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

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Abstract

Risky firms just above the investment-grade rating cutoff face the prospect of becoming "fallen angels" upon a downgrade. We document that their bond issuance, especially during periods of monetary easing after the global financial crisis, enjoyed low borrowing costs relative to their non-rating based credit risk measures. This "exorbitant privilege" appears to originate in credit rating inflation linked to M&As. While value destroying, M&As delay downgrades allowing prospective fallen angels to issue bonds met by high demand by investment-grade investors rebalancing their portfolio in response to LSAPs. As prospective fallen angels increase their market share by acquiring firms, they reduce markups, forcing their competitors to reduce employment, investment, markups, and sales, implying real effects and spillovers from their exorbitant privilege.

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. In many respects, the growth of risky investment-grade bonds may 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 the Federal Reserve 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 materialised following the Covid-19 shock and likely led to the Federal Reserve stepping in to stabilise the US corporate bond market in the wake of the Covid-19 shock.[1]

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 ratings agencies inflating their ratings when these firms engage in M&A. Even though these M&A transactions are value destroying, they are valued by bond investors because they delay downgrades of prospective fallen angels to the high-yield market. By delaying the downgrade to BB, vulnerable BBB firms lower their financing costs by around 140 bps. This is nearly three times the vulnerable BBB spread to AAA (48 bps). A back of the envelope calculation indicates that the median vulnerable BBB

[1] See Gilchrist et al. (2020) for details on the impact of the Federal Reserve's intervention on fallen angels.

firm saves around $496 million in interest expenses by conducting an M&A that delays a downgrade to junk status by three years. This amounts to saving the equivalent of around one year of interest expenses.

We further document that investors highly exposed to the Fed's large scale asset purchases (LSAPs) drive the demand for bonds issued by prospective fallen angels. This dynamic is driven by investors that predominantly hold investment grade bonds, therefore likely to be exposed to the fire sale risk related to an eventual downgrade and (ii) more pronounced for bonds issued by prospective fallen angels to fund M&A activity. Finally, we document that prospective fallen angels exert negative externalities on more prudent firms similar to the congestion effect created by zombie firms (Caballero et al. (2008)).

Our empirical analysis combines various data sources at the firm-, bond-, and investor-level. We use firm-level data from Compustat and WRDS Capital IQ, and ratings data from Standard and Poor's, Moody's and Fitch. 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.

First, we provide aggregate evidence on the developments in the U.S. debt market. We show that since 2009 corporate bond volume has steadily increased in dollar terms to over $6 trillion today, largely 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, compared to the $0.5 trillion of non-downgrade vulnerable firms. We confirm 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.

Second, 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

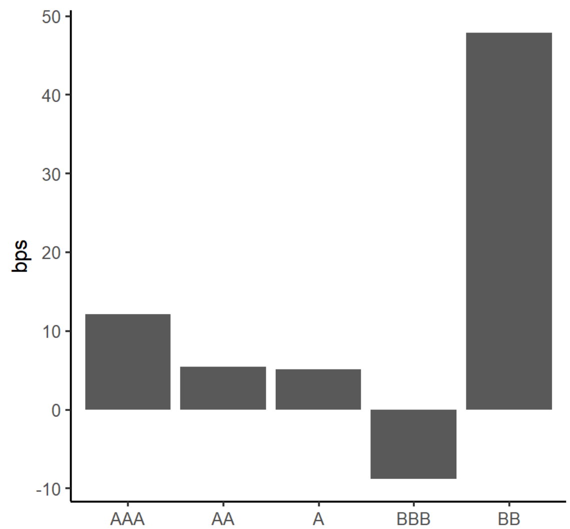

Figure 1: Prospective Fallen Angel Subsidy. This figure shows the difference between the median secondary market spread of firms defined as being vulnerable to a downgrade and the median spread of non-vulnerable firms in the same ratings category. We classify a firm as vulnerable if its estimated Z"-score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

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 post 2009. When replacing the bond spread with an equity market based measure of expected default, or examine spreads in syndicated loan markets, we find that across all rating categories (including BBB-rated firms), vulnerable firms have higher expected default frequencies.

Third, we document that credit rating inflation is particularly pronounced in the BBB segment of the bond market which in turn is closely associated with M&A activity by downgrade-vulnerable BBB firms. In particular, prospective fallen angels appear to engage in M&A activity to exploit the leniency of credit rating agencies following an M&A transaction. While these transactions are value destroying on average, we show that they might still be valued by bond investors because they delay the downgrade of prospective fallen angels to the high-yield market.

Fourth, using detailed data at the investor-security level, we show that the exorbitant privilege of prospective fallen angels is supported by the demand by investors exposed to the Fed's LSAPs, a dynamic particularly pronounced for investors that predominantly hold investment-grade bonds. We identify investors exposed to LSAPs calculating the share of investor total holdings that are held by the Fed (holdings are weighted by the share of amounts outstanding held by the Fed), capturing the rebalancing channel of LSAPs. Moreover, we show that investors' demand for bonds issued by prospective fallen angels is largely driven by the large quantity of bonds issued to fund M&A activity, consistent with the idea that, exposed to the fire sale risk related to an eventual downgrade to the high-yield market, investment-grade investors value the leniency of credit rating agencies following M&A.

Finally, we investigate the real effects of the increased investor demand for risky BBB bonds. In 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, we document that vulnerable BBB firms significantly increase their sales growth rate by charging lower markups on their products, further contributing to their rapid increase in market share in addition to their M&A activity. 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 findings contribute to two strands of literature. First, we contribute to the literature on misallocation and fragility in corporate debt markets. The documented vulnerability of the investment-grade bond market since 2009 is consistent with warning signs from practitioners about the BBB market (Altman, 2020b; S&P Global, 2020a; Blackrock, 2020; Morgan Stanley, 2018a,b) and explains the large price drop of investment grade corporate bonds at the onset of the COVID-19 pandemic (Haddad et al., forthcoming; Boyarchenko et al., 2021; Altman, 2020a). The special role of the BBB market is consistent with the role of fire sale (cliff) risk documented in the literature (Falato et al., forthcoming, 2021; Gilchrist et al., 2020). More generally, our findings are related to the literature on the misallocation of bank credit (Caballero et al., 2008; Acharya et al., 2020) and the source of financing more in general (Midrigan and Xu, 2014; Whited and Zhao, forthcoming) as well as the role of low interest rates on misallocation ((Banerjee and Hofmann, 2018, 2020)). Krishnamurthy and Muir (2020); Gilchrist and Zakrajsek (2012) discuss the real effects of credit spreads and among others, Caballero and Simsek (2020) on the role of monetary policy as a driver of asset prices.

Second, we contribute to the literature on credit ratings, their role in investors' portfolio choice, and the incentives of credit rating agencies. A large body of literature has shown that credit ratings affect investors' portfolio choice (Guerrieri and Kondor, 2012; Cornaggia and Cornaggia, 2013; Iannotta et al., 2019; Baghai et al., 2020). Becker and Ivashina (2015) shows that, within rating categories, investors reaching-for-yield might tilt their portfolio toward riskier assets. Goldstein and Huang (2020) shows that, this behavior might, in equilibrium, induce credit rating agencies to inflate their ratings. Credit rating inflation is discussed in, among others, Herpfer and Maturana (2020) that shows that credit rating agencies are less likely and slower to downgrade firms with "performance sensitive debt". Finally, our paper is also related to Aktas et al. (forthcoming) that shows that investment grade firms are concerned in their M&A activity about acquisition-related downgrades.

The remainder of the paper is structured as follows. Section 2 documents the rapid growth of the investment-grade corporate bond market, driven by BBB-rated issuers after the Global Financial Crisis. Section 3 presents the data, our measure of downgrade vulnerable firms and the definition of a prospective fallen angel. Section 4 documents that prospective fallen angels have benefited from a bond financing subsidy after the Global Financial Crisis and shows that this subsidy is driven by credit ratings inflation and reddemand for BBB bonds. Section 5 documents the real consequences of this subsidy. Section 6 concludes.

2 Aggregate Evidence

In this section, we present some aggregate facts. In Section 2.1, we document the sizable growth of the U.S. corporate debt market, mostly driven by BBB-rated issuers, following the Global Financial Crisis. In Section 2.2, we show that, during the same period, investment-grade corporate issuers paid historically low bond yields while becoming considerably riskier—a dynamic particularly pronounced for BBB-rated issuers.

2.1 The Growth of Non-Financial Corporate Debt

After reaching \$43 trillion in 2008, U.S. private debt decreased to \$39 trillion in 2011 and then steadily increased reaching \$51 trillion today, a dynamic accelerated by the COVID-19 pandemic. While the deleveraging in 2008–11 was mainly driven by the financial and household sectors, the subsequent private debt cycle has been predominantly driven by the corporate non-financial sector. The top left panel of Figure 2 shows the time-series evolution of private debt taken by the financial sector, the corporate non-financial sector, and the household and non-profit sector since 1999, as a share of GDP. The figure shows that the steady increase in the last ten years made the non-financial business debt the largest private debt category, equivalent to 82% of GDP in 2020. The top right panel normalizes these times series to 100 in 2009Q1, confirming that the last cycle has been entirely driven by non-financial business debt, which increased from \$10 trillion in 2008 to \$17 trillion in 2020.

The bottom panel of Figure 2 shows that the increase in non-financial corporate debt has been mostly driven by corporate bonds. The figure in the bottom left shows that the stock of corporate bonds outstanding issued by non-financial firms increased from around \$3 trillion in 2009 to around \$6 trillion in 2020. This increase is almost entirely driven by bonds issued by BBB-rated firms, namely the lowest rated segment of the "investment-grade" bond market. This segment represents around 52% of all investment-grade bonds outstanding in 2020, up from 33% at the start of 2009. The bottom right panel shows the unprecedented

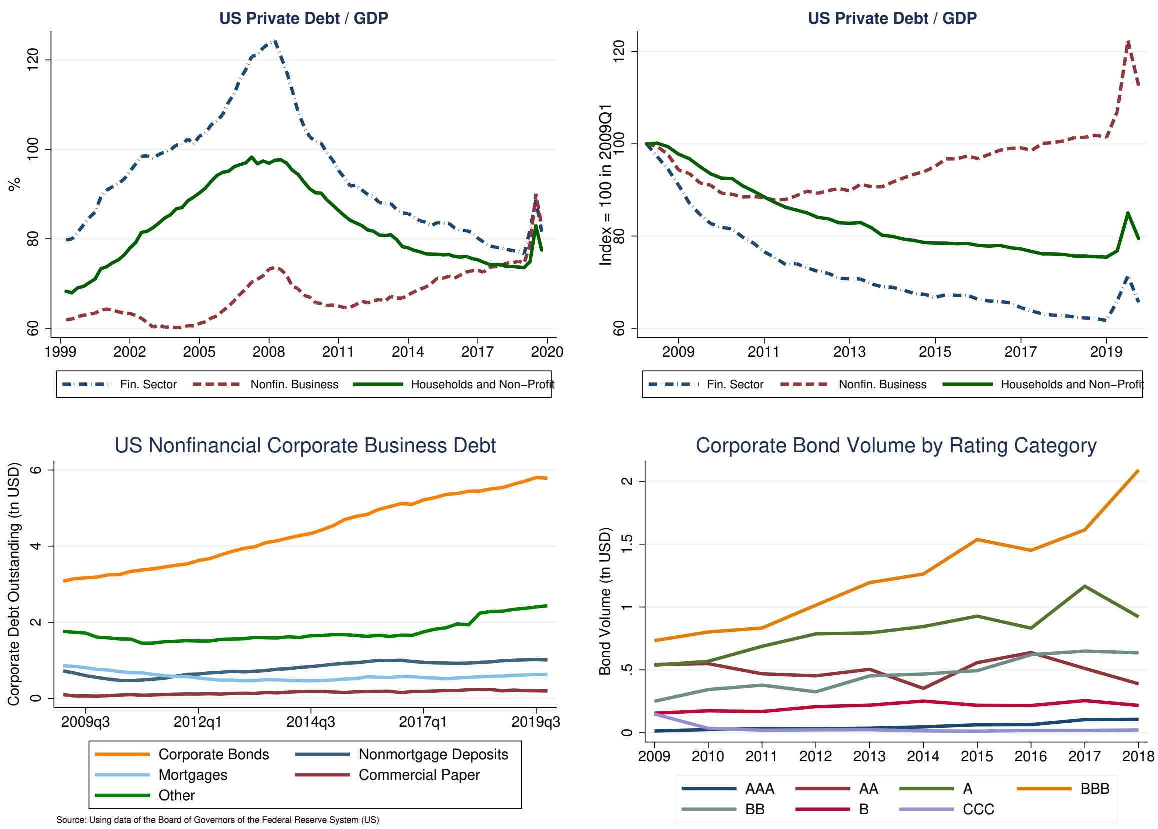

Figure 2: The Growth in U.S. Non-Financial Corporate Debt. This figure shows the growth in U.S. non-financial corporate debt and, in particular, bond markets. The top left panel shows the evolution of the financial sector debt, non-financial sector debt, and household debt, normalized by GDP. The sources are series dodfs, tbsdodns and cmdebt from FRED. The top right panel is an index where these series are normalized to 100 in 2009Q1. The bottom left panel shows the evolution of 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). The sources are series cblbsnncb, mlbsnncb, ncbilia027n, cplbsnncb and olalbsnncb from FRED. The bottom right panel shows the evolution of the stock outstanding of corporate bonds, grouped by rating category. The sources are Capital IQ and Thomson Reuters.

rise in the size of the BBB-bond market, which tripled in size from around \$0.7 trillion in 2009 to more than \$2 trillion in 2018. Figure B.2 in the appendix shows the evolution of bond issuance by rating bucket.

2.2 Firm Risk and Bond Yields

The growth of the BBB segment of the bond market has been accompanied by a deterioration in the quality of BBB-rated firms and a substantial reduction in their bond financing costs. The deterioration of issuer quality has been discussed in industry pieces (Morgan Stanley,

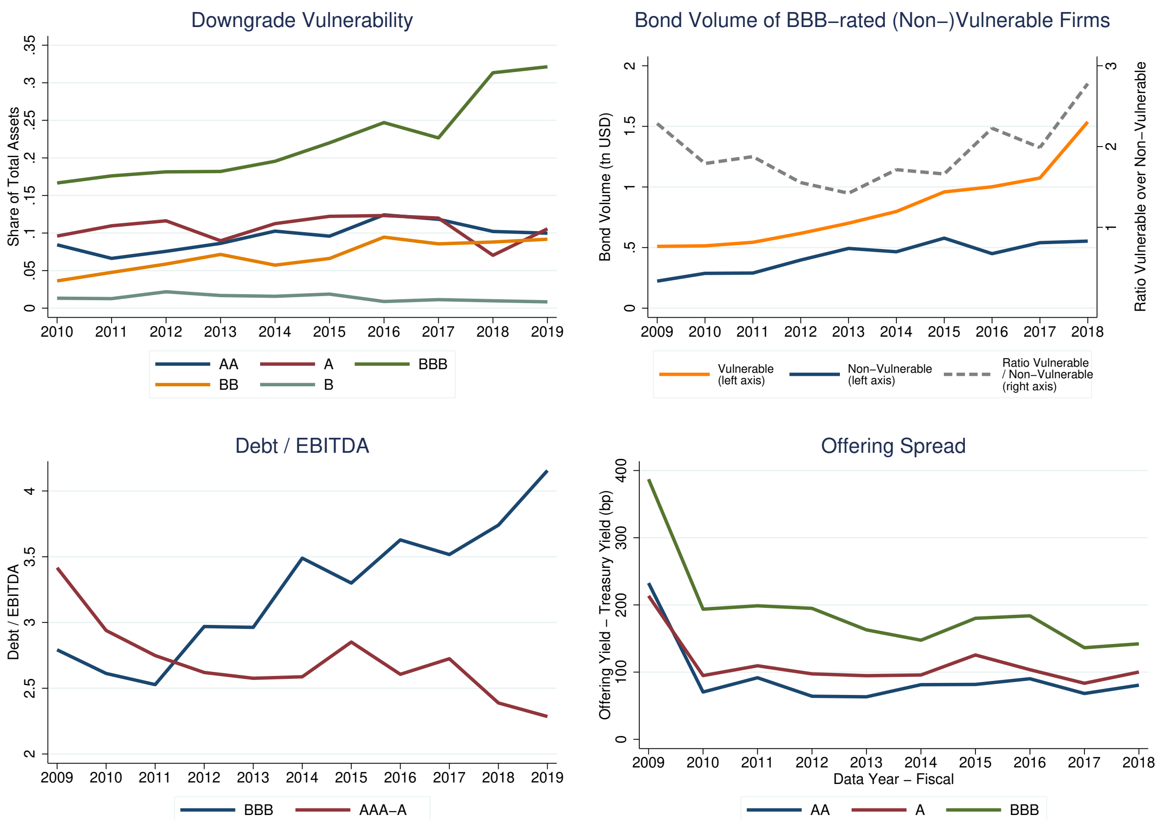

Figure 3: Downgrade Vulnerability. This figure shows the deterioration of firm quality and the declining bond financing costs for BBB-rated firms. The top left panel shows the share of firms that are vulnerable to a downgrade based on the Z"-score by rating category, where firms are weighted by total assets. The top right panel shows, within the BBB rating category, the share of stock of bond debt issued by vulnerable and non-vulnerable BBB-rated firms. The dashed line is the ratio between these two series. The bottom left panel shows the debt over EBITDA evolution for BBB and other IG-rated firms. The bottom right panel shows the offering spread (primary market bond yields minus the treasury yield with a similar maturity) for newly issued bonds.

2018a,b; Blackrock, 2020) and specialized papers (Çelik et al., 2020; Altman, 2020b; S&P Global, 2020a) that warned about the risk of a wave of "fallen angels," namely a large number of downgrades of BBB-rated firms to the sub-investment grade, or high-yield, market.

In Figure 3, we document the deterioration in issuer quality and the drop in yields paid by BBB firms since 2009. The top left panel shows the share of firms that are vulnerable to a downgrade based on the Altman Z"-score, a measure of credit risk calculated with income statement and balance sheet information (Altman, 2020a).[2]

[2]We explain this measure of downgrade vulnerability in more detail in Section 3.

The figure shows that the share of firms that are vulnerable to a downgrade increased substantially in the BBB-market, but not in other markets, since 2013. The top right panel confirms that the growth of the BBB market is driven by these "prospective fallen angels." Since 2009, their stock of bonds outstanding tripled in size to $1.5 trillion in 2018. During the same period, the non-vulnerable segment increased only from $0.2 to $0.5 trillion.

The bottom left confirms the deterioration in the quality of BBB-rated firms. The figure shows the debt-to-EBITDA ratio, a metric used by lenders and credit rating agencies to assess firms' ability to service their debt, for BBB firms and other investment-grade firms. The bottom right panel shows the evolution of offering spreads, namely the difference between primary market bond yields and the Treasury yields with a similar maturity. The offering spread of BBB issuers declined from around 400 basis points in 2009 to around 150 basis points in 2018. The figure also highlights that BBB offering spreads moved closer to AA and A offering spreads: the offering spread of BBB issuers declined by around 100 basis points relative to A and AA issuers. Over the same period, there is no evidence of a spread narrowing between A and AA firms.

3 Data and downgrade vulnerable firms

In this section, we describe our data sources and explain our strategy to identify the prospective fallen angels. In Section 3.1, we describe our data sources and data construction. In Section 3.2 we describe our definition of downgrade vulnerable firms and prospective fallen angels.

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 Refinitiv Eikon, 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 Refinitiv, a detailed data set that documents security-level holdings by individual investors at a quarterly frequency. We collapse holdings within a fund at the issuer level so that our unit of observation is holdings at quarter t by investor k of bonds issued by issuer j. We match this data with security level holdings by the Fed's in the SOMA portfolio. This data is publicly available on the website of the New York Fed.

3.2 Vulnerable firms

We define firms that are vulnerable to a downgrade based on the Altman Z"-score, a measure of credit risk calculated with income statement and balance sheet information (Altman, 2020a). The Altman Z"-score is defined as:

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

Specifically, we classify a firm as vulnerable if its Z"-score is lower than the historical median Z"-score of the next lowest rating category.[3] For example, a BBB-rated firm is

[3] We thank Ed Altman for providing us with these median "benchmark" Z" scores for each rating category.

classified as vulnerable if its Z"-score is below the median Z"-score of BB rated firms. We analyse the validity of the Altman Z" as measure of downgrade risk in Annex B.3. We define a prospective fallen angel as a BBB rated firm that is classified as being vulnerable.

4 The Exorbitant Privilege

In this section, we show that vulnerable BBB firms—prospective fallen angels—have benefited from extraordinarily low bond financing costs, supported by the leniency of credit rating agencies. In Section 4.1, we document the funding advantage, particularly large during periods of monetary easing, of prospective fallen angels. In Section 4.2 we show that this funding advantage originates, in equilibrium, from credit rating inflation and in section Section 4.3 we show how the risk materialised for vulnerable BBB firms during the initial phase of the Covid-19 shock. Finally, in Section 4.4, we show that this funding advantage originates, in equilibrium, from credit rating inflation and investors' demand for BBB-rated bonds.

4.1 The Funding Advantage

In this section, we document the funding advantage of prospective fallen angels with non-parametric and parametric tests.

First, we show that the compression of BBB bond spreads coincides with a marked decline of the spreads of vulnerable issuers relative to non-vulnerable issuers—a dynamic unique to the BBB segment of the bond market. In Figure 4, we show secondary market spreads between vulnerable and non-vulnerable issuers rated A, BBB, and BB. We observe that the difference in the spread between vulnerable and non-vulnerable BBB rated firms is (i) almost always smaller than the difference for the A and BB segments, (ii) hovering around zero, and

The bond rating equivalents 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, 2020a). For a discussion on Z"-models, we refer to Altman (2018) and Altman et al. (2019).

(iii) negative from 2013 to 2016. Non-parametric evidence presented in Annex B.4 provides further evidence that the bond financing cost of BBB firms dropped significantly, and more than the financing costs of other investment grade issuers.

Second, we document in a formal test, the exorbitant privilege of prospective fallen angels, namely we show that the financing costs of vulnerable BBB firms are lower than the financing costs of non-vulnerable BBB-rated issuers. In particular, we compare the bond spread on vulnerable vs. non-vulnerable firms within a rating category by estimating the following specification:

$$\begin{aligned} Spread_{biht} =& \beta_1 Rating_{iht} + \beta_2 Rating_{iht} \times Vulnerable_{iht} \\ &+ \mathbf{\Gamma} X_{it-1} + \delta \times Z_{bt} + \mu_{ht} + \epsilon_{biht} \end{aligned} \tag{1}$$

where $Spread_{biht}$ is the spread (in basis points) of bond b issued by firm i in industry h in year t. Bond spreads are the difference between bond and treasury yields with a similar maturity. $Rating_{iht}$ is the firm rating and $Vulnerable_{iht}$ is an indicator variable equal to one if the issuer is classified as vulnerable in period t. We also include a vector X_{it} of firm level control variables, a vector Z_{bt} of bond level characteristics, and industry-year fixed effects μ_{ht}. Note that due to a relatively low number of bonds with a AAA rating, we combine AAA and AA rated firms into one category in this analysis.

Table 1 presents the estimation results. The estimated coefficients of the uninteracted terms in the first column show that bond spreads are monotonically increasing as the ratings deteriorate. The estimated coefficients of the interaction terms show that in all rating categories, except BBB, vulnerable firms have either higher financing costs or than non-vulnerable firms or their financing costs are statistically indistinguishable from those of non-vulnerable firms. This correlation is reversed for BBB firms as prospective fallen angels pay significantly *lower* financing costs than non-vulnerable BBB firms. The second column shows the estimation results in the subsample running from 2013 to 2016. In this period of substantial monetary easing, the funding privilege of prospective fallen angels increases in magnitude. The third and fourth columns show similar estimation results using primary market offering spreads as a dependent variable. Additionally, in Annex B.5 we show that,

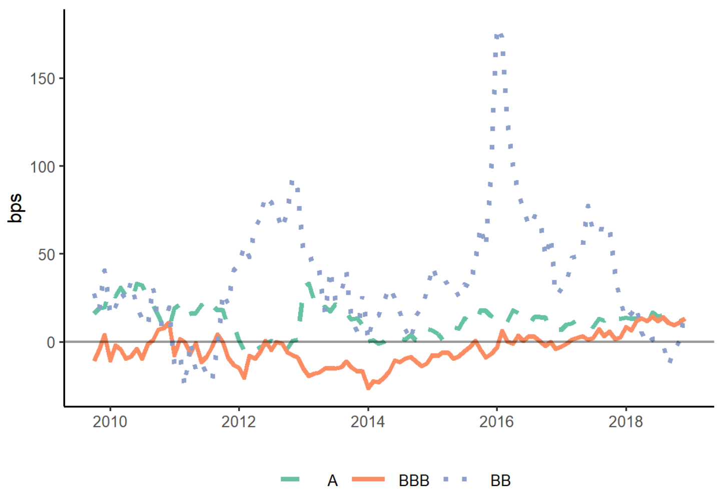

Figure 4: Secondary Market Spreads, Vulnerable Vs. Non-Vulnerable Issuers. This figure shows the difference in secondary market spreads between vulnerable and non-vulnerable issuers, separately for issuers rated A (dashed line), BBB (solid line), and B (dotted line).

consistent with an exorbitant privilege of prospective fallen angels, the sensitivity of bond spreads to changes in credit risk (measured with expected default frequencies) is the weakest for BBB-rated issuers.

To provide further evidence that this privilege is unique to the corporate bond market in the last decade, we run several additional tests.[4] First, in columns (1) and (2) of Table 2, we use the (log) expected default frequency derived from equity markets at the 2-year and 5-year horizons as dependent variables. While we confirm that the estimated coefficients on the uninteracted terms increase monotonically as ratings deteriorate, the advantage of prospective fallen angels disappears, suggesting that the exorbitant privilege documented above is specific to the bond market. Second, column (3) shows that between 2002 and 2007 (the last period of expansionary monetary policy before the global financial crisis), vulnerable BBB firms did not benefit from a similar privilege. In contrast, vulnerable BBB firms paid higher spreads in this period, in line with other rating buckets. Lastly, Table 2 shows that these firms did not have a similar funding advantage in the syndicated loan market. Taken together, these results suggest that the exorbitant privilege of prospective fallen angels was

[4]Given a limited number of observations in the highest rating buckets AAA and AA, especially in the syndicated loan market data, we further combine AAA-A ratings into a single rating category.

	Spread	Spread	Offer Spread	Offer Spread
A	11.966	16.471	7.116	3.159
	(8.687)	(12.137)	(14.539)	(11.549)
BBB	48.123***	56.481***	83.673***	76.955***
	(10.787)	(13.416)	(15.909)	(15.315)
BB	167.867***	153.839***	249.075***	220.879***
	(15.366)	(17.015)	(20.831)	(23.267)
B	295.022***	254.784***	405.273***	390.583***
	(21.595)	(27.204)	(23.612)	(33.515)
CCC	949.039***	728.100***	553.248***	-76.914
	(103.255)	(89.575)	(68.564)	(262.145)
Vulnerable × AAA-AA	20.644***	25.284***	6.370	-2.088
	(7.986)	(9.543)	(15.378)	(13.540)
Vulnerable × A	-9.299	-6.579	-8.591	3.753
	(6.858)	(8.046)	(10.015)	(16.731)
Vulnerable × BBB	-12.394**	-17.348***	-20.440**	-32.860**
	(5.038)	(6.551)	(8.275)	(12.690)
Vulnerable × BB	30.926***	29.394***	36.941**	40.121
	(10.354)	(10.785)	(14.648)	(30.366)
Vulnerable × B	51.719*	65.192**	38.424	-0.437
	(26.615)	(32.992)	(31.493)	(71.978)
Vulnerable × CCC	362.443**	228.544*		
	(167.369)	(138.583)		
Industry-Year FE	✓	✓	✓	✓
Firm-Level Controls	✓	✓	✓	✓
Bond-Level Controls	✓	✓	✓	✓
Sample	Entire	2013–16	Entire	2013–16
Observations	19,313	6,489	3,132	749
R-squared	0.755	0.761	0.918	0.934

Table 1: Bond Spread of Vulnerable and Non-Vulnerable Firms by Firm Ratings. This table shows the estimation results of Specification (1). The dependent variable in columns (1)-(2) is the secondary market bond spreads. The dependent variable in columns (3)-(4) is the primary market bond spread. Bond spreads, measured in basis points, are the difference between bond and treasury yields of the same maturity. Vulnerable is a dummy equal to one if a firm is vulnerable. Firm level controls are the log of total assets, leverage, and the interest coverage ratio. Bond level controls are residual maturity, a callable dummy, and a liquidity measure. All specifications include industry-year fixed effects (2-digit SIC). Standard errors are clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1.

unique to bond markets in the post global financial crisis period.

4.2 Credit Rating Inflation

In this section, we document that credit rating inflation is particularly pronounced, and increasing, in the BBB segment of the bond market. In addition, we show that M&A activity is closely associated with ratings inflation for prospective fallen angels such that prospective fallen angels engage in M&A activity to exploit the leniency of credit rating agencies following

	EDF 2Y	EDF 5Y	Spread	All-in-drawn Spread
BBB	0.439***	0.351***	5.618	28.513*
	(0.090)	(0.071)	(14.272)	(14.696)
BB	1.237***	0.953***	58.350**	75.864***
	(0.117)	(0.092)	(27.801)	(15.734)
B	2.571***	1.935***	170.007***	161.962***
	(0.146)	(0.112)	(23.229)	(17.302)
CCC	4.109***	3.095***	224.996**	288.495***
	(0.201)	(0.161)	(101.925)	(54.550)
Vulnerable × AAA-A	0.195*	0.159*	11.554	27.204
	(0.107)	(0.088)	(7.953)	(16.986)
Vulnerable × BBB	0.267***	0.184***	25.167**	12.380*
	(0.089)	(0.068)	(11.140)	(7.118)
Vulnerable × BB	0.572***	0.406***	21.995	20.150***
	(0.111)	(0.083)	(13.624)	(7.169)
Vulnerable × B	0.604***	0.452***	44.855	40.356***
	(0.124)	(0.092)	(29.457)	(12.583)
Vulnerable × CCC	-0.024	-0.018	330.357***	19.176
	(0.235)	(0.191)	(65.347)	(72.021)
Industry-Year FE	✓	✓	✓	✓
Firm-Level Controls	✓	✓	✓	✓
Sample	Entire	Entire	2002-2007	Synd. loans
Observations	4,223	4,223	1,855	5,273
R-squared	0.780	0.804	0.715	0.516

Table 2: Mispricing: Robustness. This table shows the estimation provides further results on the mispricing in different markets and time periods. The dependent variable in columns (1)-(2) are the expected default frequencies at the 2-year and 5-year horizon, respectively. The dependent variable in column (3) is the secondary market bond spreads in the pre global financial crisis period from 2002-2007. The dependent variable in columns (4) is the all-in-drawn spread for syndicated loans taken from DealScan. Bond spreads, measured in basis points, are the difference between bond and treasury yields of the same maturity. Vulnerable is a dummy equal to one if a firm is vulnerable. Firm level controls are the log of total assets, leverage, and the interest coverage ratio. All specifications include industry-year fixed effects (2-digit SIC). Standard errors are clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1.

an M&A transaction. While these transactions are value destroying, we show that they are valued by bond investors because they delay downgrades of prospective fallen angels to the high-yield market.

We first show that credit rating inflation is particularly high, and increasing since 2009, for BBB-rated issuers in Figure 5. The figure shows that credit rating inflation is highest for BBB-rated issuers where credit rating inflation is defined as zero for issuers that have a Z"-score above the median Z"-score of firms in the next lower rating category and equal to the difference between the issuer credit rating notch (e.g., AA+, AA, AA-, A) and the credit

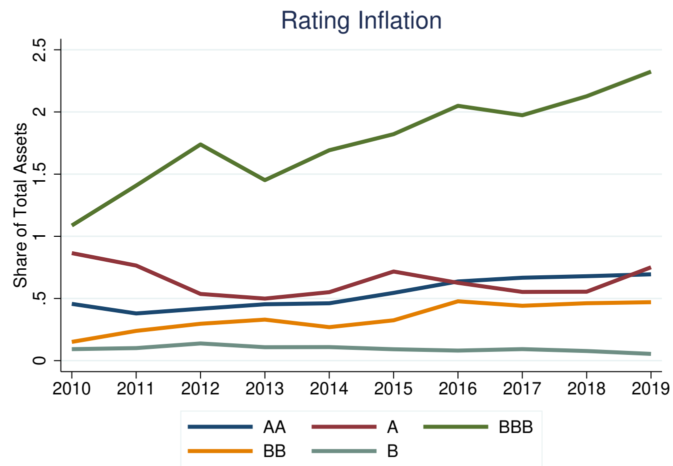

Figure 5: Credit Rating Inflation. This figure shows credit rating inflation based on the firm's Z"-score relative to Z"-scores of firms in lower ratings buckets. Credit rating inflation is equal to zero if an issuer has a Z"-score above the median Z"-score of firms in the next lower rating category, otherwise credit rating inflation is calculated as the number of notches between the issuer's credit rating notch (e.g., AA+, AA, AA-, A) and the credit rating notch implied by its Z"-score. The figure shows asset weighted credit rating's inflation in each year.

rating notch implied by its Z"-score otherwise.[5] The highest rating inflation for BBB rated issuers is consistent with credit rating agencies' reluctance to downgrade BBB-rated firms to the high-yield market. Moreover, Figure 5 shows that the rating inflation of BBB-rated issuers has been steadily increasing from 2009 to 2019 in contrast to other rating buckets.

The presence of particularly pronounced ratings inflation among BBB issuers is consistent with other studies and anecdotal evidence. For example, Bruno et al. (2016) show that Moody's avoids downgrading issuers of corporate bonds that are close to losing their investment grade certification. Investment bank analysis paints a similar picture of ratings inflation. For example in 2018 a research note by Morgan Stanley noted that, "... where 55% of BBB debt would have a high-yield rating if rated based on leverage alone. Meanwhile, interest coverage has declined steadily since 2014, particularly for BBB issuers..." (Morgan Stanley (2018a)).

Parametric tests in Table 3 show that ratings inflation is driven by vulnerable BBB firms, and importantly, that this is closely related to M&A activity. Within vulnerable firms, the results in Column (1) suggest that vulnerable BBB issuers enjoy on average an

[5] See Annex B.2 for additional details on the conversion of ratings notches to numerical values.

	Rating Inflation	Rating Inflation
BBB	0.380**	-0.041
	(0.188)	(0.290)
M&A × BBB		0.642**
		(0.302)
M&A		-0.318
		(0.199)
Controls	✓	✓
Industry-Year FE	✓	✓
Sample	Vulnerable	Vulnerable
Observations	2,750	2,750
R-squared	0.381	0.386

Table 3: Rating Inflation. This table presents firm-level regressions where the dependent variable is rating inflation - calculated as the number of notches between the issuer's credit rating notch (e.g., AA+, AA, AA-, A) and the credit rating notch implied by its Z"-score. All specifications include industry-year fixed effects and firm-level controls (log(total assets), leverage, net worth). Standard errors are clustered at the firm level.

additional 0.4 notches in ratings inflation compared to vulnerable issuers in other ratings buckets. Furthermore, Column (2) shows that within vulnerable firms ratings inflation is largely driven by firms that have undertaken an M&A. This M&A ratings inflation is, however, only enjoyed by BBB issuers. Rather, M&A by issuers in other ratings buckets tends to result in a reduction in ratings inflation on average, although not significantly.

Value creating M&A by BBB vulnerable issuers could potentially justify the M&A related ratings inflation. However, M&A by BBB vulnerable issuers has instead been value destroying. In particular, Column (1) of Table 4 shows that the cumulative abnormal returns around M&A transactions by vulnerable BBB issuers have been negative. By contrast, for non-vulnerable BBB issuers as well as vulnerable firms in other ratings buckets, M&A has not been significantly correlated with negative abnormal returns. In Columns (2), (3) and (4) we show that for vulnerable BBB rated firms Tobin's Q and productivity drop in the year following the announced M&A transaction, and that net debt over EBITDA rises. This is in contrast to BBB non-vulnerable firms which show the reverse pattern. Again, this finding is consistent with anecdotal evidence from investment bank research notes regarding risky M&A, for example, "...M&A has driven big increases in leverage and BBB debt outstanding. And while these companies may pledge to delever over time, those promises often don't materialize..." (Morgan Stanley (2018a)) Similarly, in the same year another research note noted, "...forward-looking assumptions often assume all goes well and earnings growth is

	(1) CARs	(2) Tobin's Q	(3) Productivity	(4) Net Debt/EBITDA
Vulnerable $\times BBB$	-0.014***	-0.234**	-0.140**	0.376*
	(0.005)	(0.093)	(0.067)	(0.212)
Vulnerable	0.005	-0.036	0.026	-0.263
	(0.004)	(0.073)	(0.048)	(0.183)
BBB	-0.000	0.117*	0.088*	-0.222*
	(0.002)	(0.071)	(0.047)	(0.125)
Controls	✓	✓	✓	✓
Industry-Year FE	✓	✓	✓	✓
Sample	M&A Rated	M&A Rated	M&A Rated	M&A Rated
Observations	2,566	2,621	2,540	2,622
R-squared	0.057	0.441	0.563	0.470

Table 4: Value Destruction. This table presents the value destruction of vulnerable BBB-rated firms in the year after the announced M&A transaction. Column (1) presents the 5-day cumulative abnormal returns for the M&A deals performed by the rated firms in our sample. The total return value-weighted index is used as benchmark over a -210 to -11 day period. Control variables include the logarithm of total assets, leverage, profitability, an indicator variable for whether the deal is at least partially financed with stock, an indicator variable for whether the target has the same 2-digit SIC code as the acquiror, an indicator variable for whether the deal is cross-border, an indicator variable for a publicly listed target and the pre-deal buy-and-hold returns of the acquiror from -210 to -11 days. A t-test shows that on average the CARs of BBB vulnerable firms are -1 per cent. For columns (2), (3) and (4) the dependent variables at $t+1$ include Tobin's Q, productivity (log(sale) - 2/3*log(emp)- 1/3*log(ppent)) and net debt over EBITDA. The sample consists of all firms that are rated and have an announced M&A transaction in year t. Firm controls include the log of assets, profitability, leverage and tangibility. All specifications include industry-year fixed effects. Standard errors are clustered at the firm level.

strong. In reality, issuers have been slow to actually delever..." (Morgan Stanley (2018b)).

Even though M&A by BBB vulnerable firms is value destroying, somewhat surprisingly, it does appear to postpone ratings downgrades. Indeed, prospective fallen angels appear to engage in M&A activity to exploit the leniency of credit rating agencies following an M&A transaction, allowing them to kick the downgrade can down the road. To assess the impact of M&A by vulnerable firms on the propensity to be downgraded, we calculate Kaplan-Meier (Kaplan and Meier, 1958) survival rate estimates. The Kaplan-Meier survival rate estimates are given by:

$$\hat{S}_t = \prod_{t_i < t} \left(1 - \frac{d_i}{n_i}\right) \tag{2}$$

where t_i is duration of being at particular credit rating at point i, d_i is the number of downgrades up to point i and n_i is the number of issuers at risk just prior to t_i. S estimates the probability that an issuer survives at its current rating category at the end of the time interval. We estimate the survival probability of vulnerable firms splitting them into two

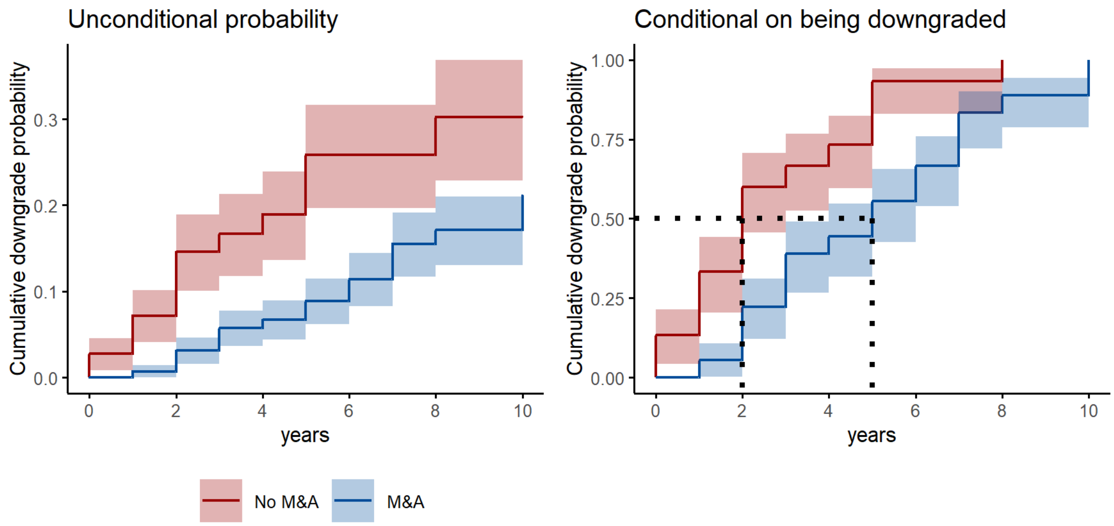

Figure 6: Cumulative Downgrade Probabilities of Vulnerable Firms. This figure shows the cumulative downgrade probabilities derived from Kaplan-Meier survival estimator together with 90% confidence bands. The left-hand panel plots the cumulative downgrade probability of vulnerable BBB firms grouped by whether the firm did or did not conduct an M&A whilst being rated BBB. The right-hand panel shows cumulative downgrade probabilities of vulnerable BBB firms conditional on the firm eventually being downgraded to high yield.

groups depending on whether they have conducted an M&A at their current rating bucket.

The left-hand panel of Figure 6 shows that the downgrade probabilities are indeed lower for vulnerable BBB issuers that have conducted an M&A compared with their vulnerable BBB peers that have not done so. After five years, only 8% of vulnerable BBB M&A issuers were downgraded. This compares with around 25% of vulnerable BBB issuers that did not undertake an M&A. The right-hand panel shows the cumulative downgrade probabilities of vulnerable issuers, conditional on being downgraded during our sample period. Conditional on being eventually downgraded, M&As still appear to delay the point at which credit rating agencies downgrade issuers, shown by the less steep curve. For the median vulnerable BBB firm, undertaking an M&A prolongs once the period before being downgraded to high yield by 3 years.[6]

By delaying the downgrade to the BB segment, a vulnerable BBB firm lowers its financing

[6] Although M&A delays the time until a vulnerable BBB issuer is downgraded, the downgrade intensity is actually higher, by on average 0.5 notches (see Annex B.6).

costs by around 140 bps. This is nearly three times the vulnerable BBB spread to AAA (48 bps). A back of the envelope calculation indicates that the median vulnerable BBB firm saves around $496 million in interest expenses by conducting an M&A that delays a downgrade to junk status by three years. This amounts to saving the equivalent of around one year of interest expenses.

Thus, the vulnerable BBB segment is characterized by high and increasing credit rating inflation. Moreover, the funding advantage of these prospective fallen angels is driven by their ability to exploit rating inflation related to value destroying M&A. Even though this M&A is value destroying on average, it delays the point at which credit ratings agencies downgrade the issuer. Nevertheless, consistent with M&A's being value destroying, vulnerable BBB issuers are downgraded by more notches on average if they conducted an M&A and were subsequently downgraded than issuers that did not. We now turn to the materialization of this risk following the COVID-19 shock.

4.3 Risk materialization during COVID-19

In this section, we use COVID-19 as exogenous shock to show how the vulnerability of BBB rated firms materialized. First, we show that the total value of assets in firms that were downgraded from BBB into high-yield in the beginning of 2020 exceeded that of previous years, and was even higher than during the global financial crisis. Second, we document that the monthly spreads of the BBB fallen angels spiked relative to the BBB non-fallen angels when the COVID-19 shock hit. Third, using a regression approach, we provide evidence that the BBB firms with more inflated credit ratings experienced a sharper increase in spreads in 2020. Finally, we show non-parametrically that the vulnerable BBB-rated firms that engaged in M&A activity in the past had more (severe) downgrades than vulnerable BBB-rated firms that did not.

Amid the sudden COVID-19 downturn, downgrades of BBB-rated firms picked up. In the left panel of Figure 7 we see that in 2020 the total balance sheet size of fallen angels downgraded from BBB status amounted to $600 billion. This number greatly surpassed the size of earlier years, including the amount brought on by the global financial crisis. As a result, the monthly spreads of BBB fallen angels surged in March 2020 (see Figure 7, right panel).

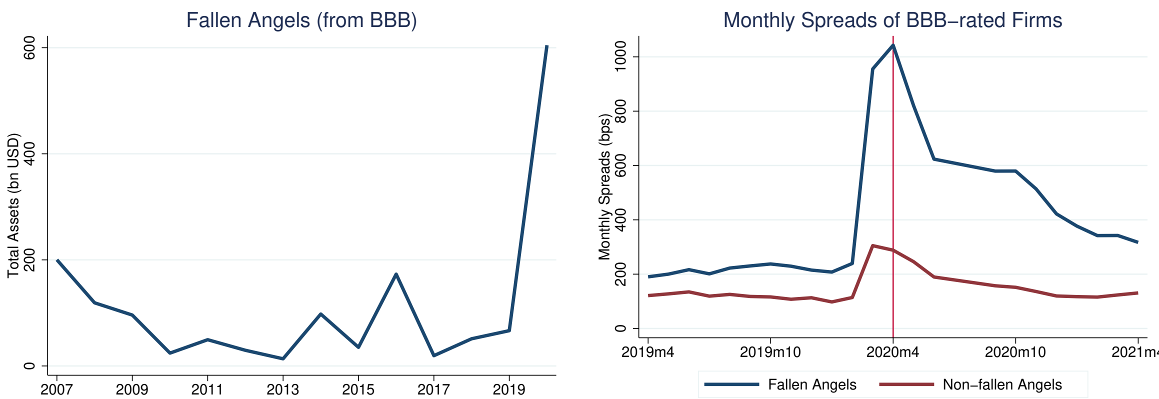

Figure 7: COVID-19 Risk Materialization This figure shows that the BBB vulnerability materialized during COVID-19. The left-hand panel shows the total assets downgraded from BBB to the high yield category over the years 2007 to 2020. The right-hand panel shows the monthly spreads of firms that were BBB-rated in 2019. The blue line represents the spreads of the fallen angels, i.e. firms that were being downgraded with COVID to the high yield category, and the red line represents the spreads of the non-fallen angels.

To stabilize the U.S. bond market, the Fed expanded its corporate bond buying program and included fallen angels under the Primary Market Corporate Credit Facility (PMCCF). Among the firms eligible for the program were Ford Motor Co., Macy's Inc. and Occidental Petroleum Corp. (S&P Global, 2020b), all of which were identified as vulnerable in our data set. As shown in Figure 7 the Fed's intervention led to a strong contraction in yields from April 2020 onwards. While the BBB fallen angels show that the potential downgrade risk materialized as soon as an exogenous shock hit, their size most likely represents a lower bound due to the the swift response of the Fed.

In a next step we provide more formal evidence for that riskier BBB firms experienced a sharper increase in bond spreads in March 2020. More precisely, we estimate the following specification in which we relate the degree of ratings inflation at the start of 2020 to the change in a firm's bond spreads:

$$\Delta Spread_{ijh} = \beta_1 Rating\,Inflation_{jh} + \gamma_{jh} + \phi_h + \epsilon_{ijh} \tag{3}$$

$\Delta\, Spread_{ijh}$ is the change in secondary market spread between January 2020 and March 2020 of bond i of firm j in industry h, $Rating\,Inflation_{jh}$ is the difference between the issuer rating at the start of 2020 and the implied rating based on Altman Z"-score, and ϕ_h are

	(1)	(2)
	Δ Spread	Δ Spread
Rating Inflation	15.804***	-1.178
	(3.529)	(5.822)
Sample	Vul BBB	Vul non-BBB IG
Industry FE	✓	✓
Firm Controls	✓	✓
Observations	751	391
R-squared	0.503	0.552

Table 5: Change in Spreads of Rating-Inflated Firms during COVID-19. This table presents estimation results from the bond-level regression (3). The dependent variable is $\Delta\, Spread$, which is defined as the change in secondary market spread between January 2020 and March 2020 of a single bond. The independent variable is $RatingInflation$ and is defined as the issuer rating at the start of 2020 minus the implied rating based on Altman Z"-score. We add a firm's total assets as firm control, and a set of industry fixed effects. In the first column the sub-sample consists of BBB rated firms and in the second column of non-BBB investment grade rated firms. Standard errors are clustered at the firm j level and reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

industry fixed effects.

Table 5 presents our results. In Column (1) we show that a greater difference between a vulnerable BBB rated firm's assigned rating and its implied rating leads to a greater change in spreads when the pandemic started. In particular, a one notch inflated issuer rating is on average associated with a 16 bps increase in bond spreads for vulnerable BBB rated firms. In contrast, Table 5 Column (2) shows that no such relationship exists for the other vulnerable investment grade rated firms.

Since our findings suggest that ratings inflation is closely connected to M&A activity (see Section 4.2), we next examine whether COVID caused the buildup of risk in M&A firms to materialize. Namely, if the M&A transactions are truly risky then we should see that at some point the inflated rating cannot be sustained, which is most likely in a recession. We plot our results in Figure 8, where the left Panel shows the downgrade frequency for vulnerable BBB M&A firms and right panel for vulnerable BBB non-M&A firms. The downgrade frequency is grouped by downgrade intensity, which is reflected by the differences in green shading.

We observe from Figure 8 that the vulnerable BBB M&A firms are more frequently downgraded in 2020 relative to non-M&A firms. For the vulnerable BBB M&A firms we observe a total of nine downgrades, compared to one downgrade for non-M&A firms. Apart from the increased number of downgrades, vulnerable BBB M&A firms also display a larger

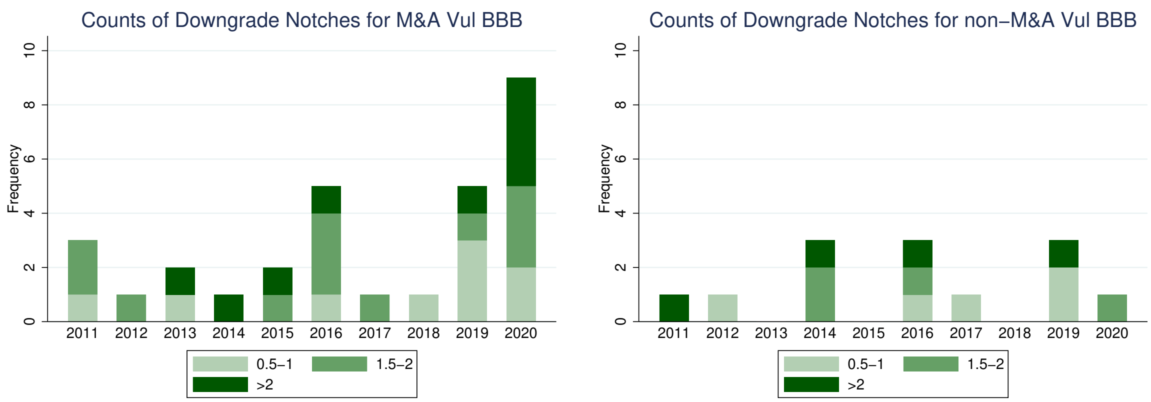

Figure 8: Downgrade Materialization. This figure shows the number of downgrades that vulnerable BBB-rated firms have experienced in the years 2011 to 2020, and groups them according to their downgrade severity. The downgrade severity is measured by the number of notches a firm is being downgraded, and is subdivided into three broad categories: 0.5-1, 1.5-2, >2 notches. The left-hand panel plots the downgrade (notch) frequency for vulnerable BBB firms that have conducted an M&A since the year that they have become vulnerable. The right-hand panel shows the downgrade (notch) frequency for firms that have not conducted an M&A since the year that they have become vulnerable.

downgrade intensity.[7] In 2020, seven vulnerable BBB firms with past M&A transactions were downgraded by more than one notch. Six of these being downgraded before the Fed started to rescue fallen angels. Although based on non-parametric evidence, these results are in line with the expectation that M&A transactions lead to more (severe) downgrades down the road. Furthermore they suggest that the number of downgrades could have been larger if the Fed had not intervened in the corporate bond market.

4.4 Investment-Grade Investors and LSAPs

In this section, we show that the exorbitant privilege of prospective fallen angels is supported by the demand by investment-grade investors exposed to large scale asset purchases (LSAPs). First, we document that investors exposed to LSAPs drive the demand for bonds issued by prospective fallen angels, a dynamic entirely driven by investors that predominantly hold investment-grade bonds. Second, we show that this demand is largely driven by the large

[7]Note that it is possible to have a downgrade of 0.5 notches because we use the median rating from S&P, Moody's and Fitch.

quantity of bonds issued to fund M&A activity, consistent with the idea that, exposed to the fire sale risk related to an eventual downgrade to the high-yield market, investment-grade investors value the leniency of credit rating agencies following M&A.

Exploiting our granular holdings data, we measure investors' exposure to LSAPs and observe investors' holdings of investment-grade bonds. We measure investor-level exposure to LSAPs merging our holdings level data with the Fed SOMA holdings data. Investor time-varying exposure to LSAPs is defined as the share of investor total holdings that are held by the Fed in the SOMA Treasury portfolio, where holdings are weighted by the share of amounts outstanding held by the Fed.[8] The idea is that investors with a substantial share of their security holdings held by the Fed at time t are more affected by LSAPs through its rebalancing channel (Gagnon et al., 2011). We classify an investor as an investment-grade investor if its mean holdings of investment-grade bonds in the entire sample period are at least 80% of its entire bond portfolio. We classify investors as non-investment grade if their holdings of investment-grade bonds are less than 60% of their portfolio.[9]

First, we analyze investors' demand for bonds issued by prospective fallen angels by estimating the following specification:

$$Holdings_{kjt} = \alpha + \beta_1 \text{LSAP Exposure}_{kt} \times Vulnerable_{jt} + \eta_{kt} + \mu_{jt} + \epsilon_{jkt} \tag{5}$$

where k is an investor, j is an issuer, and t is a date (quarterly frequency). 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 LSAP Exposure$_{kt}$ and

[8] Formally, we define the variable LSAP Exposure$_{kt}$ as follows:

$$\text{LSAP Exposure}_{kt} = \frac{\sum_i (Holdings_{ikt} \times SOMA_{it})}{\sum_i Holdings_{ikt}} \tag{4}$$

where i is a security, k is an investor, and t is a date. $SOMA_{it}$ is the share of Treasury security i held by the Fed at date t. $Holdings_{ikt}$ are the holdings of security i held by investor k at time t. This variable is calculated at a quarterly frequency.

[9] Our results are robust to different thresholds. With these somewhat arbitrary thresholds, we split the sample in three terciles with roughly the same number of observations.

PANEL A	$Holdings_{jkt}$					
LSAP Exposure$_{kt}$ × $Vulnerable_{jt}$	1.461***	1.328***	1.371***	1.271***	1.365***	-0.044
	(0.371)	(0.345)	(0.373)	(0.349)	(0.448)	(0.542)
Fixed Effects						
Issuer j	✓	✓				
Investor k	✓		✓			
Time t	✓					
Investor k - Time t		✓		✓	✓	✓
Issuer j - Time t			✓	✓	✓	✓
Sample investors	Full	Full	Full	Full	IG	non-IG
Observations	4,838,897	4,837,690	4,838,153	4,836,946	1,316,637	1,153,770
R-squared	0.505	0.556	0.524	0.575	0.605	0.547

PANEL B	$Holdings_{jkt}$					
LSAP Exposure$_{kt}$ × $Vulnerable_{jt}$	0.281	0.718*	1.939***	-1.024**	2.171***	-0.243
	(0.946)	(0.428)	(0.483)	(0.482)	(0.658)	(0.979)
Fixed Effects						
Investor k - Time t	✓	✓	✓	✓	✓	✓
Issuer j - Time t	✓	✓	✓	✓	✓	✓
Sample investors	Full	Full	Full	Full	IG	non-IG
Sample issuers	AAA/AA	A	BBB	HY	BBB	BBB
Observations	287,950	1,020,557	1,744,170	1,001,739	549,619	220,531
R-squared	0.726	0.673	0.616	0.537	0.621	0.644

Table 6: Demand for Bonds Issued by Prospective Fallen Angels. This table presents estimation results from specification (5). The unit of observation is investor k-issuer j-date 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). LSAP exposure$_{kt}$ is defined in (4). $Vulnerable_{jt}$ is a dummy equal to 1 if issuer j is vulnerable to a downgrade in date t. The uninteracted $Vulnerable_{jt}$ and LSAP exposure$_{kt}$ terms are included in the estimation but not reported for brevity. In panel A, the first four columns are estimated in the full sample of investors and the last two columns are estimated in the subsample of investors with holdings of investment grade bonds greater than 80% and smaller than 60%, respectively. In panel B, the first four columns are estimated in the full sample of investors and in the subsample of issuers based on their rating and the last two columns are estimated in the subsample of BBB issuers for investment grade and non-investment grade investors respectively.. Standard errors double clustered at the investor k level and issuer j level reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

$Vulnerable_{jt}$, a dummy equal to one if issuer j is vulnerable in year t.

The coefficient of interest β_1 captures whether investors more exposed to LSAPs hold more or fewer bonds issued by vulnerable issuers from 2009 to 2018 compared with investors less exposed to LSAPs. In the most stringent specification, we are effectively comparing bonds, at time t, issued by the same issuer that are held by investors with a different LSAP exposure. In particular, we include investor-time and issuer-time fixed effects. Investor-time fixed effects control for the potential differential portfolio choice by high- Vs. low-exposure investors, with respect to vulnerable and non-vulnerable bonds, for reasons unrelated to the LSAP-induced rebalancing channel. Issuer-time fixed effects control for the potential

	$Holdings^{M\&A}_{jkt}$				$Holdings^{nonM\&A}_{jkt}$
LSAP Exposure$_{kt}$ $\times$ $Vulnerable_{jt}$	0.233	-0.133	2.009***	-0.593	1.191*
	(0.969)	(0.597)	(0.636)	(0.500)	(0.664)
Fixed Effects					
Investor k - Time t	✓	✓	✓	✓	✓
Issuer j - Time t	✓	✓	✓	✓	✓
Sample issuers	AAA/AA	A	BBB	HY	BBB
Observations	239,536	1,020,557	1,744,170	1,745,994	1,744,170
R-squared	0.635	0.477	0.512	0.566	0.522

Table 7: Demand for Bonds Issued by Prospective Fallen Angels to Fund M&A. This table presents estimation results from specification (5). The unit of observation is investor k-issuer j-date 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). In the first four columns, the dependent variable are holdings of bonds issued to fund M&A. In the last column, the dependent variable is holdings of bonds issued for reasons other than funding M&A. LSAP exposure$_{kt}$ is defined in (4). $Vulnerable_{jt}$ is a dummy equal to 1 if issuer j is vulnerable to a downgrade at date t. Standard errors double clustered at the investor k and issuer j level reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

differential characteristics of vulnerable and non-vulnerable bonds (e.g., issuance volume) that might interact with the portfolio choice of high-exposure Vs. low-exposure investors for reasons, again, unrelated to the rebalancing channel.

Table 6 shows the estimation results. In the top panel, the first four columns show the coefficients estimated in the full sample. The estimated coefficient β_1 is positive and significant, suggesting that more exposed investors have a higher demand for bonds issued by vulnerable issuers compared to less exposed investors. In the last two columns, we estimate the specification in the subsample of investment grade and non-investment grade investors, respectively. The estimation results show that the demand of high-exposure investors for bonds issued by vulnerable firms is stronger among investment-grade investors. The bottom panel shows other sample splits. In the first four columns, the estimation is run in the subsample of AAA/AA, A, BBB, and high-yield issuers. The results show that the overall effect is driven by BBB issuers. The last two columns show results for the subsample of BBB issuers for investment grade and non-investment grade investors, respectively. The results confirm that the effects in the BBB segment are driven by investment-grade investors.

Second, we analyze investors' demand for bonds issued by prospective fallen angels to fund M&A activity by estimating (5) separately for holdings of bonds issued to fund M&A and for holdings of other bonds. The results are presented in Table 7. In the first four columns, the dependent variable is holdings of bonds issued to fund M&A. In the last column, the dependent variable is holdings of other bonds. The first four columns show that high-exposure investors hold more bonds issued by prospective fallen angels to fund M&A activity compared with low-exposure investors. This correlation is unique to the BBB segment. The last column shows that the demand by high-exposure investors for bonds issued by prospective fallen angels for non-M&A bonds is lower compared with the demand for M&A bonds.

5 Real Effects of the Exorbitant Privilege

We have documented that vulnerable BBB firms benefit from a funding privilege in their corporate bond markets. In this section, we explore the real effects of this funding advantage. In Section 5.1, we show that vulnerable BBB firms increased their sales and lowered their markups but did not invest more or employed more workers during our sample period. In Section 5.2, we show that non-vulnerable firms are negatively affected by the presence of vulnerable BBB firms.

5.1 Direct Effects

How do vulnerable BBB firms take advantage of their cheap bond financing? The first observation from raw data is a sizable increase in the market shares of vulnerable BBB firms from 2009 to 2018, and in particular from 2013 onward. We present the data in Figure 9. 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 vulnerable BBB firms increased their sales and lowered their markups, but, despite their funding advantage, did not increase their investment or employment. Also, we show that vulnerable BBB firms have larger M&A transactions relative to their size. More specifically, we estimate the

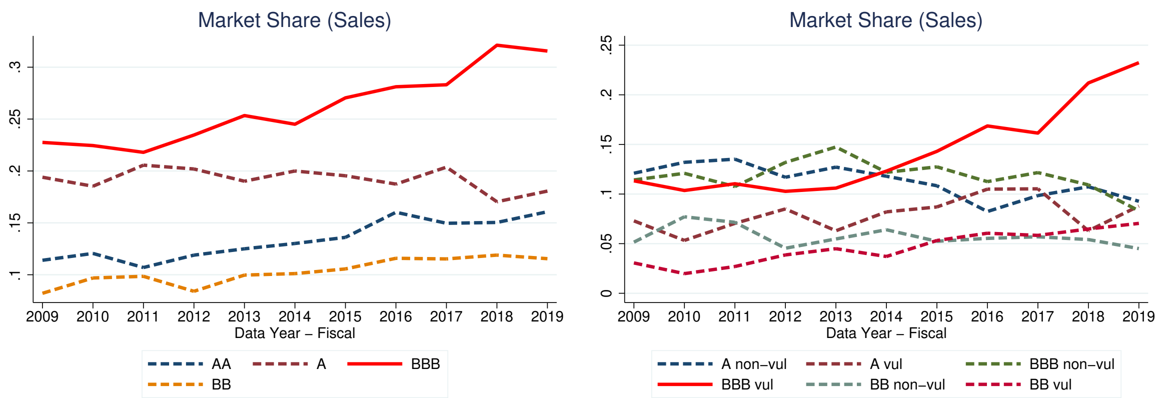

Figure 9: Market Shares. This figure shows the market share (share of sales) of firms in each rating category in the sample of Compustat Firms. The left panel shows a sample split based on rating category. The right panel shows a sample split based on rating category and firm downgrade vulnerability.

following specification:

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

where i is a firm, h an industry, and t a year. Our dependent variables are employment growth, investment, sales growth, markups and relative deal size. The coefficient β_1 captures the effect of a firm's vulnerable status on the dependent variable. The coefficient β_2 captures whether the effect of a firm vulnerable status on the dependent 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), firm fixed effects to control for time-invariant firm characteristics, and time-varying firm level controls.

We show the estimation results in Table 8. Several results are noteworthy. First, vulnerable firms have lower employment growth rates and invest less.[10] 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

[10]This is consistent with our evidence in Annex B.3 on the validity of the vulnerable measure.

	(1) Emp Growth	(2) CAPX	(3) Sales Growth	(4) Markup	(5) Deal Size
Vulnerable $\times BBB$	0.020	0.012	0.047***	-0.101**	0.032**
	(0.014)	(0.008)	(0.015)	(0.043)	(0.013)
Vulnerable	-0.027**	-0.016**	-0.014	0.031	-0.024***
	(0.011)	(0.006)	(0.010)	(0.026)	(0.008)
Industry-Year FE	✓	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓	✓
Observations	7,613	7,815	7,857	7,856	8,408
R-squared	0.360	0.745	0.475	0.930	0.284

Table 8: Real Effects - Direct Effects This table presents estimation results from Specification (6). The dependent variables are employment growth, CAPX/PPE, sales growth, markup (defined as sales/cost of goods sold) and deal size (defined as the total transaction value in a given year divided by lagged assets. The measure is set to zero in case a firm has zero transaction volume in a given year). Deal size is measured contemporaneously. 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.

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. Lastly, we show that vulnerable BBB firms conduct on average relatively larger sized M&A transactions, as measured by the firms' deal volume over lagged assets.[11] This in contrast to other vulnerable firms which on average engage in smaller sized M&A transactions.

5.2 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

[11]Results are qualitatively similar when we exclude the firm-years with no transaction volumes.

Caballero et al. (2008)) and estimate the following regression at the firm-year level:

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

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, β_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).

	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 9: 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.

6 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 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 credit rating inflation linked to M&A activity and driven by demand from investors for BBB rated bonds as treasuries supply was drained from the market.

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. An additional cost is the associated buildup of vulnerabilities in the corporate sector that arise from these subsidies. Such vulnerabilities became important during the Covid shock.

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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[12] 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[13].

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.

[12] 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. We also take into account the total trust preferred, unamortized premium, unamortized discount and adjustment items.

[13] 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.

Appendix B. Additional Figures and results

B.1 Aggregate Evidence

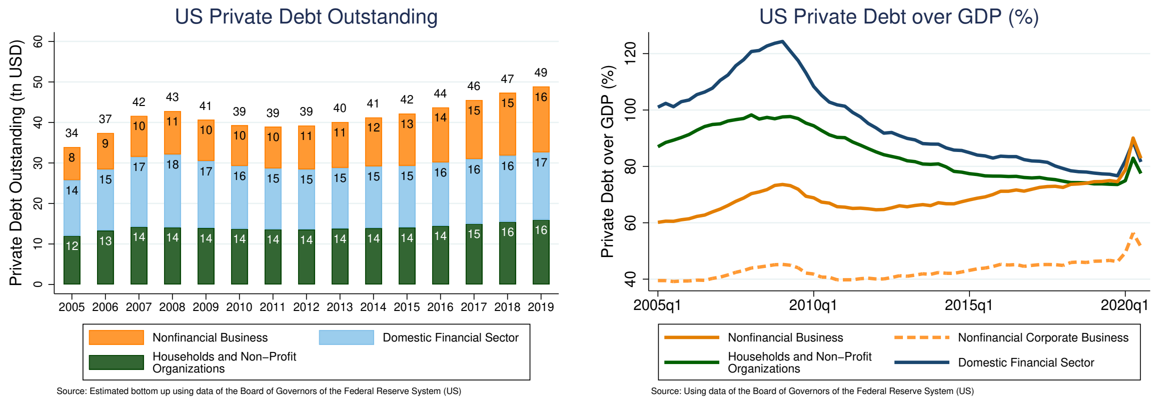

Figure B.1: US Private Debt. This figure shows the aggregate figures for the private debt outstanding in the U.S. using data of the FRED. In Panel A, we show the breakdown in absolute numbers. In Panel B, we relate the different debt components to GDP.

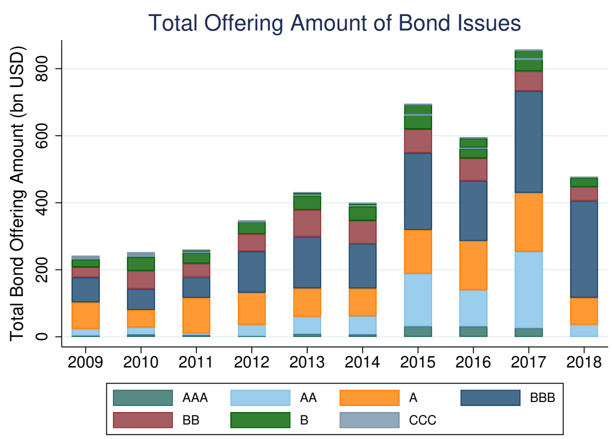

Figure B.2: US Bond Issues by Rating. This figure shows the offering amounts over time by firm rating bucket.

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 Validating the Vulnerability Measure

In this section, we first show how the balance sheet characteristics of vulnerable rated firms differ from those of non-vulnerable rated firms. Thereafter, we show how a firm's downgrade probability, balance sheet characteristics and firm performance change after a firm is classified as vulnerable.

In Table B.2, we present the descriptive statistics for the rated firms in our sample, separated for firms that are vulnerable and firms that are not vulnerable. The sample means highlight that vulnerable firms are larger and riskier along all dimensions. In particular, vulnerable firms have higher leverage, lower profitability, lower net worth, and a lower interest coverage ratio. Their sales growth, employment growth, and investment ratio are also significantly lower than those of non-vulnerable firms. The last column shows a test for the difference in means.

	Vulnerable	Non-Vulnerable	Difference
Total Assets	24,114	10,988	13,126***
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***
Employment Growth	0.008	0.036	-0.027***
Net Worth	0.183	0.248	-0.066***

Table B.2: Descriptive Statistics. This table presents descriptive statistics for rated firms in our sample, separated into vulnerable and non-vulnerable firms. *Total Assets* is in millions, *Leverage* is total debt over total assets, *Interest Coverage* is EBITDA over interest expenses, *Sales Growth* is the growth rate in sales, *CAPX* is capex over PPE, *Employment Growth* is the growth rate in employment, *Net Worth* is the difference between common equity and cash divided by total assets.

Next, we show that vulnerable firms are more likely to be downgraded and to be assigned a negative credit watch or outlook status relative to non-vulnerable firms. To this end, we estimate the following specification:

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

where i is a firm, h an industry, and t a year. Our dependent variable Y is a dummy equal to one in the case of a negative watch event in t or $t+1$, or a downgrade event in $t+1$. To qualify as downgrade event, a firm must be downgraded by at least one rating category in year $t+1$, i.e. a firm that has a rating of A+, A, or A- is downgraded to at least BBB+. $Vulnerable$ is a dummy equal to one if a firm is vulnerable in period t and μ_{ht} are industry-year fixed effects. X_{iht} is a vector of controls, namely the logarithm of total assets, leverage, and the interest coverage ratio.

Table B.3 presents the estimation results. The first two columns show that a vulnerable company in year t is more likely to have a negative watch event in year t or $t+1$. Similarly, the last two columns show that a vulnerable firm has a higher probability to be downgraded by at least one rating category in the next year.

	Negative Watch	Negative Watch	Downgrade	Downgrade
Vulnerable	0.078***	0.043**	0.021***	0.018***
	(0.018)	(0.018)	(0.005)	(0.005)
Size		0.017**		0.003*
		(0.007)		(0.002)
Leverage		0.131**		0.016
		(0.055)		(0.015)
IC Ratio		-0.010***		-0.000**
		(0.001)		(0.000)
Industry-Year FE	✓	✓	✓	✓
Observations	9,056	8,973	9,431	9,341
R-squared	0.118	0.150	0.094	0.097

Table B.3: Credit Rating Actions after Being Classified as Vulnerable. This table presents the estimation results from Specification (B1) for our sample of rated firms. The dependent variable *Negative Watch* is a dummy variable equal to one if a firm is placed on negative credit watch or outlook in year t or $t+1$. The dependent variable *Downgrade* is a dummy variable equal to one if a firm is downgraded by at least one rating category in year $t+1$, i.e., a firm that has a rating of A+, A, or A- is downgraded to at least BBB+. *Vulnerable* is a dummy equal to one if a firm is vulnerable in period t. Firm level control variables are size (log of total assets), leverage and IC ratio. Standard errors clustered at the firm level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

In Figure B.3 we plot the downgrade sensitivity coefficient of vulnerable firms for the different rating categories. The plot shows that vulnerable firms are more likely to be downgraded in each rating bucket. Moreover, the V-shape of the sensitivity plot furthermore highlights that the sensitivity coefficient is the lowest for the BBB rated category. This is in line with the suggestion that BBB vulnerable firms are less likely to be downgraded compared to other vulnerable rated firms, and that BBB represents a special category.

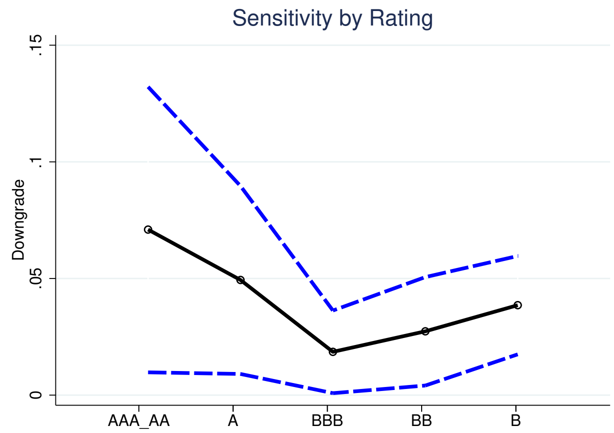

Figure B.3: Downgrade Sensitivity Plot ccross Rating Categories This figure depicts the vulnerability coefficient of Equation (B1) with downgrade in $t+1$ as dependent variable for the different rating categories. The error bars represent 95 per cent confidence intervals, with standard errors clustered at the firm-level.

Finally, we examine how the balance sheet characteristics of vulnerable firms change after the obtaining the vulnerability status. Following Banerjee and Hofmann (2020), we create a local linear projection specification, based on a sequence of regression models where the dependent variable is shifted several steps forward and backward in time, relative to a reference point. Our reference point is the date at which a firm is classified as vulnerable for the first time. Specifically, we estimate the following specification:

$$Y_{iht+q} = \beta_q EnterVulnerable_{iht} + \gamma_q Vulnerable_{iht} + \eta_q X_{iht+q} + \mu_{ht+q} + \epsilon_{iht+q}, \quad \text{(B1)}$$

where i is a firm, h an industry, t a year, and $q \in \mathcal{Q}$, where $\mathcal{Q} = \{-3, -2, -1, 0, 1, 2, 3\}$. The dependent variable Y is asset growth, employment growth, sales growth, and capital expenditures in period $t+q$. *EnterVulnerable* is a dummy equal to one if a firm becomes vulnerable for the first time in period t. *Vulnerable* is a dummy 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., it has been classified as vulnerable before. This specification ensures we compare firms becoming vulnerable for the first time only to non-vulnerable firms. X_{iht+q} is the logarithm of total assets and μ_{ht+q} are industry-year fixed effects.

The coefficient of interest β_q measures a vulnerable firm's development, in the three years before and after the firm is classified as vulnerable, of sales growth, investments, asset growth, and employment growth. 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. Figure B.4 shows the estimated β_q coefficients, documenting that firm performance deteriorates once it becomes vulnerable. Its sales growth and investment decline significantly, a dynamic also reflected in the drop in firm size and employment growth.

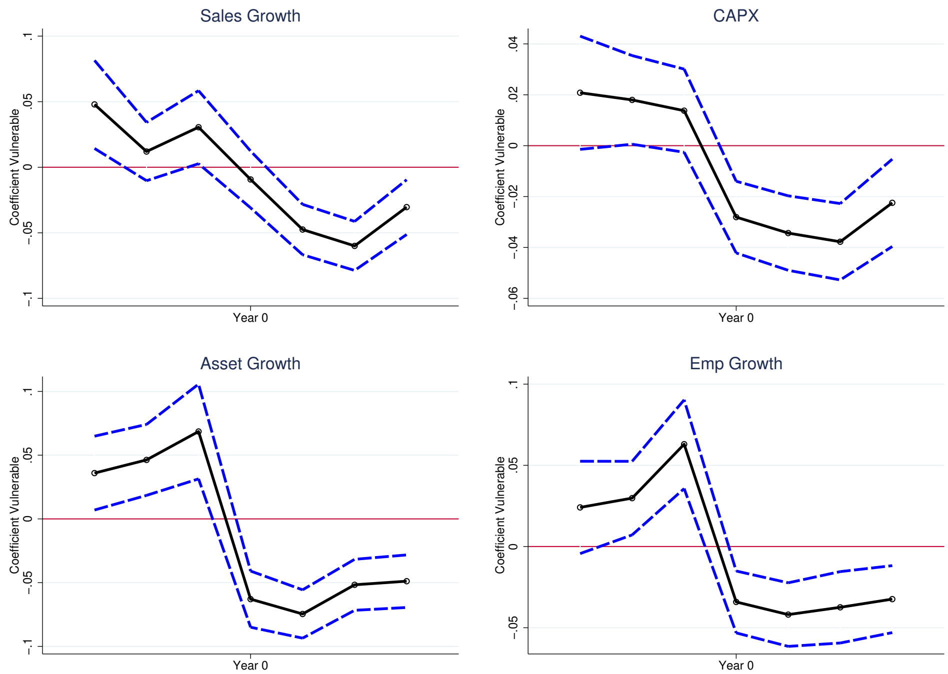

Figure B.4: Firm Performance after Being Classified as Vulnerable. This figure shows the evolution of the estimated coefficient β_q from Specification (B1) three years before and after a firm becomes vulnerable. Year zero corresponds to the first year a firm is classified as vulnerable. The 95% confidence interval is reported, with standard errors clustered at the firm level.

B.4 Compression of BBB spreads

We provide further evidence that the bond financing cost of BBB firms dropped significantly, and more than the financing costs of other investment grade issuers, since 2009. In Figure B.5, we show the compression of bond spreads by tracking the distribution of primary market spreads (top panel) and secondary market spreads (bottom panel) from 2010–12 (dashed lines) to 2013–16 (solid lines). The left panels compare the distribution of BBB bond spreads with the distribution of A bond spreads. The right panels compare the distribution of BBB bond spreads with the distribution of AA bond spreads. The four panels document a pronounced leftward shift of BBB spreads in the primary and the secondary market. If anything, we observe a slight *rightward* shift for A and AA spreads. In Figure B.8, we show that the 2013–16 is characterized by a substantial monetary easing by the Federal Reserve.

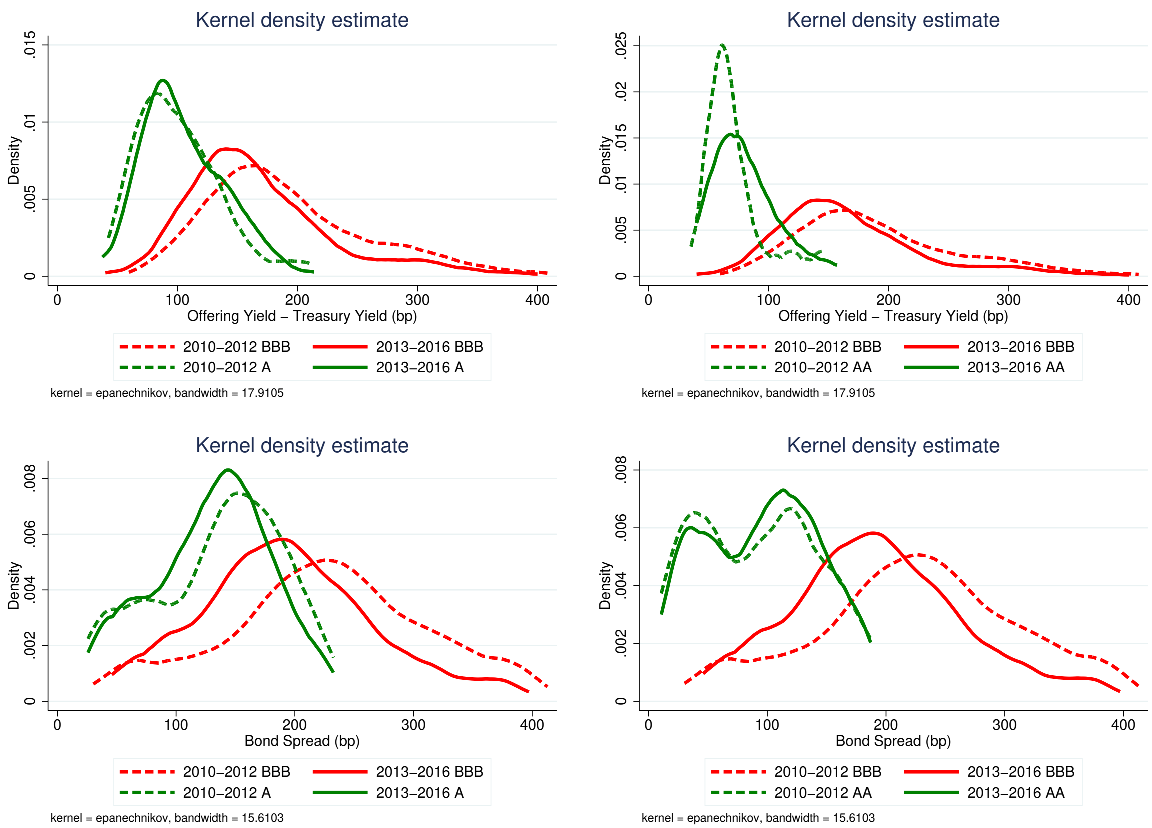

Figure B.5: Shift in Bond Spread Distributions from 2010–12 to 2013–16. This figure shows how bond spreads distributions changed from 2010–12 (dashed lines) to 2013–16 (solid lines). The top panels show the distribution of offering spreads (offering yield−maturity adjusted treasury yield) for newly issued bonds. The bottom two panels show the distribution of secondary market spreads (bond yield−maturity adjusted treasury yield) for traded bonds. The left and right panels compare the distributions of BBB bond spreads (red lines) with the distributions of A bond spreads and AA bond spreads (green lines), respectively.

B.5 Sensitivity of bond spreads to credit risk by ratings category

Fourth, we show that, consistent with an exorbitant privilege of prospective fallen angels, the sensitivity of bond spreads to changes in credit risk is the weakest for BBB-rated issuers. To this end, we estimate the following specification:

$$\begin{aligned} Spread_{biht} =& \beta_1 Rating_{iht} + \beta_3 EDF_{iht} + \beta_3 Rating_{iht} \times EDF_{iht} \\ &+ \mathbf{\Gamma} X_{iht} + \mu_{ht} + \delta \times Z_b + \phi_i + \epsilon_{iht} \end{aligned} \tag{B2}$$

where $Spread_{biht}$ is the spread of bond b issued by firm i in industry h in period t, EDF_{iht} is the expected default frequency of firm i in period t, $Rating_{iht}$ is set of dummies for rating categories, μ_{ht} are industry-time fixed effects, and ϕ_i are firm fixed effects. As in the previous parametric test, we control for firm level and bond level characteristics. Figure B.6 presents the estimated sensitivities of bond spreads to EDFs within rating category, calculated as $\beta_2 \overline{EDF}_{iht} + \beta_3 Rating_{iht} \times \overline{EDF}_{iht}$, where $\overline{EDF}$ is the mean EDF in each rating category. The U-shaped pattern with a minimum at BBB shows that the sensitivity of bond spreads to

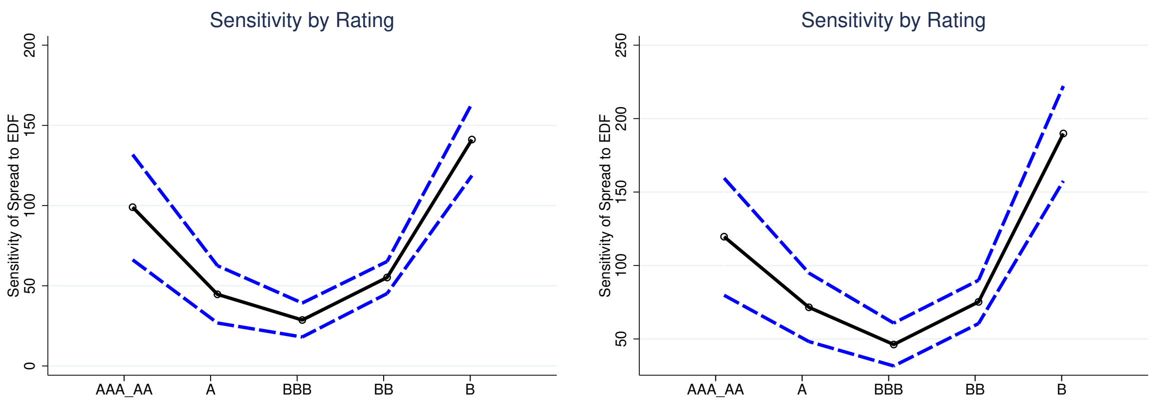

Figure B.6: Sensitivity of Bond Spreads to EDFs. This figure shows the sensitivity of bond spreads to 2-year EDFs (left panel) and 5-year EDFs (right panel). The points in the graph are obtained by calculating $\beta_2 \overline{EDF}_{iht} + \beta_3 Rating_{iht} \times \overline{EDF}_{iht}$, where the coefficients are estimated using Specification (B2) and $\overline{EDF}$ is the mean EDF in each rating category. The dashed blue lines represent 95% confidence intervals.

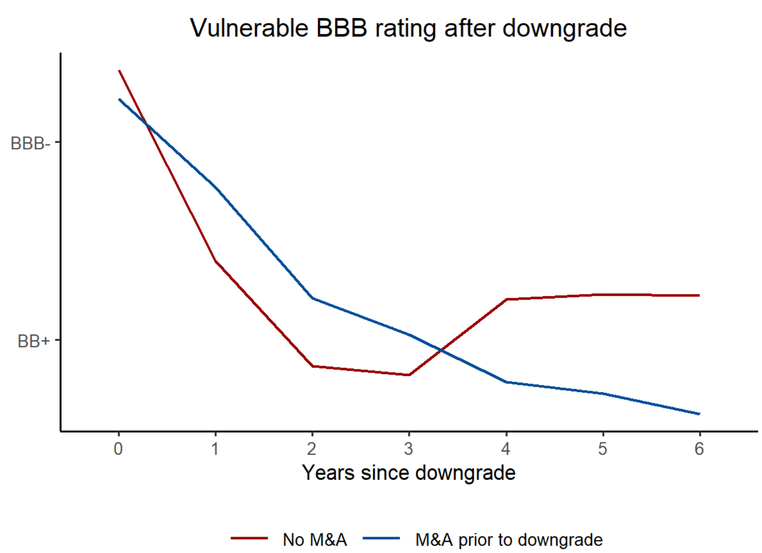

Figure B.7: Downgrade intensity of vulnerable BBB issuers. The mean rating of vulnerable BBB rated firms after six years. The red line shows the average rating if the issuer undertook an M&A in years t to $t-2$ and was eventually downgraded to high-yield status in the years $t+1$ to $t+6$. The blue line shows the mean rating of firms that did not undertake an M&A in years t to $t-2$ but was downgraded to high-yield status in the years $t+1$ to $t+6$.

equity-based EDFs is weakest for BBB-rated issuers.

B.6 M&A's and vulnerable downgrade intensitiy

Figure B.7 shows that after 6 years the average rating of a vulnerable BBB issuer that undertook an M&A in years t to $t-2$ and was eventually downgraded is around $\frac{1}{2}$ a ratings notch lower than the average firm that did not do an M&A.

B.7 Investors' Demand

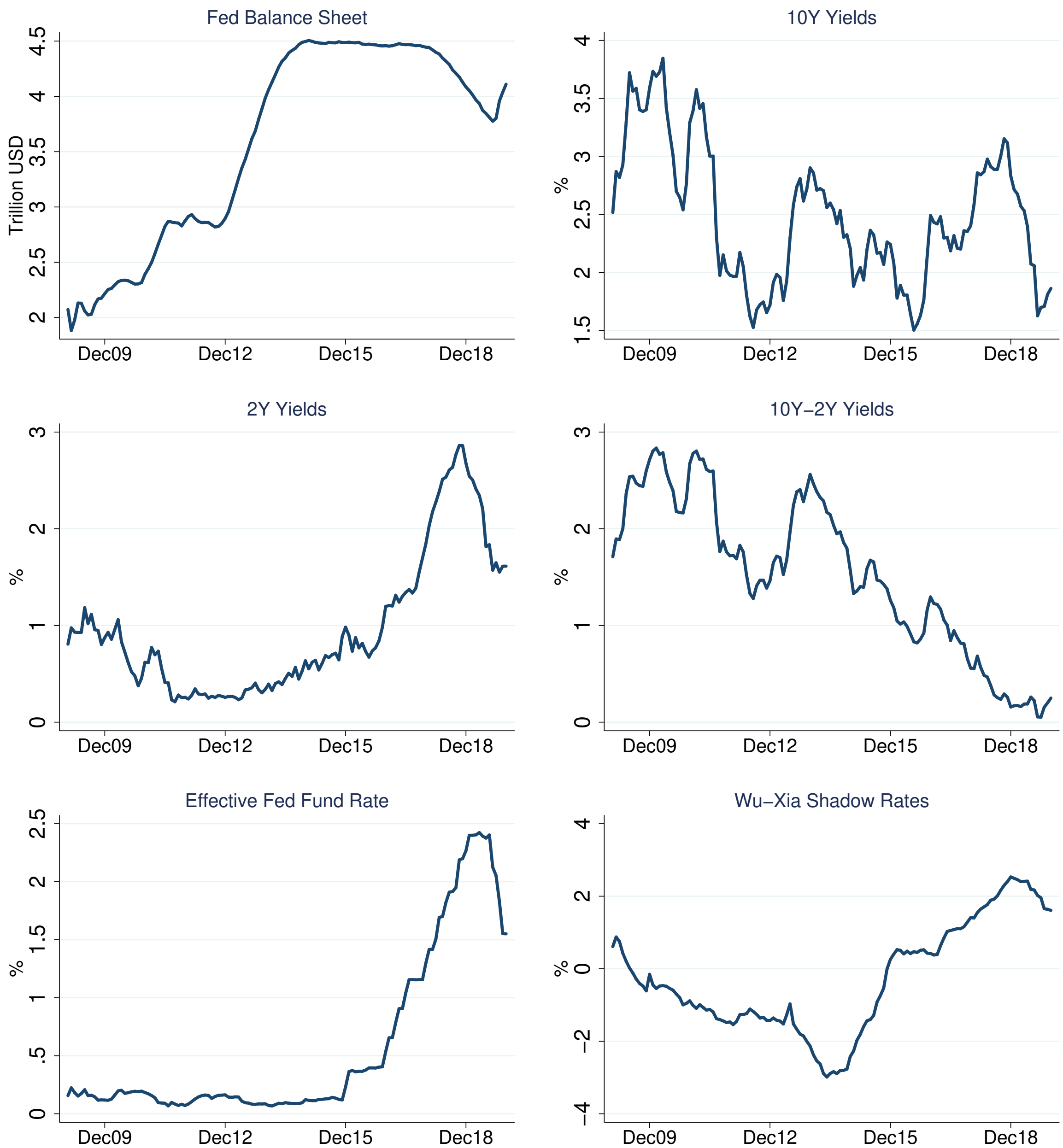

Figure B.8: Monetary Policy Stance. This figure shows the monetary policy stance in the U.S. during our sample period. The six panels show the size of the Fed balance sheet (trillion dollars), the 10-year Treasury yields (%), the 2-year Treasury yields (%), the difference between the 10-year and the 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.