Sectoral Effects of Monetary Policy: The Evidence from Publicly Traded Firms

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Abstract:

This paper examines the impact of monetary policy on net sales of publicly traded firms in various sectors of the U.S. economy. We find that monetary policy has a heterogeneous impact on firms in different industries, with the strongest effect on firms in Retail and in Wholesaling. Balance sheet characteristics, especially size, influences the impact of policy. Larger firms in several industries are able to mitigate the impact of policy. We find mixed results for firms' working capital, short-term debt ratio, and leverage ratio with respect to the operation of the credit channel.

JEL Classifications: E52, E32, L16

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I. Introduction

This paper examines the impact of monetary policy on industries in various sectors of the economy. Our goals include describing and characterizing the cross-industry heterogeneity of monetary policy effects; examining firm characteristics that might explain these heterogeneous monetary policy impacts; and exploring the cyclicality of different sectors of the economy. The credit channel of monetary policy transmission makes cross-sectional predictions that have not been previously tested using firm-level data for different sectors of the economy. Our paper provides evidence on these cross-sectional implications.

A number of papers are related to our study. Kashyap, Lamont and Stein (1994) demonstrate that monetary policy tightening has a larger impact on firms that are liquidity-constrained. Gertler and Gilchrist (1994) compare the response of large and small U.S. manufacturing firms to monetary policy actions, and find that smaller firms are more strongly impacted. Carlino and DeFina (1998) find regional differences in the impact of U.S. monetary policy, and they argue these are related to differential concentrations of industries across geographical regions. Using aggregated data, Raddatz and Rigobon (2003) show that monetary policy has the largest impact on durable consumption, non-durable consumption and residential investment, and investment in structures has no response to monetary policy actions. There are also a number of studies that look at the differential impact of monetary policy for both the U.S. and Europe. Ganley and Salmon (1997) look at aggregated industry data and find that the impact of monetary policy differs across 24 sectors of the U.K. economy. They demonstrate that the differential impact is both in speed of effect and ultimate magnitude of the effect. Their method is a VAR analysis supplemented by looking at correlations of measures of the impact of monetary policy with industry-specific factors such as average firm size, average profitability, and concentration ratios. They find, for example, that construction is relatively strongly impacted by monetary policy as compared to services. Dedola and Lippi (2005) look at monetary transmission mechanism for industries in five OECD countries including the U.S. They examine disaggregated industry-level data and document heterogeneity in the response to monetary policy shocks. They find that monetary policy's impact is related to industry output durability, financing requirements, firm size, and borrowing capacity, and argue that their results provide support for the credit channel view of monetary policy. Peersman and Smets (2005) look at the industry impact of monetary policy for eleven industries in Europe, and document heterogeneity and asymmetry in the impact on various industries. They argue that durability of goods can explain most of the differences in policy impact, while the degree of asymmetry seems linked to leverage, firm size, and the debt structure.

It is important to note that these papers mostly concentrate on manufacturing sector, and use industry-level data. Gertler and Gilchrist (1994), and Dedola and Lippi (2005) look at Quarterly Financial Report (QFR) data that is aggregated according to asset size, and they use this to generate variables that characterize the manufacturing industries. In this study we look not only at a variety of industries in different sectors of the economy, but also at estimates based on individual firm-level data. To our knowledge, our paper is the first to examine the role of balance sheet characteristics of firms, using firm level data, in different sectors of the economy as a propagation mechanism in the monetary policy transmission.

A list of industries that are considered in this paper with their value-added contribution to GDP as reported by the Bureau of Economic Analysis (BEA) is shown in Table 1[1]. This list

[1] There are several reasons why Table 1 should be considered background information, an indication of the importance of these industries in GDP. First, BEA classification of industries is based upon the NAICS codes. In

includes both very large industries such as manufacturing and services, and smaller industries such as mining and transportation. It includes construction and durable goods manufacturing sectors, typically considered to be especially sensitive to monetary policy. We report the industry value-added contribution for 1971, 1987, and 2003, to give a snapshot for a year near the beginning, middle, and end of our sample. Some of the changes in the industrial structure of the economy are apparent. Most clear is the change in relative position of manufacturing and services. Manufacturing value added was 22.1% of GDP in 1971 but only about 12.4% of GDP in 2003. In contrast, Service value added was 14.8% of GDP in 1971 but increased to 25.2% of GDP in 2003. Other industries show smaller impacts. Transportation and Warehousing, Retail Trade, and Wholesale continued to decline. Mining was fairly constant, and Construction showed a slight decline.

Our main finding is that monetary policy has a heterogeneous impact on the growth rate of real net sales of firms in different sectors, with the strongest effect on firms in Retail, Service, and in Wholesaling of Durables. We find evidence supporting the credit channel of monetary policy. In particular, we find that size of the firm matters, that larger firms in Manufacturing, Manufacturing of Non-Durables, Construction, Mining, and Service are able to mitigate the impact of monetary policy. The usual explanation given in the literature for higher sensitivity of smaller firms to tight monetary policy is that smaller firms lack access to the direct credit market. In our study, small publicly traded firms, despite of having access to the financial market, still are more sensitive to the interest rate changes relative to the large publicly traded firms in certain

our analysis we define industries by their SIC codes. The NAICS system is a fairly recent invention and the historical firm level market data does not always have NAICS entries. The SIC classification system provides us with a classification system available for our entire sample period, and one that is especially useful because our data contains a large number of firms that are no longer operating and for which no NAICS code is available. Second, we look at sales, not value added. Third, our data is from publicly traded corporations, which are an important component but obviously a subset of the universe of firms.

sectors. One possible explanation could be that the cost of raising funds directly in the financial market may be higher for smaller firms due to greater uncertainty regarding their future prospects. For other balance sheet variables we find mixed results with respect to the credit channel.

These results have implications for the effectiveness and for the redistributive effects of monetary policy. The efficacy of monetary policy may be reduced if the size of firms increases over time (perhaps due to mergers and consolidation) or if the relative importance of the policy-sensitive sectors as a fraction of GDP declines over time (for example, the decline in the relative size of manufacturing). Further, our results indicate that agents participating in the policy-sensitive sectors may face additional risk due to policy uncertainty, so that monetary policy has differential welfare impacts across agents.

The rest of the paper is organized as follows. Section II briefly reviews the monetary transmission channels, and Section III describes the data we use. Section IV presents our results, and Section V provides our conclusion.

II. Monetary Policy Transmission Channels

Changes in monetary policy can affect firms in multiple ways, and the literature has outlined a number of channels of monetary policy. There is the conventional interest rate - cost of capital channel of monetary policy. In this channel a contractionary monetary policy raises interest rates, raises a firm's cost of capital, leading to lower investment and a reduction in output. More capital-intensive industries would be expected to be more sensitive to a contractionary monetary policy.

The literature has also identified a broad credit channel for monetary policy. In this credit channel, (see Bernanke and Gertler (1989, 1995)), credit market imperfections create a wedge between the cost of funds raised externally and the opportunity cost of internal funds. This wedge, known as the external finance premium, varies in size depending on the borrower's financial position. For example, the greater the borrower's net worth, ceteris paribus, the lower the external finance premium. Fluctuations in the quality of a borrower's balance sheet will affect their financial position, the size of the external finance premium, the cost of raising funds, and hence investment and spending decisions. According to the credit channel, a contractionary monetary policy will not only increase the cost of capital through the interest rate channel but will also lead to a decline in the firm's cash flow and collateral values, thereby raising the external finance premium and causing a further decline in firm's investment and spending. Because the credit channel adds an additional effect of policy based on the external finance premium, the impact of policy on the cost of borrowing, and hence on real spending, is magnified. In addition, firms with poor access to the credit market will be more responsive to monetary shocks than firms with good access to the credit market. Thus the credit channel suggests that there are likely to be heterogeneous industry effects of monetary policy, and this heterogeneity calls for the use of firm level financial variables.

III. Data and Descriptive Statistics

We extracted quarterly data on firm specific variables – net sales, total assets, total liabilities, current liabilities, current assets, short-term debt, long-term debt, total debt, and a number of other variables from Computstat for the time period 1971:1-2004:1. Prior to 1971, there were many missing observations. Stopping in early 2004 avoids most of the housing price run-up and subsequent financial crisis. In order to avoid problems of survivor bias, we included data on both currently active and currently inactive firms in a set of eight major sectors – Manufacturing; Retail; Wholesale Durables; Wholesale Non-Durables; Construction; Transportation and Communication; Mining; and Service -, where we use the definition of major sectors following the traditional two-digit SIC categories. Certain sectors were excluded a priori, including Finance, Insurance, Real Estate (SIC 60-65, 67), Agriculture (SIC 01-09) and Public Administration (SIC 91-97)[2]. We also excluded publicly traded parent companies to avoid double counting in case a subsidiary was also publicly traded. Moving down to the subsidiary level allowed for greater match of firm-reported SIC to actual firm operations, as large firms and conglomerates may produce across several industry classifications and yet are assigned only a single SIC code in the Compustat data. We dropped any firm that has less than 8 observations. We also dropped firms for time periods in which they reported zero or negative values for net sales, current assets, total assets, current liabilities, short-term debt, and long-term debt. To adjust for outliers, we eliminated observations in which a firm's total assets or net sales tripled.[3] To match the timing of the macroeconomic series with the firm-level data timing, we keep only the firms whose fiscal-year end in either March, June, September, or in December. After discarding observations, our sample contained 208,816 observations in the manufacturing sector; 11,758 observations in the wholesale durables sector; 8,350 observations in the wholesale nondurables sector; 22,482 observations in the retail sector; 4,836 observations in the construction sector; 23,692 observations in the mining and minerals sector; 11,028 in the transportation and communication sector; and 64,987 observations in the service sector.

[2] We excluded "Finance, Insurance, Real Estate" sector since monetary policy is mainly implemented through the financial sector. We also excluded Agricultural sector since data was available for very small number of publicly traded agricultural firms.
[3] Sharpe (1994) follows the similar procedure.

Our firm level data set is an unbalanced panel, as firms come and go over time based on market forces, on merger or spinoff decisions, and on owner decisions to enter or leave the publicly traded corporate sector. The main advantage of using Compustat database over the QFR dataset (Gertler and Gilchrist 1994) is that it allows us the usage of quarterly data on balance sheet variables at the firm-level for various sectors of the economy. The main disadvantage is that small firms are underrepresented in Compustat dataset since it mainly covers publicly traded firms. However, for looking at disaggregated firm impacts there is little alternative to looking at publicly traded companies, as private firms provide very little publicly available data. Finally, we also obtained data on GDP, the GDP deflator, the federal funds rate, and certain other macroeconomic variables from the Federal Reserve Bank of St. Louis's FRED data base. Nominal data was transformed to real values using the GDP deflator.

We include descriptive statistics on firm's real total asset, working capital ratio (current asset/current liability), short-term debt ratio (short-term debt/total debt), and leverage ratio (total debt/total asset) in Tables 2-5. We use these balance sheet variables in our regression model. Table 2 provides information on the size distribution of firms, in terms of real total asset, within a sector in our sample. For the size classification, we rank firms each quarter according to their total asset. Note that firms in the durables good part of both Manufacturing and Wholesaling are smaller than firms in the non-durables part of these industries. In particular, firms in the top quartile of the Manufacturing Non-Durables are on average more than twice as large as firms in the top quartile of Manufacturing Durables. Firms in the top quartile of Wholesaling Non-Durables are on average almost three times as large as firms in the top quartile of Wholesaling Durables. Looking within a sector, the average firm size in the top quartile is usually several orders of magnitude larger than firms in the second quartile. Tables 3-5 show the average level of working capital, short term debt ratio, and leverage ratio, respectively, within the size distribution of firms. Thus Table 3 shows that the largest firms in Manufacturing have on average less working capital than the smallest firms, and this is true for Wholesaling Non-Durables, Construction, and Transportation as well. Table 4 shows that the largest firms in Manufacturing have a smaller short term debt ratio, and this pattern holds for firms in all other industries. Table 5 shows that the largest firms in Manufacturing have on average a lower leverage ratio than the smallest firms, and this holds for firms in all industries except Retail.

An important issue for our work is the identification of the monetary policy shock. The basic problem is that the observed federal funds rate, or the federal funds rate target, is endogenous, as it can and probably does respond to contemporaneous variables, so that the use of the federal funds rate (or changes in the federal funds rate) as a measure of monetary policy leaves estimates subject to simultaneous equations bias.

Several solutions are proposed in the literature. Recently Barakchian and Crowe (2010) survey the literature on various proposed measures of monetary policy and provide evidence that several measures previously used in the literature perform poorly in the period since the 1980s.[4] Here we use Barakchian and Crowe's (2010) update to the Romer and Romer (2004) shocks as our measure of monetary policy.

We emphasize that the monetary policy shock is used as the regressor in our equations because the estimated coefficient on the monetary policy shock is the estimated impact of

[4] They provide a new measure using Federal Funds Rate futures data, following the general approach introduced by Kuttner (2001) and followed by Gurkaynak (2005) and Gurkaynak, Sack and Swanson (2005). Barakchian and Crowe use information from futures contracts from the current month and up to five months ahead, and show that their measure performs well over the post-1980s period.

monetary policy on our dependent variables. The regressor is the monetary policy shock and not simply the change in the federal funds rate, but the coefficient on this regressor is the estimated impact of a monetary policy action, not just the impact of shocks to monetary policy. Barakchian and Crowe (2010) give a nice exposition of this point, which we summarize here with an extension to firm-specific shocks.

Consider first the monetary policy rule, stylized to be written as:

$$S_t = f(\Omega_t) + \epsilon_t \quad (1)$$

were S_t is the monetary policy instrument (here the Federal Funds Rate), $f(\Omega_t)$ is a function of the central bank's information set at time t, Ω_t, and ε_t is a stochastic disturbance not in the central bank's information set.

We assume a specific function for $f(\Omega_t)$:

$$S_t = \phi E_{CB}[Y_t] + \epsilon_t \quad (2)$$

where $E_{CB}[.]$ indicates expectations formed at time t based on the information set of the central bank.

The equation linking policy actions and output is also given in stylized form, written as:

$$Y_t = -\alpha S_t + u_t \quad (3)$$

where u_t is the i.i.d. disturbance term to output at time t, and we assume $Cov(u,\varepsilon) = 0$. The analogous equation for individual firms is:

$$
\begin{aligned}
Y_{i,t} &= -\alpha_i S_t + u_{i,t} \\
u_{i,t} &= \theta_i u_t + \eta_{i,t}
\end{aligned} \tag{4}
$$

Here the error term $u_{i,t}$ is the firm specific error, which shares in the aggregate output disturbance u_t with weight θ_i and has an idiosyncratic component $\eta_{i,t}$ that is distributed i.i.d. across firms at a point in time. We assume $Cov(\eta_i,\varepsilon) = Cov(\eta_i,u) = 0$.

A tempting procedure is to regress output on the monetary policy measure. This is likely to lead to a biased estimate of the impact of policy on output. To see this, first note that:

$$
E_{CB}[Y_t] = E_{CB}[-\alpha S_t + u_t] = E_{CB}[-\alpha\{\phi E_{CB}[Y_t] + \varepsilon_t\} + u_t] \Longrightarrow E_{CB}[Y_t] = \frac{\hat{u}_t}{1+\alpha\phi} \tag{5}
$$

here we adopt the notation that $E_{CB}[u_t] \equiv \hat{u}_t$ and we utilize the result that $E_{CB}[\varepsilon_t] \equiv 0$.

Using (5) we rewrite the policy rule as:

$$
S_t = \frac{\phi}{1+\alpha\phi}\hat{u}_t + \varepsilon_t \tag{6}
$$

Finally, using the policy rule in (6), we rewrite (3) as:

$$
Y_t = -\alpha\left[\frac{\phi}{1+\alpha\phi}\hat{u}_t + \varepsilon_t\right] + u_t \tag{7a}
$$

and

$$
Y_{i,t} = -\alpha_i\left[\frac{\phi}{1+\alpha\phi}\hat{u}_t + \varepsilon_t\right] + \theta_i u_t + \eta_{i,t} \, . \tag{7b}
$$

Consider now the proposed regressions of the form:

$$Y_t = \beta S_t + e_t \tag{8a}$$

$$Y_{i,t} = \beta_i S_t + e_{i,t} \tag{8b}$$

The estimates of the coefficient β and β_i will likely be a biased estimates of α and α_i. To see this, use (6) and (7) to calculate:

$$\hat{\beta} = \frac{Cov(Y_t S_t)}{Var(S_t)} = -\alpha + \frac{\frac{\phi}{(1+\alpha\phi)} Cov(u_t, \hat{u}_t)}{\frac{\phi^2}{(1+\alpha\phi)^2} Var(\hat{u}_t) + Var(\varepsilon_t)} \tag{9a}$$

and

$$\hat{\beta}_i = \frac{Cov(Y_{i,t}, S_t)}{Var(S_t)} = -\alpha_i + \frac{\frac{\phi\theta_i}{(1+\alpha\phi)} Cov(u_t, \hat{u}_t)}{\frac{\phi^2}{(1+\alpha\phi)^2} Var(\hat{u}_t) + Var(\varepsilon_t)} \tag{9b}$$

These estimates are biased for α if $Cov(u_t, \hat{u}_t) > 0$ and $\phi \neq 0$, and biased for α_i if $Cov(u_t, \hat{u}_t) > 0$ and $\phi\theta_i \neq 0$. It should be clear that using deviations of firm output from aggregate output as the dependent variable, i.e. $Y_{i,t}$ - Y_t, will not solve this bias problem.

The solution is to regress Y_t (and $Y_{i,t}$) on ε_t. The coefficient on ε in that regression will, from (7) and the assumption that $Cov(u,\varepsilon) = 0$, provide an unbiased estimate of the policy impact on aggregate output (and on firm-specific output). This is the solution to the identification problem, and the reason for using measures of the monetary policy surprise instead of a measure of monetary policy itself. It bears emphasis that the coefficient estimates from this procedure give an estimate of the impact of policy on output or firm specific output, and is not just an estimate of the impact of surprise policy on output.

IV. Results

We examine the impact of monetary policy on firm real net sales within a sector by estimating regression models with firm-level fixed effects for each of our sector.[5] For each sector we estimate the following model:

$$\begin{aligned}\Delta \ln(y_{i,t}) = &\sum_{j=1}^{4}\beta_{1,j}\Delta \ln(y_{i,t-j}) + \sum_{j=1}^{4}\beta_{2,j}\Delta \ln(pc_{t-j}) + \sum_{j=1}^{4}\beta_{3,j}\Delta \ln(p_{i,t-j}) \\ &+ \sum_{j=1}^{4}\beta_{4,j}\Delta \ln(M2_{t-j}) + \sum_{j=0}^{4}\beta_{5,j}\Delta \ln(RGDP_{t-j}) + \sum_{j=0}^{4}\beta_{6,j}(MP_{t-j}) \\ &+ \sum_{j=1}^{3}\beta_{SD,j}SD_j + \gamma_i + \varepsilon_{i,t}\end{aligned} \qquad (10)$$

Here y_{it} is real sales of firm i at time t, pc_t is the price of commodities at time t, p_t is the GDP deflator at time t, $M2_t$ is the $M2$ money supply at time t, $RGDP_t$ is real GDP at time t, MP_t is the Romer & Romer (2004) measure of monetary policy shock at time t, SD_j is the seasonal dummy for season j, γ_i is the fixed effect for firm i, and $\varepsilon_{i,t}$ is the random error for firm i at time t. In our specification, we assume that RGDP impacts firm sales contemporaneously, while individual firm sales do not impact RGDP contemporaneously. Similarly, MP impacts firm sales contemporaneously, while individual firm sales do not influence monetary policy. Finally, our

[5] Given that we have a highly unbalanced panel data set, a VAR model is not feasible.

measure of MP is a shock to monetary policy, a variable that is constructed to be, ideally, orthogonal to contemporaneous RGDP.[6]

In presenting our results we focus on the impact of RGDP and the impact of MP on firm sales. We report the sum of the coefficients on RGDP in order to calculate the total impact of a change in the growth rate of RGDP on the growth rate of firm sales. Similarly, we report the sum of the coefficients on MP in order to calculate the total impact of a change in MP on the growth rate of firm sales.

We also estimate a modification of equation (10) that allows the impact of monetary policy to be attenuated or strengthened depending on the value of measures of financial constraints on firms. Several proxies have been used in the literature on the credit channel for monetary policy, and we employ a measure of firm size, a measure of the working capital at a firm, a measure of the firm's reliance on short term debt, and a measure of leverage. We estimate the following equation for each of these four alternative measures of financial constraints, in order to see if these measures alter the impact of monetary policy. For these regressions our specification is given below as equation (11), where FC is one of our measures of financial constraint on the firm:

[6] We have a dynamic panel model with firm fixed effects. As Bond (2002) notes, the Within Groups transformation in this case is inconsistent in short panels, but is consistent in the case of large T panels Here we have a large *T* panel, and we rely on the consistency in large-*T* panels.

$$
\begin{aligned}
\Delta \ln(y_{i,t}) = & \sum_{j=1}^{4} \beta_{1,j} \Delta \ln(y_{i,t-j}) + \sum_{j=1}^{4} \beta_{2,j} \Delta \ln(pc_{t-j}) + \sum_{j=1}^{4} \beta_{3,j} \Delta \ln(p_{i,t-j}) \\
& + \sum_{j=1}^{4} \beta_{4,j} \Delta \ln(M2_{t-j}) + \sum_{j=0}^{4} \beta_{5,j} \Delta \ln(RGDP_{t-j}) + \sum_{j=0}^{4} \beta_{6,j} (MP_{t-j}) \\
& + \sum_{j=0}^{4} \beta_{7,j} FC_{t-1} \cdot (MP_{t-j}) \; + \sum_{j=1}^{3} \beta_{SD,j} SD_j + \gamma_i + \varepsilon_{i,t}
\end{aligned} \qquad (11)
$$

The results are reported in Tables 6-15. Each table covers one of our sectors, and reports results for five specifications. Table 6 covers manufacturing, while Tables 7 and 8 cover Manufacturing of Durables and Manufacturing of Nondurables, respectively. Manufacturing is a large industry with many firms, so we provide estimates for all manufacturing and then for the durable/nondurable breakdown. Tables 9-15 cover Retail, Wholesaling of Durables, Wholesaling of Non-Durables, Construction, Transportation & Communications, Mining, and Services, respectively.

Tables 6-15 provide a condensed summary of our estimation results for our five different specifications. We report the sum of the coefficients on the real GDP growth rates, the sum of the coefficients on the measures of monetary policy, and for Models 2-5, we also report the sum of the coefficients on various balance sheet variables interacted with the monetary policy measure. The parenthetical entries below the sum of coefficients report the probability values for a test of the null hypothesis that the sum of the coefficients is zero.

For Model 1, we find that for all sectors the impact of real GDP growth on firm real net sales, as measured by the sum of the coefficients on real GDP growth, is positive and statistically significant. The impact is strongest on Services (5.66) and weakest on Wholesaling Non-Durables (1.48). Thus we find in our model 1 that a 1% increase in the growth rate of real GDP leads to over a 5% increase in the growth rate of real net sales for firms in the Services industry, and almost a 1.5% increase in the growth rate of sales for firms in Wholesaling Non-Durables. Note that for Construction, an industry long considered highly subject to cyclical fluctuations, the impact of real GDP growth is strong (4.05), indicating that, as in Services, increases in real GDP growth have a strong impact on the growth rate of sales for firms in the Construction sector.

A positive change in the monetary policy variable is a contractionary policy action. In model 1, the impact of a contractionary monetary policy on firm sales growth within a sector is negative for all sectors except Mining, where it is positive and statistically significant[7]. The estimated impact of monetary policy on sales growth is negative but statistically insignificant for firms in Wholesaling Non-Durables, Construction, and Transportation. The largest negative impact is on Retail Sales (-0.51), followed closely by Services (-0.49). A 100 basis points increase in the monetary policy shocks leads to reduction of almost 0.5% in sales growth for firms in Retail and for firms in Services. Note that firms in Construction, an industry long considered strongly impacted by monetary policy, has an estimated 0.33% reduction in sales growth following a 100 basis point increase in the monetary policy shock, although this estimate is not statistically significant.

Models 2-5 provide information on how various firm-specific balance sheet variables influence the strength of the impact of monetary policy on growth in firm sales. For each model we interact one lag of a firm-specific balance sheet variable with the current and lagged

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[7] Loo & Lastrapes (1998) also find similar results for the metal mining industry. Carlino & Defina (1998) find that as the percent of a state's GSP accounted for by its extractive industries rises, the size of state's long run response to Fed policy shocks declines.

monetary policy variables. Thus model 2 starts with model 1 and adds a measure of firm size (lagged one quarter) interacted with our monetary policy measures. Model 3 adds our measure of working capital (measured with a lag of one quarter) interacted with our monetary policy measures. Model 4 adds our measure of short term debt (measured at a one quarter lag) interacted with our monetary policy measures. Finally, model 5 adds our measure of leverage (again measured at a one quarter lag) interacted with our monetary policy measures.

It is important to keep in mind the scale of these industries. For Models 1-5, our regression equations include 5,103 firms and 174,515 observations in Manufacturing; 660 firms and 18,369 observations in Retail; only 132 firms and 4,006 observations in Construction, and 2,260 firms and 49,145 observations in Services. Of course, in terms of size relative to GDP, Services and Manufacturing are the largest industries, as shown in Table 1.

Models 2-5 allow us to investigate the existence of a credit channel of monetary policy. They provide evidence on how the impact of monetary policy on industry sales is itself impacted by the balance sheet variables. These balance sheet variables at least ideally measure a firm's ability to ameliorate the impact of monetary policy. By interacting the balance sheet variables with our measure of monetary policy we can detect how the magnitude of these balance sheet variables can influence the impact of monetary policy.

We consider four balance sheet variables. First is firm size, as measured by (real) total assets from the firm's balance sheet. Our measure is a relative measure, the total assets of a firm relative to the total assets of the largest firm in the industry in a given quarter. Our hypothesis is that larger firms are more able to engage in a range of activities (issuing debt, borrowing from financial institutions other than depository institutions, internal finance, etc.) that ameliorate the impact of contractionary monetary policy on firm sales. Thus we expect that the firm size – monetary policy interaction will have a positive coefficient, so that the magnitude of the negative impact of a tight monetary policy on firm sales is reduced for larger firms.

Our second variable is a measure of working capital, the ratio of current assets to current liabilities. A higher working capital ratio indicates that a firm has relatively more current assets than current liabilities, and thus should be able to better withstand monetary policy actions. Thus we hypothesize that higher working capital ratios lead to a lessened impact of monetary policy. Again, the credit channel would lead us to expect a positive coefficient on the working capital – monetary policy interaction.

Our third balance sheet variable is a measure of firms' short term debt ratio, the ratio of short term debt to total debt. The hypothesis is that firms with more short term debt are more adversely impacted by monetary policy, because they face the more imminent task of refinancing their short term debt and in the face of a contractionary monetary policy action must do so when banks are reducing loan issuance and raising interest rates. Thus we think that firms with higher short term debt ratios will be more strongly impacted by monetary policy actions, evidenced by a negative coefficient on the interaction between the short term debt ratio and the monetary policy.

The final balance sheet variable we consider is the leverage ratio, defined as the ratio of debt to total assets. Ceteris paribus, firms with higher leverage ratios are thought to be less able to ameliorate the impacts of monetary policy, because such firms are impacted relatively more by increases in interest rates and reductions in loans. Thus the credit channel would lead to a negative coefficient on the interaction of our measure of leverage with monetary policy.

The first balance sheet variable, size, is hypothesized to have a positive coefficient, as larger firms are presumed to be less impacted by monetary policy. For overall manufacturing this holds true, and as firms get large the impact of monetary policy is greatly reduced. This result holds in the subsets of manufacturing as well, both for Manufacturing of Durables and Manufacturing of Non-Durables. For firms in manufacturing, we find that sales of larger firms are less impacted by monetary policy compared to smaller firms.

Firms in Retail also have a positive and significant size-policy interaction, as do firms in Construction and in Services. For Wholesaling Durables and Transportation, the size-policy interaction is positive but statistically insignificant. For Mining, the direct impact of policy is estimated to be positive, so while we report the results for the size-policy interaction (positive but statistically insignificant) the positive direct impact of policy makes the interaction effects less interesting. The only departure from expected results is the estimated size-policy interaction for Wholesaling Non-Durables, which we estimate is negative and statistically significant. Here the direct impact of policy is statistically insignificant, so the negative size-policy interaction indicates a negative policy impact, but an impact that contrary to the credit channel gets larger with firm size.

Overall, the hypothesis that larger firms are less impacted by monetary policy actions seems to be borne out in our data for firms in many but not all of our industries. Certainly for industries with many firms such as Manufacturing and Services, our results are consistent with a credit channel interpretation with firm size a good proxy for firm financial constraints.

The second balance sheet variable that we consider is working capital, and we expect firms with larger working capital ratios to be less impacted by monetary policy actions, so we expect a positive coefficient on the working capital – policy interaction variable. However, our estimates of the working capital-policy interaction are generally statistically insignificant. In fact, leaving Mining aside, the working capital-policy interaction is never statistically significant. It may be that working capital is not a good measure of a firm's ability to ameliorate monetary policy actions. Firms with a high ratio of current assets to current liabilities may not have an advantage in avoiding the negative impact of contractionary monetary policy on firm sales. In fact, it is possible that a high working capital ratio may indicate not so much a cushion to guard against policy changes but a necessary part of daily business such that a tightening of monetary policy make it more costly to finance the required large working capital. We note that similar results for the working capital – policy interaction were found by Peersman and Smet (2005).

Our third balance sheet variable is the short term debt ratio, and we expect the interaction of short term debt and monetary policy to have a negative coefficient. That is, we expect firms with higher levels of short term debt to, ceteris paribus, be less able to avoid the negative impact of a tight monetary policy. We find the expected negative and statistically significant result only for Manufacturing of Durables, and Wholesaling of Non-Durables. For Transportation (and Mining) we find a positive and statistically significant result. Again it seems that the short-term debt ratio may not be a good proxy for the financial constraint faced by firms in several sectors of the economy.

Finally, our last balance sheet variable is the leverage ratio, and we expect to find that firms with a higher leverage ratio are more strongly impacted by monetary policy. Firms in Manufacturing, and Manufacturing of Durables, exhibit the expected result, with a negative and statistically significant coefficient on the leverage-policy interactions. For Manufacturing of

Non-Durables, and for all other industries, we do not find statistically significant and negative coefficients on the leverage-interaction variables. In fact, for Retail we estimate a positive and statistically significant impact of the leverage-policy terms.

The results for Models 2-5 are consistent with a view that the credit channel operates on firms in most industries, and that the size of firms is the best proxy for the financial constraints faced by the firm in taking actions to ameliorate the impact of policy on firm sales. Our results do not provide much support for using working capital, short term debt ratios or leverage ratios as proxies for financing constraints facing publicly traded firms. Our results also indicate that the Mining industry is countercycle, or at least responds countercyclically to monetary policy actions.

This first look indicates some evidence for the credit channel, acting through different mechanisms for many of the industries we analyze. Setting Mining aside as an industry that does not respond in the typical fashion to a contractionary monetary policy, we find that size appears to be our best proxy for firm financing constraints. Given the results above, we further investigate the influence of size on the monetary policy response by dividing firms in each sector into quartiles for each time period, based on firm real total asset, and then re-running Model 1.

Table 16 reports our results. A finding that the impact of monetary policy is strongest on small firms would be consistent with the credit channel view. Our results do support this view for several sectors. The first column reports results for Manufacturing. Here the overall impact of monetary policy on sales was estimated to be -0.26 and statistically significant. We find the estimated impact of policy on the smallest quartile of firms is -1.08, falling to -0.34 for the second quartile of firms, -0.15 for the third quartile, and -0.02 (and statistically insignificant) for the largest quartile. This pattern of results suggests that monetary policy has an impact on the smallest quartile of firms that is several orders of magnitude greater than the impact on the largest firms, a result consistent with operation of a credit channel in Manufacturing and with using firm size as a proxy to measure the impact of financing constraints on the impact of monetary policy.

Results for Manufacturing of Durables are also consistent with operation of a credit channel. The impact of monetary policy is estimated to be -1.01 for the smallest firms and -0.16 for the largest firms, indicating that monetary policy has a six-fold greater impact on sales of the smallest firms. All estimated quartile results are statistically significant. For Manufacturing of Non-Durables, the results are also generally supportive of a credit channel interpretation, with the impact of monetary policy on sales of the smallest firms estimated as -1.24, and the estimated impact of policy on all larger quartiles is statistically insignificant. Thus the large and negative impact on the smallest firms, and the statistically insignificant impact on larger firms, is arguably consistent with a credit channel view.

Retail Trade also provides results generally consistent with the credit channel. The overall impact of monetary policy is estimated to be -0.51. The impact on the smallest quartile firms is estimated to be -0.72, smaller than the impact on the second quartile, -1.06, but larger than the impact on the third quartile, -0.55, and the largest quartile, -0.33. Thus the estimates are not monotonically decreasing in magnitude as size increases, but the smallest half of firms are more impacted by monetary policy than the largest half of firms.

Results for Wholesaling of Durables is perhaps less consistent with a credit channel view, because the smallest firms have the smallest estimated impact of monetary policy. This is also true for Wholesaling of Non-Durables, although here all estimates are statistically insignificant. For construction, the smallest half of firms are estimated to have the largest impact of monetary policy, while the largest half have a smaller estimated impact and the estimates are statistically insignificant. Transportation and Mining results are also not consistent with a credit channel view. Finally, results for Services are broadly consistent with a credit channel view, as the smallest half of firms are more strongly impacted by policy than the largest half, and indeed the estimated policy impact on the largest quartile is positive but statistically insignificant.

Overall, our results from looking in more depth at the relationship between publicly traded firm's size and the impact of monetary policy finds evidence consistent with a credit channel operating in terms of firm size for Manufacturing, Manufacturing of Durables, Retail Trade, Construction, and Services. Results for Manufacturing of Non-Durables are arguably consistent with credit channel implications. Finally, Mining has consistently positive estimated impacts of monetary policy, an expected result and one that continues to indicate that Mining is not like other industries in terms of its reaction to monetary policy actions.

V. Conclusion

We have investigated the impact of monetary policy on net sales of individual publicly traded firms in a variety of industries. Using Romer & Romer (2004) measure of monetary policy shock, we find evidence for a heterogeneous impact of monetary policy on firms in different sectors. We find that a tight monetary policy has the expected negative and statistically significant impact on publicly-traded firm's real net sales growth for Manufacturing firms, for both Manufacturing of Durables and Manufacturing of Non-Durables firms, for Retail firms, firms in Wholesaling of Durables and firms in Services. We find that the largest impact occurs in Retail, followed by Service, Wholesaling of Durables, Manufacturing of Durables, Manufacturing, and Manufacturing of Non-Durables, respectively. For Construction, we find that only smaller size publicly-traded firms are adversely affected by contractionary monetary policy actions. Transportation and communication sector has a negative but small and statistically insignificant impact of the monetary policy, and for Mining we find a statistically significant positive impact of the monetary policy.

Overall, our results support an interpretation that there is an operating credit channel of monetary policy for firms in many industries, with the best proxy variable for the operation of that credit channel being size. We find little evidence for using working capital, short term debt, or leverage as proxies for financial constraints for publicly-traded firms. Our results indicate significant heterogeneities across industries in the firm-level response to monetary policy actions. While these heterogeneous impacts are important for understanding monetary policy and how it impacts the economy, our results also raise questions about what if anything should be done about these heterogeneities. To the extent that monetary policy is like a public good, its disparate impact might suggest subsidies to those most impacted by policy. Indeed, certain features of the social safety net such as unemployment insurance might be thought of as subsidies to those most impacted by policy. However, our results suggest that in some sectors (e.g. Services) firms are strongly impacted by real GDP movements (relative to firms in other industries) and less strongly impacted by monetary policy actions. If successful monetary policy reduces real GDP volatility, and if firm-level sales volatility is a bad, then firms in the Service industry are helped by a reduction in real GDP volatility relatively more than firms in other industries. Thus the question of which industries most benefit, and are most harmed, by monetary policy actions is rather complex, as is the issue of what to do about it. An answer to such questions is beyond the scope of our present paper.

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Table 1. Value Added by Industry as Share of GDP

	1971	1987	2003
Sector			
Mining	1.3	1.5	1.3
Construction	4.9	4.6	4.5
Manufacturing	22.1	17.1	12.4
Durables	13.1	10.2	7.0
Non-Durables	9.0	6.9	5.4
Transportation, and warehousing	3.9	3.2	2.9
Wholesale Trade	6.5	6.0	5.8
Retail Trade	8.0	7.4	6.9
Service	14.8	20.3	25.2

Source: Bureau of Economic Analysis. The industries are based on the 1997 North American Industry Classification System.

Table 2: Distribution of Total Assets Within and Across Industries, by Size Percentile

	All	<25	25-50	50-75	75>
Manufacturing					
# firm-qr. obs.	208,766				
Mean real Total Assets (in mill.)	1,331.42	17.70	77.27	308.25	4,927.32
Manufacturing – Durables					
# firm-qr. obs.	132,399				
Mean real Total Assets (in mill.)	965.01	14.67	63.98	239.13	3,547.92
Manufacturing –Non- Durables					
# firm-qr. obs.	76,417				
Mean real Total Assets (in mill.)	1,966.28	24.47	108.81	499.56	7,249.92
Wholesale Durables					
# firm-qr. obs.	11,758				
Mean real Total Assets (in mill.)	364.83	15.49	61.40	191.06	1,211.65
Wholesale Nondurables					
# firm-qr. obs.	8,350				
Mean real Total Assets (in mill.)	956.85	21.36	83.50	320.42	3,483.50
Retail Trade					
# firm-qr. obs.	22,482				
Mean real Total Assets (in mill.)	602.07	18.98	68.72	212.60	2,126.52
Construction					
# firm-qr. obs.	4,836				
Mean real Total Assets (in mill.)	381.86	31.48	108.07	303.44	1,125.08
Minerals					
# firm-qr. obs.	23,692				
Mean real Total Assets (in mill.)	956.28	18.15	85.45	341.52	3,407.46
Transportation					
# firm-qr. obs.	11,028				
Mean real Total Assets (in mill.)	2,066.77	47.78	156.25	573.48	7,615.76
Service					
# firm-qr. obs.	64,987				
Mean real Total Assets (in mill.)	538.26	8.66	33.98	117.67	1,998.67

Source: Compustat North American database

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Table 3: Distribution of Working Capital Ratio Within and Across Industries, by Size Percentiles

	All	<25	25-50	50-75	75>
Manufacturing					
# firm-qr. obs.	208,766				
Mean working capital ratio	2.65	2.62	3.18	2.83	1.98
Manufacturing – Durables					
# firm-qr. obs.	132,399				
Mean working capital ratio	2.61	2.55	2.97	2.78	2.12
Manufacturing –Non- Durables					
# firm-qr. obs.	76,417				
Mean working capital ratio	2.73	2.84	3.58	2.65	1.82
Wholesale Durables					
# firm-qr. obs.	11,758				
Mean working capital ratio	2.23	1.99	2.24	2.39	2.31
Wholesale Nondurables					
# firm-qr. obs.	8,350				
Mean working capital ratio	1.80	2.02	1.85	1.68	1.63
Retail Trade					
# firm-qr. obs.	22,482				
Mean working capital ratio	1.64	1.59	1.71	1.65	1.61
Construction					
# firm-qr. obs.	4,836				
Mean working capital ratio	1.84	2.03	1.94	1.84	1.53
Minerals					
# firm-qr. obs.	23,692				
Mean working capital ratio	1.72	1.42	1.69	2.03	1.75
Transportation & Communication					
# firm-qr. obs.	11,028				
Mean working capital ratio	1.24	1.21	1.32	1.41	1.00
Service					
# firm-qr. obs.	64,987				
Mean working capital ratio	2.08	1.71	2.20	2.54	1.87

Source: Compustat North American database

Table 4: Distribution of Short-Term Debt Ratio Within and Across Industries, by Size Percentiles

	All	<25	25-50	50-75	75>
Manufacturing					
# firm-qr. obs.	208,766				
Mean short-term debt ratio	0.31	0.43	0.34	0.25	0.21
Manufacturing – Durables					
# firm-qr. obs.	132,399				
Mean short-term debt ratio	0.32	0.44	0.36	0.28	0.22
Manufacturing –Non- Durables					
# firm-qr. obs.	76,417				
Mean short-term debt ratio	0.27	0.39	0.29	0.20	0.21
Wholesale Durables					
# firm-qr. obs.	11,758				
Mean short-term debt ratio	0.35	0.54	0.38	0.28	0.20
Wholesale Nondurables					
# firm-qr. obs.	8,350				
Mean short-term debt ratio	0.32	0.46	0.33	0.30	0.20
Retail Trade					
# firm-qr. obs.	22,482				
Mean short-term debt ratio	0.26	0.37	0.31	0.19	0.17
Construction					
# firm-qr. obs.	4,836				
Mean short-term debt ratio	0.37	0.48	0.39	0.32	0.28
Minerals					
# firm-qr. obs.	23,692				
Mean short-term debt ratio	0.25	0.38	0.29	0.17	0.14
Transportation & Communication					
# firm-qr. obs.	11,028				
Mean short-term debt ratio	0.19	0.31	0.20	0.15	0.11
Service					
# firm-qr. obs.	64,987				
Mean short-term debt ratio	0.35	0.48	0.41	0.32	0.18

Source: Compustat North American database

Table 5: Distribution of Leverage Ratio Within and Across Industries, by Size Percentiles

	All	<25	25-50	50-75	75>
Manufacturing					
# firm-qr. obs.	208,766				
Mean leverage ratio	0.31	0.39	0.27	0.30	0.29
Manufacturing – Durables					
# firm-qr. obs.	132,399				
Mean leverage ratio	0.31	0.41	0.26	0.28	0.28
Manufacturing –Non- Durables					
# firm-qr. obs.	76,417				
Mean leverage ratio	0.32	0.36	0.29	0.34	0.29
Wholesale Durables					
# firm-qr. obs.	11,758				
Mean leverage ratio	0.36	0.41	0.37	0.33	0.31
Wholesale Nondurables					
# firm-qr. obs.	8,350				
Mean leverage ratio	0.35	0.41	0.33	0.33	0.33
Retail Trade					
# firm-qr. obs.	22,482				
Mean leverage ratio	0.36	0.37	0.31	0.38	0.39
Construction					
# firm-qr. obs.	4,836				
Mean leverage ratio	0.31	0.33	0.30	0.31	0.26
Minerals					
# firm-qr. obs.	23,692				
Mean leverage ratio	0.36	0.44	0.36	0.35	0.30
Transportation & Communication					
# firm-qr. obs.	11,028				
Mean leverage ratio	0.40	0.48	0.41	0.39	0.33
Service					
# firm-qr. obs.	64,987				
Mean leverage ratio	0.36	0.50	0.28	0.29	0.37

Source: Compustat North American database

Table 6: Manufacturing

Variables	Model 1	Model 2	Model 3	Model 4	Model 5
$\sum_{0}^{4} \Delta\ln(RGDP)_{t-k}$	3.43*** (0.00)	3.44*** (0.00)	3.43*** (0.00)	3.44*** (0.00)	3.45*** (0.00)
$\sum_{0}^{4} \Delta MP_{t-k}$	-0.26*** (0.00)	-0.28*** (0.00)	-0.19*** (0.01)	-0.21*** (0.00)	-0.15** (0.02)
$\sum_{0}^{4} size_{t-1} * \Delta MP_{t-k}$		1.60*** (0.002)			
$\sum_{0}^{4} wkcap_{t-1} * \Delta MP_{t-k}$			-0.0002 (0.41)		
$\sum_{0}^{4} sdebt_{t-1} * \Delta MP_{t-k}$				-0.002 (0.11)	
$\sum_{0}^{4} lever_{t-1} * \Delta MP_{t-k}$					-0.004** (0.05)
# firms	5,103				
# obs	174,515				

Note: All models also include four lags of the dependent variable, four lags of growth rate of price of commodities, four lags of GDP deflator, four lags of growth rate of M2 and 3 seasonal indicator variables.

Table 7: Manufacturing - Durables

	Model 1	Model 2	Model 3	Model 4	Model 5
$\sum_{0}^{4} \Delta \ln(RGDP)_{t-k}$	3.96*** (0.00)	3.98*** (0.00)	3.95*** (0.00)	3.97*** (0.00)	3.99*** (0.00)
$\sum_{0}^{4} \Delta MP_{t-k}$	-0.29*** (0.00)	-0.32*** (0.00)	-0.19** (0.03)	-0.22*** (0.00)	-0.18** (0.02)
$\sum_{0}^{4} size_{t-1}*\Delta MP_{t-k}$		1.43*** (0.00)			
$\sum_{0}^{4} wkcap_{t-1}*\Delta MP_{t-k}$			0.003 (0.20)		
$\sum_{0}^{4} sdebt_{t-1}*\Delta MP_{t-k}$				-0.002* (0.07)	
$\sum_{0}^{4} lever_{t-1}*\Delta MP_{t-k}$					-0.004* (0.07)
# firms	3,305				
# obs	109,827				

Note: All models also include four lags of the dependent variable, four lags of growth rate of price of commodities, four lags of GDP deflator, four lags of growth rate of M2 and 3 seasonal indicator variables.

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Table 8: Manufacturing - Non-Durables

	Model 1	Model 2	Model 3	Model 4	Model 5
$\sum_{0}^{4} \Delta\ln(RGDP)_{t-k}$	2.32*** (0.00)	2.32*** (0.00)	2.30*** (0.00)	2.31*** (0.00)	2.28*** (0.00)
$\sum_{0}^{4} \Delta MP_{t-k}$	-0.18*** (0.01)	-0.21*** (0.01)	-0.16 (0.21)	-0.18** (0.03)	-0.09 (0.44)
$\sum_{0}^{4} size_{t-1}*\Delta MP_{t-k}$		1.106*** (0.00)			
$\sum_{0}^{4} wkcap_{t-1}*\Delta MP_{t-k}$			-0.0001 (0.85)		
$\sum_{0}^{4} sdebt_{t-1}*\Delta MP_{t-k}$				-0.0001 (0.96)	
$\sum_{0}^{4} lever_{t-1}*\Delta MP_{t-k}$					-0.003 (0.26)
# firms	1,797				
# obs	64,736				

Note: All models also include four lags of the dependent variable, four lags of growth rate of price of commodities, four lags of GDP deflator, four lags of growth rate of M2 and 3 seasonal indicator variables.

Table 9: Retail

	Model 1	Model 2	Model 3	Model 4	Model 5
$\sum_{0}^{4} \Delta\ln(RGDP)_{t-k}$	2.74*** (0.00)	2.81*** (0.00)	2.74*** (0.00)	2.81*** (0.00)	2.66*** (0.00)
$\sum_{0}^{4} \Delta MP_{t-k}$	-0.51*** (0.00)	-0.62*** (0.00)	-0.38* (0.08)	-0.57*** (0.00)	-0.87*** (0.00)
$\sum_{0}^{4} size_{t-1}*\Delta MP_{t-k}$		1.39*** (0.00)			
$\sum_{0}^{4} wkcap_{t-1}*\Delta MP_{t-k}$			-0.0007 (0.48)		
$\sum_{0}^{4} sdebt_{t-1}*\Delta MP_{t-k}$				0.004 (0.39)	
$\sum_{0}^{4} lever_{t-1}*\Delta MP_{t-k}$					0.01** (0.05)
# firms	660				
# obs	18,369				

Note: All models also include four lags of the dependent variable, four lags of growth rate of price of commodities, four lags of GDP deflator, four lags of growth rate of M2 and 3 seasonal indicator variables.

Table 10: Wholesaling Durables

	Model 1	Model 2	Model 3	Model 4	Model 5
$\sum_{0}^{4} \Delta \ln(RGDP)_{t-k}$	3.67*** (0.00)	3.67*** (0.00)	3.62*** (0.00)	3.70*** (0.00)	3.71*** (0.00)
$\sum_{0}^{4} \Delta MP_{t-k}$	-0.42** (0.05)	-0.48** (0.04)	-0.16 (0.62)	-0.39* (0.08)	-0.29 (0.43)
$\sum_{0}^{4} size_{t-1} * \Delta MP_{t-k}$		0.69 (0.34)			
$\sum_{0}^{4} wkcap_{t-1} * \Delta MP_{t-k}$			-0.001 (0.24)		
$\sum_{0}^{4} sdebt_{t-1} * \Delta MP_{t-k}$				-0.001 (0.82)	
$\sum_{0}^{4} lever_{t-1} * \Delta MP_{t-k}$					-0.004 (0.72)
# firms	313				
# obs	9,697				

Note: All models also include four lags of the dependent variable, four lags of growth rate of price of commodities, four lags of GDP deflator, four lags of growth rate of M2 and 3 seasonal indicator variables.

Table 11: Wholesaling Non-Durables

	Model 1	Model 2	Model 3	Model 4	Model 5
$\sum_{0}^{4} \Delta\ln(RGDP)_{t-k}$	1.48* (0.09)	1.46* (0.10)	1.53* (0.08)	1.43* (0.10)	1.52* (0.08)
$\sum_{0}^{4} \Delta MP_{t-k}$	-0.17 (0.48)	-0.08 (0.76)	-0.19 (0.57)	-0.36 (0.22)	-0.42 (0.48)
$\sum_{0}^{4} size_{t-1}*\Delta MP_{t-k}$		-1.21** (0.07)			
$\sum_{0}^{4} wkcap_{t-1}*\Delta MP_{t-k}$			0.0001 (0.96)		
$\sum_{0}^{4} sdebt_{t-1}*\Delta MP_{t-k}$				-0.018*** (0.01)	
$\sum_{0}^{4} lever_{t-1}*\Delta MP_{t-k}$					0.008 (0.65)
# firms	210				
# obs	7,026				

Note: All models also include four lags of the dependent variable, four lags of growth rate of price of commodities, four lags of GDP deflator, four lags of growth rate of M2 and 3 seasonal indicator variables.

Table 12: Construction

	Model 1	Model 2	Model 3	Model 4	Model 5
$\sum_{0}^{4} \Delta ln(RGDP)_{t-k}$	4.05*** (0.001)	3.99*** (0.001)	4.17*** (0.002)	4.13*** (0.001)	3.99*** (0.001)
$\sum_{0}^{4} \Delta MP_{t-k}$	-0.33 (0.27)	-0.81** (0.04)	-0.21 (0.65)	-0.22 (0.68)	0.35 (0.55)
$\sum_{0}^{4} size_{t-1} * \Delta MP_{t-k}$		2.49**** (0.00)			
$\sum_{0}^{4} wkcap_{t-1} * \Delta MP_{t-k}$			-0.001 (0.69)		
$\sum_{0}^{4} sdebt_{t-1} * \Delta MP_{t-k}$				-0.001 (0.21)	
$\sum_{0}^{4} lever_{t-1} * \Delta MP_{t-k}$					-0.01 (0.61)
# firms	132				
# obs	4,006				

Note: All models also include four lags of the dependent variable, four lags of growth rate of price of commodities, four lags of GDP deflator, four lags of growth rate of M2 and 3 seasonal indicator variables.

Table 13: Transportation & Communications

	Model 1	Model 2	Model 3	Model 4	Model 5
$\sum_{1}^{4} \Delta\ln(RGDP)_{t-k}$	2.65*** (0.00)	2.66*** (0.00)	2.69*** (0.00)	2.64*** (0.00)	2.58*** (0.00)
$\sum_{0}^{4} \Delta MP_{t-k}$	-0.04 (0.76)	-0.07 (0.62)	-0.21 (0.33)	-0.32** (0.03)	-0.55 (0.24)
$\sum_{0}^{4} size_{t-1}*\Delta MP_{t-k}$		0.25 (0.35)			
$\sum_{0}^{4} wkcap_{t-1}*\Delta MP_{t-k}$			-0.002 (0.15)		
$\sum_{0}^{4} sdebt_{t-1}*\Delta MP_{t-k}$				0.017*** (0.00)	
$\sum_{0}^{4} lever_{t-1}*\Delta MP_{t-k}$					0.014 (0.24)
# firms	256				
# obs	9,542				

Note: All models also include four lags of the dependent variable, four lags of growth rate of price of commodities, four lags of GDP deflator, four lags of growth rate of M2 and 3 seasonal indicator variables.

Table 14: Mining

	Model 1	Model 2	Model 3	Model 4	Model 5
$\sum_{0}^{4} \Delta \ln(RGDP)_{t-k}$	3.44*** (0.00)	3.45*** (0.00)	3.44*** (0.00)	3.49** (0.03)	3.47*** (0.00)
$\sum_{0}^{4} \Delta MP_{t-k}$	1.09*** (0.00)	1.06*** (0.00)	0.91*** (0.00)	0.91*** (0.00)	1.14*** (0.00)
$\sum_{0}^{4} size_{t-1} * \Delta MP_{t-k}$		0.57 (0.32)			
$\sum_{0}^{4} wkcap_{t-1} * \Delta MP_{t-k}$			0.001* (0.07)		
$\sum_{0}^{4} sdebt_{t-1} * \Delta MP_{t-k}$				0.008* (0.10)	
$\sum_{0}^{4} lever_{t-1} * \Delta MP_{t-k}$					-0.002 (0.45)
# firms	715				
# obs	18,119				

Note: All models also include four lags of the dependent variable, four lags of growth rate of price of commodities, four lags of GDP deflator, four lags of growth rate of M2 and 3 seasonal indicator variables.

Table 15: Services

	Model 1	Model 2	Model 3	Model 4	Model 5
$\sum_{0}^{4} \Delta\ln(RGDP)_{t-k}$	5.66*** (0.00)	5.66*** (0.00)	5.64*** (0.00)	5.61*** (0.00)	5.68*** (0.00)
$\sum_{0}^{4} \Delta MP_{t-k}$	-0.49*** (0.00)	-0.50*** (0.00)	-0.51*** (0.00)	-0.58*** (0.00)	-0.29 (0.13)
$\sum_{0}^{4} size_{t-1}*\Delta MP_{t-k}$		0.58** (0.03)			
$\sum_{0}^{4} wkcap_{t-1}*\Delta MP_{t-k}$			0.0001 (0.81)		
$\sum_{0}^{4} sdebt_{t-1}*\Delta MP_{t-k}$				0.003 (0.34)	
$\sum_{0}^{4} lever_{t-1}*\Delta MP_{t-k}$					-0.006 (0.20)
# firms	2,260				
# obs	49,145				

Note: All models also include four lags of the dependent variable, four lags of growth rate of price of commodities, four lags of GDP deflator, four lags of growth rate of M2 and 3 seasonal indicator variables.

Table 16: Coefficients on Monetary Policy variable – Overall and by Size Quartile

SIZE	Manu.	Manu - Durables	Manu - NonDur	Retail Trade	Wholesale Durables	Wholesale NonDur	Const	Trans	Mining	Service
Overall	-0.26*** (0.00)	-0.29*** (0.00)	-0.18*** (0.01)	-0.51*** (0.00)	-0.42** (0.05)	-0.17 (0.48)	-0.33 (0.27)	-0.04 (0.76)	1.09*** (0.00)	-0.49*** (0.00)
Lowest Quartile	-1.08*** (0.00)	-1.01*** (0.00)	-1.24*** (0.00)	-0.72* (0.08)	- 0.29* (0.09)	-0.16 (0.85)	-0.99* (0.10)	0.37 (0.33)	2.82*** (0.00)	-0.90** (0.03)
Second Quartile	-0.34*** (0.00)	-0.65*** (0.00)	0.25 (0.26)	-1.06*** (0.00)	-1.57*** (0.00)	0.48 (0.46)	-1.38* (0.07)	-0.14 (0.60)	1.49*** (0.01)	-0.99*** (0.00)
Third Quartile	-0.15* (0.06)	-0.25*** (0.01)	-0.01 (0.94)	-0.55*** (0.01)	-0.50 (0.26)	-0.47 (0.21)	-0.49 (0.51)	-0.22 (0.21)	1.08*** (0.01)	-0.55** (0.02)
Highest Quartile	-0.02 (0.58)	-0.16*** (0.00)	-0.18 (0.11)	-0.33** (0.05)	-0.31** (0.04)	-0.08 (0.74)	0.50 (0.11)	-0.01 (0.94)	1.26 (0.73)	0.11 (0.51)

Data Appendix

We extracted quarterly data on firm specific variables – net sales, total assets, total liabilities, current liabilities, current assets, short-term debt, long-term debt, total debt, and a number of other variables from Computstat for the time period 1971:1-2004:1.

We also obtained data on GDP, the GDP deflator, the federal funds rate, and certain other macroeconomic variables from the Federal Reserve Bank of St. Louis's FRED data base. The updated version of Romer and Romer (2004) measure of monetary policy was provided by Christopher Crowe. Commodity prices were obtained from the IMF website.