Internet Appendix to "The Myth of the Credit Spread Puzzle"

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Abstract

This Internet Appendix has further robustness checks regarding the results in the main text.

D Robustness checks

D.1 Calculating the distribution of d if default rates at other maturities than 10 year is targeted

In the main text we calculate the distribution of the default boundary in simulations by choosing the initial leverage ratio for each rating class AAA, AA, A, BBB, BB, B and C such that the average 10-year historical default rate for the period 1970-2001 is matched in the Black-Cox model. Panel A in Table IA.1shows the characteristics of the distribution of the default boundary if the average historical default rate for other maturities (than the 10-year) is matched. We see that as long as the maturity of the matched default rates is 5 years or more, the distribution of the default boundary is similar.

When n-year historical default rates are matched, historical default rates at other maturities are not perfectly matched. Panel B in Table IA.1 shows the mean and RMSEs of the difference between actual and model-implied default rates. We see that the errors are of similar magnitude except if the 1-year default rates are matched in which case deviations are much larger.

Overall, we conclude that changing the target maturity at which historical default rates are matched does not change the distribution of the default boundary much, except for the 1-year maturity. However, we find that the 1-year maturity is not a good candidate because it produces large deviations between model probabilities and historical default rates at longer maturities.

D.2 Bid bias in dealer quotes

In the main text we use price quotes from Lehman and Merrill Lynch. These quotes are prices at which dealers are willing to buy and therefore they do not represent midprices. To examine the severity of this "bid bias" we compare dealer yield quotes with yields implied

by transaction prices. We use daily dealer quotes from Merrill Lynch as in the main text, restricted to the period July 1, 2002-July 31, 2012 for which we also have transactions data from the TRACE database. We restrict our attention to TRACE transactions with a size of $\$100,000$ or more as is common when using TRACE. For every TRACE transaction we compute the difference between the Merrill Lynch yield quote – if a quote is available – and the TRACE transaction yield. We winsorize the differences at -500bps and 500bps and report the average difference in Table IA.2 sorted according to rating, maturity, and transaction type (investor buying from dealer, all transactions, investor selling to dealer).

The difference between ML quotes and TRACE transactions where the investor sells to a dealer is small, consistent with the fact that the ML data consists of bid quotes: the average difference across maturity and rating in Panel A is 0.3bps. The difference between quoted yields and yields based on all transaction prices is sizeable for bond maturities below 6 months with an average difference of 15.7bps. For longer maturity this bid bias is attenuated and for three-year bonds the average difference is 5.6bps. In the main text we therefore restrict our sample to bond maturities of three years or more.

D.3 Using TRACE transactions data instead of bond dealer quotes

In the main text we use bond dealer quotes for the period 1987-2012. For a shorter period 2012-2012 we have bond transactions data from TRACE available. If we use TRACE data instead our results are similar. To see this we use the TRACE data at the transactions level and apply standard filters (Dick-Nielsen (2009) and Dick-Nielsen (2014)). We obtain bond information from the Mergent Fixed Income Securities Database (FISD) and limit the sample to senior unsecured fixed rate or zero coupon bonds issued by industrial firms. We exclude bonds that are callable, convertible, putable, perpetual, foreign denominated, Yankee, have sinking fund provisions, or have covenants. Table IA.3 shows actual an model-implied spreads when using this data set.

Although this data set is from a shorter period that includes the crisis 2008-2009 with very high spreads, we see that the conclusion in the main text holds: investment grade spreads are on average matched by the model while speculative grade spreads are underestimated.

D.4 Sorting according to absolute spread changes instead of rating

In the main text we regress monthly average actual spread changes on average model-implied spread changes within each major rating category. An alternative is to – on a monthly basis – sort bonds into deciles according to their absolute spread change. We expect that sorting according to absolute spread change gives similar results as sorting according to rating because more risky bonds are likely to experience larger spread changes.

The results are in Table IA.4. The commonality – measured both as the slope coefficient and R^2 – between actual and model-implied spread changes increases as absolute spread change increases with the exception of decile 10 where there is a sharp drop off in commonality. These results are similar to the results when sorting according to rating in Table 9 Panel B in the main text where we also see an increase in commonality when moving down in rating and a sharp drop off for the lowest ratings.

References

Dick-Nielsen, J. (2009). Liquidity biases in TRACE. *Journal of Fixed Income 19*(2), 43–55.

Dick-Nielsen, J. (2014). How to Clean Enhanced TRACE Data. *Unpublished Manuscript*.

Panel A: Distribution of default boundary						
Maturity	1	5	7	10	15	20
Mean	1.036	0.988	0.983	0.989	0.980	0.977
1.0% quantile	0.856	0.865	0.882	0.909	0.897	0.885
2.5% quantile	0.884	0.892	0.904	0.924	0.911	0.900
25.0% quantile	0.983	0.960	0.960	0.971	0.963	0.957
50.0% quantile	1.036	0.987	0.982	0.989	0.983	0.981
75.0% quantile	1.089	1.020	1.010	1.010	1.000	0.999
97.5% quantile	1.185	1.073	1.057	1.048	1.035	1.037
99.0% quantile	1.210	1.088	1.071	1.057	1.043	1.047
Panel B: Properties of actual minus model-implied default rates						
Maturity	1	5	7	10	15	20
Mean	-12.71	-0.18	-0.07	-0.77	-1.17	-0.71
RMSEs	16.76	4.06	2.97	3.93	4.12	3.50

Table IA.1 *Distribution of the default boundary.* In the main text we calculate the distribution of the default boundary by choosing the initial leverage ratio for each rating class AAA, AA, A, BBB, BB, B and C such that the average 10-year historical default rate for the period 1970-2001 is matched in the Black-Cox model. Panel A shows the characteristics of the distribution of the default boundary if the average historical default rate for other maturities (than the 10-year) is matched. When the n-year historical default rate is matched, historical default rates at other maturities are not matched by the Black-Cox model. Panel B shows the mean and RMSEs of the average model implied default rate minus average historical default rate (in percent)

bond maturity	0-0.25y	0.25-0.5y	0.5-1.5y	1.5-2.5y	2.5-3.5y
Panel A: Average Difference (in bps) between Merrill Lynch quotes and investor buy transactions in TRACE					
AAA	−6.3	1.0	2.1	1.4	1.0
	(3127)	(3791)	(16838)	(15062)	(12296)
AA	4.3	6.5	6.1	−0.8	−0.4
	(3486)	(4418)	(21311)	(18496)	(17544)
A	−3.5	−1.2	1.0	−2.7	−1.9
	(4364)	(5810)	(26758)	(24346)	(24053)
BBB	1.1	0.6	3.3	−5.2	−2.5
	(818)	(1169)	(5762)	(5376)	(4734)
Spec	0.3	−1.4	−5.5	−3.2	−1.7
	(783)	(1214)	(4900)	(3798)	(3511)
Panel B: Average Difference (in bps) between Merrill Lynch quotes and all transactions in TRACE					
AAA	−1.3	7.6	8.9	5.8	4.7
	(6566)	(8610)	(45303)	(51967)	(49423)
AA	12.6	18.7	16.2	8.1	5.3
	(8168)	(11293)	(61546)	(63361)	(65928)
A	13.2	15.9	16.5	8.8	5.6
	(10938)	(16455)	(84393)	(81360)	(85795)
BBB	29.1	30.6	27.3	12.8	9.6
	(2175)	(3564)	(17775)	(17361)	(14322)
Spec	16.5	14.4	9.1	4.5	3.0
	(2242)	(3911)	(14612)	(11056)	(10167)
Panel C: Average Difference (in bps) between Merrill Lynch quotes and investor sell transactions in TRACE					
AAA	4.3	11.0	14.6	8.5	6.5
	(2364)	(3136)	(16353)	(20585)	(20702)
AA	21.3	27.5	24.6	13.6	9.1
	(3319)	(4630)	(24077)	(24635)	(26339)
A	27.6	26.5	27.1	17.0	11.2
	(4383)	(6846)	(32437)	(30461)	(31978)
BBB	40.3	44.8	43.4	28.1	21.9
	(801)	(1320)	(6012)	(6096)	(4881)
Spec	27.2	22.5	27.4	15.8	10.2
	(661)	(1219)	(4231)	(3243)	(3007)

Table IA.2 *Bid-bias in corporate bond yield quotes.* In the period July 1, 2002-October 31, 2012 we find all TRACE transactions with a volume of $100,000 or more for which there is a corresponding Merrill Lynch quote. We separate the TRACE transactions into observations where an investor buys from a dealer (Panel A), two dealers trade with each other (Panel B), and an investor sells to a dealer. The panels shows the average difference between Merrill Lynch quotes and TRACE transactions sorted according to rating and maturity. The differences are truncated at -500 and 500 basis points. The number of observations are in parentheses.

		3-20y	3-7y	7-13y	13-20y
Inv	Actual spread	112	108	109	210
	Model spread	130	133	110	160
		(100;156)	(100;162)	(88;129)	(143;179)
	Difference	18	25	2	−51**
		(−12;44)	(−8;54)	(−21;21)	(−68;−31)
	Observations	120	120	120	89
Spec	Actual spread	869	531	802	778
	Model spread	469	356	489	432
		(377;545)	(274;426)	(391;570)	(370;481)
	Difference	−400**	−175**	−313**	−346**
		(−492;−324)	(−257;−105)	(−411;−232)	(−408;−297)
	Observations	119	65	109	65
AAA	Actual spread	35	45	23	33
	Model spread	9	21	5	6
		(5;14)	(10;33)	(3;7)	(4;7)
	Difference	−26**	−24**	−18**	−27**
		(−30;−22)	(−34;−12)	(−20;−16)	(−29;−26)
	Observations	59	26	10	46
AA	Actual spread	25	15	62	127
	Model spread	6	1	26	24
		(4;8)	(1;2)	(18;32)	(18;29)
	Difference	−19**	−13**	−36**	−103**
		(−21;−17)	(−14;−13)	(−44;−30)	(−109;−98)
	Observations	120	117	101	16
A	Actual spread	76	59	101	58
	Model spread	67	52	134	48
		(50;83)	(35;69)	(108;157)	(41;59)
	Difference	−10	−7	33**	−10
		(−26;7)	(−24;10)	(6;56)	(−16;1)
	Observations	120	119	93	59
BBB	Actual spread	281	278	198	360
	Model spread	359	401	190	314
		(282;423)	(312;475)	(149;225)	(276;342)
	Difference	78*	123**	−8	−46**
		(1;142)	(34;197)	(−49;27)	(−84;−17)
	Observations	120	120	94	57
BB	Actual spread	359	324	261	727
	Model spread	307	250	370	363
		(250;356)	(184;309)	(307;420)	(300;417)
	Difference	−52*	−74**	109**	−364**
		(−109;−3)	(−139;−14)	(46;160)	(−427;−309)
	Observations	93	65	56	40
B	Actual spread	892	1011	721	1027
	Model spread	525	652	526	464
		(442;595)	(568;717)	(430;612)	(405;510)
	Difference	−367**	−359**	−194**	−563**
		(−450;−297)	(−443;−295)	(−291;−109)	(−622;−517)
	Observations	85	13	49	31
C	Actual spread	1262	1451	1143	1168
	Model spread	652	1114	529	535
		(513;762)	(870;1299)	(415;623)	(438;613)
	Difference	−610**	−337**	−613**	−633**
		(−749;−499)	(−580;−151)	(−727;−519)	(−730;−555)
	Observations	95	21	72	13

Table IA.3 *Actual and model yield spreads using TRACE data.* This table shows actual and model-implied corporate bond yield spreads. Spreads are grouped according to remaining bond maturity at the transaction date. 'Actual spread' is the average actual spread to the swap rate. 'Model spread' is the average Black-Cox model spreads of the bonds in a given maturity/rating bucket. The average spread is calculated by first calculating the average spread of bonds in a given month and then calculating the average of these spreads over months. 'Difference' is the difference between the model spread and the actual spread. In parenthesis are 95% confidence bands calculated according Section 3.2; '*' implies significance at the 5% level and '**' at the 1% level. 'Observations' is the number of monthly observations. The bond yield spreads are based on TRACE transactions data from the period July 2002 - June 2012.

		3-20y	3-7y	7-13y	13-20y
decile 1	β	0.02 **	0.01 **	0.01 **	0.01 **
		(0.01)	(0.01)	(0.01)	(0.01)
	R^2	0.02	0.01	0.01	0.01
decile 2	β	0.14 **	0.08 **	0.05 **	0.19 **
		(0.03)	(0.03)	(0.02)	(0.06)
	R^2	0.07	0.04	0.05	0.14
decile 3	β	0.22 **	0.29 **	0.02 **	0.12 **
		(0.03)	(0.05)	(0.03)	(0.05)
	R^2	0.16	0.15	0.01	0.07
decile 4	β	0.36 **	0.24 **	−0.00**	0.22 **
		(0.04)	(0.03)	(0.04)	(0.05)
	R^2	0.22	0.20	0.00	0.17
decile 5	β	0.35 **	0.21 **	0.16 **	0.00 **
		(0.04)	(0.03)	(0.05)	(0.04)
	R^2	0.23	0.15	0.12	0.00
decile 6	β	0.35 **	0.35 **	0.06 **	0.34 **
		(0.05)	(0.04)	(0.04)	(0.11)
	R^2	0.18	0.26	0.02	0.11
decile 7	β	0.53 **	0.65 **	0.14 **	0.63 **
		(0.05)	(0.06)	(0.07)	(0.11)
	R^2	0.31	0.36	0.04	0.29
decile 8	β	0.69 **	0.87	0.24 **	0.40 **
		(0.06)	(0.08)	(0.07)	(0.13)
	R^2	0.36	0.35	0.11	0.11
decile 9	β	0.91	0.94	0.06 **	0.45 **
		(0.06)	(0.06)	(0.04)	(0.14)
	R^2	0.45	0.49	0.03	0.12
decile 10	β	0.74	0.46	0.18 **	0.22 **
		(0.25)	(0.30)	(0.07)	(0.24)
	R^2	0.03	0.01	0.05	0.01

Table IA.4 *Commonality in time series variation of actual and model-implied yield spreads sorted on absolute actual spread change.* For a given bond we calculate a monthly average spread by computing the average yield spread observed in that month. We then calculate yield spread changes for all months where there are two consecutive monthly observations. We do this for both model-implied spreads and actual spreads (to the swap rate). For each month we then sort all actual yield changes into deciles, where the first decile has the 10% observations with lowest actual absolute spread changes etc, and calculate the average actual and model-implied spread change in each decile. We do this for each month to derive at a time series of actual and model-implied spread changes for each decile. The table shows the slope coefficient β and R^2 when regressing the actual monthly spread change on the model-implied spread change and a constant. In parenthesis is the OLS standard error and '*' implies that β is significantly different from one at the 5% level and '**' at the 1% level.