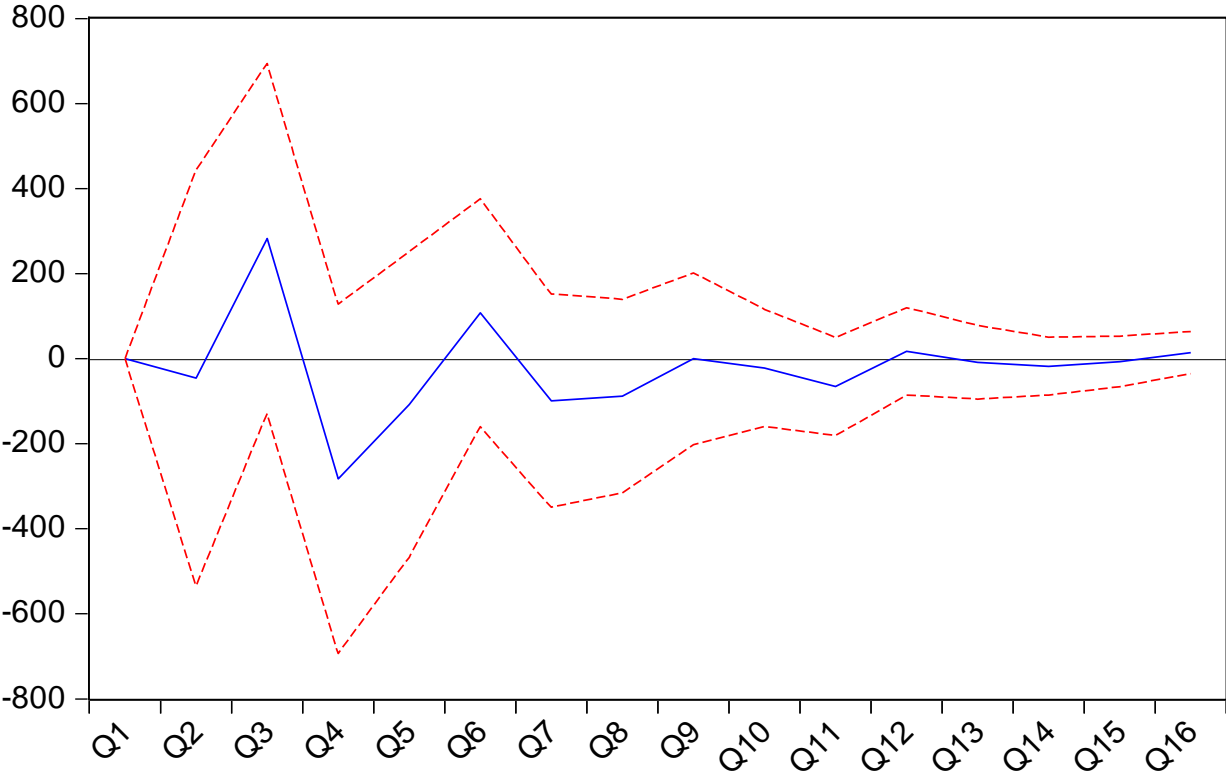
N = 141

R<sup>2</sup> = 0.999

**Firms with \$100 to \$250 million in Total Assets:  
Response of d(fixed assets) to dlog(GDP)**



**Firms with \$100 to \$250 million in Total Assets:  
Response of d(fixed assets) to dlog(federal funds rate)**



### Firms with \$250 million to \$1 billion in total assets

	t-Statistic	Prob.
d(log GDP)	-7.829	0.00%
d(fixed assets)	-12.027	0.00%
d(inventory)	-9.939	0.00%
d(long-term bank debt)	-9.074	0.00%
d(short-term bank debt)	-7.468	0.00%
d(log Federal Funds Rate)	-3.968	0.21%

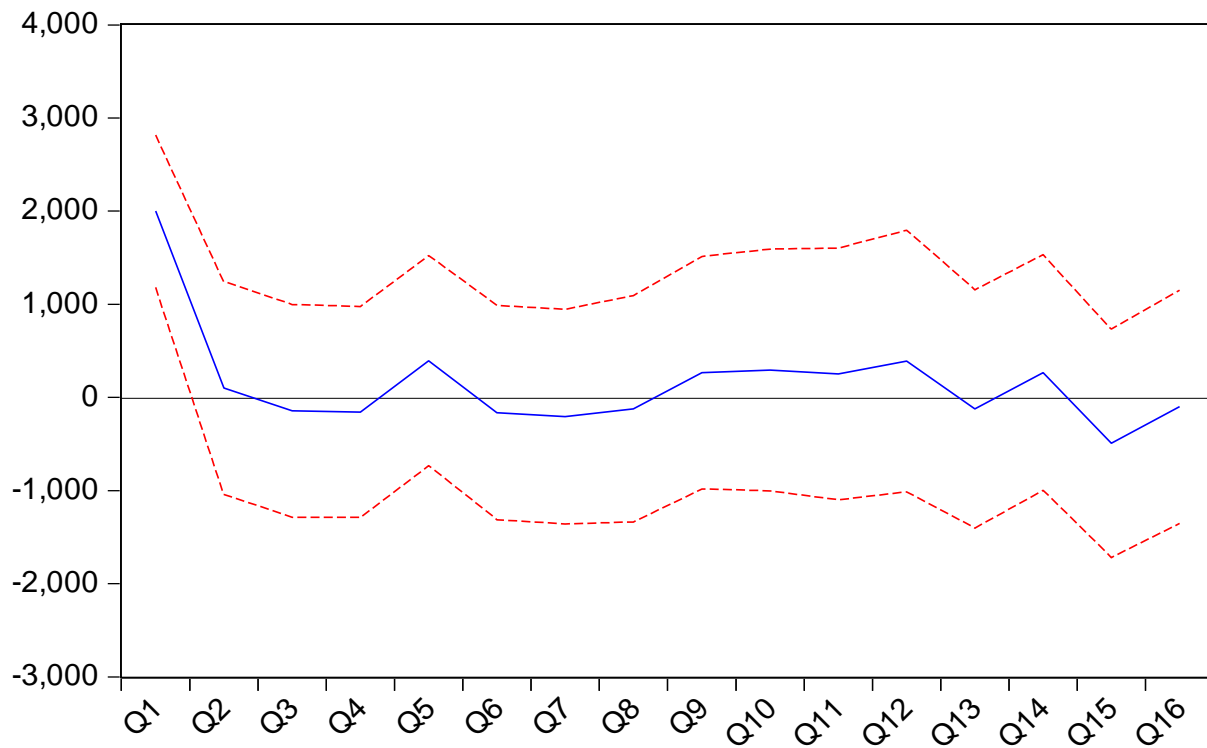
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Lags = 11

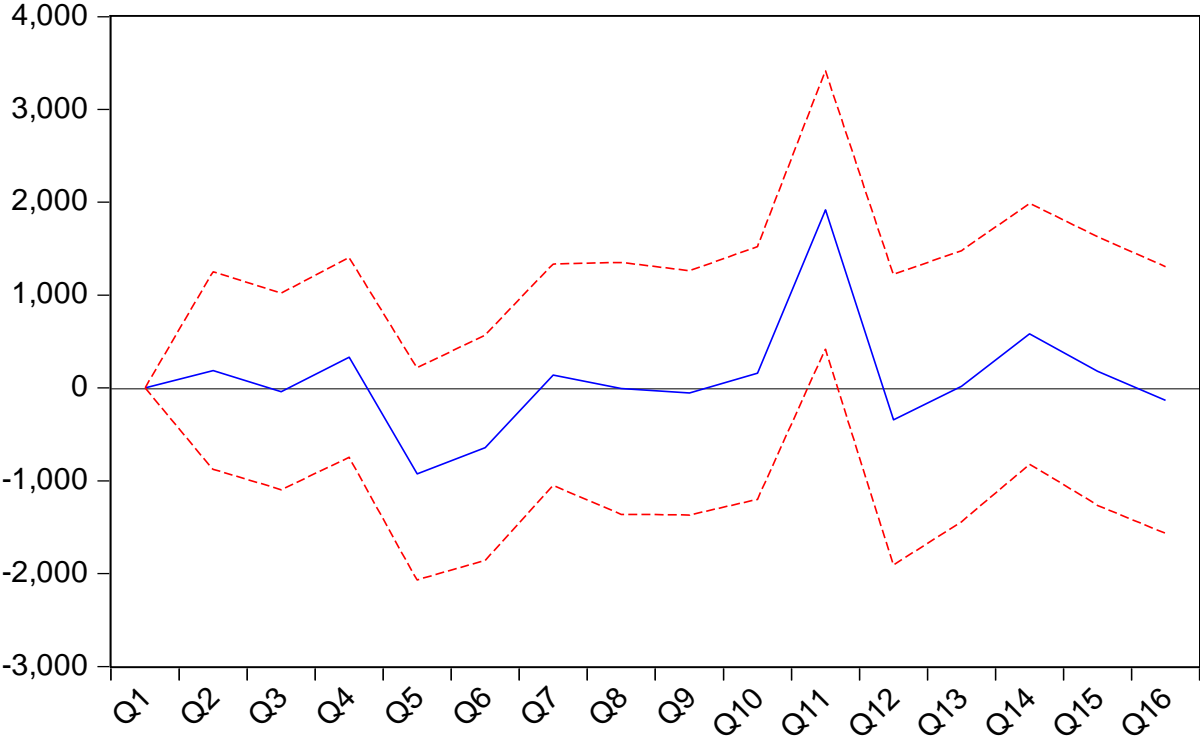
N = 141

$R^2 = 0.598$

### Firms with \$250 million to \$1 billion in Total Assets: Response of d(fixed assets) to dlog(GDP)



**Firms with \$250 million to \$1 billion in Total Assets:  
Response of d(fixed assets) to dlog(federal funds rate)**



## Firms with more than \$1 billion in total assets

	t-Statistic	Prob.
d(log GDP)	-7.829	0.00%
d(fixed assets)	-9.521	0.00%
d(inventory)	-5.441	0.00%
d(long-term bank debt)	-10.475	0.00%
d(short-term bank debt)	-13.318	0.00%
d(log Federal Funds Rate)	-3.968	0.21%

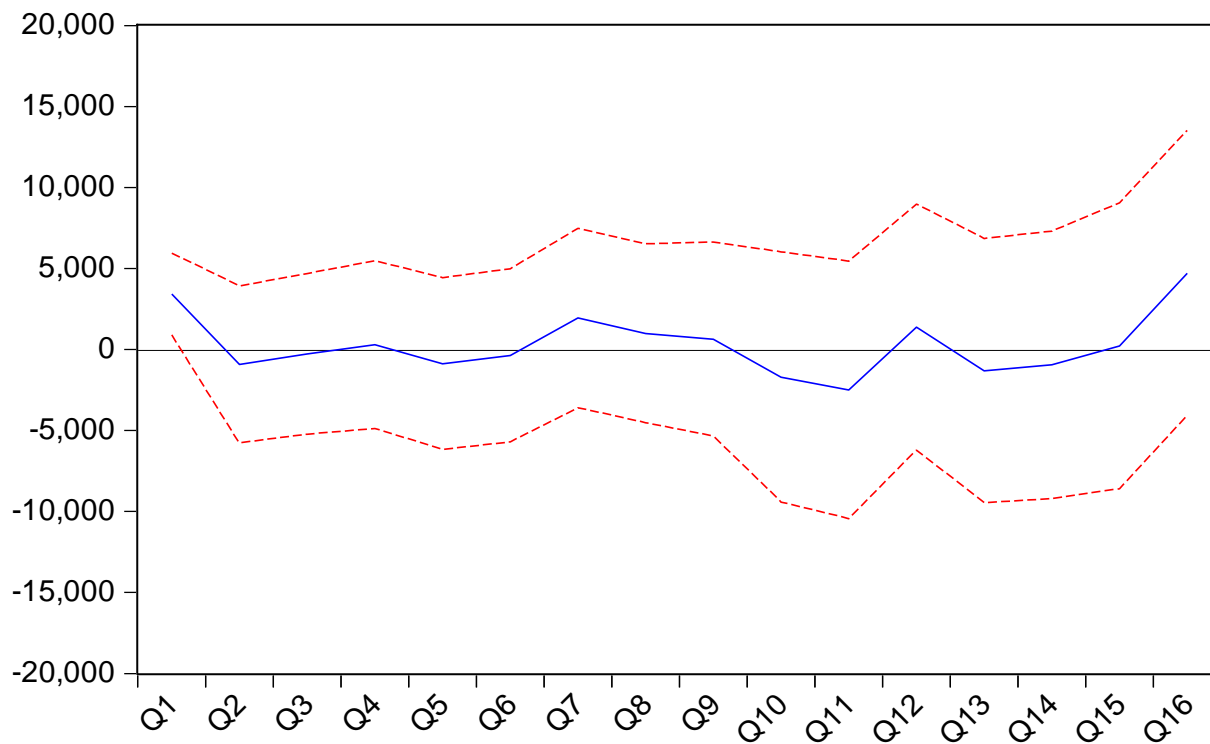
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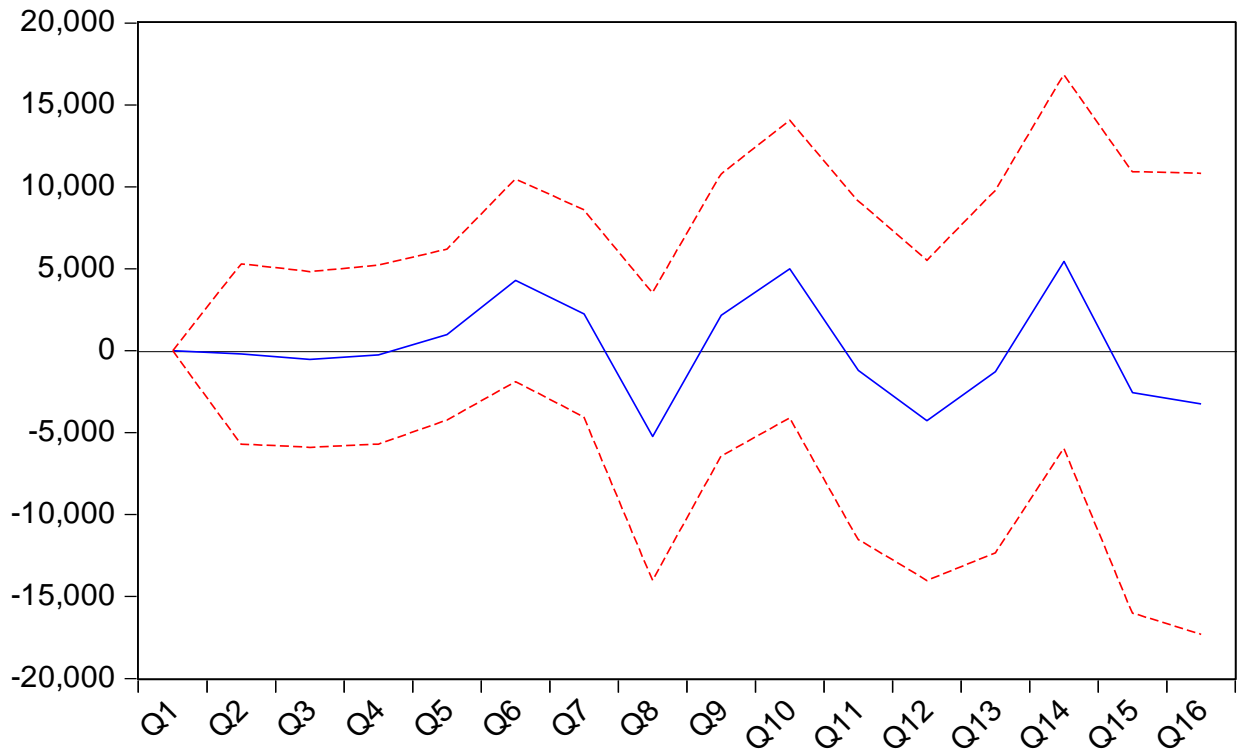
N = 141

$R^2 = 0.585$

### Firms with more than \$1 billion in Total Assets: Response of d(fixed assets) to dlog(GDP)



**Firms with more than \$1 billion in Total Assets:  
Response of  $d(\text{fixed assets})$  to  $d\log(\text{federal funds rate})$**



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