

Consequences of a Credit Crunch on Firm Financial Policy, Investment, and Risk Premia

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March 2010

Abstract

Consistent with precautionary savings models, we show evidence that firms hoard cash in response to an exogenous increase in the cost of bank financing. For identification, we compare public U.S. firms in the same industry, location, and size quintile, but whose main lenders' credit supplies are differentially affected by the WorldCom demise in 2002. The credit supply shock induces a transitory decline in investment, and a permanent increase in the likelihood of extreme negative cash flow realizations. Firm betas also increase after the supply shock, suggesting that financing constraints affect firm valuation by increasing the risk premium.

* IMF and Columbia GSB, respectively. The views expressed herein are those of the authors and should not be attributed to the IMF, its Executive Board, or its management. Paravisini acknowledges the support of the FDIC-CFR. This draft has benefited greatly from comments from Nittai Bergman, Patrick Bolton, Serdar Dinc, Raj Iyer, Wei Jiang, Atif Mian, Francisco Pérez-González, Mitchell Petersen, Verónica Rappoport, Roberto Rigobón, David Romer, Tano Santos, Antoinette Schoar, Neng Wang, and all the participants in the Columbia GSB, FDIC-CFR, IMF, MIT Sloan finance and economics workshops, and the Society for Economic Dynamics Conference.

I. Introduction

How do corporate financial and investment policies respond to unexpected credit shortages? How do these shortages ultimately affect firm cash flows and returns? The answers to these questions are central for understanding the degree to which financing constraints result in capital misallocations, a fundamental issue in corporate finance (Stein (2003)). Assessing whether and how external financing constraints affect corporate financial policy, and to which degree financial management may alleviate investment distortions induced by financing constraints are, however, challenging empirical questions. The main challenge lies in that financing constraints are unobservable (Campello, Graham, and Harvey (2009)), and financial policy is endogenous to unobserved investment opportunities (Lemmon and Roberts (Forthcoming); Riddick and Whited (2008)).

This paper estimates the causal effect of an external financing shock on firm financial policy, investment, and valuation. For identification, we exploit the cross sectional variation in bank credit supply that resulted from the fraud and subsequent bankruptcy of WorldCom Inc. in 2002. Our estimation method and rationale borrow from recent empirical work on the lending channel. This work shows that bank-dependent firms experience external financing shortages when their main lenders' credit supply drops (see for example Gan (2007); Leary (2009); Paravisini (2008)). We first identify firms that obtain financing from banks that

were also actively lending to WorldCom in the syndicated debt market prior to its demise. We then test whether these firms face a contraction in the supply of credit after the WorldCom events, relative to firms that belong to the same industry, are headquartered at the same location, and belong to the same asset size quintile, but whose lenders were not exposed to the failed firm. We find that they do: their cost of borrowing increases by 23 basis points, or 12.6% of the sample mean, during the two years after the WorldCom events relative to the comparison group. The flow of credit to these firms from the banks affected by the WorldCom events drops by 18% of the sample mean.¹

The main identification assumption our empirical approach is that firm specific changes in investment opportunities are, on average, unrelated to the identity of the firm's lenders after conditioning on industry-, location- and size-specific shocks. We validate this assumption three ways. First, spreads and debt flows of affected and unaffected firms evolve in parallel prior to WorldCom's bankruptcy but differ afterwards. Second, in a placebo test using firms with a commercial paper rating and thus less dependent of bank financing, we find no effect on credit outcomes. Third, we replicate the within-firm estimation method in Khwaja and Mian (2008) and corroborate that firms experience a credit supply shock after fully controlling for all firm specific shocks.

¹ We use Dealscan to match banks to WorldCom and firms to their lenders.

Having indentified a credit supply shock, we investigate the corporate financial and investment policy responses. We find that firms hoard cash immediately after the supply shock: the cash to assets ratio increases by 1.3 percentage points during the six months after the shock, or 18 percentage of the sample average. The effect on average cash balances remains positive and significant when measured over the two years after the credit supply shock.

We also find that firms use equity and internal financing to fund the cash balance increase. Quarterly net equity issues, defined as secondary issues minus payouts (scaled by lagged assets), increase by 61 basis points during the year after the increase in external financing costs, and revert to normal afterwards. The effect is economically significant: it implies a 70% increase in equity issuances minus payouts over the sample mean. The increase in net equity financing coincides in timing and magnitude with the cash stock buildup. In contrast, there is no statistically significant change in total debt financing activities during the same period.

This first set of findings corroborates the theoretical link between corporate saving behavior and financial constraints emphasized by Almeida, Campello, and Weisbach (2004). This link can have potentially important economic implications, as precautionary savings have been pointed out as a culprit behind the secular increasing trend of cash balances in U.S. corporations during the last two decades (Bates, Kahle, and Stulz (2006)). The results also

represent the first direct test of the causal predictions of recent dynamic investment models that incorporate financing frictions (Riddick and Whited (2008), and Bolton, Chen, and Wang (2009)). In these models, firms optimally build up precautionary cash stocks and adjust payout policy when external financing costs increase.

We then explore the effect of the credit supply shock on firm investment, cash flows, and valuation. We show that the credit shortage causes a short run decline in investment: average capital expenditures scaled by assets drop by 32 basis points, or 16% of the sample mean, during the 6 months after WorldCom's demise. The effect on investment flow is short lived: the estimates over one and two year post-WorldCom periods are not statistically significant. The investment decline and cash buildup occur during the same period, suggesting that the precautionary savings occur at the expense of investment.

The credit supply shock affects the mean, variance, and skewness of the operating cash flows. Average cash flows scaled by assets decline by 58 basis points over the two years after the external financing shock, 32% of the sample mean. Also, the 10th-percentile of the cash flow distribution (scaled by assets) drops by 1.4 percentage points during the six months after the supply shock, and remains at that level after two years. This implies that large negative cash flow realizations become more likely when a firm experiences a negative external financing shock. These changes in the cash flow distribution are difficult to

reconcile with pure neoclassical investment models, and suggest that an increase in the cost of external financing increases the likelihood of financial distress.

Finally, we explore the effect of the credit supply shock on firm betas. In theory, the effect of financing constraints on beta is ambiguous. On the one hand, financially constrained firms cannot mitigate the impact of aggregate shocks on dividend streams, which increases systematic risk (Livdan, Sapriza, and Zhang (2009)). On the other hand, financially constrained firms hold larger precautionary cash balances, which have a zero beta and drive firm beta down (Bolton, Chen, and Wang (2009)). We find that after the credit supply shock, the average beta of affected firms increases by 0.06, or 8.7% of the sample average. Thus, our results provide the first causal evidence that financing constraints affect firm valuation by increasing the risk premium.

The rest of the paper proceeds as follows. Section II describes the empirical setting. Section III describes the estimation method, data sources, and provides summary statistics. Section IV presents the empirical results and Section V concludes.

II. WorldCom and Bank Credit Supply

During the 60 days that followed the resignation of WorldCom's CEO and founder, Bernard Ebbers, in April 30th 2002, WorldCom went from an investment grade company to the world's largest corporate bankruptcy. Although

WorldCom experienced similar sales slowdown, declining profits, and poor performing stocks as the rest of the telecommunications industry during the time, the true extent of its poor operating performance and financial problems became public in June 2002, when the firm disclosed improper accounting of \$3.9 billion in expenses.

The empirical strategy of this paper exploits the heterogeneous effect of the WorldCom shock across banks as a source of time series and cross sectional variation in the supply of bank credit. The WorldCom events can potentially affect the supply of credit of its lenders through several, and not mutually exclusive, mechanisms. For example, the balance sheet of a bank that holds a substantial amount of non-hedged claims on the firm (loans, bonds) will be weakened after the bankruptcy, which can in turn increase the bank's external financing cost ((Holmstrom and Tirole (1997); Stein (1998)). Also, a bank's reputation as a delegated monitor will be negatively affected if it certifies the firm through security credit provision and/or underwriting prior to the fraud discovery (Diamond (1984); Gopalan, Nanda, and Yerramilli (2009); Lin and Paravisini (2009); Puri (1996)).² The resulting decline in charter value will also affect the bank's cost of capital. A third channel through which fraud discovery can affect the supply of credit arises if the bank learns about a weakness in its own

² For example, Citigroup's role as an underwriter for WorldCom bonds was heavily criticized in the financial press (*The Economist* article "Citigroup: Passing the Buck", September 12th 2002).

monitoring technology after the fraud is discovered. The bank can endogenously tighten lending standards in response, which would lead to restricted credit supply.

The common feature across these transmission channels is that a bank must have established a lending relationship with WorldCom in order its credit supply to be affected. Our empirical estimation uses as a proxy for the *potential* exposure of a bank to the WorldCom events by whether the bank participated in syndicated loan deals to WorldCom during the year prior to the WorldCom bankruptcy filing date. This classification plausibly groups banks according to their credit supply reaction, if any, to the WorldCom events. Preliminary evidence discussed in detail below supports this hypothesis: the portfolio of exposed banks experiences negative stock price reactions to WorldCom events, while not-exposed banks do not.

III. Estimation and Data

A. Estimation

To account for changes in investment opportunities, the econometric specification compares firms in the same industry, location, and size quintile. To illustrate the estimation procedure with an example, consider two bank-dependent

firms in our sample: Cone Mills Corp. and Guilford Mills Inc..³ Both firms are in the textile industry, headquartered in North Carolina, and have total (market) assets between \$300 and \$400 million in January 2002. Both firms are plausibly subject to the same demand and input shocks at any given time. The firms differ in that Cone Mills' main lender at the time (Bank of America) was also an important supplier of credit to WorldCom, while Guilford Mills' main lender (Wachovia) was not. The identification strategy relies on the assumption that firm specific changes in investment opportunities are, on average, unrelated to the identity of their main lender after controlling for industry-, location-, and size-specific shocks, an assumption we validate in the next subsection.

We estimate the effects on firm-level outcomes using the following specification:

$$y_i^{Post} - y_i^{Pre} = \alpha_i^{SIC2} + \alpha_i^{IncorpState} + \alpha_i^{SizeQuartile} + \beta \cdot ExposedLender_i + \varepsilon_i \quad (1)$$

The variable y_i is an outcome for firm i . We collapse the pre-bankruptcy and post-bankruptcy periods into one observation and estimate the standard errors clustering at the 2-digit SIC industry code level, to reduce the bias in point estimates and standard errors introduced by serial correlation (Bertrand, Duflo, and Mullainathan (2004)). Thus the dependent variable is the change in the

³ We deliberately chose small, bank-dependent, firms for this example. A bank credit supply shock can plausibly affect the financing costs only for firms whose marginal source of finance is bank debt.

average firm-level outcomes, before and after the WorldCom bankruptcy. The pre-bankruptcy period covers the second quarter of 2001 through the first quarter of 2002. We use a 6-month, a 1-year, and a 2-year post-bankruptcy periods in the estimation to explore the dynamics of the change in firm outcomes. The right-hand side variable of interest is an indicator variable equal to one if the firm is classified as exposed to the WorldCom events (as discussed below). The coefficient on *ExposedLender* represents the change in outcomes of the exposed firms relative to the not-exposed firms.

Note that specification (1) is first-differenced and thus accounts for any time-invariant unobserved heterogeneity across firms.⁴ To account for changes in credit demand shocks, we include a full set of industry, state of incorporation, and size quartile dummies. This is equivalent to including a dummy for every industry-quarter, state-quarter, and size group-quarter in a panel specification. Thus, these dummies account for any change in the outcome variable before and after the credit supply shock that is common across all firms in the same industry, state, and size group.

⁴ Given that there is one pre- period and one post- period, first differencing is equivalent to including firm fixed effects in a panel estimation.

B. Variable Definition and Summary Statistics

The lending relationship between a firm and a bank is obtained through the DealScan database. This database is collected by Reuters/Loan Pricing Corporation from SEC and Federal Reserve filings, and directly from private debt markets. The initial sample contains information on 69,055 loan facilities (78% syndicated) issued by 5,868 different lenders to U.S. firms from 1990 to 2005.

We define bank exposure using lending relationships established before the beginning of the WorldCom bankruptcy. Specifically, a lender is exposed to WorldCom if it participated in loan facilities to WorldCom during the year prior to the WorldCom bankruptcy. During that period, WorldCom obtained two loan facilities syndicated by 28 banks: a \$2.65 billion 364-day loan and a \$1.6 billion 5-year line of credit.

We hand-match the lender names in DealScan with the lender names in National Information Center, a repository of financial data and institution characteristics collected by the Federal Reserve System. We obtain the RSSN ID from this site which is then used to match DealScan with Call Report data to obtain lender financial statements. Among the 5,868 lenders in the full DealScan sample, 139 banks are identified to have unique RSSN ID and appear in the Call Report in the first quarter of 2002. Among these 139 banks, eight are exposed and the rest 131 are not-exposed. Table 1 shows the total assets (as of the first quarter of 2002) of syndicated lenders by their potential exposure to WorldCom

events. It indicates that exposed banks are larger than not-exposed banks. These 139 banks are then collapsed at the parent bank level to have 100 unique RSSN ID for their parent banks. We finally hand-match these 100 parent banks to CRSP, to obtain a subsample of sixty-seven publicly-traded parent banks.⁵

Syndicated lending to WorldCom is a noisy proxy for overall bank exposure. On the one hand, this proxy may overestimate the exposure to WorldCom if banks that lend to WorldCom either hedge risk using credit derivatives or dispose of their exposure by selling the loans in the secondary market. On the other hand, syndicated lending may be correlated with other cash flow generating relationships between the banks and WorldCom, i.e., security underwriting and other investment banking activities.⁶

To verify that syndicated lending is significantly related to bank overall exposure we look at how the stock returns of exposed and not-exposed banks according to our classification respond to news about WorldCom. Figure 1 plots the cumulative value-weighted returns of the portfolios of public banks classified as exposed and not-exposed from June 3, 2002 to August 24, 2002. We highlight

⁵ Among the sixty-seven publicly-traded parent banks, seven banks are exposed to WorldCom event according to our measure. They are CitiGroup Inc., J.P. Morgan Chase & Co., Bank of America Corporation, Wells Fargo & Company, Bank One Corporation, FleetBoston Financial Corporation, and Mellon Financial Corporation

⁶ Aside from their roles in syndicated loans, banks with a lending relationship to WorldCom often acted as underwriters. See, for example, an *The Economist* article “Learning to be Angels” (Oct. 31, 2002), reporting that “Wall Street's biggest bank (Citigroup) has been embarrassed by its relationship with Enron and WorldCom.”

two events: WorldCom's announcement of improper accounting practices on June 25, and its bankruptcy filing announcement on July 21. Upon improper accounting the announcement the portfolio of exposed banks experienced a 300-basis-point decline in stock returns relative to the portfolio of not-exposed banks. Upon the WorldCom bankruptcy filing on July 21, the portfolio of exposed banks experienced a 486-basis-point decline in stock returns relative to the portfolio of not-exposed banks. The bank stock price reactions to these events provide validation to our exposure classification and are in line with previous findings regarding the credit contagion from counterparty risk (Jorion and Zhang (2009)).

Figure 2 plots the monthly time series of loans spreads and flows of new syndicated loans by exposed and not-exposed banks in our sample. Loan spreads by exposed banks are always below those of not-exposed banks before the WorldCom events (Figure 2, panel A). This suggests that borrowers from exposed banks have, on average, a higher credit quality than not-exposed firms before the credit supply shock, a fact that we corroborate below. There is no pre-existing differential trend in loan spreads across the two groups of banks. This implies that after accounting for the difference in spread levels, not-exposed bank spreads constitute a plausibly valid counterfactual for the time series evolution of the spreads of exposed banks. After the WorldCom events, the loan spreads of exposed banks increase and are always above the spreads of not-exposed banks. A similar pattern arises in debt flows after accounting for level differences (Figure

2, panel 2). These patterns provide corroborating evidence for our main identification hypothesis: that the time series evolution of the investment opportunities and creditworthiness of the borrowers of exposed and not-exposed would have evolved in parallel in the absence of the WorldCom shock.

We define a firm to be exposed to the WorldCom events if it had at least one loan facility during 2000-2001 in which at least one participant in the syndicate is exposed to WorldCom events according to the above classification. We thus classify a firm into the exposed group if it has any link to WorldCom through the banking sector. This exposure classification is conservative from the estimation standpoint, i.e., misclassification will bias the estimates of specification (1) towards zero. The reason is that our procedure errs on the side of classifying firms that do not suffer a credit supply shock as exposed. In a companion paper we show that defining firm exposure based on links through syndicate lead arrangers (instead of any syndicate participation) leads to larger coefficient estimates in related specifications (Lin and Paravisini (2009)).

We limit the firm population to publicly-traded firms that had at least one loan facility reported in DealScan during 2000-2001. We restrict the sample further to exclude firms in the financial or regulated utility industries, as is standard in the literature. We obtain our main results from the subsample of firms without commercial paper ratings, a common proxy for bank-dependency, which are more likely to have bank loans as the marginal financing source. We use the

subsample of firms with commercial paper ratings to perform placebo tests. For robustness tests, we estimate all specifications excluding firms in the telecommunications, electrical equipment, and software industries, which are potentially directly related to WorldCom in the product market.

We hand-match the firm names in DealScan with firm names in Compustat - North America to obtain financial statement data. Our final firm sample includes 1,636 publicly-traded firms. Table 2 presents the firm descriptive statistics during the eight quarters before the WorldCom bankruptcy for the full sample of firms (Panel A), and for the subsample of firms without a commercial paper rating (Panel B). The table confirms the observation in Figure 2 that firms that borrow from exposed banks pay lower spreads than those that borrow from not-exposed banks. Exposed firms are also larger, as the median exposed firm has more than twice the market capitalization of the median not-exposed firm. This is expected since exposed banks are larger (Table 1), and lender size and borrower size tend to be positively correlated. If we take loan spreads and firm size as coarse indicators of firm creditworthiness and access to credit, this implies that the WorldCom shock affects the supply of credit to the ex ante more creditworthy and less credit constrained firms. Thus, our empirical setting stacks the cards against finding an effect of a credit supply shock. Moreover, biases introduced by unobserved credit quality are likely to attenuate the effect of a credit supply shock.

IV. Empirical Results

A. Credit Supply Shock

In this section we show that the WorldCom events resulted in a decline in the supply of credit by its main lenders. We begin with the effect on the cost of financing by estimating specification (1) using loan spreads on new syndicated debt as the dependent variable (Table 3, columns 1 and 2). The number of observations available for the estimation of the spread specifications is limited by the number of new syndicated loan originations in the data. For this reason we present only the estimations using 1-year and 2-year post-bankruptcy periods.

The estimated effects, β , are positive for both post period estimations, and significant at the 1-percent level of confidence over the two-year post period. The point estimates imply that firms whose main lenders were exposed to WorldCom face a 23 basis point increase in the cost of new debt financing. Loan debt spreads increase by 12.6% relative to the average spread for firms without a CP rating in the sample.

Turning to debt quantities, we estimate specification (1) using the change in new syndicated debt, scaled by lagged assets, as the dependent variable (Table 3, columns 3 through 8). We study lending by exposed and not-exposed banks separately. If the identification assumptions are valid, only exposed banks' credit

supply will decline.⁷ The point estimates of the effect over 1 and 2 years are -0.047 and -0.033, indicating that new syndicated debt from exposed banks drops between 18% and 25% relative to the sample mean. The decline is significant at the 1% confidence level in both post periods. In contrast, lending by banks that were not exposed to WorldCom appears to increase during the same period. The point estimates, positive both one and two years after the shock (columns 5 and 6), indicate that lending by not-exposed banks increases by 17% of the sample mean two years after the shock. The overall effect on syndicated lending to exposed firms is not statistically significant as a result of this debt substitution (columns 7 and 8).

The above results indicate that firms are able to partially substitute sources of financing when their main lenders reduce their supply of credit. This substitution is not costless, however. Debt from not-exposed lenders comes at a higher cost. Substitution of financing sources can be costly due to adverse selection (Rajan (1992)), or that smaller not-exposed banks are financially constrained themselves (as in Paravisini (2008)). Either way, the WorldCom events result in an increase in the cost of debt financing for firms whose lenders

⁷ The flow of credit by exposed and not-exposed banks is obtained at the loan level. For each syndicated loan, Dealscan provides information on the fraction of the loan funded by each lender. We use this information together with our lender exposure classification to calculate the amount of funding provided by exposed and not-exposed banks in each deal.

were affected by the shock. We will refer to this shock indistinctly either an increase in the debt financing cost or a decline in the supply of credit.

This analysis raises the question of why firms demand for credit is inelastic. Costly adjustment costs, lumpy investments, and other frictions in the production function are one possibility. Another possibility is that the credit supply shock is expected to be transitory. For example, if the increase in price is due to adverse selection after switching lenders, this cost is likely to drop after the firm has established a relationship with the new lenders. A third possibility is that the tests lack the statistical power to estimate a change in debt financing policy. We turn to this issue in the next subsection by estimating the effect of financing policy using financial statement data.

First, we perform a battery of additional robustness and identification tests to corroborate that exposed firms experience a credit supply shock after the WorldCom events. First, the spread and lending flow results are robust to excluding firms in electrical equipment and software industries (Table 3, panel B). Second, we perform a placebo test using firms with a commercial paper rating. These firms do not experience either the increase in borrowing spreads or the decline in loans from exposed banks (Table 3, panel C). Bank finance is unlikely to be the marginal source of financing for rated firms and thus these firms are unlikely affected by a bank credit supply shock. This is the fundamental hypothesis behind the identification strategy in Faulkender and Petersen (2006),

which has been employed in recent research on credit supply shocks (see for example Chava and Purnanandam (2009); Leary (2009)). The placebo result thus rules out that our findings are driven by aggregate demand shocks that differentially affect borrowers from exposed banks and are unaccounted for by common industry, location, and size variation. We validate our credit supply shock interpretation in all the results that follow by performing the placebo test on this subsample of firms.

Third, we perform a within firm estimation that compares the change in lending by exposed banks, relative to the change in lending by not-exposed banks, to the *same firm* (Khwaja and Mian (2008)). This specification requires stacking the data used to estimate the exposed bank lending and not-exposed bank lending from columns 3 through 6 into a single estimation, and adding firm fixed effects to specification (1).⁸ The firm fixed effects saturate all variation at the firm level and thus guarantee that changes in lending are not due to firm level shocks. The results of this estimation corroborate the previous findings: lending by exposed banks declines significantly after the WorldCom events (Table 3, columns 7 and 8).

⁸ In this specification there is one observation per firm-quarter-lender type, where lender type is either exposed or not exposed. The definition of the right-hand side variable dummy also changes: it is one if the lender is exposed, and zero otherwise.

B. Financial Policy and Investment

We first replicate the previous results by estimating specification (1) using net debt issuance, scaled by lagged total assets, as the dependent variable. The estimated parameters for different post-WorldCom periods, reported in columns 1 through 3 of Table 4, confirm that total net debt issues were not affected significantly by the decline in the supply of credit. In contrast net equity issuances, measured as share sales minus payouts (dividends and share repurchases), increase after the decline in the supply of credit. Net equity issues (scaled by assets) increase around 61 basis points, or 70% of the sample mean, during the year after the increase in external financing costs, and reverts to normal afterwards.

The result suggests that firms substitute towards equity financing as the cost of borrowing increases. Although our empirical tests lack the power to distinguish whether this substitution occurs mostly through a reduction in payouts or an increase in secondary issuances, either interpretation is consistent with the predictions in Bolton, Chen, and Wang (2009) that an exogenous increase in external financing costs induces firms to adjust payout policy. The quick financial policy adjustment is also consistent with the presence of considerable investment adjustment costs (Cooper and Haltiwanger (2006); Hennessy and Whited (2007); Whited (2006)).

We next look at the stocks of debt and cash as a proportion to total assets. The substitution towards equity financing should in principle result in a

decline in firm leverage. Our estimates indicate that firm leverage does not change significantly after the credit supply shock (see Table 4, columns 7 through 9). Firm propensity to hold liquid assets in the balance sheet increases significantly and immediately after the credit supply shock. The cash to assets ratio increases by 1.3 percentage points during the 6 months after the shock, or an 18% of the sample average. The effect on average cash balances remains positive and significant when measured over the two years after the credit supply shock. As before, the results are robust to excluding from the analysis sample firms in technology industries potentially affected directly by the WorldCom events. Also consistent with the results in the previous subsection, the credit supply shock has no significant effect on the financial policy of firms with CP ratings.

This implies that corporate propensity to hoard cash increases substantially in response to a shock to external financing, consistent with precautionary savings models (Almeida, Campello, and Weisbach (2004); Bolton, Chen, and Wang (2009); Riddick and Whited (2008)). The estimated effect on net equity financing and the change in cash levels over the two years after the external financing shock are roughly of the same magnitude, suggesting that the entire net increase in external financing was devoted to build up the cash reserves. In the short run, however, the financing required to build up the cash reserve is about half of the additional equity financing. This suggests that the operations and investment of the firm may have been disrupted during this buildup phase.

To explore this issue, we show in Table 5 the estimated effect of the negative credit supply shock on investment, measured as net investment in fixed assets scaled by total assets. To allow for our measure to capture asset sales we use the changes in property plant and equipment from the balance sheet. The estimated effects indicate that average and median firm investment dropped significantly during the 6 months after the supply shock. Mean (median) investment drops by 32 (48) basis points, or 16% of the sample mean investment (32% of the median). The estimated effect on investment one and two years after the external financing shocks are not statistically different from zero.

The investment results are consistent with those on financial policy. Firms react to the decline in the supply of credit by raising equity financing and hoarding cash. In the short run, the shock had a negative effect on investment. This disruption in investment likely also affected firm cash flows, an issue we turn to next.

V. Cash Flows and Risk Premium

Table 6 shows the estimated effect on average and median operating cash flows of the firm, measured as EBIT plus depreciation and amortization, scaled by lagged assets (columns 1 through 6). The estimates indicate that there is no immediate effect on cash flow levels after the credit supply shock. Only the estimate obtained over the two year period after the shock shows a significant

decline in operating cash flows. The point estimates indicate that average (median) cash flows to assets decline by 58 (42) basis points on average over the two years after the shock (panel B), or 32% of the sample mean (20% of the median).

A decline in the level of cash flows is to be expected if the external financing shock affects investment, and is consistent with the predictions of Bolton, Chen, and Wang (2009). However, the magnitude of the cash flow decline is too large to be explained by the estimated effect on investment alone. Note that the investment and the cash flow measures are both scaled by total assets, which implies that the median cash flow decline is roughly of the same magnitude in dollar terms that the median decline in investment. The magnitude of the cash flow decline suggests that the external financing shock has a direct effect on cash flows beyond that which occurs through its effect on investment in fixed assets. This direct effect can occur if, for example, the shortage of financing causes financial distress (see, for example, Opler and Titman (1994)).

We characterize further the effect of the financing shock on the distribution of cash flows by looking at cash flow volatility and tail events. Columns 7 through 9 of Table 6 show the estimated effect of the credit supply shock on the standard deviation of cash flows. To estimate this effect we calculate the standard deviation of cash flows (scaled by lagged assets) of each firm before and after the WorldCom events, and the difference is used as the left hand side

variable in specification (1). The pre-WorldCom standard deviation is estimated from the quarterly variation over the year prior to the WorldCom bankruptcy. The post-bankruptcy standard deviations are estimated over 6, 12, and 24 months depending on the specification.⁹ The standard deviation of cash flows increases by 63 basis points during the 2 years after the credit supply shock (Panel B). This last figure represents a 13.6% permanent increase relative to the standard deviation of cash flows in the entire sample period.

Columns 10 through 15 of Table 6 show the estimated effect of the external financing shock on the 10th and 90th percentiles of the cash flow distribution. These effects are estimated by calculating the 10th and 90th percentile of the quarterly cash flow (scaled by lagged assets) distribution for each firm during the pre-bankruptcy and post-bankruptcy periods and using the change as the dependent variable in specification (1). The estimates indicate that the 10th percentile declines by 1.4 to 1.6 percentage points. In contrast, the point estimates of the effect of the supply shock on the 90th percentile are not significantly different from zero.

These results indicate that the negative credit supply shock increases the volatility and skews the distribution of cash flows, making large negative cash flows more likely. Note that the sharp declines in cash flows do not seem to be

⁹ This implies that the standard error estimation is noisy in the 6 month specification, but the results are included for completeness.

driven by sharp disinvestments or fire sales, since the financing shock does not have the same distributional implications for investment (see Table 5, columns 10 through 15). This again suggests that the cash flow consequences of the credit supply shock cannot be explained by models where the cash flow process is solely determined by assets in place, and are more likely driven by financial distress.

This discussion suggests that a credit supply shocks can affect valuation through three different channels. The first two are characterized in Bolton, Chen, and Wang (2009): an increase in external financing costs increases the value of precautionary cash stocks, and induces the firm to endogenously increase their cash holdings. The third channel is by directly affecting increasing the volatility of cash flows through financial distress.

Although we cannot distinguish these channels empirically, we can measure the net effect of the credit supply shock on the risk premium. Table 7 shows the estimated effect on firm beta using specification (1). The dependent variable is the change in firm betas. This is obtained by first estimating each firm's beta before and after the WorldCom events and then taking the difference. Specifically, for each firm we estimate four regressions of daily stock returns on daily market returns (both net of the risk free rate) and a constant, one using a year of daily returns before the WorldCom events, and three using the 6, 12, and 24 months of daily returns after the events. As with standard deviations, the

estimated betas are noisy for the 6 month specification and must be interpreted with care.

Consistent with the predictions in Lidvan, Sapriza, and Zhang (2009), the point estimates imply that the credit supply shock increased firm beta by 0.06 immediately after the shock. The increase in betas appears to be persistent as the estimated effect is significant and of the same magnitude over the two years after the shock. The effect represents an increase of 8.7% in beta relative to the average in the full sample period. As in all previous estimations, the statistical significance and magnitude of the estimated effect is robust to the exclusion of high-tech industries from the sample and no effect is found for firms with CP rating (panels B and C). The results are also robust to the inclusion of firm book-to-market quintile indicators, which saturates variation in firm betas that is specific to growth or value stocks (Table 7, columns 4 through 6).

These results provide causal evidence that financing constraints affect firm valuation by increasing stock return covariance with the market. Our findings provide the economic rationale for the observed covariance of stock returns among firms that are likely to be constrained according to observable characteristics (Lamont, Polk, and Saa-Requejo (2001)).

I. Conclusion

This paper addresses the question of whether and how external financing constraints affect corporate financial policy, and to which degree financial management may alleviate investment distortions induced by financing constraints. To address these questions we exploit the natural experiment provided by the large and unexpected bankruptcy of WorldCom. We demonstrate that banks with a lending relationship to WorldCom reduce the supply of credit to other borrowers after the bankruptcy relative to other banks. The decline in credit supply was unrelated to these other borrowers' creditworthiness and financial position, and thus resulted in an exogenous increase in their external financing costs.

We study how firm financial policy, investment, and valuation change after the external financing shock. Consistent with a precautionary motive for holding liquid assets, we find that firms hoard cash after the shock. To build up the cash balances firms increase their equity issuances net of dividend payouts and share repurchases. Despite the increase in internal and equity financing, investment is negatively affected in the short run, and operating cash flows decline and become more volatile in the medium run (two years). The external financing shock also increases the covariance of the firm's stock returns with the market. This final result indicates that financing constraints affect firm valuation

not only through their effect on the expected level of future cash flows, but also through the risk premium, by increasing the firm's vulnerability to systematic shocks.

The overall evidence suggests that firms actively manage their financial policy in response to external financing shocks. Despite this response, financing shocks have first order effect on investment and valuation. We find that firms partially substitute debt from the affected lenders from other sources, including borrowing from banks not affected by the WorldCom events. This suggests that our estimates are, at most, a lower bound on the potential effect of systemic financing shocks to investment, cash flows, and valuation.

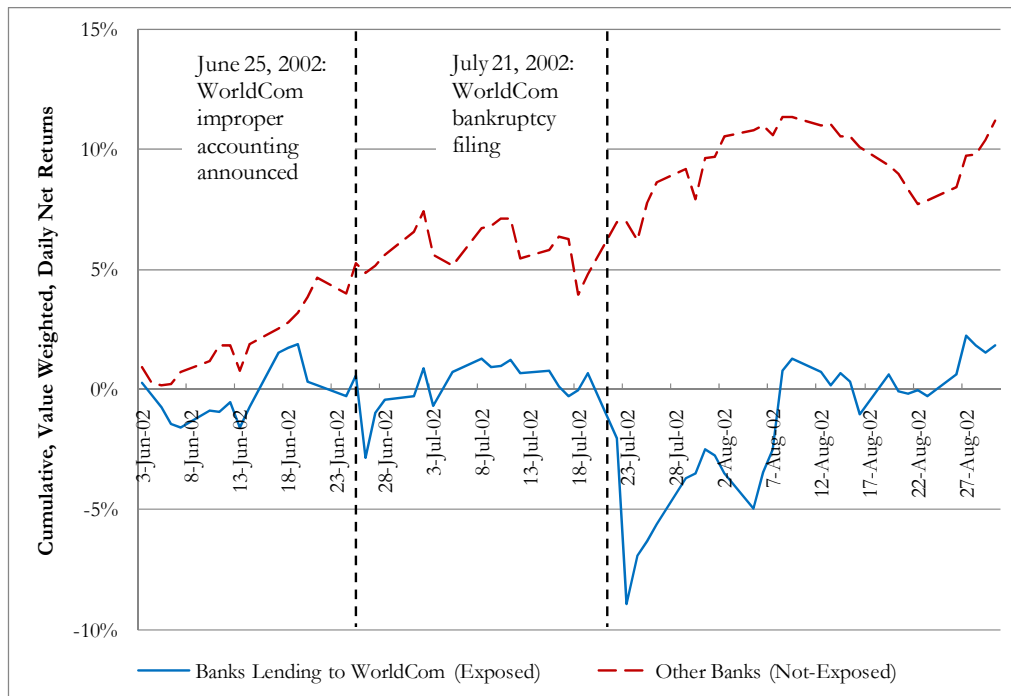
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Figure 1
 Cumulative Daily Returns of Public Banks (value weighted), by Lending Relationship to WorldCom



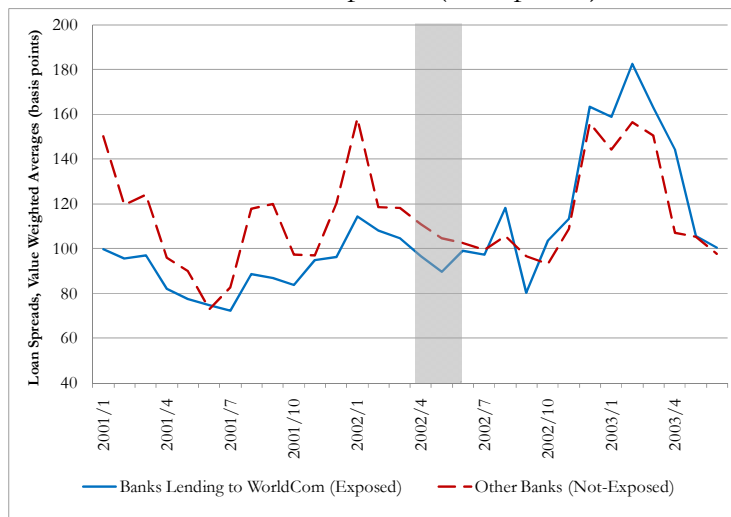
Cumulative value-weighted returns of the portfolios of public banks classified as exposed and not-exposed from June 3, 2002 to August 24, 2002. A lender is classified as exposed to WorldCom if it participated in syndicated loan facilities to WorldCom during the year prior to the WorldCom bankruptcy. The portfolios include 8 exposed banks and 131 not-exposed banks. Upon improper accounting the announcement the portfolio of exposed banks experienced a 300-basis-point decline in stock returns relative to the portfolio of not-exposed banks. Upon the WorldCom bankruptcy filing on July 21, the portfolio of exposed banks experienced a 486-basis-point decline in stock returns relative to the portfolio of not-exposed banks.

Figure 2

Loan Spreads and New Syndicated Loans, by Bank Exposure to WorldCom

Source: DealScan. Monthly time series of loans spreads and flows of new syndicated loans by exposed and not-exposed banks. A bank is classified as exposed to WorldCom if it participates in syndicated loan facilities to WorldCom during the year prior to the WorldCom bankruptcy. The shaded area highlights the three months between elapsed between WorldCom's fraud discovery and bankruptcy.

Panel A. Loan Spreads (basis points)



Panel B. New Originations (Jan 2001 = 100)

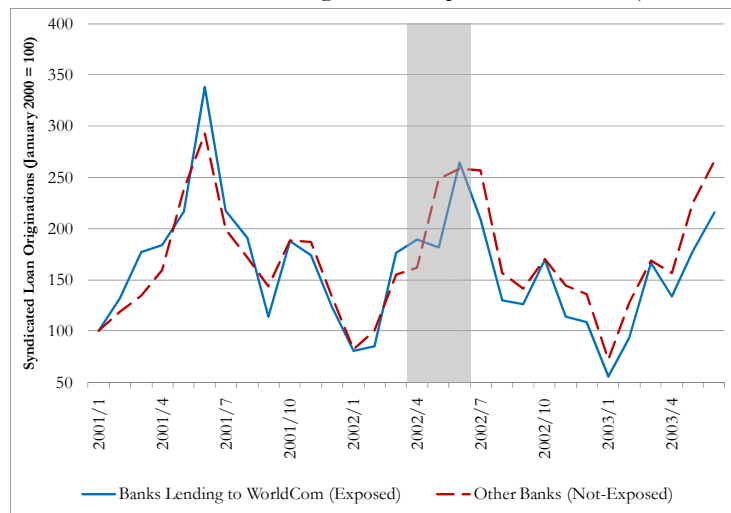


Table 1**Total Assets of Banks, by Potential Exposure to WorldCom Events**

Sample: results from hand-matching the lender names in DealScan with the bank names in National Information Center, a repository of financial data and institution characteristics collected by the Federal Reserve System. Restricted to 139 that have Call Report in the first quarter of 2002. Reported is the value of total assets as of the first quarter of 2002. A bank is classified as exposed to WorldCom if it participated in syndicated loan deals to WorldCom between the second quarter of 2001 and the first quarter of 2002. The facilities to WorldCom during that period include a \$2.65 billion 364-day loan and a \$1.6 billion 5-year line of credit.

Bank Holding Company	Total Assets
Panel A: Exposed Banks	
1 CITIGROUP INC.	1,057,657,000
2 J.P. MORGAN CHASE & CO.	712,508,000
3 BANK OF AMERICA CORPORATION	619,921,000
4 WELLS FARGO & COMPANY	311,509,000
5 BANK ONE CORPORATION	262,947,000
6 FLEETBOSTON FINANCIAL CORPORATION	192,032,000
7 MELLON FINANCIAL CORPORATION	33,278,993
8 ALLFIRST FINANCIAL INC.	17,958,179
Total	3,207,811,172
Panel B: Banks with no exposure	
1 WACHOVIA CORPORATION	319,853,000
2 U.S. BANCORP	164,745,000
3 SUNTRUST BANKS, INC.	106,244,822
4 NATIONAL CITY CORPORATION	100,196,346
5 ABN AMRO NORTH AMERICA, INC.	97,324,265
6 HSBC USA INC.	87,557,960
7 KEYCORP	80,726,567
8 BANK OF NEW YORK COMPANY, INC., THE	76,836,021
All others (123)	1,326,570,494
Total	2,360,054,475

Table 2
Firm Panel Descriptive Statistics, Full Sample and Non-Rated Subsample

Sample: results from hand-matching the firm names in DealScan with the firm names in COMPUSTAT – North America. Restricted to firms that had at least one loan facility during 2000-2001. Excludes firms in the financial, telecommunications, and regulated industries. The sample period: 8 quarters prior to WorldCom’s demise (second quarter of 2001 through the first quarter of 2002).

	mean	sd	10%	50%	90%	mean	sd	10%	50%	90%	mean	sd	10%	50%	90%
Panel A. Full Sample: 12,566 observations (N), 1,636 firms															
	All (N = 12,566)					Exposed Firms (N = 8,153)					Not-Exposed Firms (N = 4,413)				
Loan Spread (basis points)	143.3	102.4	22.0	125.0	294.8	131.4	102.3	18.5	102.5	283.3	179.9	93.8	58.8	175.0	300.0
New Synticated Loans/Assets _{t-1}	0.164	0.141	0.025	0.115	0.392	0.151	0.135	0.022	0.104	0.371	0.196	0.148	0.034	0.153	0.454
Fraction of Loans by Exposed Banks	0.717	0.231	0.393	0.732	1.000	0.763	0.195	0.500	0.765	1.000	0.447	0.237	0.171	0.415	0.757
Market Capitalization (\$ millions)	3,572	15,283	21	452	6,080	5,123	18,754	30	697	9,351	714	1,798	16	217	1,628
Market/Book	1.72	1.15	0.89	1.38	2.87	1.70	1.00	0.92	1.40	2.83	1.76	1.40	0.85	1.35	3.15
Beta (1 year)	0.684	0.548	0.157	0.567	1.365	0.672	0.493	0.173	0.578	1.240	0.706	0.638	0.123	0.553	1.608
Debt/Assets	0.290	0.231	0.015	0.274	0.549	0.303	0.220	0.025	0.287	0.559	0.267	0.247	0.005	0.245	0.534
Cash/Assets	0.084	0.137	0.004	0.029	0.236	0.068	0.109	0.004	0.026	0.185	0.114	0.173	0.003	0.037	0.344
Debt Financing (net flow)/Assets _{t-1}	0.0037	0.0852	-0.0461	-0.0006	0.0527	0.0036	0.0825	-0.0466	-0.0009	0.0536	0.0039	0.0898	-0.0449	-0.0002	0.0510
Equity Financing (net flow)/Assets _{t-1}	0.0093	0.1171	-0.0346	0.0000	0.0291	0.0020	0.0901	-0.0399	0.0000	0.0180	0.0230	0.1543	-0.0267	0.0000	0.0531
Investment in Fixed Assets/Assets _{t-1}	0.018	0.129	0.002	0.013	0.048	0.019	0.048	0.002	0.013	0.046	0.017	0.206	0.002	0.014	0.051
Cash Flow/Assets _{t-1}	0.017	0.064	-0.013	0.022	0.050	0.020	0.041	-0.005	0.022	0.050	0.011	0.091	-0.036	0.020	0.050
Panel B. Sub-Sample of Non-Rated Firms: 10,930 observations (N), 1,416 firms															
	All (N = 10,930)					Exposed Firms (N = 6,677)					Not-Exposed Firms (N = 4,257)				
Loan Spread (basis points)	176.4	95.1	61.3	162.5	300.0	170.4	96.8	58.8	150.0	300.0	190.3	89.5	75.0	190.0	300.0
New Synticated Loans/Assets _{t-1}	0.192	0.147	0.036	0.146	0.440	0.186	0.145	0.034	0.138	0.427	0.204	0.150	0.038	0.162	0.464
Fraction of Loans by Exposed Banks	0.696	0.245	0.342	0.699	1.000	0.753	0.206	0.477	0.752	1.000	0.419	0.233	0.163	0.385	0.699
Market Capitalization (\$ millions)	1,046	2,972	18	324	2,320	1,338	3,628	22	463	2,932	588	1,309	15	200	1,335
Market/Book	1.67	1.16	0.86	1.34	2.74	1.61	0.97	0.90	1.34	2.61	1.76	1.40	0.84	1.36	3.15
Beta (1 year)	0.699	0.570	0.158	0.567	1.436	0.692	0.513	0.176	0.580	1.311	0.711	0.650	0.118	0.552	1.622
Leverage	0.288	0.243	0.010	0.268	0.563	0.304	0.236	0.016	0.287	0.579	0.264	0.251	0.005	0.238	0.535
Cash/Assets	0.090	0.144	0.004	0.031	0.263	0.072	0.117	0.004	0.027	0.203	0.117	0.176	0.003	0.040	0.347
Debt Financing (net flow)/Assets _{t-1}	0.0025	0.0835	-0.0487	-0.0005	0.0535	0.0020	0.0791	-0.0502	-0.0009	0.0551	0.0033	0.0900	-0.0456	-0.0003	0.0492
Equity Financing (net flow)/Assets _{t-1}	0.0147	0.1231	-0.0268	0.0000	0.0369	0.0082	0.0957	-0.0274	0.0000	0.0252	0.0248	0.1562	-0.0252	0.0000	0.0564
Investment in Fixed Assets/Assets _{t-1}	0.018	0.137	0.001	0.013	0.050	0.019	0.050	0.001	0.013	0.049	0.017	0.210	0.002	0.014	0.051
Cash Flow/Assets _{t-1}	0.015	0.067	-0.017	0.021	0.050	0.018	0.044	-0.009	0.021	0.050	0.010	0.092	-0.039	0.020	0.051

Table 3

Effect of the WorldCom Events on the Supply of Credit: Spreads and New Syndicated Origination

Estimation results of specification (1):

$$y_i^{Post} - y_i^{Pre} = \alpha_i^{SIC2} + \alpha_i^{IncorpState} + \alpha_i^{SizeQuartile} + \beta \cdot ExposedLender_i + \varepsilon_i$$

The left hand side variable is the change in the spread of syndicated loans paid by firm i before and after the WorldCom events in columns 1 and 2. In columns 3 through 8 the left hand side variable is the change in the new syndicated loan debt origination (scaled by lagged assets) during the same period, depending on the originating bank (columns 3 and 4: debt from exposed banks; columns 5 and 6: debt from not-exposed banks; columns 7 and 8: all debt). The right hand side variable of interest is an indicator variable equal to one if the firm's lenders also lend WorldCom. The coefficient on this dummy represents the change in outcomes of the exposed firms relative to the not-exposed firms. The specification includes include a full set of industry, state of incorporation, and size quartile dummies. Column 7 (8) show the results of an estimation that stacks the observations of columns 3 and 5 (4 and 6), and includes firm fixed effects. In this specification there is one observation per firm-quarter-lender type, where lender type is either exposed or not exposed. The definition of the right-hand side variable dummy *ExposedLender* changes in this specification: it is one if the lender is exposed, and zero otherwise. Heteroskedasticity robust standard errors allow for clustering at the industry level (2-digit SIC). *, **, and *** indicate statistical significance of the point estimate at the 10%, 5%, and 1% levels respectively.

Table 3, continued
Effect of the WorldCom Events on the Supply of Credit: Spreads and New Syndicated Origination

Dependent Variable	$(\text{Spread}_t)_{\text{post}} - (\text{Spread}_t)_{\text{pre}}$		$(\text{New Syndicated Debt}_t / \text{Assets}_{t-1})_{\text{post}} - (\text{New Syndicated Debt}_t / \text{Assets}_{t-1})_{\text{pre}}$				$(\text{New Syndicated Debt}_{ij} / \text{Assets}_{t-1})_{\text{post}} - (\text{New Syndicated Debt}_{ij} / \text{Assets}_{t-1})_{\text{pre}}$			
	All Banks		Exposed Banks		Non-Exposed Banks		All Banks		All Banks (Firm-Bank Pairs)	
Post Period	1 Year	2 Years	1 Year	2 Years	1 Year	2 Years	1 Year	2 Years	1 Year	2 Years
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(7)	(8)
A. Sample: No Comercial Paper Rating										
Exposed Lender	31.35 (19.9800)	23.18*** (7.2000)	-0.0471*** (0.0160)	-0.0331*** (0.0098)	0.0295 (0.0213)	0.0321*** (0.0096)	-0.0154 (0.0280)	0.0018 (0.0150)	-0.0259** (0.0105)	-0.0222*** (0.0073)
Industry, location, size quintile FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
Firm FE									Yes	Yes
Observations	286	572	240	469	236	485	306	608	478	956
R-squared	0.26	0.20	0.41	0.25	0.33	0.20	0.28	0.19	0.81	0.78
B. Sample: No Comercial Paper Rating; excludes electrical equipment, software industries										
Exposed Lender	16.09 (20.2000)	20.01** (7.8200)	-0.0513*** (0.0170)	-0.0368*** (0.0106)	0.0413* (0.0209)	0.0380*** (0.0102)	-0.0132 (0.0315)	0.0009 (0.0171)	-0.0257** (0.0114)	-0.0203** (0.0078)
Industry, location, size quintile FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
Firm FE									Yes	Yes
Observations	250	505	208	413	209	430	266	535	419	845
R-squared	0.32	0.21	0.42	0.27	0.38	0.23	0.30	0.19	0.82	0.79
C. Sample: With Comercial Paper Rating										
Exposed Lender	33.81 (34.0300)	36.64 (36.4400)	-0.0042 (0.0068)	0.0032 (0.0162)	0.0102* (0.0059)	0.0136* (0.0080)	0.0096 (0.0128)	0.0173 (0.0200)	-0.0153*** (0.0034)	-0.0136*** (0.0034)
Industry, location, size quintile FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE									Yes	Yes
Observations	155	189	152	185	146	176	154	187	298	361
R-squared	0.38	0.38	0.48	0.41	0.61	0.55	0.53	0.43	0.78	0.71

Table 4

Effect of Credit Supply Shock on Financial Policy

Estimation results of specification (1):

$$y_i^{Post} - y_i^{Pre} = \alpha_i^{SIC2} + \alpha_i^{IncorpState} + \alpha_i^{SizeQuartile} + \beta \cdot ExposedLender_i + \varepsilon_i$$

The left hand side variable is the change in either net debt issues or equity issues minus payouts scaled by lagged assets (columns 1 through 6), or the ratio of debt to assets and cash to assets (columns 7 through 12), before and after the WorldCom events. The right hand side variable of interest is an indicator variable equal to one if the firm's lenders also lend WorldCom. The coefficient on this dummy represents the change in outcomes of the exposed firms relative to the not-exposed firms. The specification includes a full set of industry, state of incorporation, and size quartile dummies. Heteroskedasticity robust standard errors allow for clustering at the industry level (2-digit SIC). *, **, and *** indicate statistical significance of the point estimate at the 10%, 5%, and 1% levels respectively.

Table 4, continued
Effect of Credit Supply Shock on Financial Policy

Dependent Variable	$(\text{Net Debt Issue}_t / \text{Assets}_{t-1})_{\text{post}} - (\text{Net Debt Issue}_t / \text{Assets}_{t-1})_{\text{pre}}$			$(\text{Net Equity Issue}_t / \text{Assets}_{t-1})_{\text{post}} - (\text{Net Equity Issue}_t / \text{Assets}_{t-1})_{\text{pre}}$			$(\text{Debt}_t / \text{Assets}_t)_{\text{post}} - (\text{Debt}_t / \text{Assets}_t)_{\text{pre}}$			$(\text{Cash}_t / \text{Assets}_t)_{\text{post}} - (\text{Cash}_t / \text{Assets}_t)_{\text{pre}}$		
	6 months	1 year	2 years	6 months	1 year	2 years	6 months	1 year	2 years	6 months	1 year	2 years
Post Period	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
A. Sample: No Commercial Paper Rating												
Exposed Lender	-0.0003 (0.0051)	0.0004 (0.0042)	0.0034 (0.0029)	0.0069** (0.0032)	0.0062** (0.0025)	0.006 (0.0036)	0.0006 (0.0058)	0.0013 (0.0062)	0.0031 (0.0064)	0.0128*** (0.0041)	0.0104*** (0.0038)	0.0100** (0.0045)
Industry, location, size quintile FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,299	1,310	1,315	1,350	1,352	1,353	1,331	1,333	1,337	1,343	1,347	1,348
R-squared	0.11	0.10	0.10	0.06	0.07	0.08	0.08	0.08	0.09	0.08	0.07	0.08
B. Sample: No Commercial Paper Rating; excludes electrical equipment, software industries												
Exposed Lender	-0.0009 (0.0059)	-0.0001 (0.0048)	0.0034 (0.0034)	0.0057* (0.0035)	0.0045 (0.0029)	0.0025 (0.0034)	-0.0024 (0.0049)	-0.0021 (0.0049)	0.0009 (0.0066)	0.0132*** (0.0047)	0.0103** (0.0039)	0.0077* (0.0045)
Industry, location, size quintile FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,118	1,127	1,132	1,164	1,166	1,167	1,146	1,148	1,151	1,157	1,161	1,162
R-squared	0.11	0.10	0.11	0.07	0.07	0.08	0.09	0.09	0.09	0.09	0.07	0.08
C. Sample: With Commercial Paper Rating												
Exposed Lender	0.0179 (0.0208)	0.013 (0.0239)	0.0155 (0.0297)	0.0243 (0.0216)	0.0264 (0.0262)	0.0152 (0.0200)	-0.0511 (0.0443)	-0.0668 (0.0611)	-0.0763 (0.0834)	0.003 (0.0182)	0.0114 (0.0138)	0.0045 (0.0121)
Industry, location, size quintile FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	200	200	201	206	206	206	204	204	206	206	206	206
R-squared	0.39	0.43	0.41	0.31	0.26	0.30	0.45	0.41	0.35	0.48	0.44	0.48

Table 5

Effect of Credit Supply Shock on Investment Distribution

Estimation results of specification (1):

$$y_i^{Post} - y_i^{Pre} = \alpha_i^{SIC2} + \alpha_i^{IncorpState} + \alpha_i^{SizeQuartile} + \beta \cdot ExposedLender_i + \varepsilon_i$$

The left hand side variable is the change in either the mean, standard deviation, or a quantile (median, 10th percentile, 90th percentile) of a firm's capital expenditures, scaled by lagged assets, before and after the WorldCom events. The right hand side variable of interest is an indicator variable equal to one if the firm's lenders also lend WorldCom. The coefficient on this dummy represents the change in outcomes of the exposed firms relative to the not-exposed firms. The specification includes include a full set of industry, state of incorporation, and size quartile dummies. Heteroskedasticity robust standard errors allow for clustering at the industry level (2-digit SIC). *, **, and *** indicate statistical significance of the point estimate at the 10%, 5%, and 1% levels respectively.

Table 5, continued
Effect of Credit Supply Shock on Investment Distribution

Dependent Variable	$(\text{CAPEX}_t/\text{Assets}_t)_{\text{post}} - (\text{CAPEX}_t/\text{Assets}_t)_{\text{pre}}$														
	Mean			Median			SD			10th percentile			90th percentile		
	6 months	1 year	2 years	6 months	1 year	2 years	6 months	1 year	2 years	6 months	1 year	2 years	6 months	1 year	2 years
Post period	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
A. Sample: No Comercial Paper Rating															
Exposed Lender	-0.0020 (0.0017)	-0.0005 (0.0016)	0.0001 (0.0014)	-0.0035** (0.0017)	0.0000 (0.0008)	0.0000 (0.0007)	0.0007 (0.0021)	0.0002 (0.0021)	0.0019 (0.0022)	-0.0004 (0.0029)	0.0008 (0.0028)	0.0002 (0.0035)	0.0046 (0.0046)	0.003 (0.0052)	0.0057 (0.0053)
Industry, location, size quintile FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,331	1,346	1,348	1,249	1,289	1,294	1,198	1,246	1,254	1,249	1,289	1,294	1,249	1,289	1,294
R-squared	0.13	0.12	0.12	0.11	0.11	0.11	0.09	0.09	0.08	0.09	0.09	0.08	0.15	0.14	0.12
B. Sample: No Comercial Paper Rating; excludes electrical equipment, software industries															
Exposed Lender	-0.0032* (0.0017)	-0.0018 (0.0015)	-0.0007 (0.0015)	-0.0048*** (0.0017)	-0.0007 (0.0007)	-0.0006 (0.0007)	0.0015 (0.0021)	0.0001 (0.0019)	0.0017 (0.0023)	-0.0022 (0.0031)	-0.0011 (0.0030)	0.0001 (0.0037)	0.0057 (0.0049)	0.0024 (0.0052)	0.0056 (0.0058)
Industry, location, size quintile FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,145	1,160	1,162	1,081	1,112	1,117	1,030	1,071	1,078	1,081	1,112	1,117	1,081	1,112	1,117
R-squared	0.14	0.13	0.13	0.11	0.11	0.13	0.09	0.10	0.09	0.09	0.09	0.10	0.16	0.15	0.13
C. Sample: With Comercial Paper Rating															
Exposed Lender	0.0083 (0.0101)	0.01 (0.0121)	0.011 (0.0110)	0.0012 (0.0058)	0.0029 (0.0041)	0.004 (0.0031)	0.0304 (0.0293)	0.0287 (0.0302)	0.0264 (0.0252)	-0.0045 (0.0097)	-0.0032 (0.0098)	0.0032 (0.0136)	0.0806 (0.0859)	0.0838 (0.0908)	0.0783 (0.0849)
Industry, location, size quintile FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	205	205	205	192	198	200	190	197	199	192	198	200	192	198	200
R-squared	0.52	0.49	0.55	0.55	0.40	0.56	0.72	0.76	0.76	0.59	0.61	0.50	0.76	0.77	0.78

Table 6

Effect of Credit Supply Shock on Cash Flow Distribution

Estimation results of specification (1):

$$y_i^{Post} - y_i^{Pre} = \alpha_i^{SIC2} + \alpha_i^{IncorpState} + \alpha_i^{SizeQuartile} + \beta \cdot ExposedLender_i + \varepsilon_i$$

The left hand side variable is the change in either the mean, standard deviation, or a quantile (median, 10th percentile, 90th percentile) of a firm's EBIT plus depreciation and amortization, scaled by lagged assets, before and after the WorldCom events. The right hand side variable of interest is an indicator variable equal to one if the firm's lenders also lend WorldCom. The coefficient on this dummy represents the change in outcomes of the exposed firms relative to the not-exposed firms. The specification includes include a full set of industry, state of incorporation, and size quartile dummies. Heteroskedasticity robust standard errors allow for clustering at the industry level (2-digit SIC). *, **, and *** indicate statistical significance of the point estimate at the 10%, 5%, and 1% levels respectively.

Table 6, continued
Effect of Credit Supply Shock on Cash Flow Distribution

Dependent Variable	(Cash Flows _t /Assets _t) _{post} - (Cash Flows _t /Assets _t) _{pre}														
	Mean			Median			SD			10th percentile			90th percentile		
	6 months	1 year	2 years	6 months	1 year	2 years	6 months	1 year	2 years	6 months	1 year	2 years	6 months	1 year	2 years
Post period	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
A. Sample: No Comercial Paper Rating															
Exposed Lender	-0.0039 (0.0029)	-0.003 (0.0025)	-0.0055** (0.0025)	-0.0039 (0.0029)	-0.0025 (0.0022)	-0.0040* (0.0022)	0.0063* (0.0037)	0.0045 (0.0033)	0.0058* (0.0031)	-0.0114 (0.0078)	-0.0097 (0.0077)	-0.0144* (0.0076)	0.0017 (0.0036)	0.0009 (0.0035)	-0.0018 (0.0034)
Industry, location, size quintile FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,252	1,292	1,297	1,252	1,292	1,297	1,201	1,249	1,257	1,252	1,292	1,297	1,252	1,292	1,297
R-squared	0.08	0.07	0.07	0.08	0.07	0.06	0.07	0.07	0.07	0.09	0.08	0.08	0.09	0.07	0.07
B. Sample: No Comercial Paper Rating; excludes electrical equipment, software industries															
Exposed Lender	-0.0036 (0.0027)	-0.0032 (0.0024)	-0.0058** (0.0024)	-0.0033 (0.0027)	-0.0022 (0.0021)	-0.0042* (0.0022)	0.0085** (0.0035)	0.0062** (0.0031)	0.0063** (0.0030)	-0.0141* (0.0078)	-0.0134* (0.0078)	-0.0168** (0.0078)	0.0037 (0.0038)	0.0024 (0.0037)	-0.0009 (0.0038)
Industry, location, size quintile FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,084	1,115	1,120	1,084	1,115	1,120	1,033	1,074	1,081	1,084	1,115	1,120	1,084	1,115	1,120
R-squared	0.09	0.08	0.08	0.09	0.08	0.07	0.12	0.11	0.11	0.13	0.11	0.12	0.11	0.09	0.08
C. Sample: With Comercial Paper Rating															
Exposed Lender	0.0075 (0.0104)	0.0036 (0.0060)	0.0008 (0.0042)	0.0088 (0.0101)	-0.0002 (0.0027)	0.0009 (0.0027)	-0.0115 (0.0170)	-0.0091 (0.0110)	-0.0051 (0.0073)	0.0134 (0.0236)	0.0161 (0.0230)	0.008 (0.0134)	-0.0005 (0.0059)	-0.0015 (0.0054)	-0.0032 (0.0050)
Industry, location, size quintile FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	192	198	200	192	198	200	190	197	199	192	198	200	192	198	200
R-squared	0.39	0.35	0.32	0.43	0.36	0.30	0.26	0.23	0.29	0.22	0.20	0.25	0.42	0.46	0.47

Table 7
Effect of Credit Supply Shock on Risk Premia

Estimation results of specification (1):

$$y_i^{Post} - y_i^{Pre} = \alpha_i^{SIC2} + \alpha_i^{IncorpState} + \alpha_i^{SizeQuartile} + \beta \cdot ExposedLender_i + \varepsilon_i$$

The left hand side variable is the change in firm beta before and after the WorldCom events. The right hand side variable of interest is an indicator variable equal to one if the firm's lenders also lend WorldCom. The coefficient on this dummy represents the change in outcomes of the exposed firms relative to the not-exposed firms. The specification includes include a full set of industry, state of incorporation, and size quartile dummies. Heteroskedasticity robust standard errors allow for clustering at the industry level (2-digit SIC). *, **, and *** indicate statistical significance of the point estimate at the 10%, 5%, and 1% levels respectively.

Dependet Variable	(Beta) _{post} - (Beta) _{pre}					
	6 months		1 year		2 year	
	(1)	(2)	(3)	(4)	(5)	(6)
A. Sample: No Comercial Paper Rating						
Exposed Lender	0.0610** (0.0267)	0.0550** (0.0221)	0.0584** (0.0236)	0.0509* (0.0264)	0.0467** (0.0219)	0.0498** (0.0233)
Industry, location, size quintile FE	Yes	Yes	Yes	Yes	Yes	Yes
Book-to-Market quintile FE				Yes	Yes	Yes
Observations	1,193	1,194	1,194	1,191	1,192	1,192
R-squared	0.27	0.30	0.27	0.27	0.31	0.28
B. Sample: No Comercial Paper Rating; excludes electrical equipment, software industries						
Exposed Lender	0.0518* (0.0281)	0.0428* (0.0229)	0.0475* (0.0247)	0.0435 (0.0279)	0.0362 (0.0229)	0.0405* (0.0246)
Industry, location, size quintile FE	Yes	Yes	Yes	Yes	Yes	Yes
Book-to-Market quintile FE				Yes	Yes	Yes
Observations	1,026	1,027	1,027	1,024	1,025	1,025
R-squared	0.26	0.31	0.28	0.27	0.32	0.28
C. Sample: With Comercial Paper Rating						
Exposed Lender	0.0791 (0.0998)	0.0242 (0.0873)	0.0441 (0.0797)	0.0602 (0.1107)	0.0187 (0.0952)	0.0271 (0.0871)
Industry, location, size quintile FE	Yes	Yes	Yes	Yes	Yes	Yes
Book-to-Market quintile FE				Yes	Yes	Yes
Observations	202	202	202	199	199	199
R-squared	0.55	0.51	0.50	0.56	0.51	0.51