

The Response of Corporate Financing and Investment to Changes in the Supply of Credit: A Natural Experiment*

Michael Lemmon
David Eccles School of Business, University of Utah

Michael R. Roberts
The Wharton School, University of Pennsylvania

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*We thank Andy Abel, Joao Gomes, Andrew Metrick, Vinay Nair, Amir Sufi, and Toni Whited. Roberts gratefully acknowledges financial support from a Rodney L White Grant and an NYSE Research Fellowship. Lemmon: (801) 585-5210, finml@business.utah.edu; Roberts: (215) 573-9780, mrrobert@wharton.upenn.edu.

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Abstract:

We examine how shocks to the supply of credit impact corporate investment and financial policies. In order to disentangle supply-side from demand-side forces, we use two concurrent events in 1989 as an exogenous shock to the supply of capital to below-investment-grade firms: (1) the collapse of Drexel Burnham Lambert, Inc. and (2) the passage of the Financial Institutions Reform, Recovery, and Enforcement Act (FIRREA), which prevents Savings and Loans from investing in junk bonds. A difference-in-differences empirical strategy reveals that total net debt issuing activity among below-investment-grade firms declines by 8% of total assets relative to the change experienced by otherwise similar investment-grade and unrated firms. In contrast, net equity issuances and savings behavior are largely unaffected by the credit supply shock and, as a result, both gross and net investment experience significant declines of approximately 3% to 5% of total assets. Additionally, we find that the supply shock has relatively little effect on corporate leverage ratios - counter to recent empirical studies - despite the precipitous decline in net debt issuing activity. Finally, we show that the investment decline among below-investment-grade firms is concentrated in firms located in the Northeast region of the country, the region experiencing the brunt of the credit crunch in the banking sector, suggesting that capital market frictions limiting substitution across sources of capital have both financial and real effects.

A basic assumption of Modigliani and Miller's (1958) irrelevance theorem is that of perfect markets in which the supply of capital is infinitely elastic. Absent this condition, the presence of financial market imperfections can generate a role for the supply of capital in determining firms' financing and investment policies beyond that dictated by firms' demands for capital. For example, Stiglitz and Weiss (1981) illustrate how information asymmetry between managers and lenders concerning the quality of a firm and its investments can lead to the rationing of credit and the distortion of firms' investment policies.¹ Therefore, cross-sectional variation in financing and investment may reflect not only variation in demand-side factors but supply-side constraints as well.

The goal of this paper is to empirically determine whether variations in the supply of capital have a significant influence on corporate investment and financial policies. Of course, empirically identifying the existence of such a linkage is difficult because of the fundamental simultaneity occurring between the supply and demand for capital. This paper attempts to overcome this hurdle by using two concurrent events in 1989 as an exogenous shock to the supply of capital to below-investment-grade firms: (1) the collapse of Drexel Burnham Lambert, Inc. and (2) the passage of the Financial Institutions Reform, Recovery, and Enforcement Act (FIRREA). Drexel Burnham Lambert, Inc. underwrote or sold over half of the outstanding speculative-grade debt prior to the indictment of their chief financier, Michael Milken, in March of 1989 and the company's guilty plea to federal securities law violations in September of 1989 (Simonson (2000)). The FIRREA, enacted in August of 1989, prevented Savings and Loans from investing in speculative-grade securities and, further, required them to completely liquidate their positions in such securities by 1994. In concert, these events

¹ Jaffee and Russell (1976) present a related model and implication.

lead to the near disappearance of the market for junk bonds in 1990 and 1991, as indicated by Figure 1 which shows the issuance of non-investment grade debt as a fraction of stock market capitalization over the period from 1977 to 1999.

Importantly, these events have several features that, in combination, enable us to identify the impact of fluctuations in the supply of capital on corporate behavior. First, each event is largely exogenous with respect to the investment and financing decisions of individual firms. The demise of Drexel Burnham Lambert, Inc. was caused by self-serving, illegal trading activities, while the FIRREA was precipitated by a period of deregulation and mismanagement in the financial thrift industry. Second, both events occurred in 1989, enabling us to pin down the supply shock to a specific event year. Finally, these events affected a specific subset of firms, namely below-investment-grade rated firms. This last feature permits us to employ a difference-in-differences empirical approach which, in conjunction with a variety of control groups, further helps to identify the effects of the supply shock on firm behavior.

We begin by focusing our attention on a sample of firms that are close or “local” to the speculative grade distinction: BBB (investment-grade) versus BB (below-investment-grade). This sample selection aids in homogenizing the treatment (i.e., BB-rated firms) and control (i.e., BBB-rated firms) groups.² Additionally, this sample satisfies the parallel trends assumption required for the difference-in-differences analysis, though our results are robust to corrections for any deviation from this assumption. Our results show that *total* net debt issuances as a fraction of assets for BB-rated firms fell by 8% after 1989 relative to the change experienced by BBB-rated firms. This decline

² By “BBB-rated” and “BB-rated” would refer to firms with either a BBB or BB rating, not to be confused with “BBB minus” or “BB minus” ratings.

corresponds to a decrease in net debt issuing activity of approximately 50% relative to pre-1989 levels. That total net debt issuances fell so dramatically suggests that below investment grade firms were unable to substitute alternative forms of credit (e.g., bank loans, private placements) for the dearth of speculative-grade debt.

Further examination of the financial effects reveal that the net equity issuing and savings behavior of below-investment-grade firms are largely unaffected by the supply shocks. In fact, we find a slight decline in net equity issuances, although statistically insignificant, after 1989 when a recession and depressed stock market led to relatively expensive equity capital. Additionally, although there is some evidence that BB-rated firms began substituting towards cash and trade credit, the relative increases in these forms of financing fell well-short of the void left by the collapse of the speculative grade debt market.

Interestingly, though net debt issuances fell precipitously in response to the supply shock, corporate leverage of below-investment-grade firms is unaffected. Both book and market leverage ratios remain relatively stable during the 1985 to 1993 period for both BBB- and BB-rated firms. Therefore, while our evidence suggesting that capital substitution is costly is consistent with the inferences of Faulkender and Petersen (2005) and Leary (2006), the implication of this costly substitution is at odds with their conclusions that the supply of capital is an important determinant of corporate leverage.

We then examine corporate investment to understand whether the supply shocks, and subsequent financial consequences, lead to any real effects. Our results indicate that both gross (capital expenditures plus acquisitions plus changes in inventory) and net (gross investment less the sale of capital) investment for BB-rated firms decreased, on

average, by approximately 5% to 6% of total assets relative to BBB-rated firms. These estimates represent statistically and economically significant declines relative to pre-1989 average gross and net investment rates of 19.4% and 18.7%, respectively. Closer inspection reveals that approximately 17% of the decline in gross investment is due to the decline in capital expenditures, 50% is due to the decline in acquisition activity, and 33% is due to the decline in inventory investment. This is consistent with the empirical evidence in Holmstrom and Kaplan (2001) and Kaplan and Stein (1993) who show that much of the speculative grade debt issued during the mid- to late-1990s was aimed at acquisition activity. It is also complimentary to the evidence pointing to the existence of a bank lending channel for the transmission of monetary policy shocks to the real economy (Kashyap, Lamont, and Stein (1994)).

To provide additional evidence on the precise mechanism behind the observed linkages between financing and investment, we consider below-investment-grade firms stratified by the location of the company. The motivation for this distinction comes from the geographic heterogeneity of the credit crunch accompanying the recession beginning in July of 1990 (Bernanke and Lown (1991) and Peek and Rosengren (1992, 1995)) and the tendency of firms to borrow from local lenders (Bharath et al. (2004)). In particular, bank lending in the New England and Mid-Atlantic census regions experienced a sharp contraction relative to other regions during this recession. As such, firms located in the Northeast should be more sensitive to contractions in the supply of speculative grade debt because their primary alternative source of credit (bank lending) is also in relatively limited supply. Consistent with this view, we find that below-investment-grade rated firms from the Northeast experience relative declines in net debt issuing activity and

investment that are approximately 7% of assets per year greater than those for firms located in other parts of the country. Changes in other sources of financing and corporate leverage reveal no significant differences in this comparison.

Finally, to assess the robustness of our main results we employ a matched sample of unrated firms as a control group for our sample of below-investment-grade firms. Using a propensity score matching technique (Rosenbaum and Rubin (1983)) in conjunction with a difference-in-differences estimator (Blundell and Costa Dias (2002) and Smith and Todd (2003)), we obtain similar estimates for the effect of the supply shock on financing and investment decisions. Specifically, a large decline in net debt issuing activity is met with a relatively small shift towards alternative sources of capital (e.g., cash, trade credit, and equity). This dearth of funds ultimately leads to a decline in gross and net investment; however, again, we see no significant effect of the shock on corporate leverage.

Our study is related to several strands of literature, the closest being that which examines the impact of financing frictions on investment and financing. Studies by Faulkender and Petersen (2005), Leary (2006), and Sufi (2006), in particular, examine the role that the supply of capital plays in determining variation in corporate capital structures. Unlike Faulkender and Petersen (2005), we trace the implications of the supply shock through alternative sources of financing and, ultimately, to investment behavior, which both Faulkender and Petersen (2005) and Leary (2006) ignore. On the financing side, our results highlighting the different behavior of firms in the Northeast and the rest of the country are consistent with the Leary's (2006) findings that firms will substitute to alternative sources of financing when possible. However, our lack of results

concerning the impact of the supply shock on corporate leverage is at odds with the findings of both of these papers, suggesting that future work on this issue is needed.

The recent paper by Sufi (2006) presents evidence that is complimentary to our findings. Specifically, Sufi shows that that the introduction of credit ratings in the syndicated loan market lead to a subsequent expansion in the supply of capital that ultimately increased debt usage, as well as investment. Aside from obvious differences, an important distinction between our study and Sufi's is that our experimental design enables us to employ several different control groups in a difference in difference framework that, by construction, controls for unobserved heterogeneity in both a cross-sectional and longitudinal sense. The introduction of credit ratings in the syndicated loan market impacted *all* borrowers and, consequently, leaves open the possibility for time-varying demand-side factors to contaminate the identification of any supply shock. However, ultimately, Sufi's results are reassuring because they suggest that the phenomenon that we identify with our study is not isolated to our particular sample.

Our study is also related to macroeconomic research examining the existence of a credit channel in the transmission of monetary policy. Using aggregate data in the US and Japan, Kashyap, Stein, and Wilcox (1993) and Hoshi, Scharfstein, and Singleton (1993) show that the mix of capital (e.g., bank debt versus commercial paper or insurance company debt) has explanatory power to predict investment behavior over and above traditional factors, such as the cost of capital. Gertler and Gilchrist (1994) show that aggregate inventory investment among small firms is more sensitive to changes in monetary policy than that of large firms. Using firm-level data in the US, Kashyap, Stein, and Lamont (1994) show that the inventory investments of firms without bond ratings are

more sensitive to liquidity measures than rated firms, as well as showing that this sensitivity exhibits counter-cyclical variation. Other studies confirming these patterns include Gertler and Hubbard (1988), Milne (1991), Carpenter, Fazzari, and Petersen (1994), and Sharpe (1994).

Our study differs from this previous work in three important respects. First, we ask a fundamentally different question. Specifically, we ask: How does a shock to the supply of nonbank credit affect firm behavior? These previous studies ask: Does monetary policy affect firm behavior through a bank lending (or broad credit) channel? Second, our empirical approach explicitly quantifies the impact of the supply shock on financial and investment policy, as opposed to identifying the sensitivity of these policies to various nontraditional determinants (e.g., measures of liquidity). Finally, our empirical approach directly addresses the simultaneity between the supply of and demand for capital, which Oliner and Rudebusch (1996) suggest is the “shortcoming of most previous empirical work on the bank lending channel.” (P. 308) Of course, the cost of our identification strategy, indeed, of most natural experiments, is that the extrapolation of our conclusions is limited by the unique nature of our event (Meyer (1995)), though this concern is somewhat mitigated by the evidence provided by Sufi (2006) discussed above. Therefore, we view our study as complementary to these earlier studies and, in fact, our evidence illustrating the additional effect of the credit crunch on the investment behavior of below-investment-grade firms is consistent with earlier studies pointing to the importance of a bank lending channel.

The remainder of the paper proceeds as follows. Section I describes the events generating the supply shock and economic environment surrounding the shocks. Section

II begins by detailing our empirical strategy, followed by a discussion of the data and sample selection. Section III presents the results of our analysis by focusing on how firms' investment and financial policies respond to the credit supply shock. Section IV attempts to uncover why firms did not substitute towards alternative forms of capital in response to the supply shock. Section V examines the external validity and robustness of our results. Section VI concludes.

I. Background and Macroeconomic Facts

A. *The Rise and Fall of the Junk Bond Market*

Prior to 1977, junk bonds consisted of bonds originally issued as investment-grade securities that were subsequently downgraded to speculative-grade, so-called “fallen angels” (Simonson (2000)). Shortly after 1977, firms began issuing a nonnegligible amount of speculative-grade securities (Asquith, Mullins, and Wolff (1989)). Figure 1 presents the rate of issuance for speculative-grade bonds, expressed as a percentage of the total stock market capitalization.³ Evident from the figure is the rapid increase in the rate of issuance beginning in 1983 before reaching a plateau in 1986 when much of the issuing activity was directed at acquisitions (Holmstrom and Kaplan (2001)). After a slight decline in 1989, net issuances all but disappeared in 1990 and 1991, before rebounding in 1992.

The first event contributing to the precipitous decline in junk bond issuances was the collapse of Drexel Burnham Lambert Inc. (Drexel). Following the indictment of their chief financier, Michael Milken, in March of 1989, Drexel pled guilty in September of

³ We are grateful to Bengt Holmstrom and Steve Kaplan for allowing us to reproduce this figure from Holmstrom and Kaplan (2001), Figure 5.

1989 to six felony counts corresponding to insider trading activity, securities market manipulation, and tax evasion. This plea preceded their bankruptcy filing in February of 1990. Prior to this plea, Drexel and Milken were responsible for approximately half of all junk bond issuances between 1977 and 1989 (Simonson (2000)). Indeed, the development of the original-issue junk bond market is often attributed solely to Milken (Benveniste, Singh, and Wilhelm (1993)). In addition to the origination role, Drexel played a fundamental role in the secondary market for their placements by aiding with the restructuring of debt for their distressed clients (Jensen (1989)). Thus, the departure of Drexel in 1989 created a significant gap in the origination and intermediation of speculative-grade debt.

The second event contributing to the decline in junk bond issuances was the passage of the FIRREA in 1989.⁴ A response to the Savings and Loan (S&L) crisis that emerged in the 1980s, the FIRREA required financial thrifts regulated by the FDIC to liquidate their holdings of below-investment-grade debt by 1994 and prevented future investments in similar securities after 1989.⁵ This regulation had a significant impact on the supply of capital to below-investment-grade firms because S&Ls were responsible for purchasing a significant fraction of junk bond issuances.

Table 1 presents the total junk bond holdings by S&Ls from 1985 to 1989 culled from the Quarterly Reports of Condition filed with the Office of Thrift Supervision and replicates those figures presented in Table 1 of Brewer and Mondschean (1994). Also presented is the aggregate principal amount of new issues over the same time period

⁴ For more details on the FIRREA, see United States League of Savings Institutions (1989), Pulles, Whitlock, and Hogg (1991), and Brewer and Mondschean (1994).

⁵ For a more detailed treatment of the Savings and Loan crisis see, for example, Barth (1991), Kane (1992), White (1991), and Brewer and Mondschean (1994).

obtained from the SDC new issues database. All values are deflated by the GDP-deflator to year-end 1989 dollars. A casual comparison of the holdings by S&Ls and the flow of new funds suggest that S&Ls held a significant fraction of the outstanding speculative-grade debt, though we caution against a literal interpretation of the ratio of total holdings (a stock) to principal amount of new issues (a flow).⁶ Nonetheless, the exclusion of S&Ls from this market by the FIRREA coincided with a meaningful decrease in the supply of speculative-grade capital.

In sum, a significant portion of the 1990 decline in speculative-grade debt issuances was likely due to the collapse of Drexel Burnham Lambert and the passage of the FIRREA in the preceding year. Importantly, both of these events, in and of themselves, are largely independent of firms demand for capital. The collapse of Drexel Burnham Lambert was caused by insider trading and market manipulation, while the FIRREA was brought on by previous deregulation and mismanagement of S&Ls. These events – our supply shock – constitute a largely exogenous shock with respect to the demand for capital and firms’ investment and financing policies. That is, the decline in speculative-grade issuing activity in 1990 was most likely a consequence of an inward shift in the supply curve of speculative-grade capital.

B. The 1990-1991 Recession

While the events of 1989 coincided with a shift in the supply of capital, demand was unlikely constant during this period. In July of 1990, the economy moved into a recessionary period that lasted through 1991. As Bernanke and Lown (1991) note, it is

⁶ The estimates of new issuances, from SDC, also exclude mortgage- and asset-backed issues from the computation.

normal for the demand for credit to fall during a recession, reflecting declines in demand for producers' investment goods. Additionally, many borrowers significantly increased their leverage during the early and mid-1980s (Bernanke, Campbell, and Whited (1990)), suggesting that firms may have been "overlevered," entering 1990. Coupled with the downward pressure placed on cash flows by the recession and declining net worth's from the decline in asset prices, credit demand would naturally be expected to fall after 1989.

In addition to weakening balance sheets, the 1990-1991 recession was marked by a significant decline in bank lending (Bernanke and Lown (1991), Peek and Rosengren (1992), and Hancock and Wilcox (1998)). According to data from the Flow of Funds, total loan growth declined by 3.6% per annum during this period. This is in contrast to previous recessions where loan growth merely slowed to an average of 6.6% per annum.⁷ Despite this distinction in credit supply, credit terms during the 1990-1991 recession behaved quite similarly to those in previous recessions. Nominal loan rates fell only slightly during the first two quarters of the recession before dropping more sharply in the first quarter of 1991. (See Bernanke and Lown (1991) for further details on the 1990-1991 recession.)

Because the supply shock to the junk bond market was followed by a recession and changes in the demand for capital, particular care must be taken to disentangle the supply and demand effects on corporate behavior. For example, a change in the behavior of firms accessing speculative-grade debt after 1989 may simply reflect unobserved shifts in these firms' demand for capital commensurate with the change in economic

⁷ The previous recessions, defined by the year of cyclical peak, (and loan growth) are: 1960 (7.5%), 1969 (4.4%), 1973 (12.2%), 1980 (3.5%), and 1981 (5.4%).

environment. Similarly, a comparison of junk bond issuers and, for example, investment-grade bond issuers after 1989 may merely reflect unmeasured differences between the two groups demand for capital. To control for these factors, we employ a difference-in-differences empirical approach, which we now discuss.

II. Empirical Strategy and Data

A. Empirical Strategy

The difference-in-differences estimation addresses both concerns raised at the end of the previous section by subtracting the change in outcomes for a control group from the change in outcomes for a comparison, or treatment, group. In our setting, the outcomes of interest are financial (e.g., net security issuances and savings behavior) and investment policies (e.g. capital expenditures and acquisitions). The treatment group is defined as those firms affected by the supply shock, for example, speculative-grade bond issuers. The control group is defined as those firms not (directly) affected by the supply shock, for example, investment-grade bond issuers. Thus, our strategy is to identify the change in behavior of the treatment group in response to the supply shock, using the control group to estimate the unobserved counterfactual (i.e., what would have happened to the treatment group had the supply shock not occurred).

Estimation of the supply shock's impact on firm behavior is carried out with the following regression:

$$Y_{it} = \beta_0 I_{it}(Post - 1989) + \beta_1 I_{it}(Treat) + \beta_2 I_{it}(Post - 1989)I_{it}(Treat) + \gamma' X_{it-1} + \varepsilon_{it}, \quad (1)$$

where i indexes firms, t indexes years, Y is the response variable (e.g., investment), $I(Post-1989)$ is an indicator variable equal to one if the observation occurs after 1989, $I(Treat)$ is an indicator variable equal to one if the observation is in the treatment group and zero if the observation is in the control group, X is a vector of control variables, and ε is firm-year-specific effect assumed to be correlated within firms and possibly heteroscedastic. In unreported results, we also examine an alternative specification that replaces the post-1989 indicator variable with individual year indicator variables. By definition this specification controls for any time varying factors common to both groups of firms (e.g., term spreads, credit spreads, etc.). This change has little effect on our results and no effect on our inferences; as such, we do not report our findings under this alternative specification.

The coefficient of interest is β_2 , which corresponds to - approximately - the average change in Y from pre-1989 to post-1989 for the treatment group minus the change in Y from pre-1989 to post-1989 for the control group.⁸ This difference-in-differences approach is particularly well-suited to our setting, which corresponds to a sharp exogenous change in the economic environment (Angrist and Krueger (1998)). However, the key identifying restriction behind estimation of β_2 is that in the absence of the supply shock, β_2 would be zero. Since investment and financing can evolve differently across firms independent of the supply shock, it is crucial that the treatment and control groups are comparable. To this end, we now turn to a discussion of the data and our construction of these two groups.

B. Data

The starting point for our sample begins with all nonfinancial firm-year observations in the intersection of the monthly CRSP and annual Compustat databases between 1985 and 1993 – an eight year window surrounding the event year 1989. We choose this particular sample horizon for several reasons. First, credit rating information is available in Compustat only beginning in 1985, which precludes an earlier start date. Second, we wish to have a balanced time frame around the event date to avoid artificially skewing the degrees of freedom in the pre- (1985 to 1989) and post-supply (1990 to 1993) shock eras. Additionally, we do not want to extend the sample horizon too far beyond the event year for fear of introducing excessive noise into the estimation procedure. However, because we must account for potential trends in the data, we need a minimal number of observations along the time series dimension to capture these trends.

We require that all firm-year observations have nonmissing data for book assets and that leverage lie in the closed unit interval. Any market-to-book ratios in excess of 20 are set equal to missing – slightly less than 1% of the data. All other ratios used in the study are trimmed at the upper and lower 1-percentiles to mitigate the effect of outliers and eradicate errors in the data. The construction of all of the variables used in the study is detailed in Appendix A.

We use Standard and Poor’s long-term domestic issuer credit rating to categorize firms. This rating represents a “current opinion on an issuer’s overall capacity to pay its financial obligations.” (Standard and Poor’s (2001)) While there are other issue-specific ratings available (e.g., subordinated debt), Kisgen (2006) notes that most other ratings have a strict correspondence with the long-term rating and therefore, little is lost by focusing attention on this particular rating. As defined by S&P, firms rated BBB- or

⁸ The relation is only approximate because of potential correlation between the interaction term and X .

higher are defined as “investment-grade”; firms rated BB+ or lower are defined as “below-investment-grade” (or “speculative-grade” or “junk”); firms without an S&P rating during the entire sample horizon are referred to as “unrated.”

Table 2 presents summary statistics for several groups of firms differentiated by their rating status during the period 1985 to 1993. In addition to revealing the general characteristics of our sample of firms, Table 2 is also helpful in identifying along which dimensions these groups of firms differ and by how much, albeit at a coarse, aggregate level. Focusing on the first three columns, we note that average gross and net investment across investment-grade (BBB minus or higher), junk (BB+ or lower), and unrated firms are fairly similar in magnitude. A closer look reveals that capital expenditures (relative to total assets) average approximately 8% to 9%, acquisitions 2% to 3%, changes in inventory 1% to 2%, and capital sales approximately 1% for all three groups. Net security issuances differ more significantly across the three groups with Junk firms relying heavily on debt financing and unrated firms relying heavily on equity financing. Savings and dividend behavior is also somewhat different across these groups, as junk and unrated firms appear to be saving on average and paying fewer dividends relative to investment grade firms. (Note that dividends are measured with respect to operating income to preserve the interpretation of this measure as akin to a payout ratio.) This cash management policy is consistent with junk and unrated firms following a precautionary savings motive to build a buffer stock of internal resources in case of binding financing constraints; an issue that we explore in Section III.

In terms of firm characteristics, the three groups differ significantly in a number of dimensions. Leverage differences line up with the observed patterns in net security

issuance activity. On average, investment grade firms are larger, have higher cash flows, more tangible assets, and a lower likelihood of becoming financial distressed than the other two groups. This last characteristic is quantified by two measures: Altman's Z-score and an indicator for financial distress. The former measure is based on Altman's (1968) discriminant analysis, which produces a linear function of several accounting variables that predicts the onset of financial distress. (See Appendix A for the construction). The second measure is motivated by the discussion in Asquith, Gertner, and Scharfstein (1994) that identifies financially distressed firms based on the following two criteria: (1) the firm's earnings before interest, taxes, depreciation, and amortization (EBITDA) is less than its reported interest expense for the previous two years or, (2) EBITDA is less than 80% of its interest expense in the previous year. Between Junk and Unrated firms, we also observe many differences across these factors, suggesting a significant amount of heterogeneity across the all three groups.

C. Treatment and Control Groups

Because the validity of our empirical analysis rests on the comparability of the treatment and control groups, we discuss their construction in detail here. The specificity of the supply shock suggests that a natural definition for the treatment group is that it consists of below-investment-grade firms. As for the control group, two definitions naturally arise. The first is that the control group consists of all investment-grade firms; the second is that it consists of all unrated firms, neither of which was directly affected by the supply shock.⁹

⁹ Of course, these firms may have been indirectly affected by the shock because of spillover effects and substitution. Such effects, however, would tend to mute the estimated effect on the treatment group.

The differences in firm characteristics observed in Table 2, however, raise some concern over these definitions. Most firm characteristics that are related to financial and investment policy exhibit a significant amount of heterogeneity across the three groups of firms. Though we can control for these differences by including these measures in our specification (X in equation (1)), one may be concerned whether these controls are sufficient. For example, even after controlling for the observable characteristics listed in Table 2, it may prove difficult to argue that AAA-rated Exxon-Mobil is comparable to CCC-rated Empire Gas Corp. Ultimately, the concern is that the unmeasured heterogeneity between these firms may be correlated with firm behavior, resulting in a compromise of our identification strategy.

To deal with these differences we refine the definitions of the treatment and control groups. In particular, we begin by focusing on firms close to the investment-grade threshold. That is, we define the treatment group as consisting of those firms that are just below the investment-grade threshold with a credit rating between BB-plus and BB-minus, inclusive. Similarly, we define the control group as consisting of those firms that are just above the investment-grade threshold with a credit rating between BBB-plus and BBB-minus, inclusive. We refer to this sample as the “Local” sample for the proximity of its members to the investment-grade threshold. This restriction helps in homogenizing the treatment and control groups, as seen in the last two columns of Table 2. Though some differences in firm characteristics still remain, we are more confident in the ability to control for differences across these two groups of firms, as opposed to the broader investment-grade and junk groups. Nonetheless, we examine two alternative definitions for our treatment and control groups below.

We also impose two requirements on the data to ensure a proper interpretation of our estimated treatment effect (β_2 in equation (1)). First, we require that firms maintain their credit rating status during the period of observation. Given the stickiness of credit ratings, this condition is not terribly restrictive, as evidenced by the small fraction of firms (10%) affected by it. Second, we require that each firm have at least one observation in both the pre-1990 and post-1989 eras. This requirement decreases our sample size by approximately 30% but is largely irrelevant for the purpose of identifying the coefficient of interest, β_2 in equation (1). This irrelevance follows from the fact that the interaction terms is identically equal to zero for all observations corresponding to any firm appearing in only one time period, pre- or post-1989.

III. Results

This section presents our results using the Local sample detailed above. We begin with a graphical, non-parametric analysis, followed by the estimation results of equation (1). The purpose of the non-parametric analysis is twofold. First, it presents an unobstructed view of the data that is free from any assumptions implicit in the regression model. Second, it provides an important diagnostic for determining the appropriateness of our parametric framework.

A. Financial Policy

A.1 Nonparametric Analysis

We begin by examining the impact of the supply shock on the flow of different forms of capital. Panel A of Figure 2 presents average annual net debt issuances for the

treatment and control groups: junk and investment-grade, respectively. We define net debt issuances as the change in total (short- plus long-term) debt from year $t-1$ to year t on the balance sheet divided by year $t-1$ total assets.¹⁰ This measure includes net issuances of *all* forms of debt (e.g., public debt, bank debt, nonbank debt, unregistered private placements, etc.). Prior to 1990, both groups exhibit a general downward trend in net debt issuances. Additionally, below-investment-grade firms are issuing approximately twice as much debt, on average, than investment-grade firms. Consistent with the supply shock having an important effect on financing, the net debt issuances of below-investment-grade firms all but completely shuts down following the shock, falling from 17.2% of assets in 1989 to 1.6% of assets in 1990 and -0.6% of assets (net retirement) in 1991. This pattern is in contrast to that exhibited by investment-grade firms, whose net issuing activity exhibits no such break after 1989.

Panel B presents a similar analysis of net equity issuances, defined as the split-adjusted change in shares outstanding between time $t-1$ and time t times the split adjusted average price over the period dividend by the start of period assets. This definition, suggested by Fama and French (2005), captures stock issuances that do not generate cash flow, such as stock-based acquisitions, in addition to more traditional stock issuance channels (e.g., SEOs).¹¹ Other than 1988 through 1990, the net equity issuance behavior of both groups of firms is fairly similar, though investment-grade firms issue relatively less equity. In 1989, below-investment-grade firms dramatically increased equity issuances, followed by a reversal in 1990. Relatively speaking, investment-grade firms

¹⁰ We examine alternative measures of net debt issuances based on the change in only long-term debt, as well as flow measures from the statement of cash flows. The results are qualitatively similar and, consequently, not presented.

exhibited a similar, but much less severe, swing in net equity issues during these two years.

Panel C looks at the savings behavior of both groups of firms by examining the change in cash and short term investments (i.e., highly liquid securities) normalized by the start of period assets. On average, below-investment-grade firms are saving internal resources, consistent with the results in Table 2, while investment-grade firms are largely maintaining a stable cash balance over time. In 1990, both groups of firms begin dissaving, on average, possibly in response to the recession. However, neither group appears to reveal a significant average change in savings behavior after 1989 relative to before 1990. Finally, Panel D examines the change in trade credit, a short-term debt substitute defined as accounts payable less accounts receivable normalized by the start of period assets. Unlike equity and cash, trade credit usage for below-investment-grade firms does seem to respond to the supply shock in that the use of trade credit as a source of funds increases after 1989. Investment-grade firms' trade credit usage is relatively smooth over the entire period.

A.2 Difference-in-Differences Estimation

We now turn to estimation of equation (1) for each of the financing variables discussed above. The goal is to quantify the effects observed in Figure 2, while simultaneously accounting for variation in financing due to changes in other related factors. Table 3 presents the results: coefficients and t-statistics in parentheses. All t-statistics are computed using standard errors robust to within firm correlation and

¹¹ We examine an alternative measure of net equity issuances based on flow measures from the statement of cash flows. The results are qualitatively similar and, consequently, not presented.

heteroscedasticity (Bertrand, Duflo, and Mullainathan (2004) and Petersen (2005)). At the bottom of each column, the model R-square and degrees of freedom are presented. We also present the p-value corresponding to an F-test of the null hypothesis that all of the coefficients but for the intercept are zero.

For each variable we examine three specifications. The first specification is used as a benchmark for two purposes. First, it maps directly to the results observed in the Figure 2. Second, it helps identify what fraction of the estimated treatment affect is attributable to the variation in firm characteristics across the two groups. The second specification is motivated by numerous studies of capital structure that identify firm size (Log(Sales)), the market-to-book ratio, return-on-assets (Profitability), and the ratio of tangible assets to total assets (Tangibility) as important determinants of variation in financial policies (e.g., Titman and Wessels (1988), Graham (1996), and Rajan and Zingales (1995)). The final specification is akin to a “kitchen sink” model that is motivated by Frank and Goyal (2005), who perform an exhaustive identification search for the factors most relevant for capital structure. However, we incorporate two additional variables that are particularly relevant for our purposes: Altman’s Z-score and the financial distress indicator variable, $I(Distress)$ discussed above. These measures are intended to capture the financial health of the firm, a particularly relevant dimension given our sample of firms and time period. For our purposes though, these variables are only controls used to mitigate the effect of any confounding factors on our estimates of the supply shock response. As such, we refer the reader to these earlier studies for details on the economic motivations behind these variables.

Columns (a) through (c) of Panel A show that net debt issuances for below-investment-grade firms experience a relative decline of 8% in each of the three specifications. Not only is this decline highly statistically significant but it is economically large. The average pre-1990 rate of debt issuances for below-investment-grade firms is 16%, implying a decline of 50% in the average rate of debt issuance for these firms. This finding suggests substitution across various forms of credit is costly and is intuitively appealing for two reasons.

First, ex-ante, the finding is consistent with below-investment-grade firms behaving optimally and choosing the least costly form of financing. When this source is cutoff, these firms might substitute to another form of credit. That they do not substitute is consistent with a significant cost associated with this switching. Given the economic environment of 1990 and 1991, this interpretation seems quite plausible. The credit crunch accompanying the 1990-1991 recession suggests that the marginal borrower may have simply been denied credit during this time period. Assuming that below-investment-grade firms could be characterized as the marginal borrower - and given their financial profiles seen in Table 2, this assumption is not far-fetched - it is unlikely that these firms could substitute bank-debt for junk bonds. Hence, though the supply shock hit a very specific sector of the credit market, *total* net debt issuances fell because of an inability to switch among sources of credit.

This explanation, however, leaves open the possibility that firms simply moved to alternative sources of financing, such as equity. Columns (d) through (f), however, suggest that this was not the case. We find no evidence of an increase (or decrease) in equity issuances in response to the credit supply shock. Consequently, firms did not fill

the void of financing left by the credit shock with new equity issuances. Again, given the post-1989 economic environment, this finding may not be surprising. The recession-depressed stock market may have meant that equity capital was relatively expensive, perhaps because of similar frictions, such as information asymmetry, affecting the credit markets (Myers and Majluf (1984)). However, to maintain focus and manage the length of our study, we leave a more complete analysis identifying the precise mechanism that prevented this switching to future research.

Columns (a) through (c) of Panel B show that while cash balances fell, consistent with a shift toward internal funds, the change is not statistically significant. In addition, the magnitude of the effect (2% of assets) falls well short of covering the decline in net debt issuing activity. This is not surprising. Below-investment-grade firms are relatively less profitable firms with lower cash flows (Table 2) and, as such, internal resources are often an insufficient source of capital for investment demand. Columns (d) through (f) show a shift toward trade credit by below-investment-grade firms; however, the estimated effect is statistically insignificant and economically small (1% of assets). Even taken together, the shift by below-investment-grade firms towards cash and trade credit falls well short of compensating for the decline in debt capital usage. Finally, in unreported analysis, we examine the dividend behavior of below-investment-grade firms to see whether these firms scaled back on dividends. This is not the case and, in light of the low payout ratios for these firms, is not terribly surprising.

The last financial variable that we examine is leverage, defined as the ratio of total debt (short- plus long-term) to assets. Though only indirectly related to the flow of capital, recent studies by Faulkender and Petersen (2005) and Leary (2006) suggest that

the supply of capital plays an important role in determining cross-sectional variation in capital structure. However, in our setting, we find little evidence of such an affect. In no specification, (g) through (i), does leverage reveal any sensitivity to the supply shock. Clearly, in light of the sharp decline in net debt issuing activity, the level of assets must have adjusted to offset the decline. We see part of this adjustment as below-investment-grade firms decrease their savings rate, as well as passive adjustments via declines in profitability after 1989. Thus, while the supply shock had a significant impact of financing decisions, it had little affect on corporate leverage ratios, consistent with the persistence of capital structure ratios found by Lemmon, Roberts, and Zender (2006).

In sum, the supply shock to the speculative-grade debt market created a significant decline in the inflow of capital for below-investment-grade firms. Net debt issuances fell by 50% from their level before the shock and attempts by firms to substitute into alternative forms of financing appears to have fallen well short of compensating for the decline in credit. In spite of this disruption in the flow of capital, corporate leverage remained largely unaffected by the supply shock.

B. Investment Policy

B.1 Nonparametric Analysis

The fact that we find little evidence of below investment grade firms substituting into other types of financing around the shock suggests that the effects of the shock should be manifested in changes in investment behavior. We focus on several measures of investment, beginning with gross and net investment. Gross investment is defined as the sum of capital expenditures, acquisitions, and changes in inventories. Net investment

is gross investment less the sale of capital. Both measures are normalized by the start of period assets.¹²

Figure 3 presents average annual investment rates for the treatment and control groups. Panel A shows that below-investment-grade firms – denoted “Junk” in the Figure – invest more on average, both in terms of gross and net measures. The figures also reveal a downward trend in the investment rates of both groups over the time period, coinciding with the general business cycle of the period. The rate of investment, both gross and net, show increases in the rate of decline after 1989, consistent with a differential impact of the supply shock on investment. Additionally, each panel shows that the approximate pre-1989 trends in both measures of investment are fairly close.

To better understand what is driving the behavior of our aggregate investment measures, we also examine each component – capital expenditures, acquisitions, change in inventories, and sale of capital - on its own. As with the aggregate measures, all four component investment measures are normalized by the start of period assets. Panel C shows that the capital expenditures of below-investment-grade firms reveal a slightly increased rate of decline after 1989, relative to that experienced by investment-grade firms. Panels B and C reveal more dramatic changes for acquisitions and changes in inventory. The result for acquisitions is to be expected. The mid- and late-1980s were a period of significant merger activity, much of which was financed with speculative-grade debt (Holmstrom and Kaplan (2001)). The pattern in inventory is also consistent with the findings of Gertler and Gilchrist (1994) and Kashyap, Lamont, and Stein (1994) who

¹² Arguably, our aggregate measures of investment are incomplete for they do not include alternative investments such as research and development (R&D) and advertising. However, both of these channels of investment are less relevant for our specific sample of firms, most of which have no R&D expenditures and relatively little advertising expenditures.

show that capital constrained firms, proxied for by size, experience more dramatic declines in inventory investment following monetary policy shocks. We also note significant increase in acquisitions and inventory in 1986, concurrent with the boom in the speculative-grade debt market (see Figure 1).

Panel D shows relatively little difference in the behavior of asset sales, defined as the ratio of the sale of physical plant, property, and equipment to total assets, between the two groups and, if anything, that below-investment-grade firms actually cut back on asset sales. While somewhat puzzling given the dearth of capital inflows, if the demand for below-investment-grade firms' assets has been adversely affected by the recession, then this finding may be less a consequence of below-investment-grade firms' desire to liquidate assets and more a result of insufficient demand (Shleifer and Vishny (1992)).

B.2 Difference-in-Differences Estimation

Table 4 presents the estimation results of equation (1) for our investment variables. As in Table 3, we present for each investment measure three sets of results corresponding to a baseline specification and two augmented specifications. The first augmented specification incorporates controls commonly used throughout the investment literature: cash flow, market-to-book, and firm size (e.g., Lang, Ofek, and Stulz (1996), Hennessy (2004), and Rauh (2005)). The second augmented specification includes three additional variables aimed at addressing variation in financial health: leverage, Altman's Z-score, and the financial distress indicator. As before, our goal with these variables is to control for any extraneous heterogeneity across the treatment and control groups.

Panel A shows that, consistent with Figure 3, investment declines by a significant amount. Focusing on the interaction coefficient, gross investment declines, on average, by 6% per annum for BB-rated firms relative to otherwise similar BBB-rated firms, after 1989. Similarly, net investment declines by approximately 5% per annum, as well. Inclusion of additional control variables does little to mitigate the impact of the supply shock on investment, though the estimates of these control variables reveal signs and magnitudes consistent with that found in previous studies. Relative to the average annual gross and net investment rates for BB-rated firms, 15% and 14% (see Table 2), these estimates correspond to a 40% and a 36% relative decline in gross and net investment.

Turning to Panel B, we see that the supply shock induces a negative response by capital expenditures, which fall by 2% of assets. However, the magnitude of this effect decreases to 1% of assets and is no longer statistically significant once we control for other factors. Moving to acquisition behavior in columns (d) through (f), we notice an economically large decline in the acquisition behavior of below-investment-grade firms associated with the supply shock. Acquisition activity as a fraction of total assets falls, on average, by 3% per annum, consistent with the popular use of junk bonds to finance acquisition activity. Though the statistical significance of this result is somewhat weak (10% level), the magnitude of the effect suggests that this feature is more a function of low power, as opposed to an economically irrelevant result. Below-investment-grade firms also decrease inventory investment by 2% on average in response to the supply shock, an economically smaller effect than the decline in acquisition activity but a statistically stronger result. Finally, columns (j) through (l) of Panel A show that, consistent with Figure 3, capital sales decline by a slight amount for the below-

investment-grade firms relative to the controls, though this decline is statistically insignificant. Thus, these results show that investment behavior among speculative-grade firms declined across all dimensions, albeit some dimensions were more severely affected than others.

In concert with the change in capital flows and the accounting sources and uses identity, these findings fit nicely together. Debt capital inflows all but shut down leaving a financing deficit that was not filled by an increase in other sources of funds (external or internal equity) or a decrease in other uses of funds (dividends). Therefore, investment was left as the only channel to compensate for the dearth in capital. While cutting dividends was an option unavailable to most below-investment-grade firms (fewer than 25% of these firms pay dividends at all), the question as to why these firms did not substitute into alternative forms of external finance, such as bank debt and equity, still remains. We turn to this question in the next section.

IV. Why Did Firms Not Substitute Capital?

The results above suggest that substituting different sources of capital in response to the supply shock must have been costly. Because most below-investment-grade firms had relatively little cash holdings and low cash flows, their primary sources of funding come from external debt and equity. Additionally, the fact that these firms are rated below-investment-grade de-facto precludes them from issuing investment-grade public debt. These constraints leave bank-debt and public equity as potential substitutes. However, to maintain focus and manage the length of the study, we examine only

whether the supply of bank debt played a role in firms behavior, leaving the alternative of equity issuance for future research, as indicated earlier.

In considering why firms did not turn to bank debt as a substitute for the dearth of speculative-grade public debt, we face a familiar endogeneity problem. In other words, finding cross-sectional variation in the extent to which firms substituted towards bank debt may simply reflect variation in the demand for that debt driven by unobserved investment opportunities, for example. To avoid this trap, we use the geographic heterogeneity in the severity of the 1990-1991 credit crunch to identify whether the lack of substitution towards bank debt was driven by supply-side factors, as opposed to demand-side factors.

The growth of commercial lending during the 1990-1991 period was nonuniformly distributed across the country. As Bernanke and Lown (1991), Peek and Rosengren (1995), and Hancock and Wilcox (1998), among others, show, the Northeast region of the country experienced a severe slowdown in loan growth.¹³ This slowdown is primarily attributed to an erosion of bank capital driven by declining real estate prices and, therefore, this event is sometimes referred to as a “capital crunch” (Wojnilower (1980), Bernanke and Lown (1991), and Peek and Rosengren (1995)). In so far as geographic location within the US is exogenous to the financing demand and investment opportunities of firms, we can use location as an instrument to identify the impact of the loan-supply shock on firm behavior. The implicit assumption with this strategy is that firms, on average, tend to borrow from local banks. While there are likely exceptions to

¹³ The Northeast region of the country is comprised of the New England division (Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut) and the Mid-Atlantic division (New York, New Jersey, and Pennsylvania).

this assumption, Bharath, et al. (2004) show a strong propensity of public firms to borrow from local lenders.

Our empirical strategy is similar to the difference-in-differences approach discussed above. The distinction lies in how we define the treatment and control groups. Rather than focusing on the Local sample consisting of BBB- and BB-rated firms, we begin by restricting attention to only below-investment-grade firms: BB+ or lower. The treatment group is now defined as below-investment-grade firms located in the Northeast; the control group as below-investment-grade firms located outside of the Northeast. If the variation in the supply of capital prevented firms from substituting towards bank debt, then we should observe that firms located in the Northeast responded more severely to the collapse of the junk bond market than other firms.

This analysis serves two purposes. First, it can potentially provide insight into why firms did not substitute towards bank debt. Second, it indirectly acts as a robustness check on our previous evidence. That is, in so far as one may be concerned that BBB- and BB-rated firms are not sufficiently homogenous (even after conditioning on the controls, X), this comparison restricts attention to below-investment-grade firms differentiated only by their geographic location.

The results are presented in Table 5. The effect on financial policy is examined in Panel A; investment policy is examined in Panel B. We present only the results based on the full “kitchen-sink” specifications for brevity. The results in both panels confirm our earlier results and further highlight the role of capital supply for firm behavior. Among below-investment-grade firms, the firms in the Northeast experience a 7% decline in total net debt issuances relative to those firms in the rest of the country, as a result of the junk

bond supply shock. Other sources of financing show no significant changes. These findings are in contrast to the results in Gatev and Strahan (2005), who find that increases in bank deposits and lending tend to be negatively related to liquidity in the commercial paper market. Rather, we observed that capital substitutability is sometimes limited. In sum, firms which were more likely faced with credit rationing in the intermediated debt market experienced an even more dramatic decline in net debt issuing activity, which was not offset by capital inflows from other sources.

Turning to Panel B, we see that this shortage of capital translates into a decline in investment much like that observed in Table 4. Specifically, acquisition activity among Northeastern firms falls precipitously, as they also consumed inventories (though the change in inventory is statistically weak). In aggregate, gross and net investment fell by 7% per annum for these firms, an even larger decline than that estimated above. The distribution of this decline, however, is tilted more towards the drop in acquisition activity. Thus, even among the speculative-grade firms, we observe significant heterogeneity in behavior driven by differential supplies of bank capital across the country.

V. External Validity and Robustness Tests

A. Propensity Score Matching

Our first robustness test is to repeat the difference in difference analysis above using a control group based on a set of unrated firms that are matched to below-investment-grade firms by a propensity score matching technique. The motivation for this analysis is twofold. First, a matching technique relaxes the linearity assumption required by the

regression framework. Specifically, the regressions assume that all control variables (X) are linearly related to the response variable (Y). Second, our data are particularly well-suited for a matching approach (Heckman, Ichimura, and Todd (1997, 1998)). Specifically, our pool of controls is almost three times larger than the treatment set, both treatment and controls adhere to similar reporting and data requirements, and there is significant overlap in the relevant characteristics between the treatment and control groups. This section presents only a heuristic description of the matching procedure. The details and diagnostics are presented in Appendix B.

Our matching procedure relies on a caliper matching (Cochran and Rubin (1973)) of propensity scores (Rosenbaum and Rubin (1983)). Simply put, for each below-investment-grade firm-year observation (i.e., member of the treatment group), we find the unrated firm-year observation whose propensity score is closest, in terms of L^1 -norm, subject to the restriction (i.e., caliper) that the distance between the two propensity scores is less than 25% of the standard deviation of propensity scores. This restriction ensures that the matches are reasonably close and, while ad hoc, it turns out to not be binding. All of our matches are, in fact, within a 0.7% radius of each other.

Table 6 presents the results, most of which confirm our earlier findings. Panel A illustrates an even larger decline in net debt issuances (12%) for below-investment-grade firms relative to unrated firms. These alternative sources of financing reveal several significant differences not found in our earlier results. For example, below-investment-grade firms also appear to issue relatively less equity, though their use of internal funds and trade credit more than makes up for the decline in external equity. We also observe an economically larger decline in leverage for the treatment group, though the statistical

significance is marginal. Panel B shows that capital expenditures now decline significantly, whereas acquisitions are largely unaffected. Changes in inventory are affected in a similar manner as identified above, as are both gross and net investment, which decline by 5% and 6%, respectively.

At a finer level, we note that the matching results differ in several regards with respect to our earlier results. This difference may reflect the fact that rated and unrated firms are fundamentally different, beyond observable measures (Faulkender and Petersen (2005)). In which case, while the matching procedure is successful in controlling for selection on observables, unobservable differences may be sufficiently large to prevent an entirely accurate comparison. Regardless, on the whole, our inferences and conclusions from the matching analysis are largely unchanged from above. Net debt issuances significantly decline in response to the supply shock. The use of alternative sources of financing falls short of compensating for this decline, which ultimately leads to a decrease in investment activity. Thus, the general affects of the supply shock on financing and investment behavior appear robust to this alternative estimation strategy.

B. Measurement Error in Q

An existing concern with investment and capital structure regressions, such as those employed in this study, is the effect of measurement error. In particular, if market-to-book is a noisy proxy for Tobin's q (e.g., Erickson and Whited (2000, 2005), Gomes (2001), Alti (2003), and Moyen (2004)), then measurement error may contaminate other parameter estimates. Therefore, we take three additional steps to address this concern.

First, we incorporate higher order polynomials of the market-to-book ratio into the each difference-in-differences regression specification (i.e., equation (1)). As Erickson and Whited (2000) note, measurement error in market-to-book, or any other variable for that matter, may result in a non-linear projection of investment on the market-to-book ratio. Alternatively, a nonlinear relation between investment and the market-to-book ratio may simply coincide with a non-quadratic capital adjustment cost function. Second, we examine an alternative empirical proxy for Tobin's q suggested by Salinger and Summers (1983) and Erickson and Whited (2000). This measure is defined as the sum of total debt, the market value of equity, and other assets, all divided by the start of period capital stock. As indicated by Erickson and Whited (2000), this measure has two advantages over the traditional market-to-book ratio; it lessens heteroscedasticity, and, more importantly, it improves the measurement quality. Performing these specification changes to each model in Tables 3 and 4 has little effect on our results or conclusions and, therefore, these results are not presented.

Finally, we employ the reverse regression bounds approach of Erickson and Whited (2005) in order to ensure the robustness of the sign of our estimate.¹⁴ We discuss the intuition of their method here, referring the reader to their paper for technical details. The reverse regression bounds method places a lower bound on the correlation between market-to-book (the noisy proxy) and Tobin's q (the true variable) such that for any correlation above that bound, the sign of our estimated effect (i.e., investment) is unaffected by the measurement error. Intuitively, a high bound, such as 0.9, suggests that the signal-to-noise ratio between market-to-book and Tobin's q must be very large in order for us to have confidence in the estimated direction of our effect. That is, our proxy

must be very good. Alternatively, a low bound, such as 0.1, suggests that even a poorly measured proxy will likely have little impact on the estimated sign of our effect.

The estimated simple squared correlation bound for our experiment ranges from 0.10 to 0.19 depending on the particular assumption set, (b) - (d), from Erickson and Whited (2005) that we employ. Additionally, these estimates are quite accurate, all with standard errors less than 0.06. This result implies that if the simple squared correlation between the market-to-book ratio and Tobin's q exceeds 0.19 then we can be confident that the directional effect of covenant violations on investment is indeed negative. While the true squared correlation between market-to-book and Tobin's q is ultimately unobservable, Erickson and Whited (2005) estimate this statistic to be 0.40, suggesting that the direction of our effect is accurately estimated.

VI. Conclusions

We use the shock to the supply of below-investment-grade debt precipitated by the fall of Drexel Burnham, Lambert and by the enactment of FIRREA in 1989 to examine the effect of the supply of capital on the distribution of investment and financing. Because the Drexel scandal and Thrift regulation are aimed at a specific subset of firms, we are able to employ a difference-in-differences approach, employing multiple control groups, in order to cleanly identify the effect of the supply shock on firm behavior.

Our results show that net debt issuing activity among below-investment-grade firms almost completely shut down after 1989, falling by over 8% of assets relative to otherwise similar investment-grade firms. Despite this precipitous decline in debt capital inflow, below-investment grade firms did not fill the financing deficit with alternative

¹⁴ We thank Toni Whited for the use of her Gauss code.

sources of capital. Net equity issues, dissaving, and changes in trade credit all fell well short of the decline in net debt issuing activity. Additionally, we find no effect of the supply shock on firms' capital structures.

The dearth of financing ultimately lead to a decline in investment. Both gross and net investment expenditures for below-investment-grade firms fell by 6% and 5%, representing a relative decline in the rate of investment on the order of approximately 40% and 36%, respectively. A closer inspection reveals that decreased acquisition activity was responsible for the plurality of this decline; however, both capital expenditures and inventory investment experienced noticeable declines, as well.

Going forward, the question of whether the supply shock represented a socially optimal reallocation of resources is still open. Unfortunately, our analysis here precludes us from making statements about social welfare. Similarly, an investigation into the macroeconomic effects of the supply shock, which fall outside the scope of our study, may also be warranted. We hope to see future research addressing some of these issues.

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Appendix A: Variable Definitions

This appendix details the variable construction for analysis of the CRSP-Compustat sample. All numbers in parentheses refer to the annual Compustat item number.

Credit Rating = senior long-term debt rating (280). Rated debt is defined as a nonmissing and valid rating value for this variable. A below investment grade rating is defined as a credit rating less than or equal to BB+. An above investment grade debt rating is defined as a credit rating greater than or equal to BBB-.

Investment = capital expenditures (128) / lagged net PPE (8).

Total Debt = short term debt (34) + long term debt (9).

Book Leverage = total debt / book assets (6).

Firm Size = $\log(\text{book assets})$, where assets are deflated by the GDP-deflator.

Profitability = operating income before depreciation (13) / book assets.

Marginal Tax Rate = simulated marginal tax rates obtained from John Graham.

Market Equity = Stock Price (199) * Shares Outstanding (54)

Market Leverage = Total Debt / (Total Debt + Market Equity).

Market-to-Book = (market equity + total debt + preferred stock liquidating value (10)– deferred taxes and investment tax credits (35)) / book assets.

Capital Expenditures = capital expenditures (128) / book assets.

Z-Score = $3.3 * \text{Pre-Tax Income (170)} + \text{Sales (12)} + 1.4 * \text{Retained Earnings (36)} + 1.2$

$* (\text{Current Assets (4)} - \text{Current Liabilities (5)}) / \text{book assets}.$

Tangibility = net PPE / book assets.

Cash Flow = income before extraordinary items (18) / lagged net PPE

Net Debt Issuance = the change in total debt from year $t-1$ to year t divided by the end of year $t-1$ total assets. “5-Year” denotes the sum of net debt issuance over five years.

Net Equity Issuance = The split adjusted change in shares outstanding $(data25_t - data25_{t-1} * (data27_{t-1} / data27_t))$ times the split adjusted average stock price $(data199_t + data199_{t-1} * (data27_t / data27_{t-1}))$ divided by the end of year $t-1$ total assets. “5-Year” denotes the sum of net debt issuance over five years.

Industry Dummies = binary variables corresponding to the Fama and French 38 industry classification available on Ken French’s website.

Appendix B: Propensity Score Matching Description and Diagnostics

This appendix details the propensity score matching technique used to generate the control sample of unrated firm-year observations. Our basic approach is a single nearest neighbor matching method - with replacement - and a caliper of 0.25 times the estimated standard deviation of the propensity scores. That is, for a match to be valid, we require the magnitude of the difference in propensity scores to be less than one quarter of standard deviation (0.06). We also restrict our attention to only those observations, both below-investment-grade and unrated, that fall in the domain of common support defined by the distributions of estimated propensity scores.

The estimated propensity scores are obtained from a probit estimation of the probability of being rated below-investment grade. The precise specification coincides with a tradeoff between model parsimony and an accurate description of the data generating process. Too few variables may lead to a poor match between treatment and controls while too many variables may lead to a small number of matches. As such, we include in this specification most of the firm specific variables included in the “kitchen-sink” specifications for the financial and investment variables, plus year fixed effects and industry fixed effects, where industry is defined using Fama and French’s 38-industry classification.¹⁵ Because the investment and financial policy regressions differ somewhat in their specification, we perform two separate matches: one to analyze investment, the other to analyze financial policy.

Table B.1 presents diagnostics for the matching procedure. Panel A presents pairwise comparison of variable averages between the treatment (below-investment-grade firms) and control groups (unrated firms). Also presented is a two sample t-test of the difference

in means.¹⁶ Results are presented before (Pre-Match) and after (Post-Match) the matching process. Prior to matching, all variables, but for industry, show economically and statistically large differences. For the pairwise comparisons, we treat the year and industry variables as continuous measures to ease the presentation. In the probit estimation, presented in Panel B, we employ a set of indicator variables corresponding to each calendar year and industry. The results of the probit confirm the economic and statistical significance of the differences (standard errors are in parentheses). This is the same model used to produce the estimated propensity scores.

The Post-Match results in Panels A and B illustrate the effect of the matching procedure by restricting attention to the treatment and matched sample of controls. In panel A, we see that all mean differences are statistically insignificant. Panel B, shows that all of the estimated coefficients are statistically insignificant. Importantly, this decline is not simply due to a decline in the degrees of freedom. The magnitude of each coefficient experiences a significant decline. We also note that the pseudo R-square falls from 32% in the Pre-Match estimation to 1% in the post-estimation, reflecting the general accuracy of the matching procedure. In sum, the matching has eradicated any observable differences between the two samples.

¹⁵ We thank Ken French for the use of his industry classification data.

¹⁶ The standard error is robust to within firm correlation.

Figure 1

Below-Investment-Grade Issuance Volume

The figure presents the rate of below-investment-grade bond issuances as a fraction of total stock market capitalization from 1977 to 1999. The data is provided by Merrill Lynch, and Bengt Holmstrom and Steven Kaplan, who were kind enough to provide this information from Holmstrom and Kaplan (2001), Figure 5.

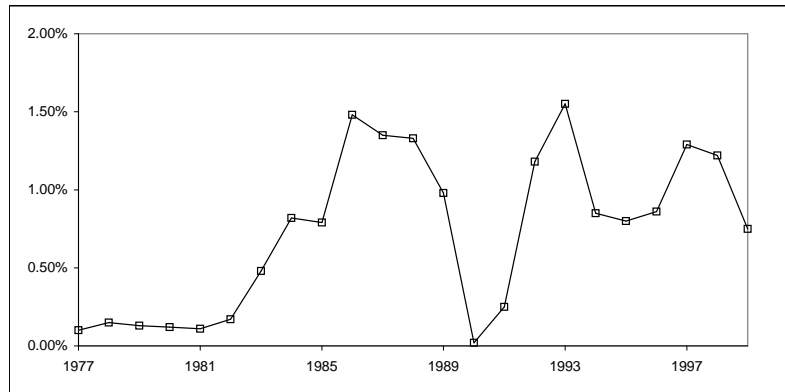
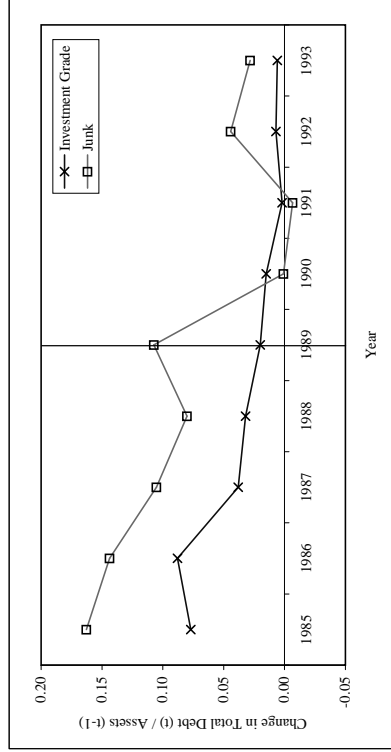


Figure 2

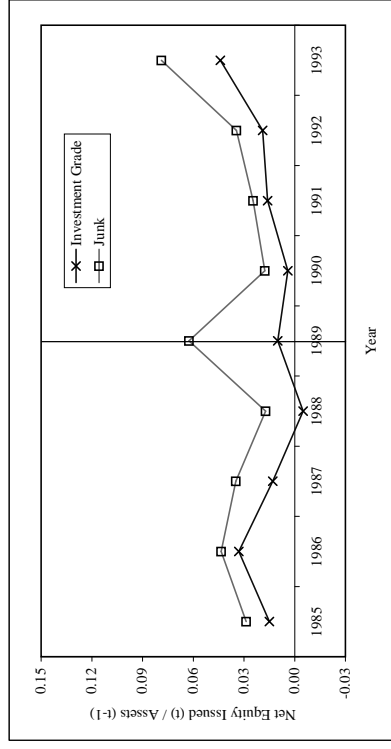
Average Annual Capital Inflows

The sample is all firms in the merged CRSP/Compustat database (excluding financial firms) with either a BB or BBB debt rating during the period 1985 to 1993. Each panel presents annual averages for BBB-rated (above investment grade) firms and BB-rated (below investment grade) firms. *Net Debt Issuance* is long term debt issuances minus long term debt reductions from the statement of cash flows. *Net Equity Issuance* is the product of (1) the split-adjusted growth in shares and (2) the average of the split adjusted stock price at the beginning and end of the fiscal year. *Change in Cash* is the change in cash and cash equivalents from the statement of cash flows. *Leverage* is defined as the ratio of total debt (short and long term) to total assets. *Change in Trade Credit* is defined as the change in accounts payable minus accounts receivable.

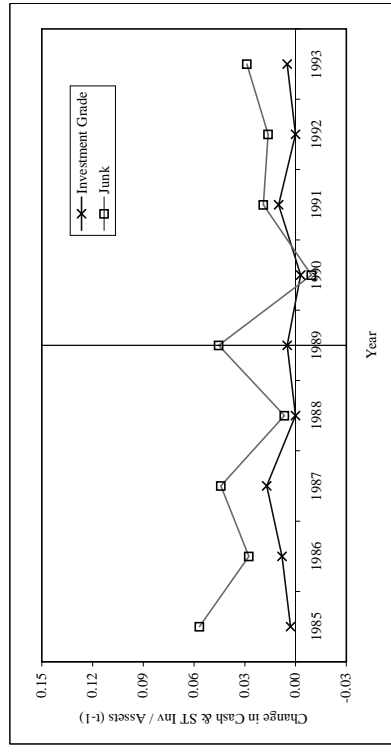
Panel A: Net Debt Issuance



Panel B: Net Equity Issuance



Panel C: Change in Cash



Panel D: Change in Trade Credit

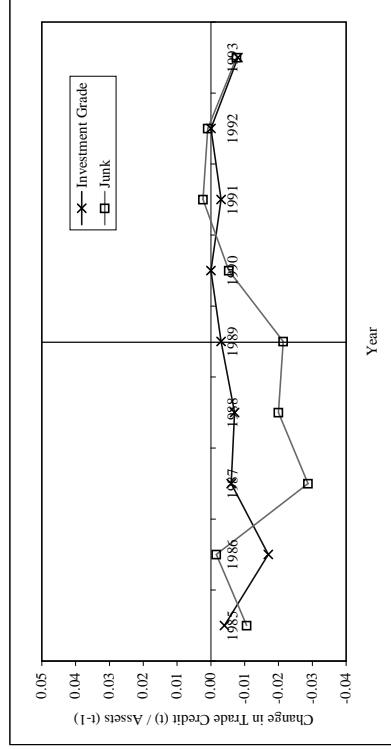
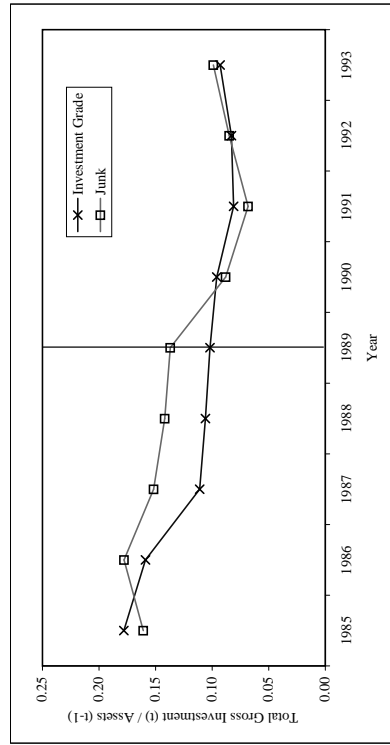


Figure 3

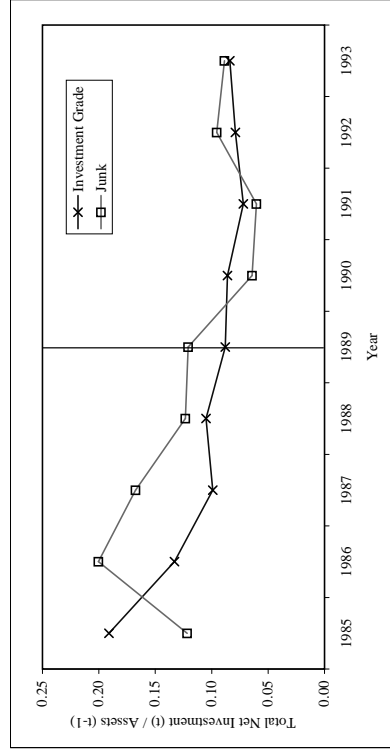
Average Annual Investment

The sample is all firms in the merged CRSP/Compustat database (excluding financial firms) with either a BB or BBB debt rating during the period 1985 to 1993. Each panel presents annual averages for BBB-rated (above investment grade) firms and BB-rated (below investment grade) firms. *Gross Investment* is the sum of capital expenditures and acquisitions. *Net Investment* is the sum of capital expenditures and acquisitions less the sale of physical plant, property, and equipment. *Capital Expenditures* are the total annual capital expenditures from the statement of cash flows. *Acquisitions* are the total annual expenditures on corporate acquisitions from the statement of cash flows. *Changes in Inventory* is the annual change in inventory holdings. *Sale of Capital* is the annual sale of capital from the statement of cash flows.

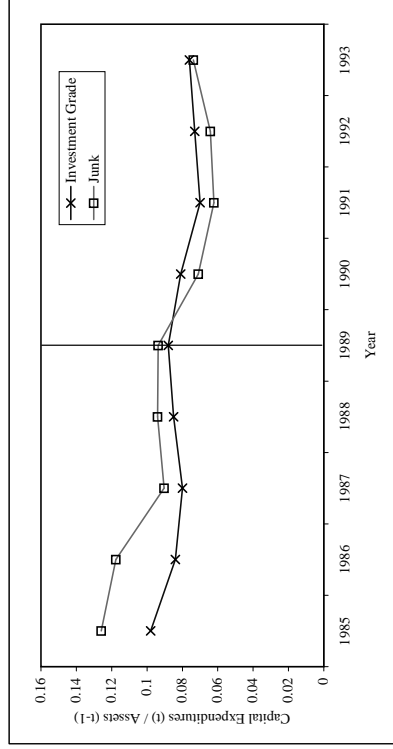
Panel A: Gross Investment



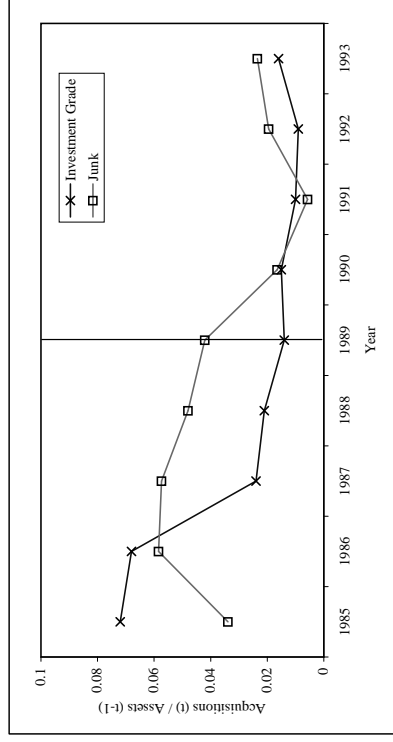
Panel B: Net Investment



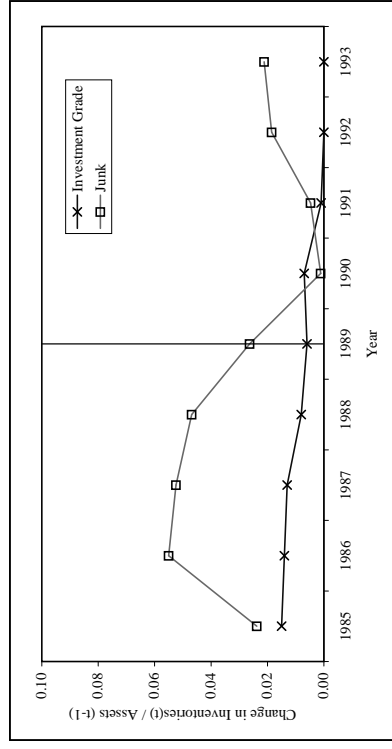
Panel C: Capital Expenditures



Panel D: Acquisitions



Panel E: Changes in Inventory



Panel F: Sale of Capital

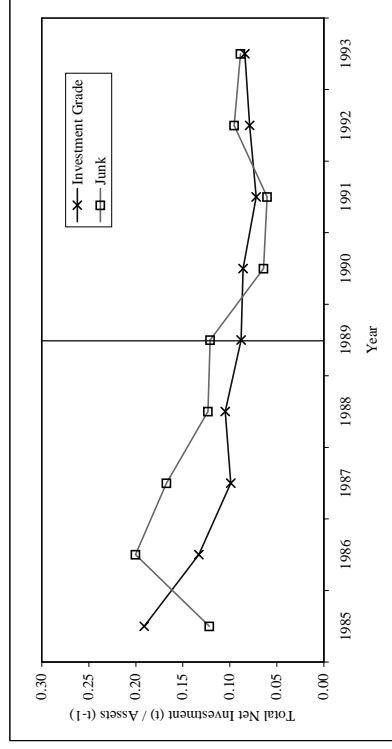


Table 1
Summary Statistics

The data are from the Quarterly Reports of Condition filed with the Office of Thrift Supervision and from SDC. The table presents the total holdings of junk bonds by Savings and Loans and the total principal amount of new issuances in millions of dollars from 1985 to 1989. All values are deflated by the GDP-deflator to year-end 1989 dollars.

Year	Total Holdings (\$Mil)	Total Principal Amount (\$Mil)
1985	6,356	17,843
1986	8,394	36,881
1987	12,853	32,891
1988	15,164	32,215
1989	10,457	28,753

Table 2
Summary Statistics

The table presents variable averages for five different subsamples of the merged annual CRSP/Compustat database during the period 1985-1993. The samples are defined as follows: *Investment Grade* consists of all investment grade rated firm-year observations (i.e., BBB- and above), *Junk* consists of all below investment grade rated firm-year observations (i.e., BB+ and below). *Unrated* consists of all firm-year observations without a credit rating, *BBB* consists of all firm-year observations with a BBB rating, and *BB* consists of all firm-year observations with a BB rating. All variables are defined in Appendix A.

Variable	Sample				
	Investment Grade	Junk	Unrated	BBB	BB
Investment Measures					
Gross Investment	0.11	0.12	0.12	0.12	0.15
Net Investment	0.10	0.11	0.11	0.11	0.14
Capital Expenditures	0.08	0.08	0.09	0.09	0.09
Acquisitions	0.02	0.03	0.02	0.02	0.04
Change in Inventory	0.01	0.02	0.02	0.01	0.02
Sale PPE	0.01	0.01	0.01	0.01	0.01
Financing Measures					
Net Debt Issues	0.03	0.09	0.03	0.03	0.08
Net Equity Issuances	0.01	0.05	0.11	0.02	0.04
Change in Cash	0.00	0.03	0.05	0.01	0.02
Change in Trade Credit	-0.00	-0.01	-0.01	-0.01	-0.01
Book Leverage	0.30	0.49	0.26	0.33	0.41
Dividend/Profits	0.17	0.04	0.06	0.15	0.05
Firm Characteristics					
Assets (\$ Mil)	6,345.96	1,194.69	503.44	4,263.70	1,028.90
Cash Flow	0.05	-0.00	-0.06	0.04	0.03
Profitability	0.14	0.10	0.03	0.13	0.12
Market-to-Book	1.08	1.06	1.69	0.93	1.07
Tangibility	0.56	0.37	0.32	0.52	0.37
Altman's Z-Score	1.56	1.26	0.64	1.65	1.79
Financially Distressed	0.04	0.20	0.39	0.01	0.08
Firms	1,088	1,091	9,587	178	121

Table 3

Financial Policy Regressions

The sample is all firms in the merged CRSP/Compustat database (excluding financial firms) with a debt rating of BBB or BB during the period 1985-1993. The table presents coefficient estimates from regressions of net debt issuances and net equity issuances in Panel A, and the change in cash holdings, change in trade credit, and level of leverage in Panel B. Each variable is normalized by the start of period assets. Net debt issuance is defined as the change in total debt from the balance sheet. Net equity issuance is defined as the product of the split adjusted change in shares outstanding and the split adjusted average price. Trade credit is defined as accounts payable minus accounts receivable. Leverage is the ratio of total debt (short-term plus long-term) to total assets. The variables are defined as follows: $I(Year > 1989)$ is an indicator equal to one if the observation is after 1989. $I(Junk)$ is an indicator equal to one if the observation is below investment grade. $Log(Sales)$ is the natural logarithm of total sales. $Market-to-Book$ is the ratio of the market value of equity to total assets. $Profitability$ is the ratio of operating income before depreciation to total assets. $Tangibility$ is the ratio of net physical plant, property, and equipment to total assets. $Industry Median Lev$ is the median leverage of the firm's 2-digit SIC code. $Altman's Z-Score$ is the ratio of 3.3 times pre-tax income + sales + 1.4 times retained earnings plus 1.22 times working capital all divided by total assets. $I(Distress)$ is an indicator equal to one if the interest coverage ratio is less than one in the previous two years or less than 0.80 in the previous year. All t-statistics are computed with standard errors that are robust to both heteroscedasticity and within firm correlation. Model P-Value is the probability value corresponding to the F-test of the null hypothesis that all of the coefficients but for the intercept are equal to zero.

Panel A: Net Debt and Net Equity Issuances

Variable	Net Debt Issuance			Net Equity Issuance		
	(a)	(b)	(c)	(d)	(e)	(f)
Intercept	0.03 (5.21)	0.02 (0.31)	-0.00 (-0.02)	0.01 (3.21)	-0.00 (-0.13)	0.00 (0.06)
$I(Year > 1989)$	-0.03 (-3.20)	-0.02 (-2.63)	-0.02 (-2.63)	0.01 (1.87)	0.01 (1.88)	0.01 (1.83)
$I(Junk)$	0.09 (4.46)	0.09 (4.17)	0.09 (4.24)	0.02 (1.80)	0.01 (1.36)	0.01 (1.49)
$I(Year > 1989) \times I(Junk)$	-0.08 (-3.47)	-0.08 (-3.69)	-0.08 (-3.65)	-0.00 (-0.16)	0.00 (0.17)	0.00 (0.10)
Log(Sales)	.	-0.01 (-1.37)	-0.01 (-1.67)	.	-0.00 (-1.36)	-0.00 (-1.24)
Market-to-Book	.	-0.00 (-0.11)	0.00 (0.13)	.	0.04 (1.87)	0.04 (1.82)
Profitability	.	0.67 (4.55)	0.49 (3.14)	.	0.03 (0.46)	0.05 (0.66)
Tangibility	.	-0.03 (-1.96)	-0.00 (-0.01)	.	0.01 (0.86)	0.00 (0.23)
Industry Med. Lev	.	.	0.03	.	.	-0.00
Altman's Z-Score	(.)	(.)	(0.52)	(.)	(.)	(-0.07)
$I(Distress)$	.	.	0.01	.	.	-0.00
	(.)	(.)	(2.55)	(.)	(.)	(-0.93)
	.	.	-0.07	.	.	-0.00
	(.)	(.)	(-2.48)	(.)	(.)	(-0.29)
R^2	0.06	0.12	0.13	0.01	0.06	0.06
Model P-Value	0.00	0.00	0.00	0.00	0.00	0.00
Obs	1,122	1,118	1,115	1,122	1,118	1,115

Panel B: The Change in Cash, Change in Trade Credit, and Level of Leverage

Variable	Change in Cash			Change in Trade Credit			Leverage		
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
Intercept	0.00 (1.74)	0.01 (0.36)	0.03 (0.81)	-0.01 (-3.67)	-0.03 (-1.88)	-0.03 (-1.84)	0.34 (30.27)	0.18 (2.74)	0.15 (2.38)
$I(Year > 1989)$	0.00 (0.31)	0.00 (0.59)	0.00 (1.08)	0.01 (2.34)	0.01 (2.12)	0.01 (2.38)	-0.01 (-1.00)	-0.01 (-0.71)	-0.02 (-2.63)
$I(Junk)$	0.02 (1.88)	0.02 (1.81)	0.02 (2.19)	-0.01 (-1.60)	-0.00 (-0.55)	-0.00 (-0.57)	0.07 (3.83)	0.10 (4.42)	0.09 (4.88)
$I(Year > 1989) \times I(Junk)$	-0.02 (-1.12)	-0.02 (-1.08)	-0.02 (-1.19)	0.01 (1.44)	0.01 (1.39)	0.01 (1.45)	-0.01 (-0.89)	-0.01 (-0.46)	-0.01 (-0.85)
Log(Sales)	.	-0.01 (-1.90)	-0.01 (-2.11)	.	0.00 (2.87)	0.00 (2.67)	.	0.00 (0.44)	0.01 (1.64)
Market-to-Book	.	0.02 (1.51)	0.02 (1.64)	.	-0.01 (-1.06)	-0.01 (-1.00)	.	0.04 (2.34)	0.04 (2.76)
Profitability	.	0.16 (1.98)	0.11 (1.20)	.	-0.08 (-2.42)	-0.10 (-2.36)	.	-0.13 (-0.78)	0.12 (0.96)
Tangibility	.	-0.01 (-0.48)	0.01 (0.83)	.	0.01 (1.73)	0.02 (2.16)	.	0.20 (6.54)	0.01 (0.20)
Industry Med. Lev	.	.	-0.07 (-2.28)	.	.	-0.01 (-0.56)	.	.	0.46 (6.66)
Altman's Z-Score	.	.	0.00 (0.67)	.	.	0.00 (1.20)	.	.	-0.04 (-5.48)
$I(Distress)$	.	.	-0.03 (-1.41)	.	.	0.00 (0.28)	.	.	-0.04 (-1.37)
R^2	0.01	0.04	0.05	0.01	0.05	0.06	0.05	0.17	0.38
Model P-Value	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Obs	1,122	1,118	1,115	1,112	1,108	1,105	1,122	1,118	1,115

Table 4
Investment Policy Regressions

The sample is all firms in the merged CRSP/Compustat database (excluding financial firms) with a debt rating of BBB or BB during the period 1985-1993. The table presents coefficient estimates from regressions of gross and net investment on various determinants. Gross investment is defined as the sum of capital expenditures, acquisitions, and changes in inventory. Net investment is defined as gross investment less the sale of physical plant, property, and equipment. All measures are normalized by the start of period assets. The variables are defined as follows: $I(Year > 1989)$ is an indicator equal to one if the observation is after 1989. $I(Junk)$ is an indicator equal to one if the observation is below investment grade. $Log(Sales)$ is the natural logarithm of total sales. $Market-to-Book$ is the ratio of the market value of equity to total assets. $Cash Flow$ is the ratio of income before extraordinary items to the start of period capital. $Leverage$ is the ratio of total debt (short- plus long-term) to total assets. $Altman's Z-Score$ is the ratio of 3.3 times pre-tax income + sales + 1.4 times retained earnings plus 1.22 times working capital all divided by total assets. $I(Distress)$ is an indicator equal to one if the interest coverage ratio is less than one in the previous two years or less than 0.80 in the previous year. All t-statistics are computed with standard errors that are robust to both heteroscedasticity and within firm correlation. Model P-Value is the probability value corresponding to the F-test of the null hypothesis that all of the coefficients but for the intercept are equal to zero.

Panel A: Gross Investment, and Net Investment

Variable	Gross Investment			Net Investment		
	(a)	(b)	(c)	(d)	(e)	(f)
Intercept	0.13 (12.90)	0.11 (2.21)	0.16 (2.94)	0.12 (12.13)	0.10 (2.10)	0.15 (2.91)
$I(\text{Year} > 1989)$	-0.03 (-3.31)	-0.02 (-2.86)	-0.02 (-2.63)	-0.03 (-2.98)	-0.02 (-2.45)	-0.02 (-2.16)
$I(\text{Junk})$	0.07 (3.09)	0.04 (1.95)	0.04 (2.01)	0.07 (2.86)	0.04 (1.76)	0.04 (1.85)
$I(\text{Year} > 1989) \times I(\text{Junk})$	-0.07 (-3.20)	-0.06 (-2.80)	-0.06 (-2.81)	-0.07 (-2.93)	-0.05 (-2.49)	-0.05 (-2.52)
Cash Flow	.	0.30 (.)	0.18 (1.65)	.	0.34 (3.07)	0.21 (1.96)
Market-to-Book	.	0.07 (.)	0.06 (3.59)	.	0.07 (3.88)	0.06 (3.50)
Log(Sales)	.	-0.01 (-1.19)	-0.01 (-1.58)	.	-0.01 (-1.27)	-0.01 (-1.74)
Leverage	.	.	-0.10 (-2.18)	.	.	-0.11 (-2.58)
Altman's Z-Score	.	.	0.01 (1.60)	.	.	0.01 (1.82)
$I(\text{Distress})$	.	.	-0.07 (-5.07)	.	.	-0.08 (-5.03)
R^2	0.07	0.17	0.19	0.06	0.16	0.20
Model P-Value	0.00	0.00	0.00	0.00	0.00	0.00
Obs	847	844	841	847	844	841

Panel B: Capital Expenditures, Acquisitions, Changes in Inventory, and Capital Sales

Variable	Capital Expenditures			Acquisitions			Changes in Inventory			Sale of Capital		
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)
Intercept	0.09 (13.02)	0.06 (1.64)	0.07 (2.06)	0.03 (4.65)	0.04 (1.66)	0.07 (2.08)	0.01 (4.66)	0.00 (0.30)	0.02 (1.02)	0.01 (6.39)	0.01 (0.91)	0.00 (0.42)
$I(Year > 1989)$	-0.01 (-1.20)	-0.00 (-0.93)	-0.00 (-0.96)	-0.02 (-2.44)	-0.01 (-2.14)	-0.01 (-1.95)	-0.01 (-3.33)	-0.01 (-2.65)	-0.01 (-2.22)	-0.00 (-2.89)	-0.00 (-3.24)	-0.00 (-3.44)
$I(Junk)$	0.01 (1.09)	-0.01 (-0.43)	-0.00 (-0.23)	0.03 (1.84)	0.02 (1.45)	0.02 (1.46)	0.03 (2.94)	0.02 (2.78)	0.02 (2.69)	0.00 (0.82)	0.00 (0.76)	0.00 (0.68)
$I(Year > 1989) \times I(Junk)$	-0.02 (-2.04)	-0.02 (-1.53)	-0.01 (-1.41)	-0.03 (-1.80)	-0.03 (-1.66)	-0.03 (-1.69)	-0.02 (-2.32)	-0.02 (-2.00)	-0.02 (-2.11)	-0.00 (-1.15)	-0.01 (-1.26)	-0.01 (-1.30)
Cash Flow	.	-0.01 (-0.13)	-0.03 (-0.42)	.	0.12 (1.84)	0.06 (1.00)	.	0.19 (4.90)	0.14 (4.00)	.	-0.05 (-3.55)	-0.03 (-3.04)
Market-to-Book	.	0.05 (4.71)	0.05 (4.53)	.	0.01 (0.87)	0.01 (0.73)	.	0.01 (1.15)	0.00 (0.68)	.	0.00 (0.36)	0.00 (0.58)
Log(Sales)	.	-0.00 (-0.55)	-0.00 (-0.59)	.	-0.00 (-1.04)	-0.00 (-1.37)	.	-0.00 (-0.54)	-0.00 (-1.43)	.	0.00 (0.11)	0.00 (0.44)
Leverage	.	.	-0.02 (-0.57)	.	.	-0.07 (-1.81)	.	.	-0.02 (-1.67)	.	.	0.01 (0.85)
Altman's Z-Score	.	.	-0.00 (-0.16)	.	.	0.00 (0.75)	.	.	0.01 (3.63)	.	.	-0.00 (-1.28)
$I(Distress)$	.	.	-0.03 (-4.21)	.	.	-0.02 (-2.55)	.	.	-0.02 (-2.87)	.	.	0.01 (1.23)
R^2	0.02	0.12	0.13	0.03	0.05	0.06	0.08	0.14	0.17	0.02	0.03	0.05
Model P-Value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Obs	847	844	841	847	844	841	847	844	841	847	844	841

Table 5

Regional Capital Flow and Investment Regressions

The sample is all firms in the merged CRSP/Compustat database (excluding financial firms) with a below-investment-grade debt rating (BB+ or lower) during the period 1985-1993. The table presents coefficient estimates from regressions of measures of capital flow in Panel A, and measures of investment in Panel B. Each variable is normalized by the start of period assets. Net debt issuance is defined as the change in total debt from the balance sheet. Net equity issuance is defined as the product of the split adjusted change in shares outstanding and the split adjusted average price. Trade credit is defined as accounts payable minus accounts receivable. Gross investment is defined as the sum of capital expenditures, acquisitions, and changes in inventory. Net investment is defined as gross investment less the sale of physical plant, property, and equipment. All measures are normalized by the start of period assets. The explanatory variables are defined as follows: $I(\text{Year} > 1989)$ is an indicator equal to one if the observation is after 1989. $I(\text{Northeast})$ is an indicator equal to one if the location of the company is in the Northeast census region. $\text{Log}(\text{Sales})$ is the natural logarithm of total sales. Market-to-Book is the ratio of the market value of equity to total assets. Profitability is the ratio of operating income before depreciation to total assets. Tangibility is the ratio of net physical plant, property, and equipment to total assets. $\text{Industry Median Lev}$ is the median leverage of the firm's 2-digit SIC code. Altman's Z-Score is the ratio of 3.3 times pre-tax income + sales + 1.4 times retained earnings plus 1.22 times working capital all divided by total assets. $I(\text{Distress})$ is an indicator equal to one if the interest coverage ratio is less than one in the previous two years or less than 0.80 in the previous year. All t-statistics are computed with standard errors that are robust to both heteroscedasticity and within firm correlation. Model P-Value is the probability value corresponding to the F-test of the null hypothesis that all of the coefficients but for the intercept are equal to zero.

Panel A: Financial Policy

Variable	Net Debt Issuances	Net Equity Issuances	Change in Cash	Change in Trade Credit	Leverage
Intercept	0.12 (1.66)	-0.01 (-0.25)	0.05 (1.08)	-0.00 (-0.23)	0.34 (4.22)
$I(\text{Year} > 1989)$	-0.08 (-4.78)	0.01 (1.62)	-0.02 (-1.73)	0.01 (2.31)	-0.01 (-1.24)
$I(\text{Northeast})$	0.04 (1.14)	-0.00 (-0.04)	-0.02 (-1.22)	-0.01 (-1.43)	0.02 (0.65)
$I(\text{Year} > 1989) \times I(\text{Northeast})$	-0.07 (-1.97)	-0.01 (-0.56)	0.02 (0.83)	0.00 (0.59)	-0.00 (-0.03)
Log(Sales)	-0.03 (-3.34)	-0.00 (-0.46)	-0.01 (-1.78)	0.00 (2.00)	-0.00 (-0.45)
Market-to-Book	0.06 (2.51)	0.07 (2.86)	0.03 (1.50)	-0.02 (-2.85)	0.02 (1.03)
Profitability	0.21 (1.14)	-0.02 (-0.32)	0.08 (0.68)	-0.05 (-1.31)	0.55 (3.59)
Tangibility	-0.04 (-1.17)	-0.00 (-0.25)	0.01 (0.46)	0.01 (0.51)	-0.13 (-2.38)
Industry Med. Lev	0.10 (1.57)	-0.04 (-1.32)	-0.09 (-2.75)	-0.02 (-1.05)	0.52 (7.67)
Altman's Z-Score	0.03 (3.24)	-0.00 (-1.28)	0.01 (1.84)	0.00 (0.10)	-0.04 (-2.46)
$I(\text{Distress})$	0.01 (0.39)	0.01 (1.15)	0.00 (0.13)	0.00 (0.76)	0.05 (2.22)
R^2	0.16	0.10	0.04	0.06	0.24
Model P-Value	0.00	0.00	0.00	0.00	0.00
Obs	812	815	814	815	815

Panel B: Investment

Variable	Gross Investment	Net Investment	Capital Expenditures	Acquisitions	Change in Inventory	Sale of Capital
Intercept	0.19 (3.06)	0.16 (2.76)	0.11 (2.56)	0.05 (1.21)	0.02 (1.30)	0.03 (2.26)
$I(\text{Year} > 1989)$	-0.04 (-3.44)	-0.03 (-2.91)	-0.01 (-1.34)	-0.02 (-2.49)	-0.01 (-2.48)	-0.01 (-2.75)
$I(\text{Northeast})$	0.03 (0.84)	0.03 (0.85)	-0.03 (-1.94)	0.05 (1.87)	0.00 (0.23)	-0.00 (-0.21)
$I(\text{Year} > 1989) \times I(\text{Northeast})$	-0.07 (-2.53)	-0.07 (-2.47)	0.00 (0.12)	-0.06 (-2.17)	-0.02 (-1.47)	-0.00 (-0.07)
Cash Flow	0.17 (3.42)	0.17 (3.32)	0.07 (2.55)	0.03 (1.19)	0.07 (1.91)	0.00 (0.25)
Market-to-Book	0.07 (4.91)	0.07 (5.14)	0.05 (4.87)	0.01 (0.59)	0.02 (3.23)	-0.00 (-1.25)
Log(Sales)	-0.02 (-2.04)	-0.02 (-2.09)	-0.01 (-1.20)	-0.00 (-0.76)	-0.01 (-2.07)	-0.00 (-0.05)
Leverage	-0.10 (-3.05)	-0.10 (-2.98)	-0.07 (-3.06)	-0.02 (-0.63)	-0.02 (-1.19)	-0.00 (-0.09)
Altman's Z-Score	0.02 (2.54)	0.02 (3.14)	0.00 (0.21)	0.00 (0.48)	0.01 (3.63)	-0.00 (-2.78)
$I(\text{Distress})$	-0.02 (-1.20)	-0.01 (-0.87)	-0.01 (-0.72)	-0.01 (-2.02)	0.00 (0.41)	-0.01 (-1.90)
R^2	0.23	0.24	0.19	0.08	0.14	0.06
Model P-Value	0.00	0.00	0.00	0.00	0.00	0.00
Obs	637	637	637	637	637	637

Table 6
Propensity Score Matching Results

The sample consists of a propensity score matched sample of below-investment-grade firms and unrated firms in the merged CRSP/Compustat database (excluding financial firms) during the period 1985-1993. The table presents coefficient estimates from regressions of measures of financial variables in Panel A, and measures of investment in Panel B. Each variable is normalized by the start of period assets. Net debt issuance is defined as the change in total debt from the balance sheet. Net equity issuance is defined as the product of the split adjusted change in shares outstanding and the split adjusted average price. Trade credit is defined as accounts payable minus accounts receivable. Gross investment is defined as the sum of capital expenditures, acquisitions, and changes in inventory. Net investment is defined as gross investment less the sale of physical plant, property, and equipment. All measures are normalized by the start of period assets. The explanatory variables are defined as follows: $I(\text{Year} > 1989)$ is an indicator equal to one if the observation is after 1989. $I(\text{Junk})$ is an indicator equal to one if the firm is rated below-investment-grade. All t-statistics are computed with standard errors that are robust to both heteroscedasticity and within firm correlation. Model P-Value is the probability value corresponding to the F-test of the null hypothesis that all of the coefficients but for the intercept are equal to zero.

Panel A: Financial Policy

Variable	Net Debt Issuances	Net Equity Issuances	Change in Cash	Change in Trade Credit	Leverage
Intercept	0.04 (3.93)	0.03 (4.17)	0.02 (3.42)	-0.01 (-1.90)	0.26 (23.15)
$I(\text{Year} > 1989)$	-0.03 (-2.79)	0.04 (2.72)	-0.01 (-1.13)	0.00 (0.13)	0.02 (1.21)
$I(\text{Junk})$	0.12 (6.69)	0.02 (2.03)	0.03 (3.42)	-0.01 (-1.59)	0.19 (11.35)
$I(\text{Year} > 1989) \times I(\text{Junk})$	-0.12 (-6.10)	-0.04 (-2.21)	-0.04 (-3.31)	0.02 (2.89)	-0.03 (-1.76)
R^2	0.08	0.01	0.01	0.01	0.18
Model P-Value	0.00	0.01	0.00	0.00	0.00
Obs	2,034	2,017	2,057	2,050	2,015

Panel B: Investment Policy

Variable	Gross Investment	Net Investment	Capital Expenditures	Acquisitions	Change in Inventory
Intercept	0.11 (13.62)	0.09 (10.21)	0.08 (14.99)	0.03 (5.99)	0.00 (0.90)
$I(\text{Year} > 1989)$	-0.03 (-3.49)	-0.02 (-1.80)	-0.01 (-1.80)	-0.02 (-4.20)	-0.00 (-1.13)
$I(\text{Junk})$	0.06 (4.34)	0.06 (3.95)	0.02 (2.31)	0.01 (1.84)	0.03 (4.98)
$I(\text{Year} > 1989) \times I(\text{Junk})$	-0.05 (-3.34)	-0.06 (-3.53)	-0.02 (-2.06)	-0.01 (-1.19)	-0.02 (-3.92)
R^2	0.06	0.05	0.02	0.03	0.04
Model P-Value	0.00	0.00	0.00	0.00	0.00
Obs	1,909	1,359	1,979	1,978	1,997

Table B.1

Propensity Score Matching Diagnostics

The sample is all firms in the merged CRSP/Compustat database (excluding financial firms) during the period 1985-1993. The table presents coefficient estimates from logit regressions of an indicator variable equal to one if the firm-year has a below investment grade credit rating. Pre-Match results are based on the entire sample, while Post-Match are based on the matched sample, restricted to matches where the magnitude of the difference in propensity scores is less 10%. Panel A presents the results from a matching model for the analysis of investment. Panel B presents the results from a matching model for the analysis of financial policies. Also included in both models but not presented are fixed effects for industry (Fama and French 48) and years. All t-statistics are computed with standard errors that are robust to both heteroscedasticity and within firm correlation. The variables are defined as follows: *Cash Flow* is the ratio of income before extraordinary items to the start of period capital. *Leverage* is the ratio of total debt (short- plus long-term) to total assets. *Market-to-Book* is the ratio of the market value of equity to total assets. *Z-Score* is the ratio of 3.3 times pre-tax income + sales + 1.4 times retained earnings plus 1.22 times working capital all divided by total assets. *Log(Sales)* is the natural logarithm of total sales. *Profitability* is the ratio of operating income before depreciation to total assets. *Tangibility* is the ratio of net physical plant, property, and equipment to total assets.

Panel A: Financial Policy - Pairwise Comparisons

Variable	Pre-Match			Post-Match		
	Control	Treatment	T-Diff	Control	Treatment	T-Diff
Log(Sales)	3.45 (0.03)	5.98 (0.09)	. 26.60	5.91 (0.08)	5.98 (0.09)	. 0.59
Market-to-Book	1.65 (0.02)	1.07 (0.04)	. -13.34	1.15 (0.04)	1.07 (0.04)	. -1.57
Profitability	0.04 (0.00)	0.10 (0.00)	. 12.51	0.10 (0.01)	0.10 (0.00)	. 0.70
Tangibility	0.30 (0.00)	0.37 (0.02)	. 3.80	0.36 (0.01)	0.37 (0.02)	. 0.35
Industry Med. Lev	0.24 (0.00)	0.29 (0.01)	. 5.90	0.28 (0.01)	0.29 (0.01)	. 1.01
Altman's Z-Score	1.16 (0.04)	1.52 (0.08)	. 4.36	1.51 (0.13)	1.52 (0.08)	. 0.10
Year	1,989.06 (0.02)	1,989.38 (0.06)	. 5.11	1,989.27 (0.08)	1,989.38 (0.06)	. 1.16
Industry	22.99 (0.15)	23.79 (0.89)	. 0.88	23.92 (0.51)	23.79 (0.89)	. -0.12
Obs	27,281	1,032	.	887	1,032	.

Panel B: Financial Policy - Multivariate Comparison

Variable	Pre-Match	Post-Match
Intercept	-4.27 (0.49)	0.40 (0.90)
Log(Sales)	0.39 (0.03)	0.00 (0.04)
Market-to-Book	-0.11 (0.05)	-0.09 (0.08)
Profitability	0.15 (0.19)	0.44 (0.42)
Tangibility	-0.06 (0.22)	0.09 (0.30)
Industry Med. Lev	1.02 (0.35)	0.35 (0.44)
Altman's Z-Score	-0.11 (0.01)	-0.02 (0.03)
Year Fixed Effects	Yes	Yes
Industry Fixed Effects	Yes	Yes
Control	42,852	887
Treatment	1,032	1,032
Obs	43,884	1,919
Pseudo R^2	0.32	0.01

Panel C: Investment Policy - Pairwise Comparisons

Variable	Pre-Match			Post-Match		
	Control	Treatment	T-Diff	Control	Treatment	T-Diff
Cash Flow	-0.05 (0.00)	-0.01 (0.00)	. 7.65	-0.00 (0.00)	-0.00 (0.00)	. -0.39
Market-to-Book	1.63 (0.02)	1.06 (0.04)	. -13.59	1.08 (0.03)	1.06 (0.04)	. -0.57
log(Sales)	3.46 (0.03)	5.97 (0.09)	. 26.07	5.85 (0.10)	5.97 (0.09)	. 0.87
Leverage	0.23 (0.00)	0.43 (0.01)	. 16.08	0.42 (0.01)	0.43 (0.01)	. 0.85
Altman's Z-Score	1.21 (0.03)	1.52 (0.08)	. 3.57	1.53 (0.08)	1.52 (0.08)	. -0.09
Year	1,989.07 (0.02)	1,989.36 (0.06)	. 4.73	1,989.25 (0.08)	1,989.36 (0.06)	. 1.12
Industry	22.96 (0.16)	23.69 (0.90)	. 0.80	23.36 (0.53)	23.67 (0.90)	. 0.30
Obs	27,207	1,020	.	847	1,019	.

Panel D: Investment Policy - Multivariate Comparison

Variable	Pre-Match	Post-Match
Intercept	-5.30 (0.53)	0.10 (0.86)
incBefExtlagA	0.01 (0.21)	-0.14 (0.34)
Market-to-Book	-0.03 (0.04)	0.00 (0.06)
log(Sales)lesReal	0.40 (0.03)	0.05 (0.04)
Leverage	2.20 (0.18)	0.21 (0.28)
Altman's Z-Scoree	-0.05 (0.02)	0.00 (0.03)
Year Fixed Effects	Yes	Yes
Industry Fixed Effects	Yes	Yes
Control	42,852	847
Treatment	1,020	1,019
Obs	43,872	1,866
Pseudo R^2	0.38	0.01