# Exorbitant Privilege? The Bond Market Subsidy of Prospective Fallen Angels*

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**Abstract**

We document that risky firms just above the investment-grade cutoff, which face the prospect of becoming "fallen angels" upon a downgrade, enjoy an exorbitant privilege in borrowing costs. In particular, these firms have benefited from investors subsidizing their bond financing costs since the Global Financial Crisis, especially during periods of monetary easing. We document two important consequences of the investor demand for bonds issued by prospective fallen angels. First, the subsidized firms grow disproportionately large and increase their market share by reducing the markup on their products. Second, the resulting spillover effects force their competitors to reduce employment, investment, markups, and sales growth. The pace of downgrades to fallen angels in the aftermath of the pandemic, rapid even when compared with the Global Financial Crisis, highlighted their vulnerability, as also evidenced in the Federal Reserve extending its backstop to bonds issued by these firms in April 2020.

JEL Codes: E31, E44, G21.

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# 1 Introduction

Risky firms just above the investment-grade cutoff face the prospect of becoming "fallen angels" upon a downgrade. Despite this risk, the BBB segment of the bond market has been the fastest growing investment-grade rating category since the Global Financial Crisis. Between 2008 and 2020, the amounts outstanding of BBB-rated bonds have more than tripled in size to $3.5 trillion, representing 55% of all investment-grade debt, up from 33% in 2008. This prominence of BBB bonds indicates that BBB has become the corporate rating bucket of choice. In many respects, the growth of risky investment-grade bonds has be a desired outcome of crisis related monetary policy easing. In particular, large scale asset purchases have aimed to push investors into riskier assets through the portfolio rebalancing channel (see Gagnon et al. (2011) for an early reference on Federal Reserve System thinking). However, the growing concentration of issuance in the riskiest investment-grade bucket also comes with a buildup of vulnerabilities in the corporate sector. Such vulnerabilities could well become important after a shock.

In this paper we examine the exorbitant privilege of prospective "fallen angels", i.e. firms on the cusp of the investment-grade cutoff, and the costs that such firms impose on the economy. We classify prospective fallen angels as BBB-rated firms that are vulnerable to downgrades, and show that BBB bond growth has largely been driven by such firms. Importantly our analysis shows that since the Global Financial Crisis, prospective fallen angels have benefited from investors subsidizing their bond financing, especially during periods of monetary easing. The subsidy appears to be driven by demand from high-duration-bond investors, consistent with a reach-for-yield motive. Such subsidies for prospective fallen angels are a bond-market phenomena, as a similar subsidy is not evident in measures based on equity market pricing.

We then document two important consequences of the investor demand for bonds issued by prospective fallen angels. First, subsidised firms grow disproportionately large and increase their market share by reducing the markup on their products. Second, the resulting spillover effects force their competitors to reduce employment, investment, markups, and sales growth. Thus, the prospective fallen angel subsidy exerts a negative externality on more prudent firms similar to the congestion effect created by zombie firms (Caballero et al. (2008)).

Our empirical analysis consists of five steps. First, we provide aggregate evidence of the developments in the U.S. debt market. We show that since 2009 corporate bond volume has steadily increased in dollar value to over 6 trillion USD today, which has largely been driven by the increasing share of BBB-rated firms. We furthermore introduce a measure of downgrade-vulnerability based on the Altman Z"-score. This allows us to determine whether a firm is prone to be downgraded, based on firm fundamentals taken from balance sheet and income statement information. Using this measure, we show that in 2018, the corporate bond volume of the prospective "fallen angels" amounted to 1.5 trillion USD, compared to the 0.5 trillion USD of non-downgrade vulnerable firms.

Second, we show the validity of our downgrade-vulnerability measure by documenting that vulnerable firms (i) look worse along various observable firm characteristics, such as leverage, net worth, and interest coverage ratio, (ii) exhibit lower employment growth, investment, sales, and asset growth once they become vulnerable, and (iii) are more likely to be downgraded or put on negative watchlist/outlook than non-vulnerable firms.

Third, using information on bond spreads in primary and secondary markets, we document that BBB-rated firms benefited more from a sharper decrease in their bond spreads than other investment-grade rated firms. The difference in the offering spread between BBB and A or AA-rated firms narrowed from 150 bps in 2009 to just about 50 bps in 2018. Conversely, the difference in offering spreads between other investment-grade categories, e.g., AA vs A barely changed.

This reduction in bond spreads in the BBB segment is primarily driven by downgrade-vulnerable BBB firms, who are able to obtain cheaper funding than their non-vulnerable counterparts (Figure 1). Crucially, this pattern is only present for BBB-rated firms and we do not find analogous evidence in other rating categories. Moreover, such underpricing is unique to corporate bond markets. When replacing the bond spread with an equity market based measure of expected default, we find that across all rating categories (including BBB-rated firms), vulnerable firms have higher expected default frequencies.

Fourth, using detailed data at the investor-security level, we show that the exorbitant privilege of prospective fallen angels is driven by investors demand for attractive yields within

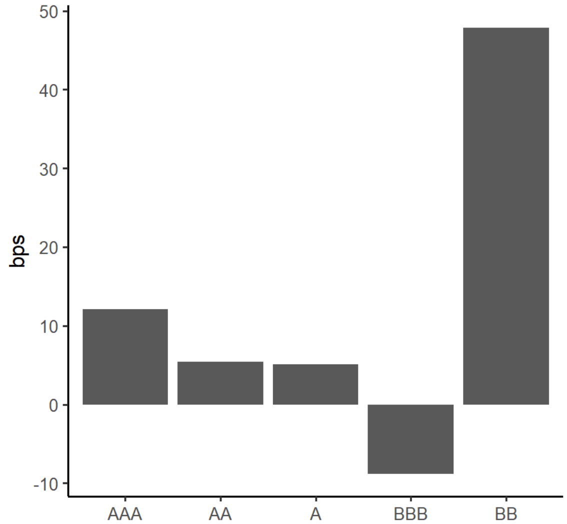


**Figure 1: Prospective Fallen Angel Subsidy.** This figure shows the difference between the median secondary market spread of firms defined as being vulnerable to a downgrade and the median spread of non-vulnerable firms in the same ratings category. We classify a firm as vulnerable if its estimated Z”-score is lower than the Altman Z”-score benchmark of the next lowest rating category.

the investment-grade space. We find that investors holding a longer duration portfolio as of 2009 increase their demand for bonds issued by vulnerable firms in the BBB-rating bucket compared with investors holding a lower duration portfolio as of 2009. This correlation, estimated within issuer, is only statistically significant for BBB-rated issuers and stronger during periods of monetary easing, when investors are pushed to generate more yields.

Fifth, we investigate the real effects of the increased investor demand for risky BBB bonds. In the aggregate, we find that BBB firms are able to significantly increase their market share. This gain in market share is largely driven by the downgrade-vulnerable firms in the BBB segment.

At the firm-level, we show that vulnerable firms in general have lower employment growth and investment levels than non-vulnerable firms. This effect holds across all rating categories. Thus, despite their cheaper funding relative to other firms, vulnerable BBB firms neither invest more, nor hire more employees than other (vulnerable) firms.

Importantly, however, we document that vulnerable BBB firms significantly increase their sales growth rate by charging lower markups on their products, likely contributing to their rapid increase in market share. This in turn negatively affects non-vulnerable firms competing with a larger share of vulnerable BBB firms in their industry. More precisely, non-vulnerable (investment-grade firms) operating in an industry with a larger share of vulnerable BBB firms have lower employment growth rates, lower investment levels, lower sales growth rates, and lower markups compared to non-vulnerable firms operating in an industry with a lower share of vulnerable BBB firms. This suggests that the relatively cheap funding of risky BBB firms indeed has negative spillover effects on higher quality competitors. Crucially, we do not find negative spillover effects when focusing on the overall share of downgrade vulnerable firms. This confirms once again the specialness of the BBB-rating segment.

Our analysis combines various data sources at the firm-, bond-, and investor-bond level. We use firm-level data from Compustat and WRDS Capital IQ, and ratings data from Thomson Reuters. Moreover, we our bond-level data consists of primary market pricing data from Mergent, and secondary market pricing data from TRACE. Finally, we use investor holding-level data from eMAXX Bond Holders. Our sample period covers the years 2009 to 2018.

Our findings are related to several strands of literature: the literature on investors' asset allocation and its interaction with credit ratings (Guerrieri and Kondor, 2012; Becker and Ivashina, 2015; Cornaggia and Cornaggia, 2013; Iannotta et al., 2019), the literature on the misallocation in financial markets (Midrigan and Xu, 2014; Whited and Zhao, forthcoming), the literature on zombie lending (Caballero et al., 2008; Banerjee and Hofmann, 2020; Acharya et al., 2020), the literature on monetary policy and asset prices (see, among others, Caballero and Simsek (2020)), and, finally the literature on the performance of investment-grade firms during the Covid-19 crisis (Haddad et al., 2020; Boyarchenko et al., 2021; Altman, 2020).

The remainder of the paper is structured as follows. Section 2 presents aggregate evidence in the U.S. bond market. Section 3 presents the data and the validation of our firm vulnerability measure. Section 4 documents that risky firms just above the investment-grade cutoff have benefited from a subsidy in their bond financing after the Global Financial Crisis. Section 5 shows that this subsidy originates from investors' demand. Section 6 shows the real consequences of this subsidy. Section 7 concludes.

# 2 Aggregate Evidence

In this section, we present some aggregate facts. In Section 2.1, we provide an overview of the main developments in the U.S. debt market following the Global Financial Crisis. In Section 2.2, we show that, during the same period, the investment-grade segment of the bond market has become considerably riskier, mainly through the increased prevalence of BBB-rated firms.

## 2.1 Developments in the U.S. Debt Market

Since the Global Financial Crisis, US private debt has been steadily increasing, accumulating to 51 trillion USD today. While the credit boom leading up to the Global Financial Crisis was mainly about household and financial sector debt, the current credit cycle seems to revolve around non-financial business debt. Compared to 2009, non-financial business debt has increased by roughly 65 per cent, accounting for a third of the private debt outstanding. This increase can be largely attributed to the rise in corporate credit, with corporations now carrying more debt to GDP (52%) than they did at their highest peak during the financial crisis (45%).[1]

Figure 2 Panel A shows the breakdown of the different corporate debt types. Although other debt categories have grown as well, the corporate bond market has been greatly surpassing them in dollar value. After a long period of low interest rates combined with large-scale asset purchase programs, the size of the US corporate bond market has reached 6 trillion USD, representing an increase of twice its size since the country's economic recession ended in 2009 Q2 (see Figure 2 Panel A). The biggest driver behind the surge is the lowest rated part of the investment-grade market, i.e. the BBB-rated segment. As of today, this segment represents roughly 52% of all investment-grade bonds, up from 33% at the start of 2009 (Altman, 2020). In Figure 2 Panel B comparable numbers are found when we split the corporate bond volume by rating category. Corporate bond volume by BBB-rated issuers has

[1]Based on data of the FRED. The figures on the private debt evolution, including its relationship to GDP, can be found in the online appendix.

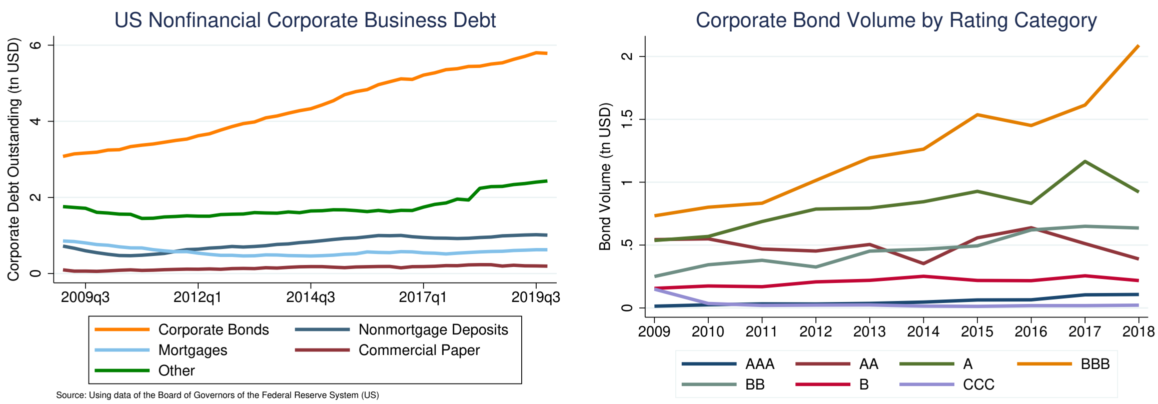


**Figure 2: US Non-Financial Corporate Debt.** This figure shows the development in non-financial corporate debt. Panel A shows the buildup of corporate debt using data of the FRED, based on the following categories: corporate bonds, mortgages, non-mortgage deposits (includes loans from banks, credit unions, and savings and loans associations), commercial paper and other (consists of loans from non-bank institutions (excl. mortgages) and industrial revenue bonds). Panel B zooms in on the corporate bond market using own estimates and depicts the evolution in corporate bond volume by issuer rating category.

increased by approximately 1.4 trillion USD from 2009-2018, mirroring an almost threefold increase.

## 2.2 Riskiness

In recent years, the financial press (e.g. Blackrock (2020) and S&P Global (2020)) as well as a study by the OECD (Çelik et al., 2020) have raised their concerns that there is a downward trend in terms of issuer quality in the BBB-rated segment. Consequently, a large number of BBB-rated issuers might face the risk of being downgraded to non-investment-grade status.

To get a better picture of the cross-section of the BBB-rated segment, we therefore divide the firms according their to downgrade vulnerability. We do so by using a measure of risk that is based on the Altman Z"-score[2] (Altman, 2020), which we validate in Section 3.2. We classify a firm as vulnerable if its estimated Z"-score is lower than the Altman Z"-score

[2] The Altman Z"-score is defined as:

$$Z" = 6.56 \times \frac{Current\ Assets - Current\ Liabilities}{Total\ Assets} + 3.26 \frac{Retained\ Earnings}{Total\ Assets} + 6.72 \frac{Earnings\ Before\ Interest\ and\ Taxes}{Total\ Assets} + 1.05 \frac{Book\ Value\ of\ Equity}{Total\ Liabilities}$$

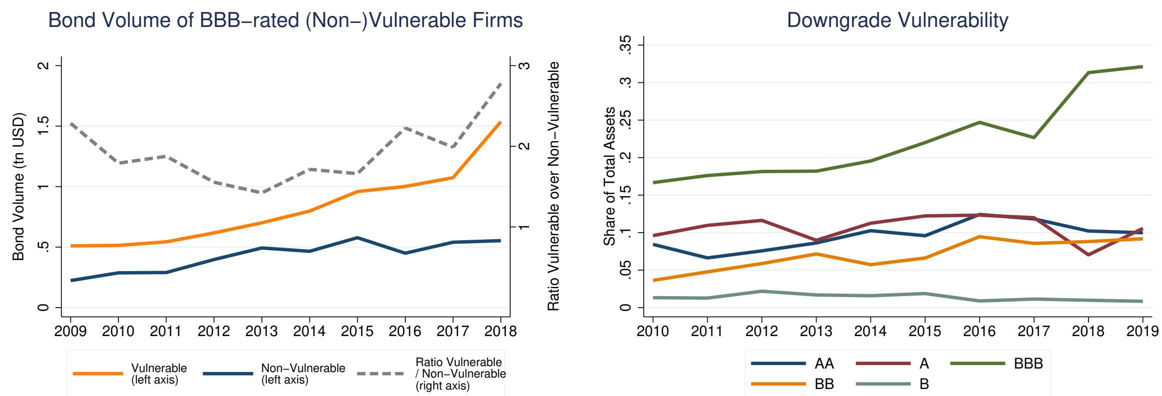


**Figure 3: Downgrade Vulnerability.** This figure demonstrates the evolution of downgrade vulnerability for the BBB-rated segment. The left panel shows the corporate bond volumes of vulnerable and non-vulnerable firms in trillion USD on the left-hand axis. On the right-hand axis, we include the ratio of the two types of corporate bond volumes. The right panel shows the downgrade vulnerability of the different rating categories as a share of total assets, allowing for a comparison across the whole spectrum.

benchmark of the next lowest rating category.[3,4]

Following this distinction, it is evident that the risky BBB-rated firms, or the so-called prospective "fallen angels", are driving the increase in the BBB-rated category. Since 2009, their bond volumes have tripled in size, amounting to 1.5 trillion USD in 2018. This in comparison to the non-vulnerable segment, which has increased from 0.2 to 0.5 trillion USD (see Figure 3 Panel A). Notably, the gap between the two types of firms starts to widen from 2013 onwards, which represents the start of a period of accomodative monetary policy.

The increasing vulnerability in the BBB-rated segment is also reflected in Panel B, where we plot the asset weighted share of downgrade-vulnerable firms in each rating category. We again document a strong increase in the share of BBB-rated firms that should be downgraded, strongly suggesting that the BBB-rated segment is comprised of riskier firms.

[3]We thank Ed Altman for providing us with the benchmark Z" scores for each rating category. The bond rating equivalents (BRE) are determined by calibrating the Z"-scores to median values of each of the S&P rating categories for various years over the last fifty or more years (Altman, 2020). For a discussion on Z"-models, we refer to Altman (2018) and Altman et al. (2019).

[4]For example, a BBB-rated firm is classified as vulnerable if its Z"-score is below the BB+ Z"-score.

# 3 Data and Empirical Work

In this section, we describe our data sources and provide a closer inspection of our vulnerability measure used to identify the prospective fallen angels, i.e., vulnerable firms just above the investment-grade cutoff.

## 3.1 Data

Our data set consists of firm-level, bond-level, and investor holding-level data from 2009 to 2018. The firm-level data includes debt capital structure data, balance sheet information, and rating information. The debt capital structure data is taken from WRDS Capital IQ, which provides extensive capital structure information for over 60,000 public and private companies globally. The balance sheet data is retrieved from Compustat North America, which provides annual report information of listed American and Canadian firms. Lastly, rating information is obtained from Thomson Reuters, which provides worldwide coverage on ratings from S&P, Moody's and Fitch. We follow Becker and Milbourn (2011) in transferring ratings into numerical values. Combining the various data sources, we analyze 5,864 firms in total.

Second, we use bond-level data to investigate the pricing in the U.S. bond market. For the primary market, we use data supplied by Mergent Fixed Income Securities Database (FISD), which is a fixed income database that includes issue details of publicly-offered U.S. bonds. We investigate 3,140 bond issues by 910 issuers. For the secondary market, we obtain data from TRACE, a database that constitutes of real-time secondary market information on transactions in the corporate bond market. This analysis is based on 7,700 outstanding bonds by 1,130 issuers, with bond $b$, firm $j$, year $t$ as unit of observation.

Third, we examine bond investor holding level data using eMAXX Bond Holders data from Thomson Reuters Eikon, a detailed data set that documents security-level holdings by individual investors at a quarterly frequency. We collapse holdings within an investor at the issuer level so that our unit of observation is holdings at quarter $t$ by investor $k$ of bonds issued by issuer $j$. Our data set includes 2,127,296 observations spanning 37 quarters from 2009Q4 to 2018Q4. There are 892 unique issuers and 569 unique investors, mostly investment

| | (1) Vulnerable | (2) Non-Vulnerable | (1)–(2) Difference |
|---|---|---|---|
| Total Assets | 24114 | 10988 | 13126*** |
| Leverage | 0.403 | 0.354 | 0.049*** |
| EBITDA/Assets | 0.104 | 0.132 | -0.028*** |
| Interest Coverage | 7.747 | 13.114 | -5.367*** |
| Sales Growth | 0.038 | 0.056 | -0.017*** |
| CAPX | 0.188 | 0.225 | -0.037*** |
| Emp Growth | 0.008 | 0.036 | -0.027*** |
| Net Worth | 0.183 | 0.248 | -0.066*** |

**Table 1: Descriptive Statistics.** This table present the descriptive statistics of the rated firms in our sample, separated into vulnerable and non-vulnerable firms. $Total\,Assets$ is the logarithm of total assets, $Leverage$ is total debt over total assets, $Interest\,Coverage$ is the ratio of EBITDA over interest expenses, $Sales\,Growth$ is the symmetric growth rate in sales, $CAPX$ is capex over PPE, $Emp\,Growth$ is the symmetric growth rate in employment, $Net\,Worth$ is the difference between common equity and cash divided by total assets.

managers (268) and insurance companies (210).

## 3.2 Validating the Vulnerability Measure

In this part, we show that vulnerable firms significantly differ form non-vulnerable firms in terms of balance sheet characteristics and their life cycle projections over time. Moreover, we show that our measure correlates well with alternative definitions of vulnerability, such as a firms' watch list and credit outlook status and its actual downgrade probability.

Table 1 presents the descriptive statistics for the rated firms in our sample, separated into firms that we classify as being vulnerable to being downgraded and firms not vulnerable to being downgraded. The sample averages highlight that vulnerable firms are weaker along all key dimensions. Vulnerable firms have on average a higher leverage ratio, lower profitability, lower net worth and a lower interest coverage (IC) ratio. Also their sales growth, employment growth and investment ratio are significantly lower, confirming that vulnerable firms are of lower quality.

Next, we follow the approach of Banerjee and Hofmann (2020) to investigate how vulnerable firms' (weak) performance evolves over time. We create a local linear projection specification, which represents a sequence of regression models in which the dependent variable is shifted several steps forward and backward in time, relative to a certain reference point. In our case this is the point in time at which a firm is classified as vulnerable for the first time, allowing us to track its development before and after. We thus estimate the following specification:

$$\begin{aligned} Y_{iht+q} &= \beta_q \times EnterVulnerable_{iht} + \gamma_q \times Vulnerable_{iht} \\ &+ \eta_q \times X_{iht+q} + \mu_{ht+q} + \epsilon_{iht+q}, \end{aligned} \tag{1}$$

where $i$ represents a firm, $h$ an industry, $t$ a year and $q$ is defined for $\{-3, -2, -1, 0, 1, 2, 3\}$. Our dependent variable $Y$ includes asset growth, employment growth, sales growth and capital expenditure over PPE in period $t+q$. $EnterVulnerable$ is a dummy variable equal to one if a firm becomes vulnerable for the first time in period $t$. $Vulnerable$ is a dummy variable equal to one if a firm is vulnerable in period $t$, but did not become vulnerable in period $t$ for the first time, i.e., has been classified as vulnerable before. This ensures we compare firms becoming vulnerable for the first time only to non-vulnerable firms. $X_{iht+q}$ controls for any size differences using the logarithm of total assets and $\mu_{ht+q}$ denotes industry-year fixed effects.

Our coefficient of interest $\beta_q$ measures a vulnerable firm's development in terms of sales growth, investments, asset growth and employment growth, over time, considering three years before and after the firm is classified as vulnerable. A positive (negative) coefficient implies that a vulnerable firm has a higher (lower) value of the respective dependent variable compared to a non-vulnerable firm.

The panels in Figure 4 show that a firm's performance deteriorates once it enters the vulnerability status. Not only does its sales growth decline, also its investments decrease significantly. This is also reflected in the drop in growth figures related to firm size and employment, which adds to the deteriorating picture.

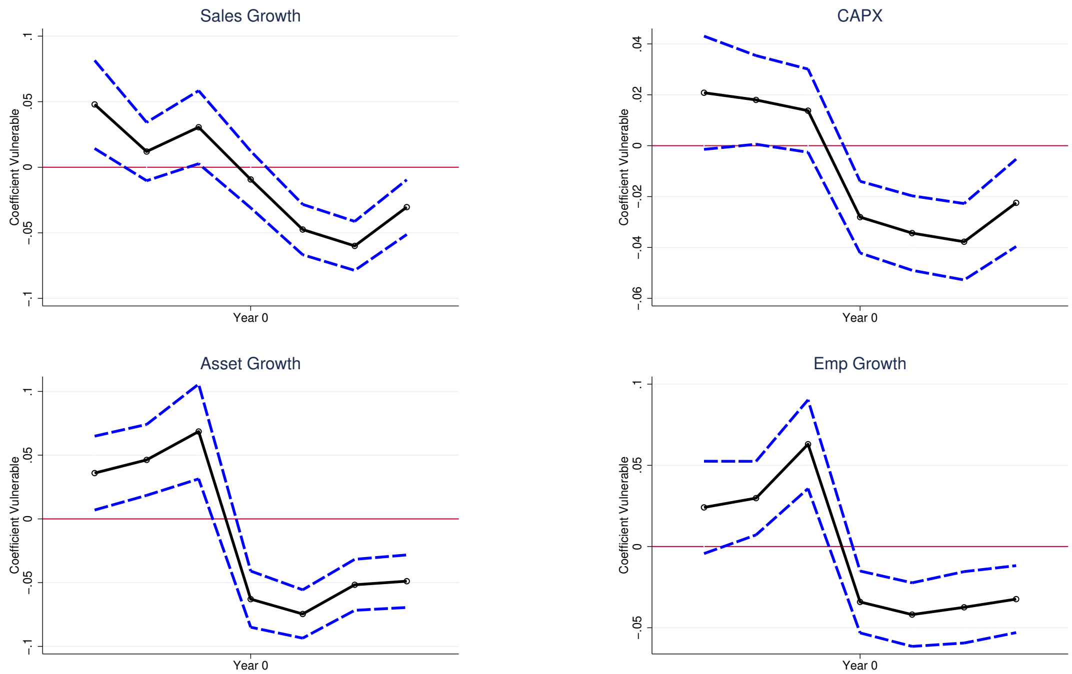


**Figure 4: Local projection figures - Performance** This figure shows the evolution of our coefficient of interest $\beta_q$ of Specification (1), three years before and after a firm becomes vulnerable, with year zero corresponding to the first sample year when a firm is classified as vulnerable. The coefficient measures a vulnerable firm's asset growth, CAPX over PPE, sales growth and employment growth relative to non-vulnerable firms. The error bars represent 95 per cent confidence intervals, with standard errors clustered at the firm-level.

### 3.2.1 Correlation Alternative Measures

Given that our vulnerability measure seems to track firm performance well, we further investigate whether it also correlates with alternative vulnerability indicators. Using Specification (2), we test whether being vulnerable is associated with a higher probability of a negative credit watch / outlook status or actual downgrade:

$$Y_{iht+1} \quad = \quad \beta_1 \times Vulnerable_{iht} + \beta_2 \times X_{iht} + \mu_{ht} + \epsilon_{iht+1},$$

where $i$ represents a firm, $h$ an industry, $t$ a year. Our dependent variable $Y$ is a dummy variable that is equal to one in case of a negative watch event in $t$ or $t+1$ or a downgrade event in $t+1$. $Vulnerable$ is a dummy variable equal to one if a firm is vulnerable in period $t$. $X_{iht}$ denotes a set of controls, including leverage, IC ratio and the logarithm of total assets. Finally, $\mu_{ht}$ denotes industry-time fixed effects.

| | Negative Watch | Negative Watch | Downgrade | Downgrade |
|---|---|---|---|---|
| Vulnerable | 0.078*** | 0.031* | 0.021*** | 0.016*** |
| | (0.018) | (0.018) | (0.005) | (0.006) |
| Total Assets | | 0.016** | | 0.003* |
| | | (0.007) | | (0.002) |
| Leverage | | 0.226*** | | 0.022 |
| | | (0.057) | | (0.016) |
| Interest Coverage | | -0.006*** | | -0.000 |
| | | (0.001) | | (0.000) |
| Profitability | | -0.669*** | | -0.076 |
| | | (0.124) | | (0.047) |
| Observations | 9,056 | 8,973 | 9,431 | 9,341 |
| R-squared | 0.118 | 0.160 | 0.094 | 0.097 |
| Industry-Year FE | ✓ | ✓ | ✓ | ✓ |

**Table 2: Alternative Vulnerability Measures** This table presents estimation results from Specification (2) for a sample of rated firms. The dependent variable in Column (1) and (2) $NegativeWatch$ is a dummy variable equal to one if a firm is put on negative credit watch / outlook in year $t$ or $t+1$. The dependent variable in Column (3) and (4) *Downgrade* is a dummy variable equal to one when a firm encounters an actual downgrade to the rating category below in year $t+1$. $Vulnerable$ is a dummy variable equal to one if a firm is vulnerable in period $t$. Firm level control variables include log of total assets, leverage, IC ratio and profitability, with industry-year FE added. Standard errors are clustered at the firm level and reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 2 presents our results. In line with our expectation, Column (1) and (2) show that when a company is vulnerable in year $t$, it is more likely to have a negative watch event in year $t$ or $t+1$. Similarly, in Column (3) and (4) we find that when a firm is vulnerable, it has a higher probability to be downgraded in the next year.[5]

# 4 Subsidized Bond Financing Costs

In this section, we show that reaching-for-yield by institutional investors drive a mispricing in specific parts of the bond market during our sample period. In Section 4.1, we present evidence on mispricing. In Section 5, we present evidence on reaching-for-yield by investors.

[5]In the online appendix we provide the local projection figure for the downgrade propensity, showing its evolution over time (see Figure B.2). Moreover, we provide evidence that the rating dynamics in the BBB-rated segment are presumably impaired, which is reflected by the negative credit event and downgrade friction at the investment-grade cutoff (see Figure B.3).

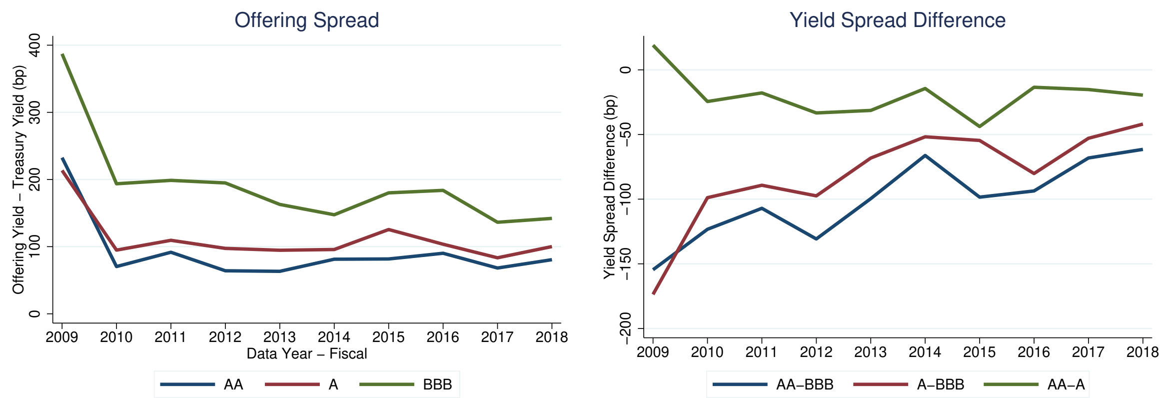


**Figure 5: Offering spread at issuance by firm rating** This figure shows the offering spread relative to treasury bonds with a similar maturity of newly issued bonds (left Panel) and the difference between the yields of bonds from different rating categories (right Panel).

## 4.1 Mispricing

In this section we document the particularly strong compression of spreads for BBB rated firms. We show that this compression can be traced to mispricing of riskier bonds within the BBB segment. Such evidence of mispricing of riskier firms' bonds is not evident in other rating categories. Moreover, it is not evident in measures of risk derived from equity markets for rated firms.

We start by showing evidence on the yield compression of bond spreads across ratings categories (see left panel of Figure 5). The right panel shows that between 2009 and 2019 the average offering spread of BBB issuers declined by around 100 basis points relative to A and AA issuer. Over the same period, there is no evidence of a spread narrowing between A and AA rated firms.

Non-parametric evidence on the bond spread distribution by rating categories in the primary market similarly shows a strong compression. The left Panel of Figure 6 shows a comparison of the spread distribution of the period 2010-2012 and 2013-2016. There has been a pronounced leftward shift of the offering spread distribution of BBB rated bonds. By contrast, no shift is evident for A rated issuers. When comparing the distribution of BBB offering spreads to that of AA spreads, one can even observe a shift to the right for AA rated firms, implying higher cost of funding for newly issued bonds (see right Panel of Figure 6).

Similar evidence can be found in secondary market prices (see bottom Panels in Figure 6).

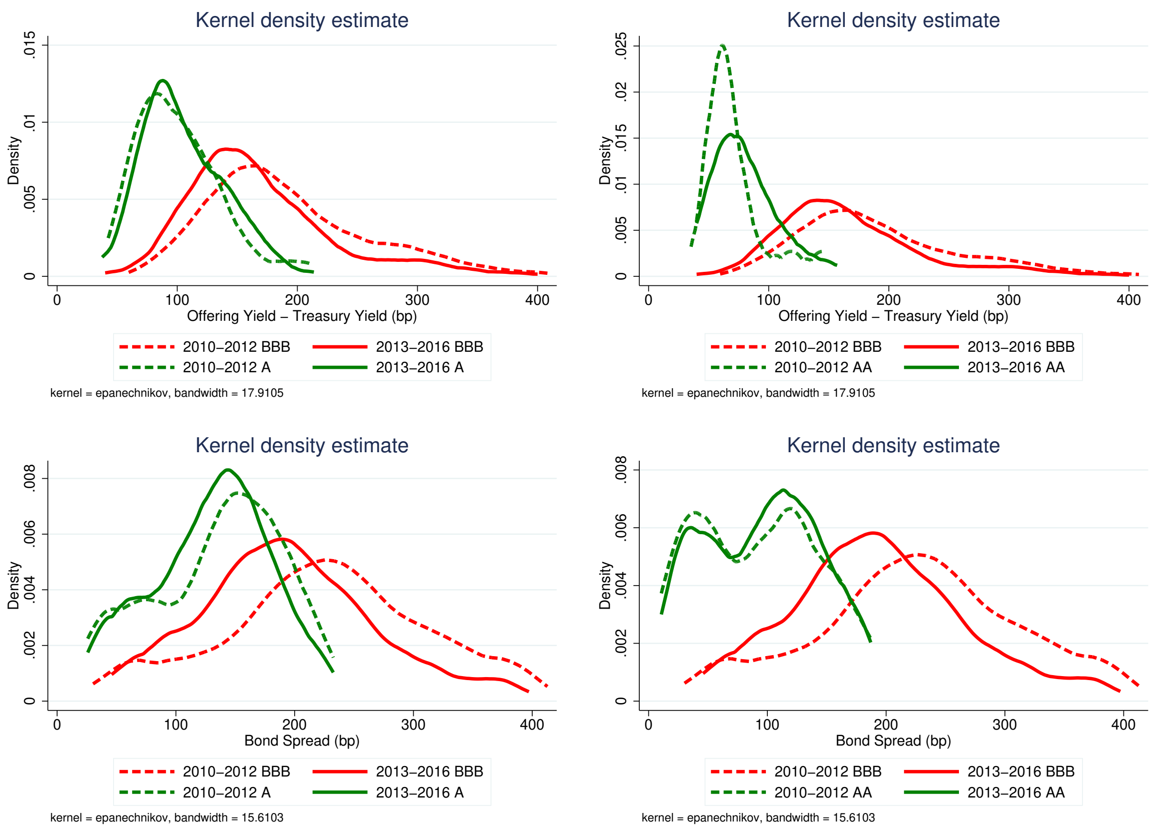


**Figure 6: Spread Distribution** The top two panels show the distribution of offering spreads (offering yield - maturity adjusted treasury yield) for newly issued bonds. The bottom two panels show the distribution of secondary market spreads (bond yield - maturity adjusted treasury yield) for traded bonds.

Figure B.5 shows that this period of cheaper funding for BBB firms coincides with a period of very loose monetary policy in the U.S.

A driver of this leftward shift of BBB rated bond spreads is a strong compression of spreads of vulnerable BBB firms relative to non-vulnerable BBB rated firms. Figure 7 shows two facts. First, that the difference in the spread between vulnerable and non-vulnerable BBB rated firms has almost always been smaller than that for the A and BB rated segments. Moreover, for a substantial period of our sample period, vulnerable BBB rated firms actually had on average lower spreads compared with non-vulnerable BBB rated firms. The spread reversal is highly suggestive of mispricing in the BBB segment of the bond market.

We formalise this descriptive evidence of mispricing of vulnerable BBB firms with the following formal test comparing the bond spread on vulnerable vs. non-vulnerable firms within a rating category by estimating the following regression at the bond-year level:

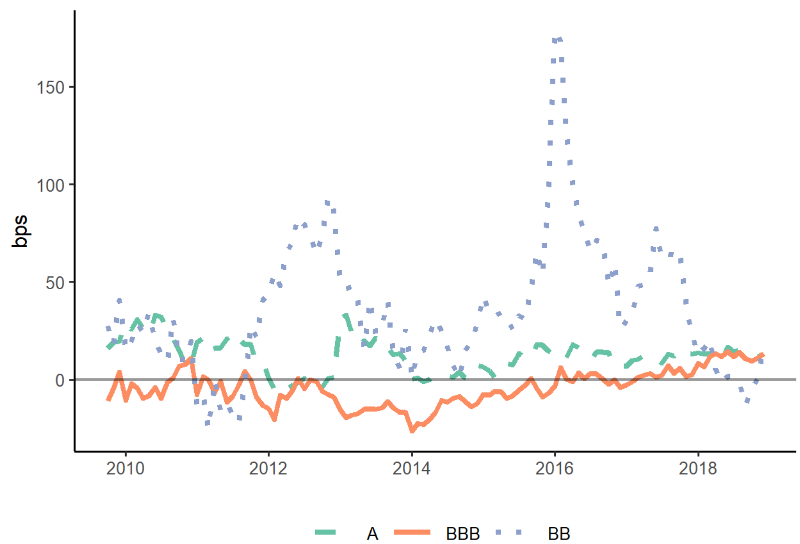


**Figure 7:** Difference in secondary market spreads between vulnerable and non-vulnerable firms within ratings categories

$$Spread_{biht} = \beta_1 Rating_{iht} + \beta_2 Rating_{iht} \times Vulnerable_{iht} \\ + \mathbf{\Gamma} X_{iht-1} + \delta \times Z_b + \mu_{ht} + \epsilon_{biht} \quad (2)$$

where, $Spread_{biht}$ is the spread (in bps) of a bond $b$ by firm $i$ in industry $h$ in year $t$. We measures bond spreads as the difference between bond and treasury yields. $Rating_{iht}$ is the firm's rating and $Vulnerable_{iht}$ is an indicator variable taking the value of one if it is classified as vulnerable in period $t$. We include a vector for firm-level control variables as well as industry-year fixed effects $\mu_{ht}$. Moreover, we control for bond characteristics such as bond maturity and whether the bond is callable.

Table 3 presents our baseline finding of mispricing in the BBB segment of the bond market from estimating equation (2). Column (1) presents our main results indicative of mispricing in the BBB ratings segment in the secondary market. The coefficient estimates on the uninteracted ratings show that as expected, the spread is monotonically increasing with declining ratings. The coefficient estimates on the $\beta_2 Rating \times Vulnerable$ interactions also show that in all rating categories, except the BBB, the coefficients are either positive and significant or insignificant. By contrast, for BBB rated vulnerable firms, the interaction term

| | Spread | Spread | Offer Spread | Offer Spread | ln(EDF 2Y) | ln(EDF 5Y) |
|---|---|---|---|---|---|---|
| AA | 1.746 | -17.597 | 16.091 | -6.215 | 0.468* | 0.239 |
| | (13.065) | (21.188) | (21.738) | (8.670) | (0.265) | (0.183) |
| A | 13.188 | 9.170 | 18.773 | -8.315 | 0.586*** | 0.401*** |
| | (8.817) | (13.644) | (21.545) | (10.791) | (0.133) | (0.099) |
| BBB | 58.673*** | 56.923*** | 94.111*** | 61.258*** | 1.016*** | 0.762*** |
| | (11.969) | (18.709) | (22.281) | (13.215) | (0.148) | (0.113) |
| BB | 187.948*** | 174.870*** | 266.736*** | 232.979*** | 1.789*** | 1.328*** |
| | (16.400) | (25.753) | (24.525) | (20.766) | (0.176) | (0.134) |
| B | 347.962*** | 337.087*** | 386.862*** | 346.288*** | 3.141*** | 2.360*** |
| | (24.574) | (39.757) | (26.699) | (29.786) | (0.201) | (0.150) |
| CCC | 1,077.630*** | 1,141.733*** | 388.735*** | 44.463 | 4.719*** | 3.574*** |
| | (134.709) | (247.433) | (45.244) | (172.345) | (0.242) | (0.191) |
| Vulnerable x AAA | 22.965*** | 19.383* | 5.825 | -9.696 | 0.639** | 0.362*** |
| | (7.451) | (10.401) | (21.962) | (15.681) | (0.258) | (0.129) |
| Vulnerable x AA | 22.230* | 39.289** | 4.293 | -11.001 | 0.177 | 0.250 |
| | (12.535) | (19.453) | (13.240) | (15.747) | (0.275) | (0.189) |
| Vulnerable x A | -6.707 | -13.110 | -7.641 | -10.587 | 0.226* | 0.174* |
| | (6.695) | (10.993) | (9.519) | (13.156) | (0.129) | (0.102) |
| Vulnerable x BBB | -11.135** | -23.924*** | -15.572** | -23.096** | 0.261*** | 0.176*** |
| | (5.180) | (7.934) | (7.736) | (10.090) | (0.090) | (0.067) |
| Vulnerable x BB | 34.636*** | 43.936*** | 30.039** | 41.139 | 0.567*** | 0.432*** |
| | (10.148) | (14.124) | (13.213) | (25.042) | (0.108) | (0.077) |
| Vulnerable x B | 54.908** | 33.364 | 19.991 | 4.313 | 0.626*** | 0.470*** |
| | (25.505) | (32.282) | (19.190) | (53.462) | (0.124) | (0.089) |
| Vulnerable x CCC | 246.180 | 164.243 | | | -0.017 | 0.001 |
| | (193.113) | (288.661) | | | (0.225) | (0.180) |
| Observations | 20,106 | 9,514 | 3,140 | 1,163 | 4,353 | 4,606 |
| R-squared | 0.733 | 0.709 | 0.925 | 0.915 | 0.778 | 0.797 |
| Industry-Year FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Firm-Level Controls | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Bond-Level Controls | ✓ | ✓ | ✓ | ✓ | | |
| Sample | Entire | 2013-2016 | Entire | 2013-2016 | Entire | Entire |

**Table 3: Bond spread of vulnerable and non-vulnerable firms by firm ratings** This table shows the relation between bond spreads in the secondary (Columns (1) and (2)) or primary market (Columns (3) and (4)) and ratings and vulnerability status of firms. Bond spreads (in bps) are the difference between bond and treasury yields of the same maturity. Vulnerable is defined in Section 2.2. Besides firm-level controls such as the log of total assets, leverage, and the interest coverage ratio, we also control for bond characteristics (remaining maturity and whether the bond is callable). Columns (5) and (6) show the relation of EDFs at 2 and 5 year horizon at the firm-year level. All specifications control for industry-year fixed effects (2-digit SIC). Standard errors are clustered at the firm-level. *** p<0.01, ** p<0.05, * p<0.1.

is actually negative and significant at the 5% level, suggesting that BBB vulnerable firms indeed benefit from a funding advantage.

Restricting our results to the subsample from 2013 to 2016, i.e., a period of very accommodating monetary policy, the negative coefficient on the $Vulnerable \times BBB$ becomes significant at the 1% level and more than doubles in magnitude (Column (2)).

The evidence of mispricing of BBB vulnerable bonds is also evident when equation (2) is estimated on spreads at issuance. Column (3) show that our coefficient estimates on the uninteracted rating buckets are qualitatively very similar to those derived from secondary market pricing. Similarly, the coefficient on the $Vulnerable \times BBB$ interaction is negative and significant, suggesting that vulnerable BBB firms also benefit from a funding advantage when issuing new bonds. Results are again stronger for the period 2013-2016 (see Column (4)).

Importantly, we do not find such apparent mispricing of risk in measures based on equity markets. In particular, in Columns (5) and (6) of Table 3 we use the log expected default frequency (EDF) at different horizons derived from equity prices instead of the bond spread as our dependent variable. This regression is run at firm-year level. While we again find that the coefficient estimates on the uninteracted ratings increase monotonically as one moves down the rating spectrum, vulnerable firms, including those with a BBB rating consistently have significantly higher EDFs. Thus, while bonds spreads do not appear to price the additional risk of vulnerable BBB rated firms, equity markets do.

## 4.2 Sensitivity of bond spreads to EDFs

Table 3 showed that while equity based EDFs consistently priced vulnerable firms as being more risky compared to their non-vulnerable firms in the same ratings buckets, this effect was not evident in bonds spreads, and even negative for BBB rated firms. In our second test of mispricing we examine the sensitivity of bond spreads to EDFs within different ratings buckets with the following equation:

$$\begin{aligned} Spread_{biht} = & \beta_1 Rating_{iht} + \beta_3 EDF_{iht} + \beta_3 Rating_{iht} \times EDF_{iht} \\ & + \mathbf{\Gamma} X_{iht} + \mu_{ht} + \delta \times Z_b + \phi_i + \epsilon_{iht} \end{aligned} \tag{3}$$

where $EDF_{iht}$ is the expected default frequency of firm $i$ in period $t$, $\mu_{ht}$ are industry-time fixed effects and $\phi_i$ are firm fixed effects. Moreover, we again control for bond characteristics such as bond maturity and whether the bond is callable.

The estimates of the sensitivity of bond spreads to EDFs within ratings categories are

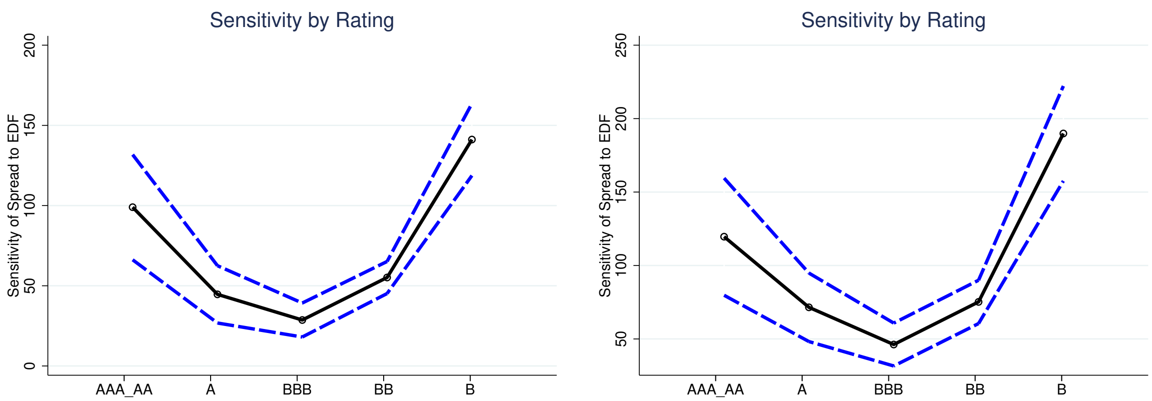


**Figure 8: Sensitivity of bond spreads to EDFs** This figure shows the sensitivity of bond spreads to 2-year EDFs (left Panel) and 5-year EDFs (right Panel). The dashed-blue lines represent 95% confidence intervals.

summarised in Figure 8 which plots the total effect of $\beta_3 EDF_{iht} + \beta_3 Rating_{iht} \times EDF_{iht}$ evaluated at the mean EDF at each ratings category. A strongly U-shaped pattern is evident with a minimum at the BBB rating segment. This shows that the sensitivity of bond spreads to equity based EDFs is weakest for BBB firms, and rises for both higher and lower rated firms.

# 5 Investors' Demand

In this section, we show that investors' demand for bonds issued by BBB-rated vulnerable firms explains the bond pricing dynamics documented in the previous section. Consistent with the evidence on prices, we show that this demand channel is stronger during periods of monetary easing. In Section 5.1, we present our empirical strategy. In Section 5.2 and Section 5.3, we show that investors demand for bonds issued by prospective fallen angels explains the pricing subsidy using non-parametric and parametric evidence, respectively.

## 5.1 Empirical Strategy

In our empirical strategy, we test a simple theory of investors' demand exploiting our detailed holdings data. Our hypothesis is that investors with a longer duration in their bond portfolio at the end of 2009 are likely more negatively affected by the monetary policy easing that followed the Global Financial Crisis. The idea is that these investors likely suffered more

| Panel A | $\mu$ | $\sigma$ | p25 | p50 | p75 |
|---|---|---|---|---|---|
| $Duration_k^{09}$ (years) | | | | | |
| Full Sample | 8.45 | 4.73 | 5.57 | 7.55 | 10.13 |
| Insurance Companies | 8.51 | 4.87 | 5.15 | 7.46 | 10.60 |
| Investment Managers | 8.64 | 5.05 | 6.03 | 7.74 | 10.35 |
| Other investors | 7.68 | 2.95 | 5.34 | 7.22 | 9.78 |
| $Holdings_{kjt}$ (\$ million) | | | | | |
| Full Sample | 11.85 | 42.15 | 0.27 | 1.70 | 8.50 |
| Insurance Companies | 11.33 | 27.01 | 0.50 | 2.85 | 10.65 |
| Investment Managers | 12.16 | 41.64 | 0.21 | 1.35 | 8.06 |
| Other investors | 11.88 | 64.89 | 0.20 | 1.00 | 5.00 |

| Panel B | 2009Q4 | 2012Q4 | 2015Q4 | 2018Q4 |
|---|---|---|---|---|
| $\mu(Duration_{kt})$ (years) | | | | |
| Full Sample | 7.85 | 7.77 | 8.03 | 7.62 |
| Insurance Companies | 7.94 | 7.86 | 8.24 | 8.15 |
| Investment Managers | 7.88 | 7.79 | 7.74 | 6.99 |
| Other investors | 7.44 | 7.47 | 8.09 | 7.56 |
| $\sum_j Holdings_{kjt}$ (\$ million) | | | | |
| Full Sample | 386,493 | 585,873 | 830,151 | 851,228 |
| Insurance Companies | 135,766 | 190,930 | 255,711 | 273,156 |
| Investment Managers | 198,448 | 311,762 | 452,680 | 447,234 |
| Other investors | 52,279 | 83,180 | 121,760 | 130,839 |

| Panel C | $\mu$ | $\sigma$ | p25 | p50 | p75 | $\sum$ |
|---|---|---|---|---|---|---|
| **High-duration investors** | | | | | | |
| Holdings (\$ million) | 13.58 | 35.52 | 0.45 | 2.332 | 10.51 | 214,697 |
| **Low-duration investors** | | | | | | |
| Holdings (\$ million) | 7.66 | 23.99 | 0.28 | 1.5 | 6.7 | 171,525 |

**Table 4: Investor-Issuer Level Data, Summary Statistics.** This table presents summary statistics from our data set at the investor $k$, issuer $j$, and quarter $t$ level. Panel A shows summary statistics, in the full sample period, of the duration of the investors' portfolio as of 2009Q4 and of the holdings of issuer $j$'s bonds by investor $k$ in a quarter. Panel B shows summary statistics, at four points in time, of the average duration of investor $k$'s portfolio and of the total holdings of investor $k$. In Panels A and B the summary statistics are reported for the full sample of investors as well as broken down by investor type. Panel C shows the average holdings of issuer $j$'s bonds by investor $k$ in the full sample.

from the rapid reduction of long-term yields and the flattening of the yield curve compared with other investors that had a shorter duration in their corporate bond portfolio. To this end, we define an investor level variable based on the residual maturity of the investor's portfolio as of 2009Q4, $Duration_k^{09}$ (measured in years).

Table 4 presents some summary statistics of our investor level data set. Panel A shows the distribution of the $Duration_k^{09}$ and $Holdings_{kjt}$ in the full sample as well as in the three subsamples of investor types. Panel B shows the average duration of the investors' portfolio in time, also broken down by investor type, and the total holdings of investor $k$ at time $t$. We observe the rapid increase in holdings by insurance companies and, even more, by investment managers, especially from 2012Q4 to 2015Q4. Finally, Panel C shows the average holdings held by high-duration Vs. low-duration investors, where this sample split is based on the average duration of investors' portfolio in 2009Q4. High-duration investors typically hold a larger portfolio compared with low-duration investors.

## 5.2 Non-Parametric Evidence

In this section, we show, using raw data, that investors increased (i) their holdings of bonds issued by BBB-rated firms compared with other bonds and (ii) their holdings of vulnerable bonds compared with non-vulnerable bonds. Finally, we show that these differential time-series dynamics are more pronounced for high-duration investors compared with low-duration investors, consistent with a reaching-for-yield motive within BBB-rated bonds.

The left panel of Figure 9 shows that our sample investors increased their holdings of bonds issued by BBB-rated issuers, especially starting in 2014-15. The plot shows the evolution of holdings of bonds, broken down by issuer rating during our sample period. We observe (i) that holdings of investment-grade bonds are quantitatively more important than holdings of sub-investment-grade bonds and (ii) that, within the investment-grade segment, holdings of BBB bonds diverge from holdings of better rated bonds starting in 2015. Figure B.4, shows (i) that holdings of bonds issued by vulnerable firms increased starting in 2013 compared with bonds issued by non-vulnerable firms and (ii) that, within bonds issued by BBB-firms, investors hold more vulnerable than non-vulnerable bonds starting in around 2014. Moreover, the volumes of issuance of bonds rated BBB and rated above BBB are parallel during this period, suggesting an increase demand of BBB-rated bonds by our sample investors.

The right panel introduces the source of variation based on the maturity of investors' portfolio in 2009Q4. In particular, high-duration and low-duration investors have a duration above and below median as of 2009Q4, respectively. This panel shows that, within the BBB segment, holdings of vulnerable bonds increase more than holdings of non-vulnerable bonds for

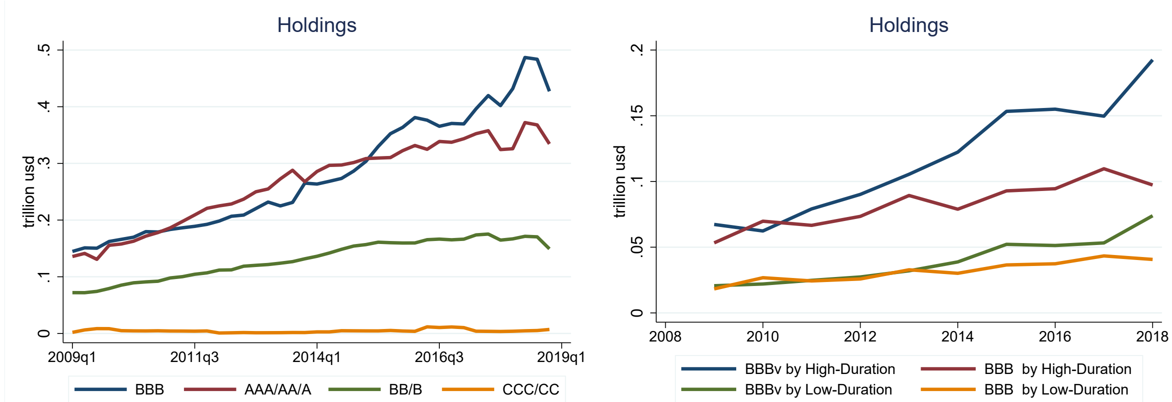


**Figure 9: Investors' Demand, Non-Parametric Evidence.** This figure shows non-parametric evidence suggesting that investors' demand might drive the bond pricing subsidy to BBB vulnerable firms. The left panel shows holdings of bonds by rating of the issuer. The right panel shows holdings of BBB bonds, broken into vulnerable and non-vulnerable bonds and bonds held by high-duration investors and low-duration investors. High-duration investors have a portfolio duration above the median in 2009Q4. Both figures are totals in trillion dollars.

both high-duration and low-duration investors. However, the divergence is more pronounced for high-duration investors, suggesting that these investors' demand for these riskier bonds increased more than the demand by low-duration investors. In the next subsection, we show that this evidence suggesting a reaching-for-yield behavior by investors is confirmed by a battery of parametric tests.

## 5.3 Parametric Evidence

In this section, we confirm, using parametric tests, the preliminary evidence from raw data presented above. Taking advantage of our granular data, we estimate the following specification:

$$Holdings_{kjt} = \alpha + \beta_1 Duration_k^{09} \times Vulnerable_{jt} + \eta_{kt} + \mu_{jt} + \epsilon_{jkt} \tag{4}$$

where $k$ is an investor, $j$ is an issuer, and $t$ is a year. The dependent variable is the log of (one plus) holdings by investor $k$ in year $t$ of bonds issued by issuer $j$. The independent variable of interest is the interaction between $Duration_k^{09}$, the duration of investor $k$'s portfolio as of 2009Q4 (in years) and $Vulnerable_{jt}$, a dummy activated if issuer $j$ is vulnerable in year $t$.

The coefficient of interest $\beta_1$ captures whether high-duration investors hold more or less

| | $Holdings_{jkt}$ | | | | | |
|---|---|---|---|---|---|---|
| $Duration^{09}_{k} \times Vulnerable_{jt}$ | 1.200** | 0.602 | 0.307 | 1.183** | 1.609*** | 0.574 |
| | (0.495) | (0.394) | (0.559) | (0.570) | (0.614) | (0.462) |
| Fixed Effects | | | | | | |
| Investor $k$ - Time $t$ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Issuer $j$ - Time $t$ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Sample Issuers | BBB | [A,AAA] | [CCC,BB] | BBB | BBB | BBB |
| Sample Period | Full | Full | Full | [09,12] | [13,16] | [17,18] |
| Observations | 213,626 | 151,992 | 158,589 | 59,243 | 95,903 | 58,480 |
| R-squared | 0.512 | 0.621 | 0.413 | 0.487 | 0.529 | 0.510 |

**Table 5: Investors' Demand, Double Interaction Specification.** This table presents estimation results from specification (4). The unit of observation is investor $k$-issuer $j$-year $t$. The dependent variable is $log(1 + Holdings_{jkt})$, where $Holdings$ are holdings by investor $k$ in year $t$ of corporate bonds issued by issuer $j$ (thousands dollars). $Duration_k$ is the duration of investor $k$'s portfolio (in years) as of 2009Q4. $Vulnerable_{jt}$ is a dummy equal to 0.01 (for legibility) if issuer $j$ is vulnerable to a downgrade in year $t$. The first three columns are estimated in the full sample period and in the subsample of bonds issued by BBB-rated issuers, by issuers rated above BBB, and issuers rated below BBB, respectively. The last three columns are estimated in the subsample of BBB-rated issuers in 2009-12, 2013-16, and in 2017-18, respectively. Standard errors are clustered at the investor $k$ level and reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

bonds issued by vulnerable issuers from 2009 to 2018. In the most stringent specification, we are effectively comparing bonds issued by the same issuers that are held by investors with a different duration of their portfolio in 2009Q4. In our most stringent specification, we include investor-time and issuer-time fixed effects. Investor-time fixed effects control for the potential differential portfolio choice by high- Vs. low-duration investors, with respect to vulnerable and non-vulnerable bonds, for reasons unrelated to reaching-for-yield. Issuer-time fixed effects control for the potential differential characteristics of vulnerable and non-vulnerable bonds (e.g., issuance volume) that might interact with the portfolio choice of high-duration Vs. low-duration investors for reasons, again, unrelated to reaching-for-yield.

Table 5 shows the estimation results. The first three columns show the coefficients estimated in the full sample period in the subsamples of bonds issued by BBB-rated firms, firms with a rating above BBB, and firms with a rating below BBB (sub-investment-grade), respectively. The coefficient $\beta_1$ is positive and significant for the subsample of BBB bonds only, suggesting that high-duration investors have a higher demand for these bonds during

| | *Holdings*$_{jkt}$ | | | | | | |
|---|---|---|---|---|---|---|---|
| $Duration_k^{09} \times BBB_{jt} \times Vulnerable_{jt}$ | 1.352** | 1.398** | 1.273** | 1.308** | 1.124* | 1.771** | 0.595 |
| | (0.540) | (0.548) | (0.540) | (0.548) | (0.604) | (0.714) | (0.581) |
| $Duration_k^{09} \times BBB_{jt}$ | -0.004 | 0.006 | 0.016 | 0.032 | -0.288 | -0.323 | 1.079 |
| | (0.635) | (0.633) | (0.646) | (0.643) | (0.681) | (0.749) | (0.830) |
| $Duration_k^{09} \times Vulnerable_{jt}$ | -0.066 | -0.071 | 0.009 | 0.018 | 0.179 | -0.053 | 0.015 |
| | (0.359) | (0.360) | (0.343) | (0.346) | (0.383) | (0.382) | (0.441) |
| Fixed Effects | | | | | | | |
| Time $t$ | ✓ | | | | | | |
| Investor $k$ | ✓ | ✓ | | | | | |
| Issuer $j$ | ✓ | | ✓ | | | | |
| Investor $k$ - Time $t$ | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Issuer $j$ - Time $t$ | | ✓ | | ✓ | ✓ | ✓ | ✓ |
| Sample Period | Full | Full | Full | Full | [09,12] | [13,16] | [17,18] |
| Observations | 630,188 | 630,059 | 630,136 | 630,006 | 191,413 | 284,861 | 153,732 |
| R-squared | 0.389 | 0.412 | 0.422 | 0.446 | 0.427 | 0.452 | 0.456 |

**Table 6: Investors' Demand, Triple Interaction Specification.** This table presents estimation results from specification (5). The unit of observation is investor $k$-issuer $j$-year $t$. The dependent variable is $log(1 + Holdings_{jkt})$ where $Holdings$ are holdings by investor $k$ in year $t$ of corporate bonds issued by issuer $j$ (thousands dollars). $Duration_k^{09Q4}$ is the duration of investor $k$'s portfolio (in years) as of 2009Q4. $Vulnerable_{jt}$ is a dummy equal to 0.01 (for legibility) if issuer $j$ is vulnerable to a downgrade in year $t$. $BBB_{jt}$ is a dummy equal to 0.01 (for legibility) if issuer $j$ is rated BBB in year $t$. The first four columns are estimated in the full sample. The last three columns are estimated in the subsamples from 2009 to 2012, from 2013 to 2016, and from 2017 to 2018, respectively. The three investor $j$-year $t$ double interaction terms in columns (1) and (3) are included in the estimation but not reported for legibility. Standard errors are clustered at the investor $k$ level and reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

our sample period.[6] The last three columns show the coefficients estimated in the subsample of BBB bonds in three subperiods: 2009 to 2012, 2013, to 2016, and 2017 to 2018. We find that that the estimated coefficient is positive and significant in the first two subperiods and larger in magnitudes in the middle sample period. As shown in Figure B.5 the middle sample period is characterized by substantially monetary easing.

To formally test whether the differential behavior of high- Vs. low-duration investors is more pronounced in the BBB segment of the corporate bond market, we estimate the

[6] Table C.1 shows that the estimated coefficient $\beta_1$ is stable and significant as we progressively saturate the specification with more and more stringent fixed effects.

following specification:

$$\begin{aligned} Holdings_{jkt} = \alpha &+ \beta_1 Duration_k^{09} \times BBB_{jt} \times Vulnerable_{jt} \\ &+ \beta_2 Duration_k^{09} \times BBB_{jt} \\ &+ \beta_3 Duration_k^{09} \times Vulnerable_{jt} + \eta_{kt} + \mu_{jt} + \epsilon_{jkt} \end{aligned} \tag{5}$$

where $BBB_{jt}$ is a dummy activated if issuer $j$ is rated BBB in year $t$. The structure of the specification is otherwise unchanged from specification (4).

Table 6 shows the estimation results. The first four columns, estimated in the full sample, confirm that high-duration investors have higher holdings of vulnerable bonds, especially in the BBB segment of the bond market. The last three columns are estimated in three sample periods from 2009 to 2012, from 2013 to 2016, and from 2017 to 2018, respectively. The estimated coefficients on the triple interaction term show that the correlation is stronger from 2013 to 2016, a period characterized by substantial monetary easing. The coefficient plots in Figure B.6 confirm that the estimated coefficients are stronger when monetary policy is more accommodative.

# 6 Real Effects of the Funding Advantage

We have documented that vulnerable BBB firms benefit from a funding privilege in their corporate bond funding. In this section, we explore the real effects of this funding advantage. In Section 6.1, we show that BBB vulnerable firms increased their sales and lowered their markups but did not invest more or employed more workers during our sample period. In Section 6.2, we show that non-vulnerable firms are negatively affected by the presence of vulnerable BBB firms.

## 6.1 Direct Effects

How do BBB vulnerable firms take advantage of their cheap bond financing? The first observation from raw data is a sizable increase in the market shares of BBB vulnerable firms from 2009 to 2018, and in particular from 2013 onward. We present the data in Figure 10.

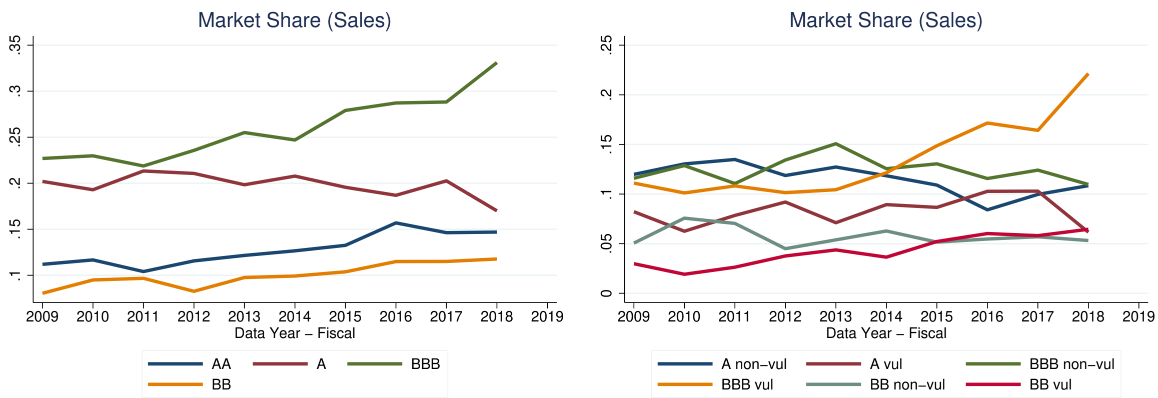


**Figure 10: Market Shares.** This figure shows the market share (share of sales) of firms in each rating category in the sample of Compustat Firms. The left panel shows a sample split based on rating category. The right panel shows a sample split based on rating category and firm downgrade vulnerability.

The left panel shows the market shares of firms in each rating category. The right panel shows the market shares by rating category separately for vulnerable and non-vulnerable firms. These figures show that BBB firms increased their market share from around 25% in 2013 to around 33% in 2018, driven by vulnerable BBB firms that more than doubled their market share from around 10% in 2013 to around 22% in 2018.

Having documented the large increase in market shares, we now show that BBB vulnerable firms increased their sales and lowered their markups, but, despite their funding advantage, did not increase their investment or employment. More specifically, we estimate the following specification:

$$\begin{aligned} Y_{iht+1} &= \beta_1 Vulnerable_{iht} + \beta_2 Vulnerable_{iht} \times BBB_{iht} \\ &+ \gamma \times X_{iht} + \eta_{ht} + \epsilon_{ihjt}, \end{aligned} \tag{6}$$

where $i$ is a firm, $h$ an industry, and $t$ a year. Our dependent variables are employment growth, investment, sales growth, and markups. The coefficient $\beta_1$ captures the effect of a firm vulnerable status on the independent variable. The coefficient $\beta_2$ captures whether the effect of a firm vulnerable status on the independent variable is different for BBB rated firms compared with non-BBB rated firms. We include industry-year fixed effects to absorb time-varying industry level heterogeneity (e.g., demand shocks), and time-varying firm level controls.

| Direct Real Effects | Emp Growth | CAPX | Sales Growth | Markup |
|---|---|---|---|---|
| Vulnerable × BBB | 0.003 | -0.003 | 0.018** | -0.259** |
| | (0.010) | (0.011) | (0.009) | (0.130) |
| Vulnerable | -0.017** | -0.013* | -0.015** | -0.114** |
| | (0.007) | (0.007) | (0.007) | (0.053) |
| Observations | 7,746 | 7,952 | 7,992 | 7,992 |
| R-squared | 0.113 | 0.331 | 0.266 | 0.253 |
| Industry-Year FE | ✓ | ✓ | ✓ | ✓ |
| Firm-Level Controls | ✓ | ✓ | ✓ | ✓ |

**Table 7: Real Effects - Direct Effect** This table presents estimation results from Specification (6). The dependent variables are employment growth, CAPX/PPE, sales growth, and markup (defined as sales/cost of goods sold). Vulnerable is defined in Section 2.2. Firm level control variables include log of total assets, leverage, net worth, and indicator variables for the rating bucket (AAA, AA, A etc.). Standard errors are clustered at the firm-level and reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

We show the estimation results in Table 7. Several results are noteworthy. First, consistent with our evidence in Section 3.2, vulnerable firms have lower employment growth rates and invest less. The employment and investment outcomes of vulnerable BBB firms do not differ significantly from those of other vulnerable firms. These estimation results suggest that, despite their funding advantage, BBB vulnerable firms did not invest significantly more or hired significantly more employees. Second, we find a positive and significant effect on sales growth and significantly lower markups for vulnerable BBB firms. Consistent with the substantial increase in the market share of vulnerable BBB firms, these results suggest that these firms have used their cheap funding to expand their sales volume by charging lower markups.

## 6.2 Spillover Effects on Non-Vulnerable Firms

Having shown the effect of the funding advantage on employment, investment, and market share, we now focus on spillover effects from BBB vulnerable firms to non-vulnerable firms. In particular, we follow the literature on the spillover effects of zombie lending (most notably Caballero et al. (2008)) and estimate the following regression at the firm-year level:

$$\begin{aligned} Y_{iht} &= \beta_1 \times Non-Vulnerable_{iht} \\ &+ \beta_2 \times Non-Vulnerable_{iht} \times Share\ VulnerableBBB_{ht-1} + \eta_{ht} + \epsilon_{iht}, \end{aligned} \tag{7}$$

| | Emp Growth | CAPX | Sales Growth | Markup |
|---|---|---|---|---|
| Panel A: Rated Firms - Vulnerable IG | | | | |
| Non-vulnerable IG | 0.013 | 0.029** | -0.003 | 0.570** |
| | (0.008) | (0.011) | (0.008) | (0.261) |
| Non-vulnerable IG × Share Vulnerable BBB | -0.090** | -0.112*** | -0.089** | -1.555** |
| | (0.042) | (0.041) | (0.038) | (0.767) |
| Observations | 6,923 | 7,113 | 7,121 | 7,121 |
| R-squared | 0.112 | 0.318 | 0.278 | 0.256 |
| Panel B: Rated Firms - Placebo | | | | |
| Non-vulnerable IG | 0.023 | 0.019* | 0.003 | 0.363 |
| | (0.014) | (0.010) | (0.012) | (0.219) |
| Non-vulnerable IG × Share Vulnerable | -0.040 | -0.009 | -0.022 | 0.087 |
| | (0.030) | (0.023) | (0.025) | (0.336) |
| Observations | 6,923 | 7,113 | 7,121 | 7,121 |
| R-squared | 0.112 | 0.318 | 0.278 | 0.256 |
| Panel C: All Firms | | | | |
| Non-vulnerable | 0.038*** | 0.040*** | 0.038*** | 0.395** |
| | (0.010) | (0.011) | (0.012) | (0.190) |
| Non-vulnerable × Share Vulnerable BBB | -0.068*** | -0.094** | -0.074** | -0.873** |
| | (0.025) | (0.046) | (0.029) | (0.432) |
| Observations | 26,009 | 27,471 | 26,978 | 26,872 |
| R-squared | 0.042 | 0.191 | 0.045 | 0.133 |
| Industry-Year FE | ✓ | ✓ | ✓ | ✓ |
| Firm-level Controls | ✓ | ✓ | ✓ | ✓ |

**Table 8: Real Effects - Spillover Effects** This table presents estimation results from Specification (7). The dependent variables are employment growth, CAPX/PPE, sales growth, and markup (defined as sales/cost of goods sold). Vulnerable/non-vulnerable is defined in Section 2.2. Panel A focuses on non-vulnerable investment-grade firms and limits the sample to firms with a rating from at least one rating agency. Panel B focuses on all non-vulnerable firms. In Panel C we focus on non-vulnerable firms, using the entire sample of firms. $Share\,Vulnerable\,BBB$ measures the asset-weighted share of vulnerable BBB firms in a two-digit SIC industry. Firm level control variables include log of total assets, leverage, net worth, and indicator variables for the rating bucket (AAA, AA, A etc.). Standard errors are clustered at the industry-level and reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

where $i$ is a firm, $h$ an industry, and $t$ is a year. As in specification (6), our dependent variables are employment growth, investment, sales growth, and markups and we include industry-year fixed effects. Our coefficient of interest, $\beta_2$, captures whether non-vulnerable firms that operate in industries with a high share of vulnerable BBB firms perform differently than non-vulnerable firms in industries with a lower share of vulnerable BBB firms.

Panel A shows that in the sample of rated firms non-vulnerable investment-grade firms are negatively affected by the presence of vulnerable BBB firms. More precisely, Columns (1) and (2) show that while non-vulnerable firms have on average higher employment growth rates and invest more, both employment and investment are significantly impaired by the presence of vulnerable BBB firms. Moreover, these firms face lower sales growth and lower markups, compared with firms that do not compete with a large share of vulnerable BBB firms in their industry.

Importantly, Panel B shows that these spillover effects are not present when we replace that share of vulnerable BBB firms with the overall share of vulnerable rated firms. This suggests that it is indeed the specialness of the vulnerable BBB firms that drives the negative spillover effects. Panel C confirms our main results for the full sample of firms (rated and unrated).

# 7 Conclusion

In this paper we document the exorbitant privilege of prospective "fallen angels", i.e. firms on the cusp of the investment-grade cutoff, and the [exorbitant] costs that such firms impose on the economy. We find that these firms have benefited from investors subsidizing their bond financing costs since the Global Financial Crisis. The subsidy appears to be driven by demand from high-duration-bond investors, consistent with a reach-for-yield motive and is greater during periods of monetary easing.

Our results suggest that although the growth of risky investment-grade bond segment may have been a desired consequence of large scale central bank asset purchases, which push investors into riskier assets, the growing concentration of issuance in the riskiest investment-grade bucket also comes at a cost that may run counter to central bank objectives. First, the subsidised firms grow disproportionately large and increase their market share by reducing the markup on their products. Second, the resulting spillover effects force their competitors to reduce employment, investment, markups, and sales growth.

A additional cost is the associated buildup of vulnerabilities in the corporate sector that arise from these subsidies. Such vulnerabilities could well become important after a shock.

Finally, the exorbitant privilege of prospective fallen angels appears equally driven by demand from both insurance companies, who face regulatory capital requirements that favour investment-grade bonds, as well as asset managers which do not face such explicit constraints yet are still affected by the investment-grade cut-off. As a result, standard macroprudential tools appear less able to tackle the exorbitant privilege distortion. Instead, measures that enhance the relationship between ratings and firm risk may been more fruitful.

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# Appendix A. Data Set Construction

We start with the capital information provided by WRDS Capital IQ, which covers over 60,000 public and private companies globally. We drop the observations for which the debt categories[7] do not add up to 100 per cent and deviate by more than 5 per cent. Moreover, we exclude the observations for which the principal debt amount percentage is missing[8].

We then combine the CapitalIQ data with the company specific information from Compustat North America, which provides the financial statements of listed American and Canadian firms. We further reduce the sample by dropping firms that are not incorporated in the U.S. or have a SIC-code between 6000-6999. In addition, we exclude the observations that contain missing values for the CapitalIQ debt categories or the Compustat debt items. To merge the debt items of the two providers, we match the total amount of debt outstanding of CapitalIQ to the sum of the current liabilities (DLC) and long-term debt (DLTT) items of Compustat. We drop the observations for which the two values vary by more than 10 per cent to assure a clean matching procedure. Moreover, we drop firms that have a leverage ratio exceeding one.

The issuer CUSIPs allow us to merge the Capital IQ Compustat data set to the rating data from Thomson Reuters, which provides worldwide coverage on ratings from S&P, Moody's and Fitch. We follow Becker and Milbourn (2011) in transferring the ratings into numerical values to estimate the firms' median ratings. For the rating classification, we refer to Table B.1 in the Appendix. Combing all the data sources, we investigate a total of 5,864 firms.

The second type of data sets we create are on a bond-level and are used to investigate primary and secondary market pricing. For the primary market analysis, we use Mergent Fixed Income Securities Database (FISD), a fixed income database that includes issue details of publicly-offered U.S. bonds. This sample consists of 3,140 bond issues and 910 issuers. For the second market pricing, we use TRACE, which is a database that constitutes of real-time secondary market information on transactions in the corporate bond market. This analysis is based on 7,700 outstanding bonds by 1,130 issuers, with bond $b$, firm $j$, year $t$ as unit of observation.

**Holdings Data** Lastly, we examine bond investor holding level data using eMAXX Bond Holders data from Thomson Reuters Eikon, a detailed data set that documents security-level holdings by individual investors at a quarterly frequency. We collapse holdings within an investor at the issuer level so that our unit of observation is holdings at quarter $t$ by investor $k$ of bonds issued by issuer $j$. Our data set includes 2,127,296 observations spanning 37 quarters from 2009Q4 to 2018Q4. There are 892 unique issuers and 569 unique investors,

[7] The debt categories consist of commercial paper, revolving credit, subordinated bonds and notes, senior bonds and notes, general/other borrowings, capital leases and term loans. For this particular step we also take into account the total trust preferred, unamortized premium, unamortized discount and adjustment items.

[8] The principal debt amount outstanding percentage can deviate from 100 per cent due to potential debt adjustments. The percentage is used to scale the principal debt outstanding to the total amount of debt outstanding.

mostly investment managers (268) and insurance companies (210).

# Appendix B. Additional Figures

## B.1 Aggregate Evidence

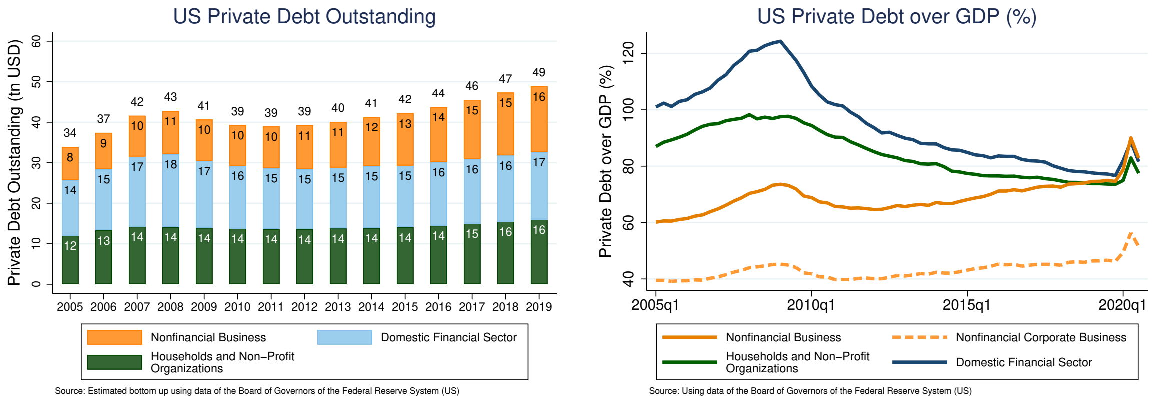



**Figure B.1: US Private Debt.** This figure shows the aggregate figures for the private debt outstanding in the U.S. using data of the FRED. In Panel A, we show the breakdown in absolute numbers. In Panel B, we relate the different debt components to GDP.

## B.2 Transferring Ratings into Numerical Values

Following Becker and Milbourn (2011), we transfer the ratings of S&P, Moody and Fitch into numerical values using Table B.1. This way we can estimate the median rating for each rated firm in our data set.

| Moody's | S&P, Fitch | Numerical Value Assigned |
|---|---|---|
| AAA | AAA | 28 |
| Aa | AA | 24, 25, 26 |
| A | A | 21, 22, 23 |
| Baa | BBB | 18, 19, 20 |
| Ba | BB | 15, 16, 17 |
| B | B | 12, 13, 14 |
| Caa | CCC | 9, 10, 11 |
| Ca | CC | 7 |
| C | C | 4 |
| D | D | - |

**Table B.1: Rating Classification.** Based on the approach of Becker and Milbourn (2011).

## B.3 Validation of the Vulnerability Measure

### B.3.1 Rating Dynamics Aggregate

Figure B.2 shows that the downgrade propensity rises in the year after a firm becomes vulnerable for the first time, and peaks in the subsequent year.

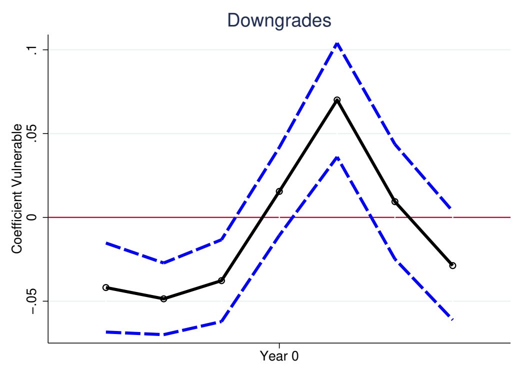



**Figure B.2: Local Projection Figure - Downgrades** This figure depicts the evolution of our coefficient of interest $\beta_q$ of Specification (1), three years before and after a firm becomes vulnerable, with year zero corresponding to the first sample year when a firm is classified as vulnerable. The error bars represent 95 per cent confidence intervals, with standard errors clustered at the firm-level.

### B.3.2 Rating Dynamics per Rating Category

To assess whether vulnerable firms are more likely to have a negative credit event or face a downgrade in each rating category, we run the following regression for firm $i$ in industry $h$ and year $t$ separately for each rating category:

$$Y_{iht+1} = \beta_1 Vulnerable_{iht} + \mathbf{\Gamma} X_{iht} + \mu_{ht} + \epsilon_{iht}$$

$Y_{iht+1}$ refers to either a downgrade or negative credit event (watchlist/outlook). The results of these estimations are shown in Figure B.3.

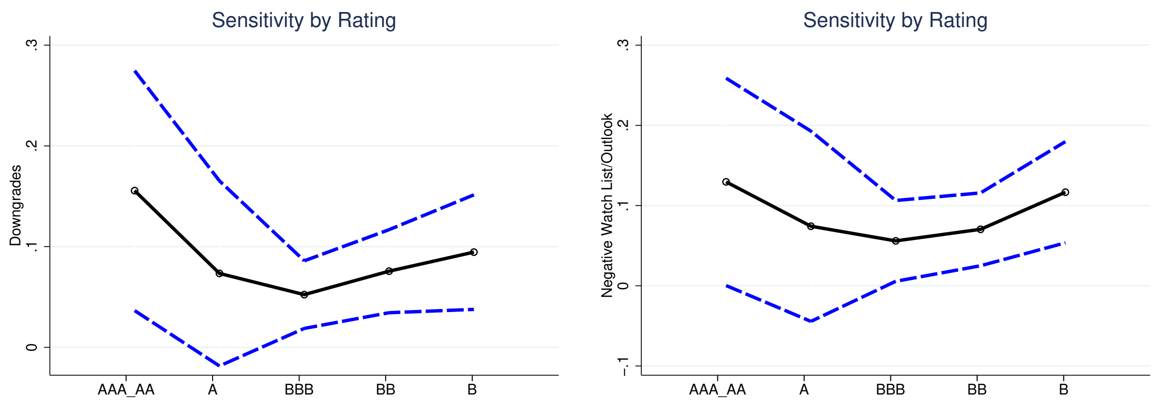



**Figure B.3: Rating Actions by Rating Category** This figure depicts the coefficient of interest $\beta_1$ of Specification (B1) for each rating category. The error bars represent 95 per cent confidence intervals, with standard errors clustered at the firm-level.

Panel A shows that relative to other rating categories, the vulnerable firms in the BBB-rated segment have a lower chance of being downgraded. Similarly, vulnerable firms are less likely to experience a negative credit event, compared to other rating categories. These results suggest that there is friction in the rating dynamics at the investment-grade cutoff.

## B.4 Investors' Demand

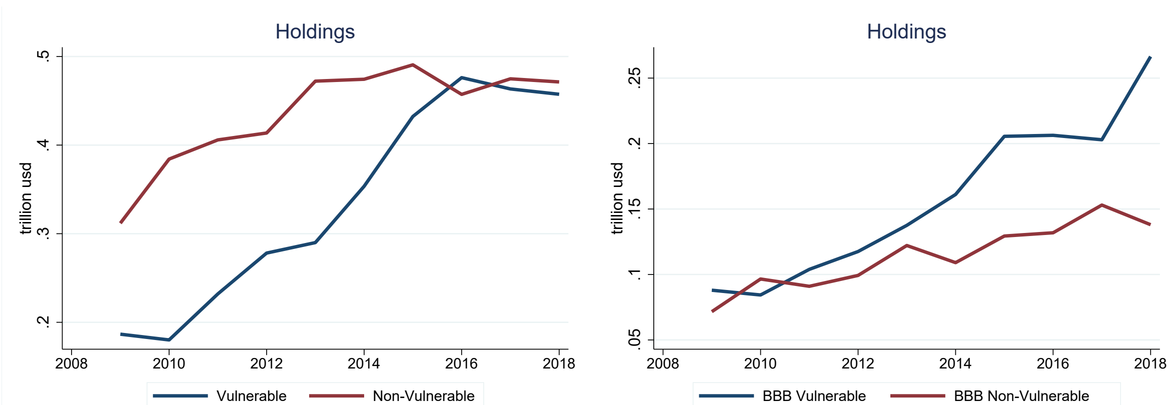



**Figure B.4: Investors' Demand, Non-Parametric Evidence, Additional Plots.** This figure shows additional non-parametric evidence. The left panel shows holdings of bonds issued by vulnerable and non-vulnerable firms. The right panel shows holdings of BBB bonds issued by vulnerable and non-vulnerable issuers. Both figures are totals in trillion dollars.

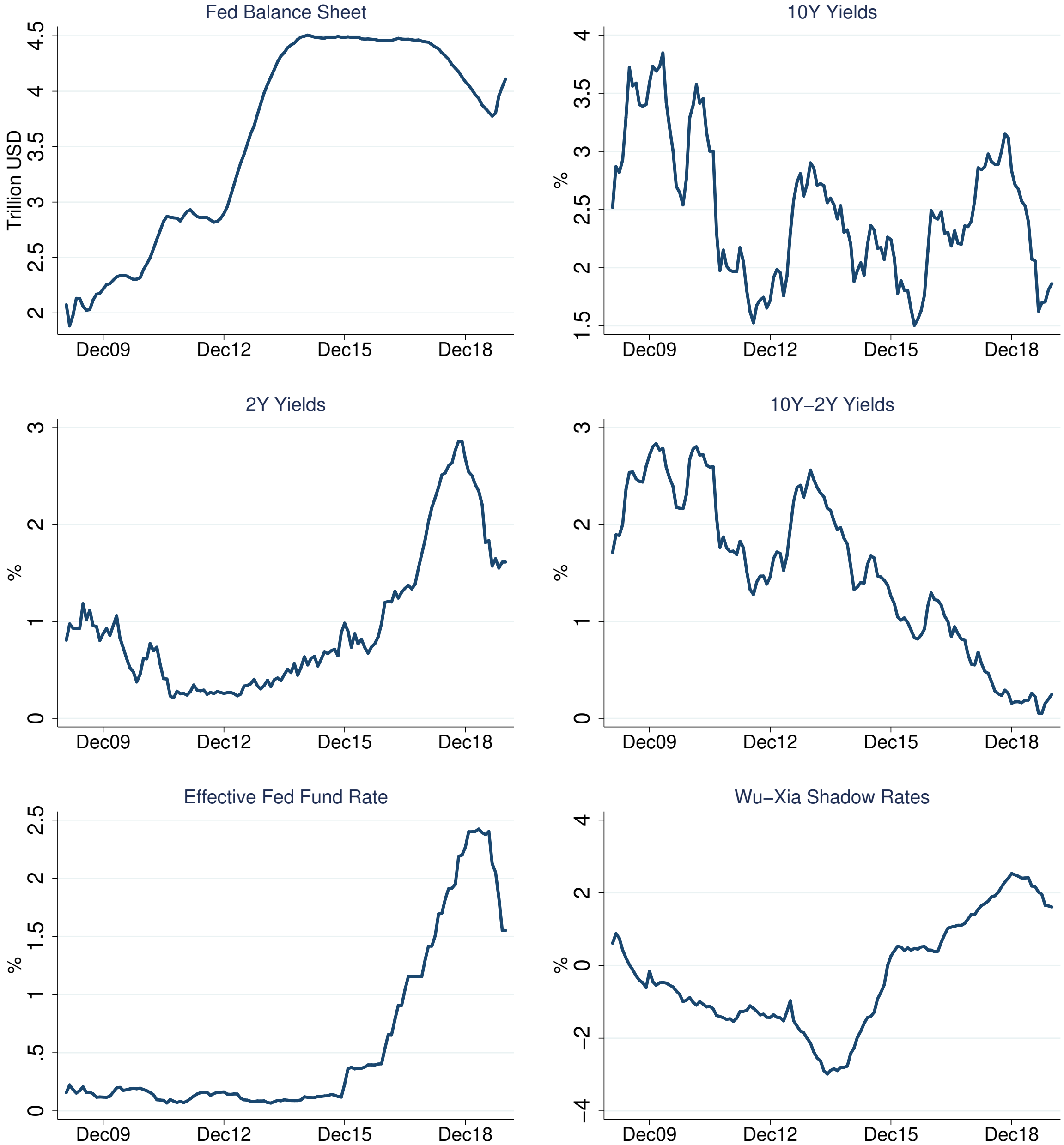
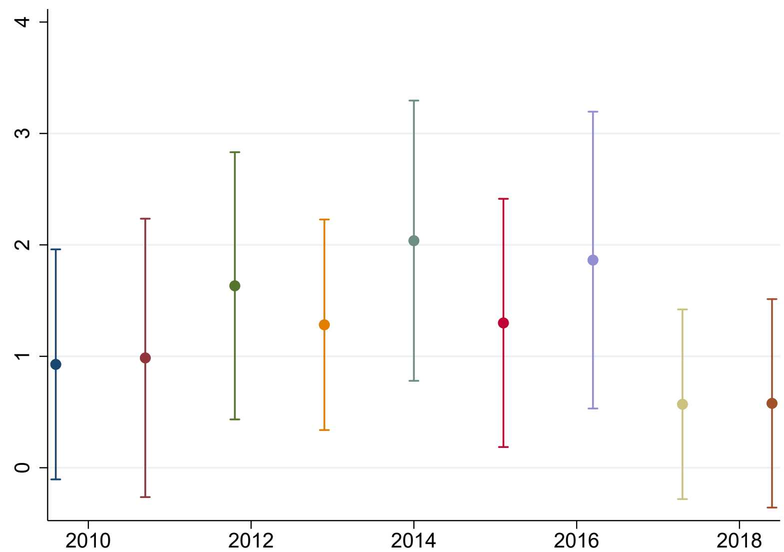



**Figure B.5: Monetary Policy Stance.** This figure shows the monetary policy stance in the U.S. during our sample period. The six panels show the size of the Fed balance sheet (trillion dollars), the 10-year Treasury yields (%), the 2-year Treasury yields (%), the difference between the 10-year and the 2-year Treasury yields, the effective fed fund rate, and the shadow rate developed in Wu and Xia (2016). The series are plotted with observations at a monthly frequency. The 10-year yields, the 2-year yields, and the effective fed fund rate are monthly averages of daily data. The fed balance sheet size is the monthly average of weekly data.

$$Holdings_{kjt} = \alpha + \beta_{1\tau} Duration_k^{09} \times Vulnerable_{jt} \times \mathbf{I}_\tau + \eta_{kt} + \mu_{jt} + \epsilon_{jkt}$$




$$Holdings_{jkt} = \alpha + \beta_{1\tau} Duration_k^{09} \times BBB_{jt} \times Vulnerable_{jt} \times \mathbf{I}_\tau + \beta_{2\tau} Duration_k^{09} \times BBB_{jt} \times \mathbf{I}_\tau + \beta_{3\tau} Duration_k^{09} \times Vulnerable_{jt} \times \mathbf{I}_\tau + \eta_{kt} + \mu_{jt} + \epsilon_{jkt}$$

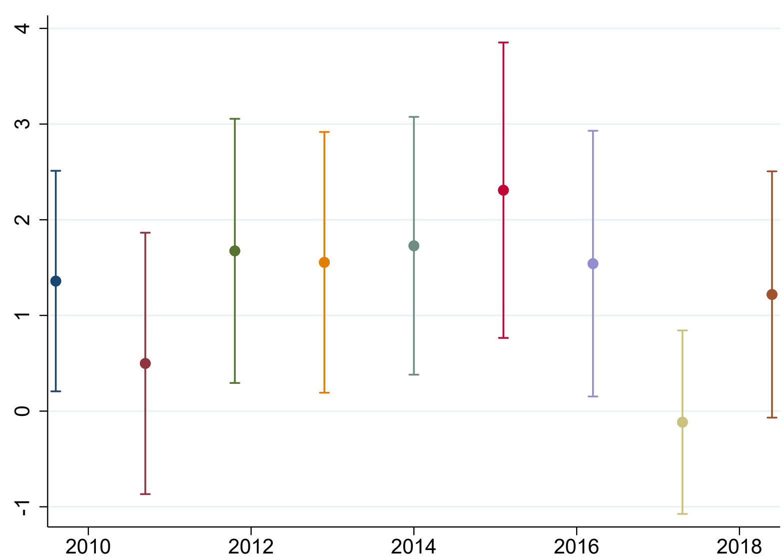



**Figure B.6: Investors' Demand, Coefficient Plots.** These coefficient plots show that the investors' demand for bonds issued by BBB-rated firms was particularly high from 2012 to 2016. The top panel shows the estimated coefficients $\beta_{1\tau}$ from the first specification. The bottom panel shows the estimated coefficients $\beta_{1\tau}$ from the second specification. Each specification is run nine times, where $\tau = \{2010, ..., 2018\}$. Standard errors are clustered at the investor $k$-time $t$ level and reported with 90% significance.

# Appendix C. Additional Tables

| | $Holdings_{jkt}$ | | | |
|---|---|---|---|---|
| $Duration_k^{09} \times Vulnerable_{jt}$ | 1.177** | 1.190** | 1.175** | 1.200** |
| | (0.502) | (0.506) | (0.492) | (0.495) |
| $Vulnerable_{jt}$ | -1.901 | | -1.390 | |
| | (5.063) | | (4.986) | |
| Fixed Effects | | | | |
| Time $t$ | ✓ | | | |
| Investor $k$ | ✓ | ✓ | | |
| Issuer $j$ | ✓ | ✓ | | |
| Investor $k$ - Time $t$ | | ✓ | ✓ | ✓ |
| Issuer $j$ - Time $t$ | ✓ | | ✓ | ✓ |
| Sample Issuers | BBB | BBB | BBB | BBB |
| Observations | 213,898 | 213,893 | 213,631 | 213,626 |
| R-squared | 0.452 | 0.464 | 0.500 | 0.512 |

**Table C.1: Investors' Demand, Double Interaction Specification, Robustness.** This table presents estimation results from specification (4). The unit of observation is investor $k$-issuer $j$-year $t$. The dependent variable is $log(1 + Holdings_{jkt})$, where $Holdings$ are holdings by investor $k$ in year $t$ of corporate bonds issued by issuer $j$ (thousands dollars). $Duration_k^{09}$ is the duration of investor $k$'s portfolio (in years) as of 2009Q4. $Vulnerable_{jt}$ is a dummy equal to 0.01 (for legibility) if issuer $j$ is vulnerable to a downgrade in year $t$. The regressions are run in the subsample of bonds issued by BBB-rated issuers in the full sample period. Standard errors are clustered at the investor $k$ level and reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.