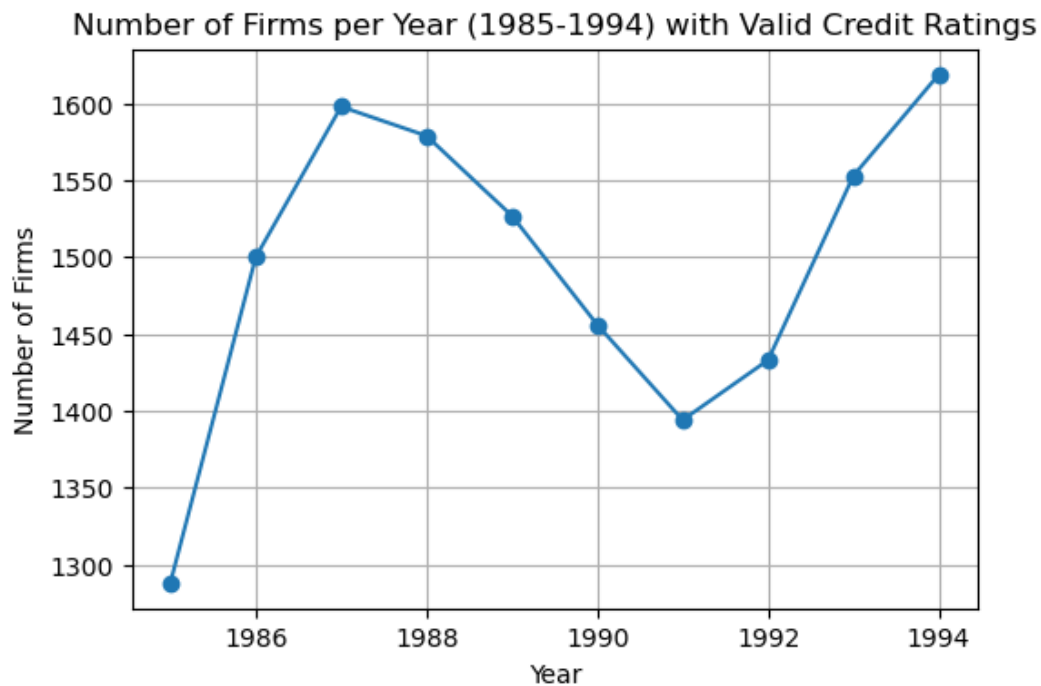


Corporate Finance (Difference in Difference)

November 11, 2024

1 Firm-year observations from 1985 to 1994

We begin our analysis by looking into the number of unique firms per year over the period before and after the credit market storm. This is done to check whether there are fluctuations in the number of data available during the years, especially surrounding the event in question. If the sample is uneven it might bias our estimates and lead to incorrect inferences about the impact of the event around 1989. As we can see below, the number of firms per year, filtered for years 1985 to 1994 with a valid credit rating, is rather stable, fluctuating from ~1400 to ~1600 with a low of ~1300 in 1985.



The average number of time series observations per firm is: 5.96

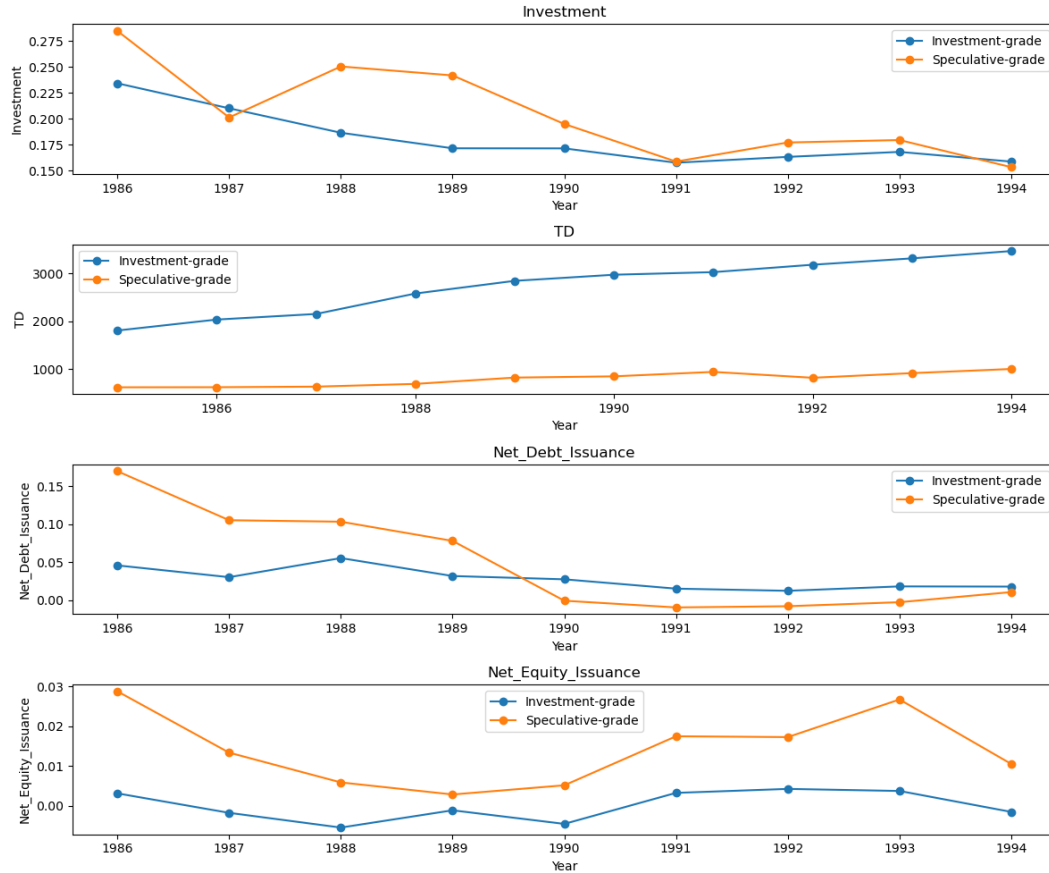
2 Summary statistics

In this part we will import data from Compustat using the gvkeys we previously filtered out and merge this dataset with the credit ratings one. Once this is done we generate the outcomes variables and control variables using Stata, then we winsorize all ratios at upper and lower one percentile. Here are the summary statistics:

Variable	Obs	Mean	Std. dev.	Min	Max
Investment	5,737	.1893482	.2021482	-.066197	1.319916
TD	10,020	2116.097	5182.592	1.95	39890.09
Net_Debt_I~e	8,988	.0328193	.1415515	-.2966025	.8415596
Net_Equity~e	7,817	.0048529	.0431597	-.1142468	.2586104
Book_Lever~e	10,020	.3421436	.2043526	.0078097	1.099179
Profitabil~y	9,802	.1225813	.069437	-.0651091	.3248675
Tangibility	9,850	.4472602	.2932132	.0049098	.9125285
Market_to_~k	6,847	1.127394	.5724228	.1543192	3.595381
Firm_Size	10,095	7.58595	1.633203	3.884261	11.50049

3 Defining treatment and control group

We define treatment and control groups as firms with speculative-grade rating (S&P below BBB-) and investment grade (BBB- and above). After that we can graph the outcome variables against time to see the trend and we have in fact some interesting results: - First we see that investments in speculative-grade rating have decreased substantially after 1989, even though it stays at a level similar to that of investment-grade after the decline - A steady increase in total debt for investment-grade firms, this is probably related to the switch in investments as seen above - A sharp decrease to basically 0 after 1989 in net debt issuance for speculative-grade firms - Not much change in net equity



4 Comparability and parallel trends

We will check here if the two groups are comparable and so we will check whether the parallel trends assumptions holds. This is important because if they differ significantly in the pre-event period, then that would suggest underlying trend differences that would make it difficult to attribute the changes after the event to the event itself. First we look at the summary statistics for pre-event period of the twop groups and what we see is that speculative-grade firms (the treatment group) generally have higher average values for Investment and Net Debt Issuance but lower values for Total Debt and Profitability than investment-grade firms (the control group). This suggests that the treatment group was more reliant on debt financing and riskier growth strategies compared to the control group. Then from the previous section we can look graphically at the trends before 1989 and we can state that the changes year-over-year look pretty regular, with the exception of 1987 where investments for speculative-grade firms dipped below the level of investment-grade firms, before going back up almost to previous levels already the year after.

```
. summarize Investment TD Net_Debt_Issuance Net_Equity_Issuance if Rating_Group
> == "Investment-grade"
```

Variable	Obs	Mean	Std. dev.	Min	Max
Investment	1,483	.1945466	.1810627	-.066197	1.319916
TD	3,298	2302.71	5324.685	1.95	39890.09
Net_Debt_I~e	2,687	.0407916	.1176815	-.2966025	.8415596
Net_Equity~e	2,254	-.001327	.0351762	-.1142468	.2586104

•

Variable	Obs	Mean	Std. dev.	Min	Max
Investment	652	.2425594	.3116025	-.066197	1.319916
TD	1,098	691.3846	1391.83	1.95	24761
Net_Debt_I~e	953	.1110088	.2683641	-.2966025	.8415596
Net_Equity~e	869	.011875	.0565378	-.1142468	.2586104

5 Difference in Difference

We run a Difference-in-Differences (DiD) regression to estimate the effect of being junk-rated on Net Debt Issuance, with the following equation:

$$NetDebtIssuance_{it} = \beta_0 + \beta_1 * junkrating_{it} + \beta_2 * post1989_t + \beta_3 * (junkrating_{it} * post1989_t) + \varepsilon_{it}$$

Where: - $\text{NetDebtIssuance}_{it}$ is the net debt issuance for firm i at time t . - junkrating_{it} is a binary variable that equals 1 if firm i is junk-rated at time t . - post1989_t is a binary variable that equals 1 if the year t is after 1989. - $\text{junkrating}_{it} * \text{post1989}_t$ is the interaction term to capture the combined effect of being junk-rated and after 1989. - β_1 , β_2 , and β_3 are the coefficients for junk rating, the post-1989 period, and their interaction, respectively. - ϵ_{it} is the error term.

Interpretation of Coefficients: - `_1 (junk_rating)`: The effect of being junk-rated on net debt issuance for firms before 1989. - `_2 (post_1989)`: The effect of the post-1989 period on net debt issuance for all firms. - `_3 (junk_rating * post_1989)`: The DiD coefficient, capturing the differential effect of being junk-rated after 1989 on net debt issuance. A negative value of 3 would indicate that junk-rated firms experienced a larger decrease in net debt issuance after 1989 compared to investment-grade firms.

Standard errors are clustered by firm (gvkey) to account for within-firm dependence.

```
. quietly {  
  
    reg Net_Debt_Issuance junk_rating post_1989 junk_post_interaction ///  
>      if year > 1984, cluster(gvkey)
```

Linear regression Number of obs = 8,988

```

F(3, 1013)      =      76.12
Prob > F        =      0.0000
R-squared       =      0.0500
Root MSE       =      .13799

```

(Std. err. adjusted for 1,014 clusters in gvkey)

		Robust				
Net_Debt_I~e	Coefficient	std. err.	t	P> t	[95% conf. interval]	
junk_rating	.0659111	.0090378	7.29	0.000	.0481761	.0836461
post_1989	-.0312917	.0029859	-10.48	0.000	-.0371511	-.0254324
junk_post_~n	-.0823819	.0102095	-8.07	0.000	-.102416	-.0623478
_cons	.0450976	.0027013	16.69	0.000	.0397968	.0503985

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Before 1989: Junk-rated firms had a higher level of net debt issuance compared to investment-grade firms, by about 0.0659. After 1989: There was a general decrease in net debt issuance for investment-grade firms by 0.0313, but the decline for junk-rated firms was more pronounced. Difference-in-Differences (DiD): The interaction term of -0.0824 shows that the net debt issuance of junk-rated firms decreased more sharply than that of investment-grade firms after 1989, indicating that junk-rated firms were more impacted by the changes in market conditions post-1989 (this is related to the credit crunch and subsequent regulation, forcing all saving and loans to eliminate speculative grade debts). The p-values for all coefficients are highly significant (0.000), meaning all the estimated effects are statistically robust.

There result is in line with what happened, because of the credit crunch and subsequent regulatory framework, it is normal that speculative grade firms suffered higher borrowing costs or difficulty accessing financing.

6 Focusing on firms close to the boundary

In this conclusion we will focus on firms close to the boundary, where the main difference from the two groups is largely just a labelling question, apart from that, other metrics should be fairly similar to each other. We will look at this comparability starting by some summary statistics

```
. summarize Investment TD Net_Debt_Issuance Net_Equity_Issuance if BBB == 1
```

Variable	Obs	Mean	Std. dev.	Min	Max
Investment	170	.2177114	.240605	-.066197	1.319916

TD		327	1874.026	3615.646	21.937	27546
Net_Debt_I~e		273	.0540634	.1684405	-.2966025	.8415596
Net_Equity~e		245	.0048873	.0458661	-.1142468	.2586104

```
. summarize Investment TD Net_Debt_Issuance Net_Equity_Issuance if BB == 1
```

Variable		Obs	Mean	Std. dev.	Min	Max
Investment		113	.2566156	.337687	-.066197	1.319916
TD		185	785.7526	2170.526	26.661	24761
Net_Debt_I~e		158	.0928465	.2313144	-.2966025	.8415596
Net_Equity~e		139	.0111546	.0548424	-.1142468	.2586104

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We can see some differences but they don't seem too large in absolute value, except for the total debt, which is almost double for BBB grade firms compared to BB.

Now we should look at the growth rates, but unfortunately, due to too many missing values, we end up with not enough values to compute a significant test, further study should manage these values to get enough observation and complete this test. We are still going to compute the Difference in Difference, but we have to keep in mind that the parallel trends assumption has not been verified at this stage, we compute so that the analysis can be easily replicated with a better management of the observations

```
. reg Net_Debt_Issuance BB post_event BB_post_interaction ///
> if year > 1984, cluster(gvkey)
```

Linear regression	Number of obs	=	8,988
	F(3, 1013)	=	54.48
	Prob > F	=	0.0000
	R-squared	=	0.0294
	Root MSE	=	.13948

(Std. err. adjusted for 1,014 clusters in gvkey)

			Robust			
Net_Debt_I~e		Coefficient	std. err.	t	P> t	[95% conf. interval]
BB		.0245523	.0221587	1.11	0.268	-.0189299 .0680345
post_event		-.0503418	.004019	-12.53	0.000	-.0582283 -.0424553
BB_post_in~n		-.0214923	.0243742	-0.88	0.378	-.069322 .0263374
_cons		.0660252	.0037363	17.67	0.000	.0586935 .0733569

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- BB has a coefficient of 0.0246, but it is not statistically significant (p-value = 0.268). This suggests that, on average, there is no significant difference in Net Debt Issuance between BB-rated firms and non-BB firms in the pre-event period.
- Post_event (the effect of the period after the event) has a coefficient of -0.0503, which is statistically significant (p-value = 0.000). This indicates that, on average, Net Debt Issuance decreases by about 5.03% in the post-event period compared to the pre-event period.
- BB_post_interaction (the interaction term between BB and post_event) has a coefficient of -0.0215, but it is not statistically significant (p-value = 0.378). This suggests that there is no significant differential effect of the event on BB-rated firms relative to other firms.

To conclude, we would expect a lower differential between the two groups than the one we found before. Since the two groups are fairly similar, the impact of the event should not be too strong, given that BBB firms, even though they are above the threshold, they still have a poor investment grade, so it can be assimilated to BB grade firms. This is different from looking at investment grade and speculative grade, since in that case we consider firms at the two extremities too, making the impact of the event more pronounced.

In this case we didn't find any significant different effect of the event on BB-rated firms relative to BBB-rated firms, but further analysis could find a significant differential, since BBB-rated firms, labelled as investment-grade, might still have more advantages accessing credit for example, but still the differential should be lower than that previously seen when comparing the two groups at large.