Commonality in Credit Spread Changes: Dealer Inventory and Intermediary Distress
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Discussion

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NBER - 2020

- Motivation
- Summary
- Comments
- Final Remarks

Credit Spread Changes and Structural Models

- Structural model of credit risk (Merton (1974)) view Equity and Debt as contingent claim on same underlying asset value.
  - → Both equity and debt are functions of same state-variables (asset value, leverage, asset volatility, risk-free rate . . .)
  - → credit spread changes should be explained by changes in these firm-specific variables.
- CD, Goldstein, and Martin (2001) used 10 years of monthly bond **quotes** data from 688 firms from 1988 to 1997 to study **credit spread changes**:

Commonality in Credit Spread Changes (quotes)

Table VII

Principal Components

For each industrial bond i having at least 25 monthly quotes CS_t^i over the period July 1988 to December 1997, we estimate equation (1): $\Delta CS_t^i = \alpha + \beta_1^i \, \Delta lev_t^i + \beta_2^i \, \Delta r_t^{10} + \beta_3^i \, (\Delta r_t^{10})^2 + \beta_4^i \, \Delta slope_t + \beta_5^i \, \Delta VIX_t + \beta_6^i \, S\&P_t + \beta_7^i \, \Delta jump_t + \epsilon_t^i$. For each industrial bond i having at least 36 monthly quotes CS_t^i over the period July 1988 to December 1997, we estimate equation (3): $\Delta CS_t^i = \alpha + \beta_1^i \, \Delta lev_t^i + \beta_2^i \, \Delta r_t^{10} + \beta_3^i \, (\Delta r_t^{10})^2 + \beta_4^i \, \Delta slope_t + \beta_5^i \, \Delta VIX_t + \beta_6^i \, S\&P_t + \beta_7^i \, \Delta jump_t + \beta_8^i \, quote_t + \beta_9^i \, on\cdot off_t + \beta_{10}^i swap_t + \beta_{11}^i \, ret_t^i + \beta_{12}^i \, (\Delta r_t^{10})^3 + \beta_{13}^i \, smb_t + \beta_{14}^i hml_t + \beta_{15}^i \, r_{t-1}^{10} + \beta_{16}^i \, lev_{t-1}^i + \beta_{17}^i \, VIX_{t-1} + \beta_{18}^i \, Spread_{t-1} + \beta_{19}^i r_{t-1}^{SP} + \epsilon_t^i$. Finally, for the "$\Delta BBB$" regression, we add to equation (3) changes in the BBB credit spread as reported in Datastream, and then rerun the regression. Quotes are discarded whenever a bond has less than 4 years to maturity. The residuals are then assigned to one of 15 analysis bins based on maturity and firm leverage. Short maturity is under 12 years; Medium maturity is 12 to 18 years; Long maturity is over 18 years. Monthly averages for each bin are calculated, and then the principal components of the resulting covariance matrix are extracted. The first two vectors for each set of residuals are reported below, along with the percent of the remaining variance associated with each vector. The adjusted R^2 and unexplained variance from each regression are reported as well.

Analysis Bins		Principal Components					
		Equation (1) Residuals		Equation (3) Residuals		ΔBBB Residuals	
Maturity	Leverage	First	Second	First	Second	First	Second
Short	Low	0.23803	0.11438	0.24327	−0.05569	0.15353	0.21257
Short	2	0.24508	0.12107	0.25666	−0.05202	0.16936	0.21077
Short	3	0.27665	0.04722	0.26324	−0.07952	0.13979	0.21893
Short	4	0.30059	−0.08293	0.26757	−0.04632	0.14980	0.17982
Short	High	0.26998	−0.63059	0.26441	−0.01370	0.19105	0.17506
Medium	Low	0.23074	0.28626	0.25312	−0.09284	0.12572	0.22903
Medium	2	0.25226	0.22294	0.26871	−0.07669	0.14537	0.21452
Medium	3	0.27640	0.16116	0.26986	−0.10780	0.12765	0.23277
Medium	4	0.28481	0.11761	0.29077	−0.11450	0.14421	0.24728
Medium	High	0.25870	−0.52780	0.23424	0.95794	0.79434	−0.58382
Long	Low	0.23811	0.23054	0.25385	−0.09508	0.14877	0.27150
Long	2	0.22060	0.13328	0.21696	−0.07955	0.12553	0.21473
Long	3	0.23623	0.11610	0.23824	−0.08967	0.13327	0.23880
Long	4	0.25895	−0.00930	0.27148	−0.03257	0.20496	0.22586
Long	High	0.27196	−0.17609	0.27139	0.06468	0.25808	0.13027
Cum. % explained by PC		75.9	82.2	58.5	79.1	39.8	70.4
Avg. adj. R^2 of regression		0.21		0.35		0.60	
Unexplained variance		0.114		0.078		0.048	

Credit Spread Changes and Structural Models

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  - → Both equity and debt are functions of same state-variables (asset value, leverage, asset volatility, risk-free rate . . .)
  - → credit spread changes should be explained by changes in these firm-specific variables.
- CGM (2001) used 10 years of monthly bond **quotes** data from 688 firms from 1988 to 1997 and find
  - **Low average R^2** $\sim 21\%$ of regressions of individual firm **credit spread changes** on variables predicted by structural models.
  - Residuals largely driven by **one common factor**: first principal component explains roughly 75% of the variance of the unexplained 'first stage' regression residuals.
- What drives the common factor in residuals?
  - → Measurement errors, noise?
  - → Bond market 'liquidity'?
  - → Bond market specific risk-factors?
- Are bond and equity market segmented? Implications for structural models?

Commonality in Credit Spread changes (transaction prices)

- HKS use comprehensive bond **transactions** data from 2005 to 2015 and find:
  - First-stage average regression $R^2 \approx 25\%$ (monthly) and 45% (quarterly)
  - Common component in residuals: first PC explains $\approx 75\%$ (monthly) and 80% (quarterly) of first-stage residual variance.

$\sim$ Friewald and Nagler (2019) who use bond transactions from 2003 to 2013
  - First-stage average regression $R^2 \approx 22\%$ (monthly)
  - Common component in residuals: first PC explains $\approx 48\%$ of first-stage residual variance.

- Both papers propose different explanations for the common factor in residuals:
  - FN: Liquidity and microstructure trading frictions

  $\rightarrow$ 12 measures of dealer-inventory, search, and bargaining frictions explain 23% of the common factor variance.
  - HKS: Intermediary asset pricing frictions

  $\rightarrow$ Two factors (Dealer-inventory and Intermediary distress) explain 48% (quarterly) and 20% (monthly) of common factor variance

  $\rightarrow$ Propose simple theoretical model where equilibrium prices are determined by 'hedgers' bond supply shocks ($\sim$ inventory factor) and shocks to margin-constrained risk-neutral intermediary's wealth ($\sim$ distress factor).

Intermediary-leverage or liquidity?

- HKS show that intermediary factors work better at quarterly frequency than at monthly frequency.
- HKS show that trading liquidity measure of Dick-Nielsen, Feldhuetter, Lando (2012) ($\sim$ price-impact and round-trip cost) explains less than 3% of common factor variance.

→ would be interesting to see explanatory power of FN's trading frictions a quarterly frequency (but clearly not frequency at which 'microstructure' typically operates).

- Both HKS and FN rely on dealer-inventory measure which explains on its own about 8% of unexplained factor variance.

→ Would expect bond market liquidity and intermediary leverage to be related (funding and trading liquidity).

- Intermediary distress is average of:
  - He, Kelly, Manela (2017) **primary dealer holding company leverage** computed with aggregate market equity and book debt.
  - Hu, Pan, Wang (HPW2013) **noise**: RMSE of observed Treasury yield vs. implied from yield-curve model.

→ It's mostly **noise** which drives explanatory power and loading monotonicity of distress factor!

- What does HPW 's noice measure capture?

HPW's noise or dealer leverage?

Table 8: Measures of Intermediary Distress

Groups		A: $\Delta Noise$		B: $\Delta \text{NLev}^{\text{HKM}}$		C: $\Delta Noise + \Delta \text{NLev}^{\text{HKM}}$		
Maturity	Rating	$\Delta Noise$	R^2_{adj}	$\Delta \text{NLev}^{\text{HKM}}$	R^2_{adj}	$\Delta Noise$	$\Delta \text{NLev}^{\text{HKM}}$	R^2_{adj}
Short	AA	0.043*	0.113	0.021	0.026	0.042*	0.005	0.114
		(1.683)		(0.845)		(1.883)	(0.199)	
Short	A	0.082**	0.225	0.029	0.028	0.083**	-0.004	0.226
		(2.429)		(1.026)		(2.494)	(-0.141)	
Short	BBB	0.132***	0.306	0.069*	0.083	0.124***	0.021	0.312
		(3.368)		(1.682)		(2.973)	(0.619)	
Short	BB	0.320***	0.399	0.010	0.000	0.373***	-0.135*	0.459
		(2.804)		(0.097)		(3.610)	(-1.958)	
Short	B	0.389***	0.221	0.206	0.062	0.363***	0.065	0.226
		(2.762)		(1.115)		(2.668)	(0.399)	
Medium	AA	0.058***	0.188	0.023	0.029	0.058**	0.001	0.188
		(2.614)		(1.363)		(2.358)	(0.030)	
Medium	A	0.077**	0.182	0.070**	0.152	0.058	0.047	0.241
		(1.980)		(2.180)		(1.431)	(1.601)	
Medium	BBB	0.127**	0.224	0.115**	0.184	0.097*	0.077*	0.295
		(2.376)		(2.284)		(1.868)	(1.771)	
Medium	BB	0.310***	0.448	0.107	0.053	0.316***	-0.016	0.449
		(3.550)		(1.224)		(2.951)	(-0.286)	
Medium	B	0.432***	0.304	0.422***	0.290	0.316**	0.300***	0.429
		(2.669)		(3.070)		(2.352)	(2.700)	
Long	AA	0.034	0.076	0.021	0.030	0.030	0.010	0.081
		(1.102)		(0.734)		(1.425)	(0.367)	
Long	A	0.066*	0.186	0.043	0.079	0.058*	0.021	0.202
		(1.815)		(1.354)		(1.715)	(0.711)	
Long	BBB	0.177***	0.155	0.114***	0.064	0.156***	0.054*	0.167
		(3.037)		(4.169)		(2.762)	(1.806)	
Long	BB	0.291***	0.457	0.114	0.071	0.290***	0.002	0.457
		(4.632)		(1.423)		(3.664)	(0.047)	
Long	B	0.672***	0.374	0.566**	0.265	0.533**	0.359*	0.465
		(2.851)		(2.412)		(2.282)	(1.769)	
FVE			0.321		0.168			0.380

Notes: This table reports quarterly time series regressions of each of the 15 residuals of quarterly credit spread changes (in percentage), for cohorts based on time-to-maturity and credit rating, on $\Delta Noise$ (in panel A), on $\Delta \text{NLev}^{\text{HKM}}$ (in panel B), and on both (in panel C). Robust t-statistics based on Newey and West (1987) standard errors using the optimal bandwidth choice in Andrews (1991) are reported in parentheses. Significance levels are represented by * $p < 0.1$, ** $p < 0.05$, and *** $p < 0.01$ with p as the p-value. The last row reports the fraction of the total variation of residuals that is accounted for by $\Delta Noise$,

Insights from other asset classes

- HKM document many interesting 'spillover' effects results from other asset classes (CDS, MBS, CMBS, ABS, SPX)!
- CDS exhibit similar commonality as corporate bond credit spreads, in that first PC explains about 80% of unexplained first-stage CDS residual variance.
- This is in contrast to Ericsson, Jacobs, Oviedo (2009) who used CDS data from 1999-2002 and found little commonality in regression residuals.
- Since typically CDS are viewed as more liquid than bonds (CDS require less funding), this is perhaps also suggesting that liquidity is not the main driver of unexplained commonality in credit spreads.

Evolution in Dealer Model and market liquidity

- Big case has been made of a change from **principal** to **agency** model after the great financial crisis of 2008.
- Would expect that this would change the importance of intermediary balance-sheet factors and how they are priced in cross-section of corporate bonds?
- Surprising that results appear to be quantitatively very similar across CGM, FN, HKS which span different data-sets and periods from 1988 to today?

→ Might expect that dealer-leverage becomes more important in specific periods (during and after the great financial crisis, high volatility. . .)?

Structural models, credit spread level and changes

- **First-generation** structural models, which view bonds and equity as contingent claims on the **same** underlying firm value, tend to underpredict the level of credit spreads when calibrated to low historical default rates:

→ The **credit spread puzzle**
(Jones, Mason, and Rosenfeld (1984), Huang and Huang (2003))

- **Second-generation** structural models calibrated to match equity risk premia and equity option implied volatilities improve significantly at matching the **level** of credit spreads
(Cremers, Driessen, and Maenhout (2008), Chen, Collin-Dufresne, and Goldstein (2009), Du, Elkamhi, and Ericsson (2019))

→ "a **good deal of integration** between corporate bond and options markets" (Culp, Nozawa, and Veronesi (2018)).

- **Mixed evidence** when looking at corporate bond **returns**:
  - Common factors in credit spread changes (CGM, FN, HKS)
  - Equity factor bond betas do not explain cross-section of bond returns (Fama and French (1993), Choi and Kim (2018), Bai, Bali, and Wen (2019))
  - CDS and bond returns seem integrated with equity returns (Ericsson, Jacobs, and Oviedo (2009), Koijen, Lustig, and Van Nieuwerburgh (2017))

⇒ More to be done to understand role of common factors for pricing the cross-section of corporate bond returns and equity/bond market integration.

Conclusion

- **Lots** of empirical results.
- Nice model.
- Interesting paper!