Credit ratings and abnormal investment behavior*

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Abstract

I examine how rating downgrades impact firms' investment efficiency. Using fourth fiscal quarter capital expenditure spikes, typically linked to budget policy and tax strategies, I show firms reduce abnormal investments by −24.4% following downgrades. This decrease is especially pronounced for financially constrained firms and those facing budgeting complexity, suggesting improvements in "use it or lose it" policies rather than tax avoidance. Investment rates unaffected by spikes remain constant following downgrades. Firms decreasing abnormal investments face lower downgrade likelihood. Stock market reaction is more muted around downgrade announcements when firms have larger investment spikes, indicating downgrades efficiently discipline corporate investment decision-making. *[100 words]*

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1 Introduction

Credit ratings have a significant impact on corporate behavior. Rating downgrades result in increased borrowing costs, which directly affect investment decisions[1]. The relevance of credit ratings in shaping firm behavior furthermore extends to diverse domains, including mergers and acquisitions (Bongaerts and Schlingemann, 2024; Aktas et al., 2021) and information production (Wang and Xie, 2022). This emphasizes the importance of credit ratings for corporate executives (Graham and Harvey, 2001) and provides an incentive for managers to improve their credit ratings (Kisgen, 2006, 2009).

In this paper, I examine whether credit ratings lead to changes in firms' investment efficiency. Whereas recent evidence suggests that firms reduce capital expenditures after experiencing rating downgrades (e.g., Almeida et al., 2017; Bannier et al., 2012; Begley, 2015; Chava et al., 2019), it remains unclear whether this reduction is associated with a decrease in profitable investments, thus potentially indicating inefficient investment strategies. By employing quarterly data, I investigate instances of abnormal increases in capital expenditures occurring during the fourth quarter of a firm's fiscal year. Research in the field points out that firms tend to spend more on investments in the last quarter of their fiscal year (e.g., Bartov, 1993; Callen et al., 1996; Shin and Kim, 2002; Kinney and Trezevant, 1993; Liebman and Mahoney, 2017; Xu and Zwick, 2022). Liebman and Mahoney (2017) provide first evidence that these abnormal investments are of lower quality and therefore should be considered as "wasteful investments". The first potential way to interpret this excessive capital spending in the last quarter is by recognizing that investment choices are in the hands of divisional managers and the value-enhancing nature of investments is often hard to verify. This may lead to agency conflicts in internal capital allocation (Scharf-

[1]For example, Hand et al. (1992) show a reduction in the share price after downgrades, while Bhanot and Mello (2006) and Kraft (2015) provide direct cost implications if bond contracts contain rating triggers that lead to increases in coupon payments following a downgrade. Bongaerts et al. (2012) and Opp et al. (2013) show increases in the firm's cost of debt and financial distress costs, as well as a tightening of financial constraints. In addition, Goldstein and Huang (2020) and Manso (2013) provide evidence for a tightening of financial constraints due to a feedback effect of rating agencies.

stein and Stein, 2000). Especially when considering the allocation of investment budgets, managers are incentivized to increase investments towards the close of the fiscal year by "use it or lose it" policies (Shin and Kim, 2002; Liebman and Mahoney, 2017). Second, investment spikes in the last quarter could be interpreted as tax-minimizing investments, as capital expenditures allow to use deprecation deductions during the current tax year and reduce the firms' profit which ultimately leads to lower tax obligations (Xu and Zwick, 2022; Kinney and Trezevant, 1993).

I posit that both effects are unfavorable after rating downgrades and the additional financial constraints that arise with the increased cost of capital may lead to a reduction in "wasteful year-end spending" (Liebman and Mahoney, 2017). Boot et al. (2006) show in their theoretical model the disciplinary role of credit rating agencies (CRAs). While previous studies demonstrate that downgrades generally lead to a decline in firm investments, I examine whether this decline arises from the reduction of wasteful investments, indicating improvements in investment efficiency. First, managers could reduce the annual allocation of budgets, allow to extend the allocated budget over longer periods, or reallocate budgets to high-productivity divisions. Second, after a deterioration of a firm's credit rating, tax-minimizing investments might be of secondary importance. If firms target good credit ratings as shown in the literature, the aim of managers should be to boost the firm's net income, showing that the firm is profitable.

I construct a large sample of 3,181 unique firms with a long-term issuer credit rating of Standard & Poor's (S&P) and obtain quarterly capital expenditures data from Compustat during 1988 to 2022. I follow the literature and examine whether investments on the annual level are generally decreased after rating downgrades. I then focus on the fourth quarter capital expenditures and compare the firm's abnormal investments pre and post rating downgrades.

My results are as follows: I first find evidence that firms reduce their abnormal investments by 6.0% in the fourth quarter in the year following a rating downgrade. The reduction

of abnormal investment behavior remains significant controlling for several factors, such as profitability, growth opportunity, cash holdings, and the firm's life cycle. Relative to the median abnormal investment rate of 24.6%, this estimates into a relative change of about −24.4%. When analyzing the firm's annual investment rate, I similarly identify reductions consistent with prior literature. However, it is important to note that the reduction in the median investment rate is not as substantial as that for the fourth-quarter spike, amounting to approximately 7.3%, and is therefore less than a third of the reduction observed for the abnormal investment rate. When examining the normalized firm's investment rate, which excludes the fourth quarter capital expenditures and relies only on the average of the first three quarters, the results even lack significance. This indicates that primarily the wasteful investments, proxied as excess investments close to the end of the fiscal year, are reduced following rating downgrades, but not the firm's standard investments. Following rating upgrades, the results do not show a significant change in abnormal investments.

Next, I provide evidence for a financial constraint channel (e.g., Almeida and Campello, 2007; Campello et al., 2010; Whited, 1992), as the results are most pronounced for financially constrained firms. When examining, whether firms rather reduce abnormal investments due to budget complexity (Shin and Kim, 2002; Liebman and Mahoney, 2017) or reductions of tax-minimizing investments (Xu and Zwick, 2022; Kinney and Trezevant, 1993), I find evidence that firms facing budget complexity, characterized by large deviations in investments, sales, or number of employees across segments, or those with a greater number of operating segments, reduce their abnormal investments following downgrades. While I also demonstrate associations between tax reduction and abnormal investment, I do not find conclusive evidence that tax strategies are a channel following rating downgrades.

While my findings align with prior literature regarding overall capital expenditures and the impact of credit ratings, I contribute by providing novel insights demonstrating that a significant portion of this reduction in capital expenditures can be attributed to year-end budget adjustments. Consequently, my results suggest that firms initially alter their budget

policies, providing evidence that CRAs serve as delegated monitors within the context of corporate investment decision-making.

I conduct a variety of additional tests and robustness checks to support my previous findings. I begin to control whether my results are driven by my sample selection. While I already control for firm fixed effects, I eliminate firms from the financial industry and utilities as they are highly regulated. My sample also includes approximately 17% non-US firms, which I also exclude in further robustness tests. I find that my results are not driven by certain industries or the multinational sample.

In further tests, I do not use actual rating changes, but focus on potential downgrade risk. I first use silent thresholds of Debt/EBITDA as my identification strategy, leveraging the fact that S&P maps Debt/EBITDA ratios to potential credit ratings which changes at particular thresholds. I follow Begley (2015) and analyze whether firms near thresholds, facing higher marginal benefits from Debt/EBITDA improvements, are more keen in reducing their end-of-the-year investments. Moreover, I apply the approach of Almeida et al. (2017) who use the sovereign ceiling as a potential channel. They show that firms which have ratings above or equal to the sovereign rating significantly reduce their investments due to the potential rating downgrade. While applying both approaches as alternative identification strategies, I find that my results are robust and firms facing downgrades significantly decrease their investments in the fourth quarter relative to the other quarters.

Next, I demonstrate that firms reporting significant investment spikes at the end of the fiscal year and subsequently receiving a rating downgrade experience a more muted stock price response around the downgrade announcement. Although rating downgrades are typically perceived as negative news, resulting in average stock price drops of -1.9% around the announcement, I find that abnormal investment activity is positively related to this reaction, indicating that investors acknowledge a discipline effect on the firm's investment behavior.

I finally rule out alternative mechanisms that may lead to the observed effects. First,

I do not find evidence that abnormal investment behavior is generally a determinant for future ratings. Investment spikes are equally distributed over rating classes and changes in the abnormal investment spikes are not predicting rating downgrades or upgrades within industries. However, when using firm fixed effects and measuring the variation of a firm's abnormal investment activity over time, I find that firms increasing their abnormal investments, are more likely to receive a rating downgrade in the future. Second, I check for economic cyclicality and control for years with large macroeconomic shocks. The results are robust and do not depend on economic condition. I also examine different regulatory environments and do not find that changes in credit rating regulation have an impact on the results. Third, I leverage calendar-year seasonality, specifically focusing on firms with fiscal years aligned with the calendar year. My findings indicate that the observed results are primarily driven by firms with fiscal year-ends in December. Firms with fiscal year-ends in months other than December, likely indicative of different cycles for budgeting and financial reporting, do not exhibit similar patterns. This aligns with my assumptions regarding the immediate impact on budgeting practices. Furthermore, when analyzing data using calendar years instead of fiscal years, I find comparable results to the main findings, suggesting an improvement in budgeting complexity following rating downgrades, particularly as budgeting cycles are typically aligned with the calendar year. Fourth, I entropy balance all control variables to exclude that the main results are driven by differences in firm characteristics. The results of this entropy-balanced sample remain as reported in the base results.

This paper is the first to identify the type of investment reduced following downgrades. I show that end-of-year investments, considered wasteful in the literature (Liebman and Mahoney, 2017), decrease, while normal investments remain unchanged. This finding suggests that firms adjust their budget allocation in response to rating downgrades, providing evidence for a credit rating discipline channel, as suggested by Boot et al. (2006).

The rest of this paper is organized as follows. Section 2 presents the motivation of this

study and the related literature. Section 3 explains the data collection process and provides descriptive statistics. Section 4 reports the empirical main results, while Section 6 provides additional tests and robustness checks. Section 7 concludes the paper.

2 Motivation and Related Literature

In theory, a firm's investment policy should be solely driven by its assessment of investment opportunities and whether those investments add value to the firm. However, evidence suggests that conflicts of interest and information asymmetry, particularly stemming from suboptimal capital allocation, can lead to inefficient investments. Scharfstein and Stein (2000) propose a model demonstrating how internal capital markets within conglomerate firms can lead to suboptimal resource allocation, as funds may flow from high-productivity divisions to low-productivity ones due to agency problems and information asymmetry. Empirical support for this model is found by Ozbas and Scharfstein (2010) and Graham et al. (2015). Additionally, Shin and Kim (2002) argue that bureaucratic obstacles in the capital budgeting process, or the equal distribution of budgets regardless of divisional growth opportunities, can also lead to investment inefficiencies.

Drawing from financial constraints theory, which posits that firms tend to enhance efficiency and productivity under such constraints, Hovakimian (2006) demonstrates that diversified and constrained firms exhibit more efficient capital markets. Similarly, Stein (1997) shows that credit constraints improve investment efficiency of multi-divisional firms. Moreover, Brown et al. (2013) and Hsu et al. (2014) highlight the differing roles of credit and equity markets in influencing investment decisions, with credit markets being more significant for investments, whereas the equity market is more essential for R&D. These collective insights motivate the investigation into the interplay between credit ratings, budgeting efficiency, and investment decisions.

First, my findings contribute to the implications of credit ratings on corporate decisions.

Kisgen (2006, 2009) shows that managers target credit ratings by issuing less debt when the firm is near a rating downgrade (Kisgen, 2006) or once they receive a downgrade (Kisgen, 2009), indicating that firms aim for good credit ratings. Wang and Xie (2022) demonstrate that firms bound by the sovereign ceiling enhance information production, which in turn improves their access to bond markets. Credit ratings also impact merger activity, as rated firms are more likely to undertake acquisitions (Harford and Uysal, 2014), and better ratings are associated with more merger deals (Aktas et al., 2021). In contrast, recently downgraded firms are more engaged in corporate restructuring (Bongaerts and Schlingemann, 2024). Moreover, a growing literature, described in detail below, documents the importance of credit ratings on firm investments.[2] The documented impact of credit ratings on investments raises the question of whether the reductions are a result of lowering wasteful investments (Liebman and Mahoney, 2017), suggesting that the observed effects in investment reduction are efficient.

Several studies examine the relationship between credit rating changes and the firm's investment policy. Almeida et al. (2017) exploit the sovereign ceiling rules and create a quasi-natural experiment around sovereign downgrades. They show that 73 firms affected by the sovereign ceiling rule reduced their investments due to the increased borrowing costs after the sovereign downgrade. While the sample size of Almeida et al. (2017) is limited as not many firms have the same or even a better rating than the firm's country of domicile, Begley (2015) relies on the Debt/EBITDA thresholds of CRAs for identification. S&P provides certain Debt/EBITDA ratios for corporate credit ratings which are somewhat arbitrary as they are often within intervals such as 2 and 2.5 (Chava et al., 2019). He provides evidence that firms near such key Debt/EBITDA thresholds significantly reduce their investment activity in order to increase EBITDA. He further shows that these firms

[2]Other studies that examine the impact of rating changes on firm investments include Bayona et al. (2023) who focus on inflated credit ratings and provide a theoretical model on how inflated rating affect investment decisions. Manso (2013) likewise provides a theoretical model and focuses on rating biases. Tang (2009) and Kisgen (2019) examine changes in the rating methodology of CRAs and empirically show an impact on firm investment decisions.

have declines in productivity, profitability, and Tobin Q's. Bannier et al. (2012) and Chava et al. (2019) likewise show that US firms reduce their investments following downgrades, whereas Chernenko and Sunderam (2012) find that firms positioned slightly below the threshold for speculative-grade ratings exhibit reduced investment levels in contrast to firms that maintain a position just above the threshold.

While existing research consistently demonstrates that firms tend to decrease investments either in response to rating downgrades or to prevent them, I provide new evidence on the effects of rating decisions on capital expenditures. I examine quarterly investment spending to determine whether these reductions yield positive or negative outcomes. Several papers have shown that firms frequently tilt their investments towards the end of the fiscal year, leading to significant spikes in capital expenditures in the fourth quarter. Liebman and Mahoney (2017) examine US federal contracting and show a surge of spending at the end of the year. Moreover, projects which started at the end of the year were of lower quality, indicating wasteful year-end spending. They also find that permitting rollover of spending into subsequent periods eliminates the end-of-year spending spike and leads to higher quality of the investments.

There are two main explanations for the increased capital expenditures in the fourth quarter. On the one hand, Shin and Kim (2002) and Liebman and Mahoney (2017) explain the observed effects with "use it or lose it" budget policies based on capital budgeting theories, leading to moral hazard. Managers often aim to spend their assigned budgets by the end of the year to secure similar or larger budgets for the following year when they have discretionary authority. This practice is common among professionals, as unspent funds are typically non-transferable across years. This theory of wasteful investments when budget expires would be in line with Jensen (1986) and Stulz (1990) who argue that firms with larger cash holdings may invest more than economically efficient. On the other hand, Xu and Zwick (2022) and Kinney and Trezevant (1993) interpret the investment spikes in the fourth quarter as a result of tax-minimizing investments. Firms have two compelling

tax-incentive reasons to boost their investments at the end of the fiscal year. Firstly, the deduction of depreciation allowances from pre-tax income lowers their tax obligations, and conventionally, these deductions allow firms to treat year-end capital purchases as if they were deployed midway through the year. This creates a depreciation motive that encourages them to invest more at the end of the fiscal year.[3] In addition, investing near the fiscal year-end allows firms to maximize tax benefits of depreciation because, at this point, they can more accurately estimate their tax positions, considering most revenues and expenses for the year have been recorded. This is driven by the idea that firms have an incentive to wait and observe how their tax situation develops throughout the fiscal year. If their financial performance has been strong, they can increase investments at the end of the year to minimize their remaining tax burden.[4]

While there is no dominant argument why literature has observed increased capital expenditures in the fourth fiscal quarter, I posit that firms are interested in lowering their investment spikes, or abnormal investments, following downgrades. First, the financial constraints from the rating downgrade force firms to allocate the capital in a more efficient way. This would lead to a reduction in non-value adding investments, such as described by Shin and Kim (2002), Xu and Zwick (2022), Liebman and Mahoney (2017), Kinney and Trezevant (1993), Bartov (1993) and Callen et al. (1996). I would expect that firms continue to invest in value adding investments but to observe a reduction in wasteful investments. In particular, financially constrained firms should improve their investments following downgrades (Almeida and Campello, 2007). Altieri and Schnitzler (2023) use end-of-the-year spikes as a proxy for managerial agency conflicts in investment decisions and report that large spikes are associated with negative stock returns in the future.

Tax-minimizing investments have a direct impact on EBITDA as it leads to a reduction

[3]This is due to the fact that investments made late in the year benefit from a lower effective tax rate and yield a higher rate of return, making it financially advantageous (Xu and Zwick, 2022).

[4]Conversely, if the year has not gone well and taxable income is already close to zero, there is less reason to invest during the current fiscal year to reduce taxes.

in the net income of the firm and subsequently the firm's taxes. While Begley (2015) shows that EBITDA is a main criteria for CRAs, indicating that the firm's profitability is an important determinant for the credit rating, Wang and Xie (2022) document an increased information production following rating downgrades. I would assume that firms do not want to report reductions in net income and that corporate executives rather show to the market that the firm is profitable. I further postulate that reductions in the last fourth quarter should be more pronounced for firms that face rating downgrades. I therefore follow previous literature and proxy increased downgrade risk being close to a silent threshold (Begley, 2015) or being exposed to the sovereign ceiling rule (Almeida et al., 2017).

Finally, I empirically examine the discipline channel, as suggested by Boot et al. (2006). Specifically, I analyze the stock price response around rating downgrades conditional on abnormal investment activity. The discipline channel predicts that stock market reaction is more muted when firms reported larger abnormal investment activity. According to this theory, rating downgrades and the consequent rise in borrowing costs should incentivize managers to make more efficient investment decisions, which would be viewed positively by investors.

3 Data and Descriptive Statistics

3.1 Sources and Sample Construction

The data collection process initiates by incorporating all firms from Compustat that provide quarterly data on capital expenditures. Quarterly capital expenditure data is globally available from 1988, which I chose as the start of the investigation period. I exclude observations with negative values and missing observations for annual data. In the next step, I add historical credit rating data from S&P. To match firms, I first index on the S&P Capital IQ platform all firms that have or had an S&P long-term issuer rating at some point in time which results in more than 5,000 international firms. I require that a

firm had at least in one year a credit rating from S&P during the observation period. The historical rating data is then directly obtained from the S&P website, with the focus on the firm's historical long-term issuer rating. Note that there are not many issuer ratings available prior to mid-1980, supporting the decision not to start the investigation period earlier. After merging both data sets, my sample comprises 193,205 quarterly-firm years between 1988 and 2022. Figure 1 shows the average capital expenditures per quarter over the investigation period. For most years, the capital expenditures in the fourth quarter exceed their annual average by 10%-20% which is in line with current literature (e.g., Altieri and Schnitzler, 2023; Xu and Zwick, 2022).[5] I observe that fourth quarter spikes exists in every year of the sample period, while the spikes are most pronounced around 2005, 2011, and towards the end of my investigation period. In absolute terms, the average quarterly expenditure for the first three quarters in the sample is $155.2 million (median $26.3 million), while the fourth quarter capital expenditure is on average $188.8 million ($32.0 million).

[Insert Figure 1 around here]

To measure a firm's abnormal investment behavior, I follow Shin and Kim (2002), Xu and Zwick (2022), Kinney and Trezevant (1993), and Altieri and Schnitzler (2023), and define it as the investment spike in the fourth quarter relative to the average investment in the first three quarters:

$$Qspike_{i,t} = \frac{capex_{i,t;Q4}}{\mu(capex_{i,t;Q1-Q3})} \tag{1}$$

where $capex_{i,t;Q4}$ is the capital expenditure in the fourth quarter of firm i in fiscal year t, and $\mu(capex_{i,t;Q1-Q3})$ is the average capital expenditure of the first three quarters of firm i in fiscal year t. I assign a cap using the 99th percentile value to ensure that the results are

[5]Note that Oyer (1998) shows also sales spikes in the fourth quarter due to seasonal sales patterns but also year-end incentive contracts to increase sales. I control for sales and cashflows as in Xu and Zwick (2022) and find that fourth quarter spikes are not driven by sales or cashflows.

not driven by large outliers. My final sample after matching with annual accounting data includes 36,794 firm-year observations and covers 3,181 unique firm identifiers.

3.2 Descriptive Statistics

The descriptive statistics of my variables are reported in Table 1 and the definitions of the variables are provided in Table A-1 in the appendix. The investment spike in the last quarter exceeds the average investments of the first three quarters by approximately 40% (median 24.6%), which is in line with the numbers presented in Xu and Zwick (2022). The average rating in my sample is between "BBB-" and "BB+", and I observe in 9.3% and 6.8% of the firm-years a rating downgrade and upgrade, respectively.[6] I transform credit ratings into a cardinal scale, starting with 1 for "AAA" and ending with 21 for "D".[7] In addition, for the stock price regression, which I discuss in Section 6, I obtain US stock market data from the Center for Research in Security Prices (CRSP) and compute abnormal stock returns around rating downgrades. In line with literature, I find that rating downgrades are considered generally negative with highly significant average returns of -1.94% in the $[-1, +1]$ event window surrounding the downgrade announcement. To control for other potential factors that may affect changes in abnormal investment behavior, I add several firm control variables obtained from related literature (e.g., Begley, 2015; Bannier et al., 2012; Bongaerts and Schlingemann, 2024). My control variables cover certain firm aspects, such as size, capital structure, market-to-book ratio, but also the firm's profitability, cash holdings, tangibility, and age. All my control variables are in line with the findings of prior literature.

[Insert Table 1 around here]

[6] The average rating and also the distribution of downgrades and upgrades (provided in Figure OA-1) are in line with current literature (see e.g., Becker and Ivashina, 2015; Bongaerts and Schlingemann, 2024; Kempf and Tsoutsoura, 2021). The average number of firms rated is 1,158 (median 1,209) per year and is comparable to Bedendo and Siming (2018) when matching samples and focusing on US firms only.

[7] Table OA-1 provides the translation of credit rating letters to the numerical scale and is as in Fracassi et al. (2016) and Kempf and Tsoutsoura (2021).

Panel A of Figure 2 illustrates the changes in the average capital expenditures in the five years around rating downgrades. The blue bars indicate the average quarterly capital expenditures of all four quarters, while the red bar is the average capital expenditure of the fourth quarter alone. As noted before, the capital expenditure in the fourth quarter is higher than the first three quarters. While there is already a slight reduction of 3% and 4%, respectively, in the year of the rating downgrade, I observe a sharp reduction in the average capital expenditure of 11% in the year following the downgrade. This reduction is largely driven by the fourth quarter in which the capital expenditures is reduced by 17%. I also find that the investments in the fourth quarter are reduced two years following the rating downgrade, with a reduction of 9%. The average investment is only marginally reduced with an average reduction of 4%. As average values might be driven by large firms, I also illustrate the median values around rating downgrades. Panel B of Figure 2 provides a similar pattern as median capital expenditures are significantly reduced following rating downgrades. The largest reduction can be found in the year following the rating downgrade but also the reduction two years following the rating downgrade.

[Insert Figure 2 around here]

The illustrations of average and median capital expenditures around rating downgrades provide initial evidence that rating downgrades may indeed have an impact on abnormal investment behavior as capital expenditures are more reduced in the fourth quarter than the average or median.

4 The Effect of Rating Changes on Corporate Investments

4.1 The Impact of Rating Changes on Abnormal Investments

I begin examining the impact of rating downgrades and upgrades on abnormal investments. I therefore consider the following base model:

$$Qspike_{i,t} = \alpha_0 + \beta_0 Ratingchange_{i,t-1} + \beta_1 X_{i,t-1} + \eta_i + \vartheta_t + \epsilon_{i,t} \tag{2}$$

where $Qspike_{i,t}$ is the abnormal investment behavior in the fourth quarter in year t of firm i, $Ratingchange_{i,t-1}$ is dummy variable equal to 1 if a rating downgrade, respectively upgrade, occurred in the year $t-1$ and is otherwise zero, $X_{i,t-1}$ is a vector of control variables, η_i is a firm fixed effect, ϑ_t is a year fixed effect and $\epsilon_{i,t}$ is a random error term. I add year fixed effects to control for general market conditions.[8] Standard errors are clustered at the firm level.

The main results for abnormal investments are reported in Table 2. The first two columns only include firm and year fixed effects, while the following models also include firm control variables. In line with my assumption, I find that rating downgrades have a significant negative impact on abnormal investments. The results further show that rating upgrades have a positive impact on abnormal investments. However, while the results for downgrades remain statistically significant when adding firm controls, the results for rating upgrades become insignificant. The relevance of rating downgrades on abnormal investments not only demonstrates a statistical impact but also holds substantive economic implications. From the last specification of Table 2, the full model, I find that firms reduce their abnormal investments by -0.060 if their credit rating was downgraded in the preceding year. Relative to the median abnormal investment of 24.6%, this estimate translates into a relative change in abnormal investments of about -24.4%.

[8] I also use industry fixed effects and industry $\times$ year fixed effects to control the robustness of the results. The alternative specifications support the main findings and are available upon request.

Summarizing, the results provide evidence for a discipline channel of credit ratings but also support that financial constraints from rating downgrades force firms to allocate the internal capital in a more efficient way. My results indicate that one way to better allocate the capital is to reduce abnormal investments at the end of the last quarter. The second advantage of avoiding excessive capital expenditure in the fourth quarter is the positive effect on net income, showing the firm's profitability.

[Insert Table 2 around here]

Besides the rating change itself, I observe that several firm control variables have an impact on the firm's abnormal investment behavior. First, I observe that the rating level has a significant impact at the 10% level.[9] The positive coefficient indicates that firms with better ratings have lower abnormal investment spikes. This is in line with the managerial discipline channel and the monitoring effect as proposed by Boot et al. (2006). Focusing on the firm control variables, I find that the investment-to-capital ratio has a significant impact on the abnormal investments, suggesting that larger relative capital expenditures also results in more pronounced abnormal investments.[10] Moreover, if the firm has high return on assets (ROA) and growth opportunities, measured as Tobin's Q, in the preceding year, I observe a significant increase in abnormal investments. This finding is again in line with the financial constraint hypothesis as firms are able to invest more due to the capital in the firm. On contrary, tangibility, proxied by property, plant, and equipment (PP&E) to total assets and the age of the firm are significantly lowering the abnormal investments by a firm.

[9]Note that this variable accounts for rating notches as first order differences in the firm fixed effect setting.

[10]In an additional test, I use the firm's logarithm of the annual capital expenditure. I do not find that the size of the capital expenditure is associated with abnormal investments. This also excludes potential concerns of mechanical effects.

4.2 The Impact of Rating Changes on Investment Rates

Next, I analyze the impact of credit rating changes on annual capital expenditures. I follow, among others, Bannier et al. (2012) and Kempf and Tsoutsoura (2021) and examine the investment rate, proxied as the ratio of capital expenditures to capital. The regression model and the set of control variables are the same as before. The results are provided in Table 3 and indicate that firms reduce their investment rates subsequently after rating downgrades. The impact of rating downgrades is statistical highly significant but also economical. The coefficient of -0.012 in the last specification translates to a 7.3% investment reduction relative to the median investment rate. I do not find an increase in the investment rate following rating upgrades. The initial statistical impact in specification (2) is fully absorbed when adding firm controls. For the control variables, I also find different determinants in the investment rate as previously for the abnormal investments. First, while rating level has an impact on abnormal investments, rating level now lacks significance. However, and in line with literature, I find that larger firms and more matured firms have lower investment rates as well as higher levered firms and firms with increased Debt/EBITDA ratios. As before, I observe a statistical negative impact for tangibility but a positive one for ROA and growth opportunities. The results of the control variables are all in line with prior literature.

[Insert Table 3 around here]

The results suggest that both abnormal investment rates and normal investment rates are significantly reduced after rating downgrades. However, I find that the reduction of abnormal investments is -24.4% and the reduction in the investment rate is 7.3% following downgrades. The results therefore indicate that large parts of the reduction in the investment rates are due to the reduction in abnormal investments.

To better distinguish between the firm's average, or "normal", capital expenditures which is unaffected by spikes in the fourth quarter and its abnormal investment behavior,

I examine the firms "normal" investment rate based on the average capital expenditures in the first three quarters. By excluding the potential noise from the last quarter, I focus on the period when managerial agency conflicts from budget expiration or tax-minimizing investments are low. For comparison reasons, I continue to report the normalized investments relative to the firm's capital, representing now the firm's capital expenditures unaffected by spikes relative to capital. The results are presented in Table 4.

[Insert Table 4 around here]

While the coefficient for downgrades is slightly larger (-0.0130), it now lacks significance. This supports my argument that firms do not change their normal investment behavior but reduce excess investments near the end of the fiscal year. In line with the previous results, I do not find that rating upgrades have an impact on capital expenditures. Finally, I observe that most of the control variables lack significance or are only weak significant, suggesting that firms keep their normal investment rates rather constant. Instead they reduce their spikes in the last fiscal quarter. Overall, the results support my previous observations that the changes in the firm's total investment rate is mainly driven by the fourth quarter, while the investment rates in the first three quarters are not significantly reduced following rating decisions.

4.3 Dynamic Effects between Rating Changes and Investments

In the previous sections, I solely focused on the year subsequent to rating changes. In this section, I am examining the dynamic effects between credit rating downgrades and firm investments. I study the five years surrounding a rating downgrade and use dummy variables for each year surrounding the rating downgrade. I also add rating, firm and year fixed effects, leading to the following regression model:

$$Invest_{i,t} = \alpha_0 + \theta_i + \zeta_i + \eta_i + \vartheta_t + \epsilon_{i,t} \tag{3}$$

where $Invest_{i,t}$ is either the abnormal investment behavior, proxied as investment spike in the fourth quarter, or the investment rate in year t, θ is a vector of five dummy variables indicating each year around a rating change in the $[t-2; t+2]$ year window, ζ_i is a fixed effect for the rating level, η_i is a firm fixed effect, ϑ_t is a year fixed effect and $\epsilon_{i,t}$ is a random error term. I illustrate the results for the years around rating downgrades graphically in Figure 3.

[Insert Figure 3 around here]

In line with my previous results, I find a significant reduction in a firm's abnormal investments subsequent to a rating downgrade (Panel A). While the coefficient at the year of the rating downgrade ($t = 0$) lacks significance, I find a large reduction in the subsequent year. The coefficient is -0.117 and highly significant. The reduction in the abnormal investments also remains in the second year following the rating downgrade. The coefficient of -0.075 is again highly significant and indicates a reduction in abnormal investments. I do not observe any pre-trends in the data as the years $t-2$ and $t-1$ both lack significance. Panel B of Figure 3 shows the dynamic effects of rating downgrades on investment rates. The coefficient estimates are lower compared to abnormal investments. I again find no pre-trends but also no significant reduction in the investment rate at the year of the rating downgrade. I however find that the coefficients of both years subsequent to the rating downgrade are significantly reduced at around 2%, which supports the assumption that investments are generally cut after rating downgrades.

Summarizing, I find a strong impact of rating downgrades on the abnormal investments of a firm. While I find that firms generally reduce their investment rate, the sharpest declines can be found for the abnormal investment spending near the end of the fiscal year. I observe no pre-trends in the data, which further indicates that shifts in the abnormal investment behavior are a result of the disciplining effect of the credit rating (Boot et al., 2006).

5 Rating Downgrade and Moderating Effects on Abnormal Investments

This section explores how different moderating factors influence the magnitude of abnormal investment behavior following downgrades. I first examine whether financially constrained firms show more pronounced effects. I then explore whether the results can rather be explained by "use it or lose it" budget policies or tax strategies.

5.1 Financially Constrained Firms and Abnormal Investments

I start to examine whether the results are more pronounced for financially constrained firms following the predictions of, among others, Almeida and Campello (2007), Campello et al. (2010), and Whited (1992). These firms face limitations on their access to funds, which then can impact their ability to invest in projects. If such firms receive a rating downgrade, this financial constraint channel is even more pronounced, which then should lead to investment efficiency. I employ five measures that have previously been used to empirically test a firm's financial constraints. Besides the rating itself, I calculate the firm's industry average credit rating level and use a dummy variable if the firm's credit rating is below the average. Moreover, I use the proxy suggested by Faulkender and Petersen (2012), which is a dummy variable if capital expenditures exceeds the firm's internal cashflow and the Kaplan and Zingales (1997) index. Finally, as the latter one might be sensitive to general market environments, I again compare it with the industry's average. To interpret the moderating impact of financial constraints, I use the interaction term of the respective financial constrain variable and the rating downgrade dummy.

Table 5 reports how financial constraint firms change their abnormal investment behavior following rating downgrades. All interaction terms are statistically significant and negative, indicating that when firms face financial constraints, the additional constraint from the rating downgrade leads to less abnormal investments. The results are in line with the financial constraint hypothesis, suggesting that firms face limitations in accessing

external financing, tend to make better investments and that these firms engage less in wasteful spending, as they cannot recover any potential losses.

[Insert Table 5 around here]

5.2 Budget Complexity or Tax Avoidance Strategies?

I find that firms reduce their fourth quarter investment activity following rating downgrades. The literature provides two different potential explanations for increased capital expenditures in the fourth quarter. First, Shin and Kim (2002) and Liebman and Mahoney (2017) explain the observed effects with "use it or lose it" budget policies based on internal capital budgeting theories, leading to moral hazard.[11] On the other hand, Xu and Zwick (2022) and Kinney and Trezevant (1993) interpret fourth quarter investment spikes as a result of tax-minimizing investments. I empirically test whether the effects of rating downgrades are more pronounced for firms facing budget complexity or for firms applying tax avoidance strategies.

To empirically investigate the relationship between rating downgrades, abnormal investments, and budget policies, I calculate three different proxies for budget complexity using historical Compustat segment data. Compustat reports several accounting data of a firm on segment level. I calculate the segment deviation based on capital expenditure, sales and employees, assuming that firms with more segments and more heterogeneity of the segments face more budget complexity. This variable controls for firm diversification but also for varying levels of diversification and complexity (Stein, 1997). In addition, I use the firm's number of operating segments following the definition of Hoberg and Phillips (2024). This variable does not control for the variation in capital expenditures between the operating segments, but assumes that budget complexity increases with firm diversification.

The results for budgeting complexity are reported in Table 6. I report results using

[11] Note that moral hazard follows the two-tiered agency model on internal capital markets developed by Scharfstein and Stein (2000) and empirically tested by Ozbas and Scharfstein (2010) and Graham et al. (2015).

firm fixed effects, but I also report results using industry fixed effects, as variations in budget complexity within the firm might be small but could be large within industries. The results show that all interaction term are significant and negative. This indicates that firms being diversified, having large variations in investments, sales or employees, but also more operating segments, experience investment efficiency following a rating downgrade. This further suggests that firms reallocate the budget more efficiently following rating downgrades, leading to better investment decisions.

[Insert Table 6 around here]

Next, I examine whether also tax optimisation strategies could moderate the previous findings on abnormal investments. I use common measures to proxy for tax avoidance. First, to compare results with Xu and Zwick (2022), I use a dummy variable if the taxable income before depreciation is positive (Zwick and Mahon, 2017). Second, following the majority of tax avoidance literature, I use effective tax rate (ETR) and cash ETR.[12] Third, I examine the logarithm of total tax loss carry forward and a dummy if the firm reported any tax loss carry forward in the respective year. As tax rates are subject to the firm's country of domicile, I consider for this test only US firms. I also do not lag tax data, i.e., I obtain tax information from the same fiscal year as the abnormal investments. In addition, regression includes firm and year fixed effects to exploit only the variation in a firm's tax position over time.[13]

The results on the relationship between rating downgrades, tax avoidance, and abnormal investments are reported in Table 7. While I find that having taxable income is generally positively associated with excess investments, supporting the findings of Xu and Zwick (2022), I find that the coefficient of the interaction term is negative, indicating a reduction

[12]See for example, Ayers et al. (2010); Bonsall IV et al. (2017); Flynn et al. (2024) who examine the relationship between tax avoidance and credit ratings. More generally, Hanlon and Heitzman (2010) show that effective tax rate based on income, GAAP ETR or cash payments, are the commonly used measures for tax avoidance.

[13]Note that my investigation period starts in 1988 and therefore begins after the introduction of the US Tax Reform Act of 1986 (TRA86), which has been used to test tax policy changes by Kinney and Trezevant (1993) and Xu and Zwick (2022).

of abnormal investments after rating downgrades is more pronounced for firms reporting taxable income. In addition, the results show that abnormal investments are larger when effective tax rate is lower at the same year, supporting the link between tax avoidance and fourth quarter investment spikes. However, the interaction term of effective tax rate and downgrade lacks significance, indicating that rating downgrades do not have an impact on tax avoidance strategies. The results for the other proxies of tax avoidance all lack significance, suggesting that these proxies have less impact on abnormal investments, but also that the impact of rating downgrades does not seem to alter the firm's tax avoidance behavior.

[Insert Table 7 around here]

Summarizing, the results indicate that rating downgrades have an impact on investment efficiency. First, I show that financial constraint firms reduce their fourth quarter investment spikes, leading to more efficient investments. Second, I observe that firms facing budgeting complexity are more engaged in reducing their abnormal investments. While I can show that firms with taxable income before depreciation are more affected in adjusting their abnormal investment and that the effective tax rate is negatively correlated with abnormal investments, I do not find supporting evidence that rating downgrades have an impact on firms' tax avoidance strategies.

6 Further Analyses and Robustness Checks

My results provide evidence that firms reduce their abnormal investments subsequently to rating downgrades. I conduct several analyses and robustness tests to verify my empirical results.

6.1 Potential Sample Selection Biases

I begin to examine whether my results are biased due to the sample selection. I use the largest possible data set and include all global firms with an available S&P issuer rating. This leads to the inclusion of banks and utilities. While some studies include such firms (e.g., Kempf and Tsoutsoura, 2021), other studies (e.g., Bongaerts and Schlingemann, 2024; Bedendo and Siming, 2018) exclude financial firms (Standard Industrial Classification (SIC) code 6000 to 6999) and regulated utilities (SIC code 4900 to 4999). The treated firms from Almeida et al. (2017) however are to a large extent utilities and the sample contains only four US firms. My firm-year observations include 7.3% from the banking industry and 10.8% from regulated industries, leading to roughly 18% of my total number of observations. Moreover, my data set captures not only US firms but also large international corporations. While most of my firms are from the US (83.1%), given the requirement of having capital expenditures information on a quarterly basis, my results might be potentially biased from the international sample. Whereas I have already initially accounted for firm fixed effects, which absorbs the firm's industry and country, I nonetheless control whether my results hold when eliminating certain firms from the sample. The results for abnormal investments excluding banks, utilities, and non-US firms are provided in Table 8.

[Insert Table 8 around here]

I first start by excluding banks and utilities from the sample. The significant coefficient of -0.062 for rating downgrades (when firm control variables are included) is similar to the previous finding of -0.060, indicating that banks and utilities are not driving my results. When I further restrict the sample to US firms, eliminating potential concerns of country effects, my results still hold with a significant coefficient of -0.056, which translates to a reduction of 23.2%, suggesting that abnormal investment behavior is significantly improved after rating downgrades. Note that the most stringent exclusion of firms reduce the firm-year observations by 28%, but the main results still hold.

6.2 Ex-ante Evidence from Salient Thresholds and Sovereign Downgrade Risk

Credit ratings play a significant role in the credit market, influencing firms to adjust their financial choices to prevent potential downgrades (Kisgen, 2006; Kisgen and Strahan, 2010). In this section, I use two different identification strategies and examine the ex-ante incentives of firms to avoid rating downgrades. I specifically target one group of firms: those near a salient Debt/EBITDA threshold. In a second robustness test, I examine the impact of the sovereign ceiling and the potential downgrade risks from sovereign downgrades.

One crucial factor that CRAs use to evaluate a company's creditworthiness is the firm's Debt/EBITDA ratio. CRAs offer recommendations regarding the usual range of Debt/EBITDA ratios (as noted by Begley, 2015). However, the specific thresholds, both minimum and maximum, for different Debt/EBITDA ranges are somewhat arbitrary (Chava et al., 2019) and often determined within intervals such as 2 and 2.5.[14]

I exploit the fact that a firm's Debt/EBITDA ratio is an important criterion for CRAs when they rate firms, expecting that a firm whose Debt/EBITDA ratio is close to a threshold will reduce its abnormal investment behavior to avoid being downgraded. Following Begley (2015) and Chava et al. (2019), I use as my identification the rating-based salient thresholds of Debt/EBITDA and classify firms according to their high (or low) incentives to change their ratios. Intuitively, a high-incentive zone (*High Incentive Zone*) is a small range of Debt/EBITDA ratios around, and containing, a rating-based salient threshold[15]. A low-incentive zone is a range of Debt/EBITDA ratios that do not contain any rating-based salient thresholds and do not overlap with any high-incentive zones. The identifying assumption is that these two sets of firms face different levels of incentives to improve their ratio while they remain similar on unobserved determinants of investment (Begley, 2015).

The results using the *High Incentive Zone* variable instead of actual rating changes are

[14]The thresholds used in Begley (2015) are 1.25, 1.5, 2, 2.5, 3, 4, and 5. S&P classifies the financial risk from minimal risk (lower than 1.5) to highly leveraged (above 5).

[15]I follow Begley (2015) and define high-incentive zones as (1.125, 1.35), (1.475, 1.70), (1.95, 2.20), (2.45, 2.70), (2.95, 3.40), and (3.90, 4.40).

provided in Table 9. I find that firms near a salient Debt/EBITDA threshold significantly reduce their abnormal investments. Focusing on corporates by excluding banks and utilities firms from the sample[16], I find that firms in high incentive zones reduce their abnormal investments by 2.9% compared to firms in low-incentives zones. I also exclude years in which a rating change occurred, eliminating concerns of overlapping events, and the results still hold. The findings suggest that firms aim to prevent rating downgrades or opt for rating upgrades and actively reduce their abnormal investment spikes in the fourth quarter when the firm is near a salient threshold. This identification strategy of the institutional feature of the rating process allows to alleviate concerns of unobservable determinants (Begley, 2015) and support the findings of a monitoring discipline role of CRAs which leads to a reduction of abnormal investments.

[Insert Table 9 around here]

In an additional test, I also examine the potential sovereign ceiling channel. The sovereign ceiling requires that firm ratings remain at or below the rating of the firm's country of domicile. Almeida et al. (2017) show that firms reduce their investments due to a rising cost following a sovereign downgrade. The caveat of this identification strategy is that not many firms have a credit rating above or equal to the sovereign rating which then is downgraded. I use the list of 73 firm-years which are impacted by a sovereign downgrade provided by Almeida et al. (2017). As I require S&P long-term issuer ratings and quarterly observations for capital expenditures, this sample is further reduced to 22 firm-year observations.[17] I then apply a propensity score matching using firms with the same four-digit SIC code and observations from the same year. The results indicate that the average treatment effects is -0.273, which is statistically and economically significant. While the results should be interpreted carefully due to the reduced sample size, they support the overall

[16] S&P has different ratings criteria and models for corporate, financial institutions, and infrastructure (which includes utilities). The Debt/EBITDA thresholds are obtained from the corporate rating methodology and our results including banks and utilities are therefore less reliable than focusing on corporates.

[17] I controlled the sample and most of the firms are excluded while quarterly capital expenditures were not available. In some rare cases, the firm was not found in Compustat.

findings that firms reduce their abnormal investments when they face rating downgrades.

6.3 Price Effects

Several studies examine the reaction of stock prices to credit rating downgrades and find significant negative abnormal returns following the announcement (e.g., Hand et al., 1992). Given the potential association between downgrades and investment efficiency, one would anticipate a less pronounced market reaction to downgrades in firms that have reported larger fourth-quarter investment spikes. If credit ratings serve as a disciplinary mechanism for firms, the stock market should perceive this as a positive signal, despite the typically negative perception of downgrade announcements. Therefore, I conduct an event study to analyze abnormal US stock returns surrounding the date of the rating downgrade announcement by S&P. I use a market-adjusted model and subtract the CRSP value-weighted market return from the realized return.[18]

Table 10 presents the cross-sectional results for the stock price reaction around rating downgrades. I find that abnormal investments have a positive effect on stock returns, suggesting market reaction is more muted when the firm has larger investment spikes. The results are significant at the 10% in most of the of the models, indicating that it might not be a main determinant when considering rating downgrades, but results generally support the assumption that downgrades have a discipline effect on firm investment. The results are furthermore consistent with the model of Boot et al. (2006), as I find that firms showing potential improvements in capital expenditures experience only a small stock price drop at the announcement of the rating downgrade.

[Insert Table 10 around here]

[18] Kempf and Tsoutsoura (2021) report average returns of −1.9% as well. Regression results do not change when market model or Fama-French three-factor model are used.

6.4 Alternative Mechanisms

The presented findings indicate that firms tend to have larger capital expenditures in the fourth quarter. Moreover, rating downgrades have a significant influence on this abnormal investment spending. This behavior aligns with reductions of wasteful year-end investments (Liebman and Mahoney, 2017) and the impact of CRAs as a monitoring function (Boot et al., 2006). In this section, I additionally test whether the results are robust and control for reversed causality, economic cyclicality, and calendar-year seasonality. I finally entropy balance all control variables.

6.4.1 Reversed Causality

I begin by controlling for reversed causality and test whether firms with larger abnormal investments are more likely to experience rating downgrades in the future. Differently to Debt/EBITDA ratios, there is no public information whether or how S&P is treating (abnormal) investment behavior in their rating decisions. In a first univariate analysis, I plot the fourth-quarter investment spikes across rating categories, as shown in Table OA-2. The overview does not indicate that investment spikes are particularly pronounced in one rating category, and firms with larger investment spikes at the end of the year are not necessarily more likely to be downgraded. Subsequently, I conduct several regression analyses to examine the impact of abnormal investments on future ratings and the likelihood of being upgraded or downgraded. Table OA-3 shows the predictability of abnormal investments on future rating downgrades (Panel A) and upgrades (Panel B), respectively, in the one-year horizon using a similar approach as in Agarwal et al. (2016).[19] I do not find that investment spikes have an impact on future rating decisions when using industry fixed effects (columns 4 to 6), supporting the distribution of the descriptive statistics. However, when employing firm fixed effects (columns 1 to 3), which measure the variation of a firm's

[19]Results are robust using a two-year horizon but omitted for reasons of brevity.

abnormal investment activity over time, I find that an increase in abnormal investment is associated with a higher likelihood of being downgraded in the following year. Conversely, I do not observe such predictive power for rating upgrades, consistent with my previous findings. The results also indicate that firms receiving rating changes in one year are less likely to receive a rating upgrade in the subsequent year.

6.4.2 Economic Cyclicality

Another mechanism that could lead to the observed effects is economic cyclicality. The simultaneous effects of abnormal investments and rating downgrades could be driven by general market trends. In a first test, I exclude years with large macroeconomic shocks that are potentially correlated with downgrade decisions, specifically I exclude the years 2000 and 2001 (due to the Dot-com bubble), 2007, 2008, and 2009 (due to the global financial crisis), as well as 2020 and 2021 (due to Covid-19). When these years are excluded, the results for downgrades remain consistent with the previous findings, and the coefficients fall within a comparable range (see Table OA-4).[20] In a similar vein, I control for several regulatory changes that may affect the impact and the relevance of credit ratings for firm investment policies, such as the SEC Regulation Fair Disclosure (Reg FD) in 2000 (Jorion et al., 2005) and the Dodd-Frank Act in 2010 (Dimitrov et al., 2015; Jankowitsch et al., 2023). Using binary variables for post-Reg FD and Dodd-Frank, respectively, and interacting it with the downgrade variable, I do not find that my results are driven by the regulatory environment for CRAs (see Table OA-5).

6.4.3 Calendar-year Seasonality

Calendar-year seasonality, as a consequence of differences in the calendar year and the firm's fiscal year, may also drive the results. While the majority of companies end their financial year on December 31, some firms have different fiscal year endings. Firms can choose their

[20]Note that even during crisis years the results remain robust, but are not reported due to brevity.

fiscal year according to their business needs and may prefer their fourth quarter to be the strongest quarter, ending the year on a high note – consistent with the tax-minimization strategy and boosting EBITDA at the end of the year. In my sample, most firms end the year in December (77.3%), and all other months are relatively equally distributed, with no other month exceeding 5% in frequency.[21] However, it might be that firms using a fiscal year different from the calendar year show different effects as budget planning (mostly calendar year) and financial reporting (fiscal year) diverge from each other. In this case, I would expect less impact of downgrade decisions than for firms aligning fiscal year and calendar year. As firms cannot change their fiscal year once chosen, this choice is captured in the firm fixed effects. I therefore exclude firms with a fiscal year ending differently than December. The results are provided in Table OA-6.

In line with expectations, I find that the results for rating decisions on abnormal investments are more pronounced than initially reported in the base case. The coefficient for downgrades is now -0.072 (significant at the 1% level), suggesting that the results are more pronounced for firms with aligned fiscal and calendar years. However, using the smaller sample of firms with a fiscal year end different than December reveals stark differences. When using their fiscal year, I do not find that downgrades have a significant impact on investment spikes (see Panel B). This finding aligns with the results reported on tax avoidance, indicating that rating downgrades do not appear to have a significant impact on tax strategies. As budget planning is mostly based on calendar years, I re-run the regression but based on calendar year. The results are now comparable to the main results and downgrades have an impact on the last quarter in the calendar year, which is in line with capital budgeting complexity rather than tax avoidance strategies.

[21] Xu and Zwick (2022) report 64% of US corporates end their fiscal year in December. Matching the samples, I find a comparable ratio of 69%.

6.4.4 Entropy Balancing and Sample Matching

To further minimize the concerns that other determinants might explain the observed treatment effects, I entropy balance all control variables, such that the means and variances of the control group equal those of the treatment group. The treated group includes all downgraded (upgraded) firm-year observations and the control group contain firm-year observations without rating changes. Table OA-7 provides information on the balancing and shows the differences in the treatment and control group before and after balancing for downgrades and upgrades, respectively. I observe some considerably differences in the control variables between treatment and control group before balancing matching. The differences are most pronounced for the firm's profitability and capital structure. Firms receiving downgrades have generally higher debt levels and are less profitable than firms without rating changes. The results for the entropy-balanced sample on abnormal investments are provided in Table OA-8. I do not find that differences in the control variables caused the previous findings as the results after entropy balancing show significant reductions in abnormal investments after rating downgrades.

The results presented in this subsection alleviate concerns that differences in the treatment and control group explain the results. In an untabulated robustness test, I also use propensity score matching using a logit regression and match treated observations with no observations of changes. I estimate the average treatment effects on the treated and find a statistical coefficient of -0.088 (at the 1% level).[22]

7 Conclusion

There is ample evidence that credit ratings have a significant impact on firm decisions. In particular, firms appear to reduce their investments following downgrades or in anticipation

[22] In a further robustness check, I matched control and treatment observations using firms having the same two-digit SIC code industry and the same year. Even when adding the same rating level in the year prior to the rating change, the results are similar as the ones reported.

of a potential downgrade. I leverage more granular data and focus on abnormal fourth-quarter capital expenditures. Several studies have shown that capital expenditures are not evenly distributed throughout the fiscal year but tend to be concentrated in the last quarter. This phenomenon can be attributed to tax-minimizing investments or the need to spend remaining budgets that cannot be carried over into the next fiscal year.

My results reveal that the overall decrease in investments following downgrades previously observed in the literature can be largely attributed to a significant reduction in firms' fourth-quarter capital expenditures. I find that firms exhibit a 6.0% decrease in abnormal fourth-quarter investments following a rating downgrade, which amounts to a relative change of approximately -24.4% compared to the median abnormal investment rate of 24.6%.

In addition, I apply alternative identification strategies, such as silent thresholds of Debt/EBITDA ratios and the impact of the sovereign ceiling on investment behavior as proxies for potential downgrade risk and rule out other potential mechanisms, such as reversed causality or economic cyclicality. In addition, the stock price response around downgrade announcements is more muted for firms reporting larger investment spikes at the end of the fiscal year. These additional tests consistently support my main conclusion: firms facing rating downgrades significantly reduce abnormal investments, both economically and statistically.

This study lends support to the disciplining effects of CRAs and model predictions of wasteful year-end spending. While firms maintain their average investment rates in the first three quarters, I show that the decrease in investments is driven by end-of-the-year investment cuts. This finding supports the notion that credit ratings are crucial tools in financial markets mitigating managerial agency conflicts.

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Table 1: Descriptive statistics

This table provides the descriptive statistics for the sample of abnormal investment behavior. The sample covers 3,181 firms between 1988 to 2022. The average, median and standard deviation are reported, alongside the 25% and 75% percentiles. All continuous variables are winsorized at the 1% and 99% percentiles. The variable definitions are provided in Table A-1.

	Count	Mean	SD	p25	p50	p75
Qspike	36,794	1.401	0.910	0.936	1.246	1.637
CAR$[-1,+1]$	2,152	-1.941	9.681	-4.584	-0.816	2.111
Downgrade	36,794	0.093	0.291	0.000	0.000	0.000
Upgrade	36,794	0.068	0.252	0.000	0.000	0.000
Rating level	36,794	10.580	3.699	8.000	10.000	13.000
Investment/Capital	36,479	0.200	0.139	0.105	0.164	0.251
Firm size	36,661	8.169	1.717	6.951	8.063	9.295
Capital Structure	36,608	0.354	0.225	0.203	0.323	0.461
Market-to-Book	31,852	2.584	4.344	1.203	1.935	3.183
Debt/Ebitda	36,410	3.516	4.958	1.424	2.733	4.610
ROA	36,660	0.028	0.080	0.008	0.032	0.063
Growth opportunity	31,855	1.626	0.861	1.101	1.358	1.824
Cash holdings	35,596	0.063	0.076	0.011	0.035	0.088
Tangibility	36,497	0.383	0.263	0.152	0.343	0.603
Profitability	35,369	0.081	0.065	0.048	0.077	0.115
Rollover	36,630	0.044	0.073	0.003	0.019	0.053
Firm age	36,665	3.002	0.830	2.398	3.091	3.714

Table 2: Abnormal investment behavior after rating changes

This table reports the cross-sectional regression results on abnormal investment behaviour. Abnormal investment behavior is defined as investment spike in the fourth quarter of the fiscal year. The variable definitions are provided in Table A-1. Standard errors are clustered at the firm and given in parentheses. *,**,*** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Downgrade	-0.092***		-0.070***		-0.061***		-0.060***
	(0.016)		(0.017)		(0.018)		(0.018)
Upgrade		0.037**		0.036*		0.022	0.018
		(0.017)		(0.019)		(0.020)	(0.020)
Rating level					0.010**	0.012**	0.009*
					(0.005)	(0.005)	(0.005)
Investment/Capital			0.313***	0.311***	0.319***	0.318***	0.320***
			(0.104)	(0.104)	(0.104)	(0.105)	(0.105)
Firm size			-0.009	-0.010	0.000	0.001	-0.000
			(0.014)	(0.014)	(0.015)	(0.015)	(0.015)
Capital Structure			-0.071	-0.076	-0.084	-0.091	-0.084
			(0.055)	(0.054)	(0.055)	(0.055)	(0.055)
Market-to-Book			0.002*	0.002*	0.003**	0.003**	0.003**
			(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Debt/Ebitda			-0.001	-0.001	-0.001	-0.002	-0.001
			(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
ROA			0.636***	0.664***	0.653***	0.680***	0.651***
			(0.114)	(0.114)	(0.115)	(0.115)	(0.115)
Growth opportunity			0.038***	0.040***	0.041***	0.043***	0.040***
			(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Cash holdings			0.117	0.116	0.112	0.112	0.111
			(0.125)	(0.125)	(0.125)	(0.125)	(0.125)
Tangibility			-0.556***	-0.561***	-0.543***	-0.545***	-0.544***
			(0.093)	(0.093)	(0.094)	(0.094)	(0.094)
Profitability			-0.065	-0.070	-0.041	-0.040	-0.045
			(0.174)	(0.174)	(0.174)	(0.174)	(0.174)
Rollover			-0.221	-0.232*	-0.216	-0.225*	-0.216
			(0.136)	(0.135)	(0.136)	(0.136)	(0.136)
Firm age			-0.124***	-0.125***	-0.122***	-0.123***	-0.123***
			(0.034)	(0.034)	(0.034)	(0.034)	(0.034)
Observations	36,599	36,599	29,464	29,464	29,464	29,464	29,464
R^2	0.173	0.173	0.187	0.187	0.188	0.187	0.188
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 3: Investment rates after rating changes

This table reports the cross-sectional regression results on a firm's annual investment behaviour. Investment behavior is measured by investments to capital. The variable definitions are provided in Table A-1. Standard errors are clustered at the firm and given in parentheses. *,**,*** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Downgrade	-0.025***		-0.012***		-0.012***		-0.012***
	(0.002)		(0.002)		(0.002)		(0.002)
Upgrade		0.006***		0.000		-0.000	-0.001
		(0.002)		(0.002)		(0.002)	(0.002)
Rating level					-0.000	0.000	-0.000
					(0.001)	(0.001)	(0.001)
Firm size			-0.010***	-0.010***	-0.010***	-0.010***	-0.010***
			(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Capital Structure			-0.055***	-0.056***	-0.055***	-0.056***	-0.055***
			(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Market-to-Book			0.000	0.000	0.000	0.000	0.000
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Debt/Ebitda			-0.000**	-0.001**	-0.000**	-0.001***	-0.000**
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ROA			0.086***	0.091***	0.085***	0.092***	0.086***
			(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Growth opportunity			0.027***	0.027***	0.027***	0.028***	0.027***
			(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Cash holdings			-0.002	-0.001	-0.002	-0.001	-0.001
			(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
Tangibility			-0.221***	-0.222***	-0.221***	-0.222***	-0.221***
			(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Profitability			0.051**	0.051**	0.051**	0.052**	0.051**
			(0.023)	(0.023)	(0.023)	(0.023)	(0.023)
Rollover			-0.029	-0.031	-0.029	-0.030	-0.029
			(0.020)	(0.020)	(0.020)	(0.020)	(0.020)
Firm age			-0.032***	-0.032***	-0.032***	-0.032***	-0.032***
			(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Observations	36,289	36,289	29,464	29,464	29,464	29,464	29,464
R^2	0.622	0.622	0.643	0.643	0.644	0.644	0.644
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 4: Normalized investment rates and the impact of rating changes

This table reports the cross-sectional regression results on average investment rates excluding fourth quarter spikes. Average investment rates are measured using the average capital expenditure of the first three quarters to capital. The variable definitions are provided in Table A-1. Standard errors are clustered at the firm and given in parentheses. *,**,*** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Downgrade	-0.106*		-0.201**		-0.134		-0.130
	(0.063)		(0.089)		(0.098)		(0.097)
Upgrade		0.153***		0.177**		0.082	0.073
		(0.058)		(0.069)		(0.074)	(0.072)
Rating level					0.076***	0.078***	0.073***
					(0.021)	(0.020)	(0.022)
Firm size			-0.149	-0.150	-0.080	-0.079	-0.082
			(0.094)	(0.092)	(0.085)	(0.087)	(0.085)
Capital Structure			0.501	0.483	0.397	0.383	0.399
			(0.315)	(0.311)	(0.333)	(0.325)	(0.333)
Market-to-Book			0.004	0.004	0.005*	0.005*	0.005*
			(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Debt/Ebitda			0.012	0.012	0.011	0.011	0.011
			(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
ROA			-1.381**	-1.301**	-1.255**	-1.197**	-1.261**
			(0.617)	(0.594)	(0.634)	(0.605)	(0.635)
Growth opportunity			-0.213***	-0.210***	-0.193***	-0.189***	-0.194***
			(0.045)	(0.043)	(0.048)	(0.046)	(0.048)
Cash holdings			0.342	0.332	0.309	0.305	0.304
			(0.365)	(0.365)	(0.361)	(0.362)	(0.362)
Tangibility			1.730***	1.718***	1.824***	1.818***	1.821***
			(0.451)	(0.447)	(0.441)	(0.439)	(0.440)
Profitability			0.755	0.738	0.955	0.952	0.940
			(1.073)	(1.070)	(1.042)	(1.044)	(1.037)
Rollover			1.375*	1.344*	1.413*	1.393*	1.412*
			(0.756)	(0.748)	(0.755)	(0.746)	(0.754)
Firm age			-0.251	-0.257	-0.240	-0.243	-0.242
			(0.373)	(0.374)	(0.375)	(0.376)	(0.375)
Observations	34,503	34,503	28,215	28,215	28,215	28,215	28,215
R^2	0.283	0.283	0.279	0.279	0.279	0.279	0.279
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 5: The moderating impact of financial constraints on abnormal investment behavior

This table reports the cross-sectional regression results on the moderating effect of financial constraints on abnormal investment behavior. Abnormal investment behavior is defined as investment spike in the fourth quarter of the fiscal year. Financial constraint is proxied by the firms rating level prior to the rating downgrade, a dummy if the firm's rating is below the industrial average rating, a dummy if capital expenditures exceed internal cashflow following Faulkender and Petersen (2012), the Kaplan and Zingales (1997) index, and a dummy variable if the KZ-index is at least two times larger than the industrial average. The firm control variable definitions are provided in Table A-1. Standard errors are clustered at the firm and given in parentheses. *,**,*** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)
Downgrade × Rating level	-0.012***				
	(0.004)				
Downgrade × Below Average		-0.084**			
		(0.034)			
Downgrade × Faulkender-Petersen			-0.117**		
			(0.047)		
Downgrade × Kaplan-Zingales				-0.044**	
				(0.018)	
Downgrade × D(Kaplan-Zingales)					-0.074*
					(0.040)
Below Average		0.037			
		(0.026)			
Faulkender-Petersen			-0.065**		
			(0.033)		
Kaplan-Zingales				0.048***	
				(0.014)	
D(Kaplan-Zingales)					0.041**
					(0.020)
Downgrade	0.056	-0.030	-0.046**	-0.023	-0.009
	(0.044)	(0.022)	(0.019)	(0.023)	(0.033)
Rating level	0.011**	0.008	0.010**	0.005	0.006
	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)
Observations	29,496	29,496	29,496	24,413	24,413
R^2	0.188	0.188	0.188	0.193	0.193
Firm controls	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

Table 6: The moderating impact of budgeting complexity on abnormal investment behavior

This table reports the impact of the moderating effect of budgeting complexity on the firm's abnormal investment behavior. Abnormal investment behavior is defined as investment spike in the fourth quarter of the fiscal year. Budgeting complexity is proxied using the standard deviation of capital expenditures, sales, and employee across the firm's segments and the number of operating segments, following the definition of Hoberg and Phillips (2024) Firm control variables and definitions are provided in Table A-1. Standard errors are clustered at the firm and given in parentheses. *,**,*** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Downgrade × Segmental Investment Deviation	-0.231**				-0.307***			
	(0.115)				(0.112)			
Downgrade × Segmental Sales Deviation		-0.190**				-0.144*		
		(0.083)				(0.078)		
Downgrade × Segmental Employee Deviation			-0.059**				-0.031**	
			(0.024)				(0.015)	
Downgrade × Hoberg-Philips				-0.006**				-0.007***
				(0.003)				(0.003)
Segmental Investment Deviation	0.018***				0.013***			
	(0.005)				(0.004)			
Segmental Sales Deviation		-0.014				-0.070*		
		(0.048)				(0.040)		
Segmental Employee Deviation			-0.003				0.005	
			(0.012)				(0.009)	
Hoberg-Philips				-0.000				-0.001
				(0.002)				(0.001)
Downgrade	-0.067***	-0.036	-0.049*	-0.036	-0.079***	-0.058**	-0.078***	-0.037
	(0.019)	(0.026)	(0.030)	(0.032)	(0.018)	(0.024)	(0.027)	(0.031)
Observations	23,623	23,940	12,586	24,625	23,771	24,083	12,762	24,743
R^2	0.201	0.199	0.230	0.186	0.084	0.084	0.088	0.075
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	No	No	No	No
Industry FE	No	No	No	No	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 7: The moderating impact of tax avoidance on abnormal investment behavior

This table reports the impact of tax avoidance on the firm's abnormal investment behavior. Abnormal investment behavior is defined as investment spike in the fourth quarter of the fiscal year. Tax avoidance is proxied using a dummy variable, if the taxable income before depreciation is positive (following Zwick and Mahon, 2017), the effective tax rate (ETR), the cash effective tax rate, the natural logarithm of the firm's tax loss carry forward, and a dummy variable if the the tax loss carry forward is larger than zero. Proxies for tax avoidance are obtained from the same year as the abnormal investment (year following the rating downgrade). Firm control variables and definitions are provided in Table A-1. Standard errors are clustered at the firm and given in parentheses. *,**,*** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)
Downgrade × Zwick-Mahon	-0.160**				
	(0.065)				
Downgrade × Effective Tax Rate		0.066			
		(0.054)			
Downgrade × Cash ETR			0.048		
			(0.051)		
Downgrade × Tax Loss Carry Forward				-0.004	
				(0.006)	
Downgrade × D(Tax Loss Carry Forward)					-0.013
					(0.037)
Zwick-Mahon	0.130***				
	(0.031)				
Effective Tax Rate		-0.082***			
		(0.028)			
Cash ETR			-0.004		
			(0.029)		
Tax Loss Carry Forward				0.002	
				(0.004)	
D(Tax Loss Carry Forward)					-0.009
					(0.019)
Downgrade	-0.034	-0.076**	-0.069**	-0.049*	-0.052*
	(0.021)	(0.031)	(0.027)	(0.026)	(0.027)
Observations	23,502	23,582	23,582	25,388	25,388
R^2	0.196	0.193	0.193	0.195	0.195
Firm controls	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Exclude non-US	Yes	Yes	Yes	Yes	Yes

Table 8: Excluding specific industries and non-US firms and abnormal investment behavior

This table reports the impact of rating changes on the firm's abnormal investment behavior when certain firms are excluded. I exclude firms from the financial sector (Standard Industrial classification (SIC) codes 6000-6999) and regulated utilities (SIC codes 4900-4999) from the sample. I also exclude non-US firms. Firm control variables and definitions are provided in Table A-1. Standard errors are clustered at the firm and given in parentheses. *,**,*** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Downgrade	-0.111***	-0.070***	-0.062***	-0.108***	-0.066***	-0.056***
	(0.017)	(0.018)	(0.018)	(0.019)	(0.020)	(0.020)
Upgrade	0.032*	0.022	0.009	0.033*	0.020	0.006
	(0.019)	(0.020)	(0.021)	(0.019)	(0.021)	(0.022)
Investment/Capital		0.187*	0.193*		0.180	0.187
		(0.108)	(0.108)		(0.117)	(0.117)
Rating level			0.012**			0.013**
			(0.005)			(0.006)
Observations	29,031	25,594	25,594	24,081	21,231	21,231
R^2	0.180	0.193	0.193	0.182	0.193	0.194
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm controls	No	Yes	Yes	No	Yes	Yes
Exclude Banks & Utilities	Yes	Yes	Yes	Yes	Yes	Yes
Exclude non-US	No	No	No	Yes	Yes	Yes

Table 9: Proximity to salient thresholds and abnormal investment behavior

This table reports the impact of nearby rating changes, using salient thresholds as identification strategy, on the abnormal investment behavior. The indicator variable *High Incentive Zone* is equal to 1 if the firm-year observation is in a high-incentive zone, and 0 otherwise. Rating-based salient thresholds are defined as regions of Debt/EBITDA in which firms are incentivized to avoid being downgraded (see Begley, 2015). Firm control variables and definitions are provided in Table A-1. Standard errors are clustered at the firm and given in parentheses. *,**,*** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
High incentive zone	-0.031***	-0.028***	-0.035***	-0.027**	-0.029**	-0.038***
	(0.009)	(0.010)	(0.012)	(0.011)	(0.012)	(0.014)
Observations	36,599	29,477	24,626	25,603	21,237	17,446
R^2	0.173	0.186	0.199	0.192	0.193	0.205
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm controls	No	Yes	Yes	Yes	Yes	Yes
Exclude Rating events	No	No	Yes	No	No	Yes
Exclude Banks & Utilities	No	No	No	Yes	Yes	Yes
Exclude non-US	No	No	No	No	Yes	Yes

Table 10: Stock market reactions around downgrade announcements

This table reports the stock market reaction around the rating downgrade decision and the impact of abnormal investment spikes. The dependent variable is the cumulative abnormal return in the $[-1, +1]$ event window, calculated using the market adjusted model. Firm control variables and definitions are provided in Table A-1. Standard errors are clustered at the firm and given in parentheses. *,**,*** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)
Qspike	0.318*	0.456**	0.303*	0.445**	0.404*
	(0.167)	(0.179)	(0.172)	(0.197)	(0.220)
Observations	2,152	2,088	2,087	1,834	1,718
R^2	0.001	0.112	0.162	0.294	0.302
Controls	No	No	No	No	Yes
Firm FE	No	No	No	Yes	Yes
Year FE	No	No	Yes	Yes	Yes
Rating FE	No	No	Yes	No	No
Industry FE	No	Yes	Yes	No	No

Figure 1: Distribution of quarterly capital expenditures

This figures displays the firm's average capital expenditures during the time frame spanning from 1988 to 2022 for my sample of 193,205 quarterly-firm years. Quarterly expenses are normalized based on each firm's average capital expenditure within the corresponding year.

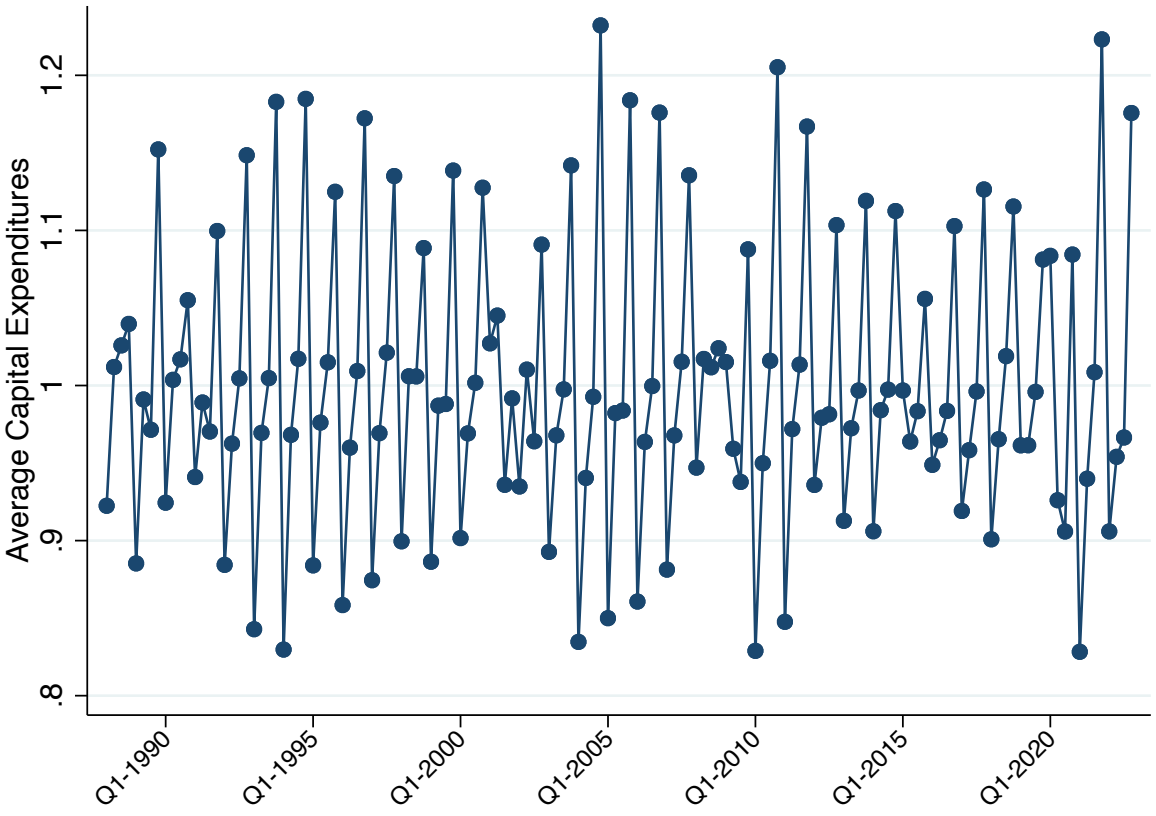
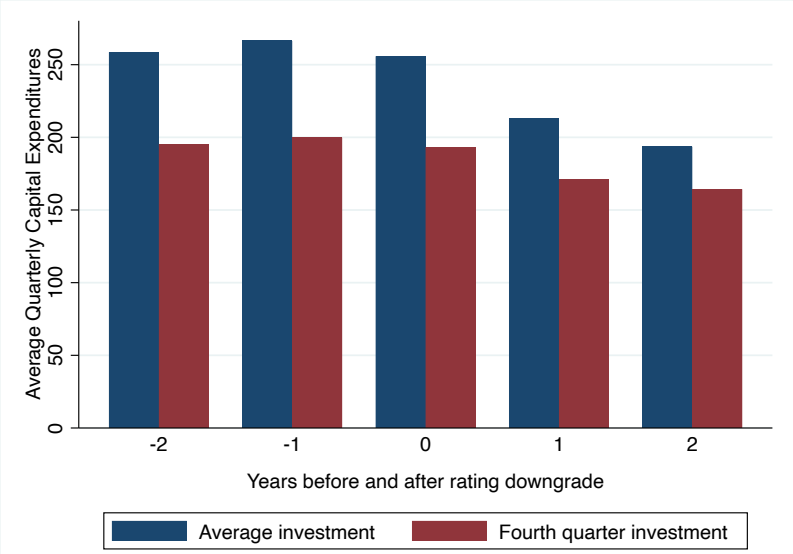


Figure 2: Capital expenditures around rating downgrades

This figures presents the capital expenditures of the fourth quarter and of all four quarters in the years around a rating downgrade. Panel A shows the average capital expenditure development over the period $[-2, +2]$, where the rating downgrade is in year $t = 0$. Panel B shows the median values.

Panel A: Average values



Panel B: Median values

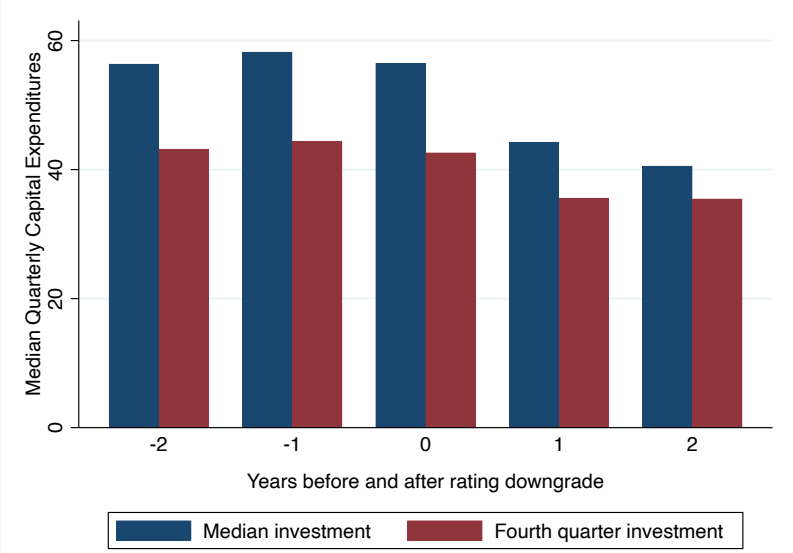
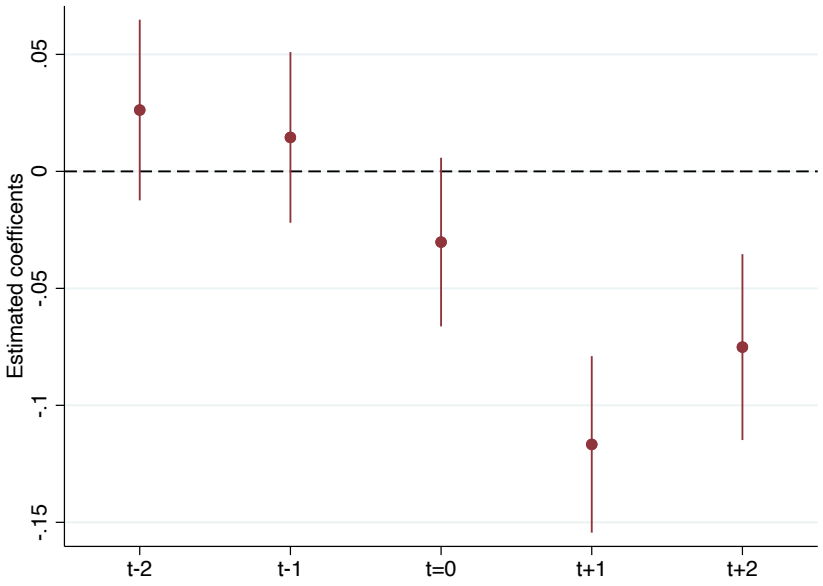


Figure 3: Coefficient estimates and the dynamic effect of rating downgrades

This figures presents the coefficient estimates over the five year period $[-2, +2]$, where the rating downgrade is in year $t = 0$. I use a regression and include rating, firm, and year fixed effects. Time indicates are relative to the year of the rating change. Standard errors are clustered at the firm level and 95% confidence intervals are displayed in the figure.

(a) Abnormal investments (qspikes)



(b) Investment rate

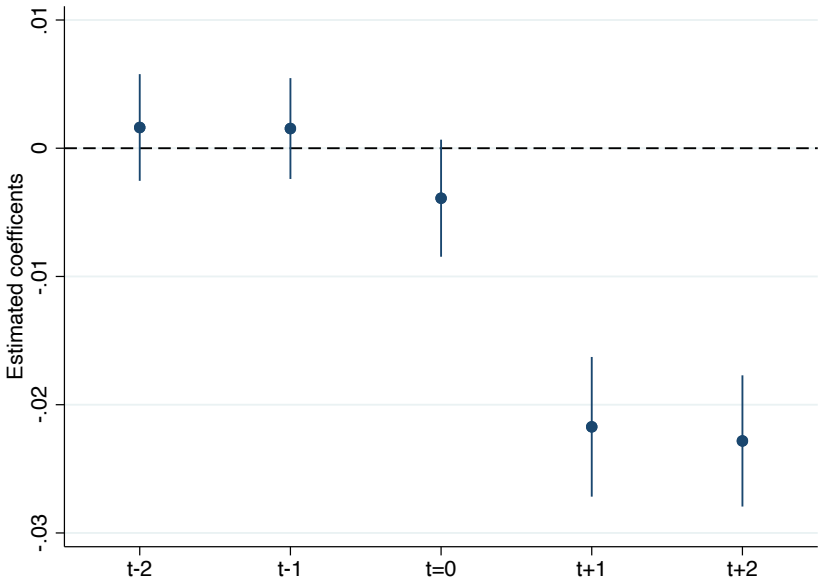


Table A-1: Variable definitions

Variable	Definitions	Source
Investment-related variables		
Qspike	Abnormal investment behavior as investment spikes in the fourth quarter defined as capital expenditures in the fourth quarter divided by the average capital expenditures of the first three quarters.	Compustat
Investment/capital	Capital expenditures divided by property, plant, and equipment (PP&E).	Compustat
Stock market variable		
CAR$[-1,+1]$	Cumulative abnormal return around rating downgrade announcements in the $[-1,+1]$ event window, calculated using the market adjusted model and substracting the CRSP value-weighted market return from the realized return.	CRSP
Rating-related variables		
Downgrade	Binary variable defined as 1 if the credit rating at the beginning of the year is higher than at the end of the year, 0 otherwise.	S&P website
Upgrade	Binary variable defined as 1 if the credit rating at the beginning of the year is lower than at the end of the year, 0 otherwise.	S&P website
Rating level	Standard & Poor's long-term issuer credit rating at the beginning of the year measured on a 21-step numerical scale (AAA=1, AA+=2,. . ., D=21) as shown in Table OA-1.	S&P website
High incentive zone	Binary variable defined as 1 if the firm-year observation is in a high-incentive zone, 0 otherwise. High-incentive zones are defined as rating-based salient thresholds as regions of Debt/EBITDA following the methodology of Begley (2015).	Compustat
Firm control variables		
Firm size	Logarithm of total assets of the firm.	Compustat
Capital structure	Leverage defined as total debt divided by total assets.	Compustat
Market-to-Book	Market to book ratio.	Compustat
Debt/EBITDA	Total debt divided by Earnings before interest, tax, depreciation and amortization (EBITDA).	Compustat
ROA	Operating income before depreciation divided by total assets.	Compustat
Growth opportunity	Tobin's Q.	Compustat
Cash holdings	Cash divided by total assets.	Compustat
Tangibility	PP&E divided by total assets.	Compustat
Profitability	Operating profit by total assets.	Compustat
Rollover	Short-term debt divided by total assets.	Compustat
Firm age	Logarithm of age of the firm in years.	Compustat
Financial constraint variables		
Below Rating	Binary variable defined as 1 if the credit rating at the beginning of the year is worse than the average three-digit SIC code industry in a given year, 0 otherwise.	S&P website

Table A-1 continued from previous page

Variable	Definitions	
Faulkender-Petersen	Binary variable defined as 1 if the firm's capital expenditures is larger than the firm's internal cashflow following the approach of Faulkender and Petersen (2012), 0 otherwise.	Compustat
Kaplan-Zingales	Financial constraint proxy as suggested by Kaplan and Zingales (1997) defined as using cash flow scaled by book equity, debt ratio, total distribution scaled by total assets and Tobins Q.	Compustat
D(Kaplan-Zingales)	Dummy variable defined as 1 if the firm's Kaplan-Zingales index is two times larger than the average of the SIC code industry in a given year, 0 otherwise.	Compustat
Budgeting complexity variables		
Segmental Investment Deviation	Standard deviation of capital expenditures across the firm's segments in a given year, adjusted relative to the firm's total sales.	Compustat Historical Segments
Segmental Sales Deviation	Standard deviation of sales across the firm's segments in a given year, adjusted relative to the firm's total sales.	Compustat Historical Segments
Segmental Employee Deviation	Standard deviation of employees employed across the firm's segments in a given year, adjusted relative to the firm's total sales.	Compustat Historical Segments
Hoberg-Philips	Number of operating segments based on textual analysis of 10-Ks (D2V-scope), following the definition of Hoberg and Phillips (2024).	Hoberg-Phillips Library
Tax avoidance variables		
Zwick-Mahon	Dummy variable defined as 1 if the firm's taxable income before depreciation is positive in the year +1, 0 otherwise (following Zwick and Mahon, 2017).	Compustat
Effective Tax Rate	GAAP effective tax rate calculated as income tax rate scaled by pre-tax income in the year following the rating downgrade.	Compustat
Cash ETR	Cash effective tax rate calculated as cash taxes paid scaled by pretax income in the year following the rating downgrade.	Compustat
Tax Loss Carry Forward	Natural logarithm of the firm' tax loss carry forward in the year following the rating downgrade.	Compustat
D(Tax Loss Carry Forward)	Binary variable if tax loss carry forward is larger than zero in the year following the rating downgrade, otherwise 0.	Compustat

Note: This tables provides the variables and the variable descriptions that are used across the paper. All continuous variables are winsorized at the 1% and 99% percentile, except effective tax rate and cash effective tax rate which are scaled between zero and one.

Online Appendix to "Credit ratings and abnormal investment behavior"

FLORIAN KIESEL

This appendix presents additional results to accompany the paper "Credit ratings and abnormal investment behavior".

Table OA-1: Credit rating system and letter rating conversion

The table shows the credit rating systems for Standard & Poor's ratings and the frequency of each credit rating at the beginning of the fiscal year. The rating scale is as in Fracassi et al. (2016).

Credit rating	Rating level	Freq.	Percent	Cum.
AAA	1	320	0.87	0.87
AA+	2	96	0.26	1.13
AA	3	486	1.32	2.45
AA-	4	769	2.09	4.54
A+	5	1,200	3.26	7.80
A	6	2,451	6.66	14.46
A-	7	2,481	6.74	21.21
BBB+	8	3,280	8.91	30.12
BBB	9	4,250	11.55	41.67
BBB-	10	3,252	8.84	50.51
BB+	11	2,348	6.38	56.89
BB	12	3,156	8.58	65.47
BB-	13	3,882	10.55	76.02
B+	14	3,618	9.83	85.85
B	15	2,407	6.54	92.40
B-	16	1,432	3.89	96.29
CCC+	17	650	1.77	98.05
CCC	18	183	0.50	98.55
CCC-	19	57	0.15	98.71
CC, C	20	95	0.26	98.96
D	21	381	1.04	100.00
Total		36,794	100.00	

Table OA-2: Distribution of year-end investment spikes across rating categories

This table shows the distribution of abnormal year-end investment spikes (qspikes) across different rating categories. Panel A summarizes the ratings into broader rating categories and Panel B provides the statistics on the individual rating level, respectively.

Credit rating	Rating level	Count	Mean	SD	p25	p50	p75
Panel A: Broad rating categories							
AAA	1	320	1.498	0.497	1.182	1.382	1.671
AA	2-4	1,351	1.437	0.690	1.051	1.310	1.603
A	5-7	6,132	1.418	0.594	1.032	1.298	1.639
BBB	8-10	10,782	1.394	0.648	0.988	1.267	1.616
BB	11-13	9,386	1.412	0.961	0.887	1.225	1.665
B	14-16	7,457	1.380	1.075	0.822	1.178	1.649
CCC	17-19	890	1.359	1.333	0.752	1.103	1.586
Below CCC-	20-21	476	1.341	1.064	0.728	1.156	1.697
Panel B: Detailed rating categories							
AAA	1	320	1.498	0.497	1.182	1.382	1.671
AA+	2	96	1.403	0.324	1.146	1.325	1.496
AA	3	486	1.431	0.576	1.091	1.314	1.589
AA-	4	769	1.445	0.809	1.002	1.303	1.635
A+	5	1,200	1.460	0.587	1.067	1.336	1.707
A	6	2,451	1.418	0.589	1.040	1.310	1.641
A-	7	2,481	1.399	0.603	1.012	1.270	1.599
BBB+	8	3,280	1.388	0.623	1.012	1.259	1.588
BBB	9	4,250	1.394	0.602	0.990	1.275	1.622
BBB-	10	3,252	1.399	0.734	0.962	1.266	1.639
BB+	11	2,348	1.430	0.931	0.929	1.244	1.659
BB	12	3,156	1.411	0.845	0.897	1.242	1.687
BB-	13	3,882	1.403	1.074	0.848	1.202	1.654
B+	14	3,618	1.388	1.081	0.823	1.189	1.663
B	15	2,407	1.396	1.106	0.837	1.185	1.655
B-	16	1,432	1.335	1.007	0.793	1.137	1.598
CCC+	17	650	1.331	1.174	0.762	1.115	1.558
CCC	18	183	1.404	1.750	0.729	1.040	1.600
CCC-	19	57	1.533	1.817	0.821	1.176	1.953
CC,C	20	95	1.279	1.501	0.605	1.046	1.651
D	21	381	1.357	0.958	0.788	1.174	1.723
Total		36,794	1.401	0.828	0.936	1.246	1.637

Table OA-3: Predictability of abnormal investments on future rating changes

This table reports the impact of abnormal investment behavior on changes in credit rating in the next fiscal year. Panel A provides the results on rating downgrades within the next fiscal year of the firm and Panel B provides the results on future rating upgrades, respectively. Abnormal investment behavior is defined as investment spike in the fourth quarter of the fiscal year. Firm control variables and definitions are provided in Table A-1. Standard errors are clustered at the firm and given in parentheses. *,**,*** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A: Impact on future rating downgrades						
	(1)	(2)	(3)	(4)	(5)	(6)
Qspike	0.005**	0.003*	0.005**	0.002	0.002	0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Downgrade		-0.025*			0.041***	
		(0.015)			(0.015)	
Qspike × Downgrade		0.013			0.010	
		(0.010)			(0.010)	
Upgrade			-0.004			0.007
			(0.016)			(0.015)
Qspike × Upgrade			-0.000			0.002
			(0.010)			(0.009)
Observations	29,026	28,932	28,932	29,169	29,073	29,073
R^2	0.178	0.176	0.176	0.105	0.105	0.103
Firm FE	Yes	Yes	Yes	No	No	No
Industry FE	No	No	No	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes
Panel B: Impact on future rating upgrades						
	(1)	(2)	(3)	(4)	(5)	(6)
Qspike	-0.000	-0.000	-0.001	0.001	0.001	-0.000
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Downgrade		-0.030***			-0.018**	
		(0.009)			(0.009)	
Qspike × Downgrade		-0.001			-0.001	
		(0.006)			(0.005)	
Upgrade			-0.039**			0.040**
			(0.018)			(0.017)
Qspike × Upgrade			0.015			0.011
			(0.011)			(0.011)
Observations	29,026	28,932	28,932	29,169	29,073	29,073
R^2	0.134	0.135	0.134	0.057	0.057	0.059
Firm FE	Yes	Yes	Yes	No	No	No
Industry FE	No	No	No	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes

Table OA-4: The impact of rating changes during normal times

This table reports the cross-sectional regression results on abnormal investments during normal market times. In this specification, the following years are excluded due to increased market turmoils: 2000, 2001 (due to the Dot-com bubble), 2007, 2008, 2009 (due to the global financial crisis), 2020 and 2021 (due to Covid-19). Abnormal investment behavior is defined as investment spike in the fourth quarter of the fiscal year. The variable definitions are provided in Table A-1. Standard errors are clustered at the firm and given in parentheses. *,**,*** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Downgrade	-0.073***	-0.067***			-0.069***	-0.063***
	(0.021)	(0.021)			(0.021)	(0.021)
Upgrade			0.052**	0.046**	0.044**	0.038*
			(0.021)	(0.021)	(0.021)	(0.021)
Observations	22,928	22,928	22,928	22,928	22,928	22,928
R^2	0.195	0.201	0.194	0.201	0.195	0.201
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	Yes	No	Yes	No	Yes

Table OA-5: The impact of the regulatory environment of rating agencies on the results

This table reports the impact of rating decisions on abnormal investment spikes conditional the regulatory environment. Panel A reports the impact of rating downgrades and Panel B the impact of rating upgrades, respectively. *Dodd-Frank* is a binary variable defined as 1 if the year is after 2010, and 0 otherwise. *Regulation FD* is a binary variable defined as 1 if the year is after 2001, and 0 otherwise. Abnormal investment behavior is defined as investment spike in the fourth quarter of the fiscal year. Firm control variables and definitions are provided in Table A-1. Standard errors are clustered at the firm and given in parentheses. *,**,*** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Downgrade	-0.075***	-0.086***	-0.073***	-0.081***	-0.073***	-0.117***
	(0.017)	(0.021)	(0.017)	(0.021)	(0.017)	(0.031)
Dodd-Frank Act	-0.033*	-0.037**			-0.051**	-0.057***
	(0.017)	(0.017)			(0.021)	(0.021)
Downgrade × Dodd-Frank		0.038				0.068*
		(0.034)				(0.041)
Regulation FD			-0.002	-0.004	-0.023	-0.028*
			(0.013)	(0.014)	(0.016)	(0.017)
Downgrade × Regulation FD				0.018		0.054
				(0.034)		(0.041)
Observations	29,477	29,477	29,477	29,477	29,477	29,477
R^2	0.180	0.180	0.180	0.180	0.180	0.180
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	No	No	No	No	No

Table OA-6: Calendar-year seasonality and abnormal investment behavior

This table reports the impact of rating decisions on abnormal investment behavior conditional on the firms last financial months. Panel A reports the results for firms whose fiscal year ends in December and Panel B reports the results for firms having year-ends from January to November. Panel C reports the regression results for firms having year-ends from January to November on calendar year. Abnormal investment behavior is defined as investment spike in the fourth quarter of the fiscal year. Firm control variables and definitions are provided in Table A-1. Standard errors are clustered at the firm and given in parentheses. *,**,*** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A: Firms having December as fiscal year end							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Downgrade	-0.095***		-0.080***		-0.074***		-0.072***
	(0.018)		(0.020)		(0.021)		(0.021)
Upgrade		0.043**		0.044**		0.033	0.027
		(0.019)		(0.023)		(0.024)	(0.024)
Investment/Capital			0.224*	0.221*	0.231*	0.229*	0.233*
			(0.126)	(0.126)	(0.126)	(0.126)	(0.126)
Rating level					0.008	0.009*	0.007
					(0.006)	(0.006)	(0.006)
Observations	28,264	28,264	22,201	22,201	22,201	22,201	22,201
R^2	0.170	0.170	0.183	0.182	0.183	0.182	0.183
Firm controls	No	No	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Panel B: Firms with non-December fiscal year-ends; fiscal years							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Downgrade	-0.083***		-0.024		-0.007		-0.008
	(0.031)		(0.033)		(0.034)		(0.034)
Upgrade		0.014		-0.000		-0.024	-0.024
		(0.035)		(0.034)		(0.036)	(0.036)
Investment/Capital			0.579***	0.580***	0.579***	0.579***	0.579***
			(0.176)	(0.176)	(0.176)	(0.176)	(0.176)
Rating level					0.019**	0.021**	0.021**
					(0.010)	(0.010)	(0.010)
Observations	8,334	8,334	7,263	7,263	7,263	7,263	7,263
R^2	0.186	0.186	0.210	0.210	0.211	0.211	0.211
Firm controls	No	No	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Panel C: Firms with non-December fiscal year-ends; calendar years							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Downgrade	-0.086***		-0.063**		-0.073**		-0.072**
	(0.032)		(0.030)		(0.031)		(0.031)
Upgrade		0.036		-0.005		0.008	0.001
		(0.032)		(0.034)		(0.033)	(0.034)
Investment/Capital			-0.900***	-0.906***	-0.897***	-0.904***	-0.897***
			(0.144)	(0.144)	(0.143)	(0.143)	(0.143)
Rating level					-0.015	-0.013	-0.016
					(0.010)	(0.010)	(0.010)
Observations	8,294	8,294	7,205	7,205	7,205	7,205	7,205
R^2	0.190	0.190	0.213	0.213	0.214	0.213	0.214
Firm controls	No	No	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table OA-7: Covariates before and after entropy balancing

This table presents the means, variances, and skewness of the covariates for the treated sample and the control group before and after entropy balancing matching. Panel A provides the matching results when the treatment is a downgrade, while Panel B reports the results when rating upgrade is the treatment. The control groups do not have any rating events in the corresponding year. The sample includes 2,640 treated observations for rating downgrades and 1,991 treated observations for rating upgrades, respectively. Variable definitions are provided in Table A-1.

Panel A: Treatment is downgrade

	Means			Variance			Skewness		
	Treated	Pre	Post	Treated	Pre	Post	Treated	Pre	Post
Investment/capital	0.1884	0.2079	0.1884	0.0148	0.0191	0.0158	1.7490	1.6960	1.8940
Rating level	10.2500	10.7200	10.2500	12.1500	13.2800	13.7700	-0.1202	-0.0065	0.0429
Firm size	8.4440	8.0450	8.4440	2.2850	2.9990	3.2710	0.4159	0.2624	0.2848
Capital structure	0.3989	0.3352	0.3989	0.0441	0.0444	0.0548	1.1480	1.0500	1.0870
Market-to-Book	2.1330	2.6310	2.1330	19.7600	18.8400	15.0100	1.7850	1.6090	2.1700
Debt/EBITDA	4.1630	3.1570	4.1630	40.2200	22.4000	36.4500	0.9472	1.6990	1.5000
ROA	-0.0078	0.0335	-0.0078	0.0109	0.0063	0.0136	-1.9830	-2.0420	-2.3730
Growth opportunity	1.3940	1.6560	1.3940	0.4036	0.7650	0.2661	3.0460	2.5880	2.4830
Cash holdings	0.0599	0.0692	0.0599	0.0046	0.0061	0.0047	2.2120	1.9850	2.1110
Tangibility	0.3749	0.3704	0.3749	0.0572	0.0649	0.0667	0.3966	0.4264	0.3521
Profitability	0.0667	0.0858	0.0667	0.0050	0.0044	0.0049	-0.9023	-0.4136	-1.1890
Rollover	0.0510	0.0393	0.0510	0.0064	0.0042	0.0071	3.2630	3.7470	3.3370
Age	3.1360	3.0040	3.1360	0.6076	0.6589	0.5914	-0.5330	-0.5006	-0.6135

Panel B: Treatment is upgrade

	Means			Variance			Skewness		
	Treated	Pre	Post	Treated	Pre	Post	Treated	Pre	Post
Investment/capital	0.1963	0.2079	0.1963	0.0165	0.0191	0.0170	1.5810	1.6960	1.6350
Rating level	12.1000	10.7200	12.0900	10.7000	13.2800	15.5600	0.1576	-0.0065	0.1706
Firm size	8.3410	8.0450	8.3410	2.0270	2.9990	2.9080	0.4201	0.2624	0.1989
Capital structure	0.3636	0.3352	0.3636	0.0474	0.0444	0.0568	1.2090	1.0500	1.0700
Market-to-Book	2.9780	2.6310	2.9780	27.1000	18.8400	31.5200	1.0090	1.6090	1.4630
Debt/EBITDA	3.2000	3.1570	3.2000	19.0300	22.4000	22.8200	1.9770	1.6990	0.9658
ROA	0.0403	0.0335	0.0403	0.0067	0.0063	0.0069	-1.9180	-2.0420	-1.1650
Growth opportunity	1.7800	1.6560	1.7800	0.7767	0.7650	1.1490	2.4120	2.5880	2.3710
Cash holdings	0.0779	0.0692	0.0779	0.0060	0.0061	0.0069	1.5980	1.9850	1.8330
Tangibility	0.3610	0.3704	0.3611	0.0605	0.0649	0.0615	0.4613	0.4264	0.4474
Profitability	0.0936	0.0858	0.0936	0.0043	0.0044	0.0052	-0.0240	-0.4136	0.1307
Rollover	0.0362	0.0393	0.0363	0.0041	0.0042	0.0036	4.0160	3.7470	3.9690
Age	3.0730	3.0040	3.0730	0.5598	0.6589	0.5704	-0.4098	-0.5006	-0.4470

Table OA-8: Entropy balancing matching results

This table reports the cross-sectional regression results on abnormal investment behavior after entropy-balancing matching. Abnormal investment behavior is defined as investment spike in the fourth quarter of the fiscal year. All control variables are first entropy-balanced, such that the means and the variances of the control group equal those of the treatment group. Information on the balancing is provided in Table OA-7. The variable definitions are provided in Table A-1. Standard errors are clustered at the firm and given in parentheses. *,**,*** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Downgrade	-0.073***	-0.062***	-0.064***	-0.056***				
	(0.019)	(0.019)	(0.018)	(0.020)				
Upgrade					0.014	0.015	0.016	0.013
					(0.019)	(0.020)	(0.020)	(0.022)
Investment/Capital			0.441**	0.451**			0.176	0.179
			(0.194)	(0.194)			(0.194)	(0.193)
Rating level				0.011				0.004
				(0.007)				(0.010)
Observations	27,424	27,424	27,424	27,424	26,656	26,656	26,656	26,656
R^2	0.279	0.289	0.290	0.291	0.284	0.290	0.290	0.290
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm controls	No	Yes	Yes	Yes	No	Yes	Yes	Yes

Figure OA-1: Total number of rated firms and average credit rating

This figure shows the total number of firm-year observation and the average S&P credit rating during the investigation period on an annual basis.