Market Value of U.S. Universities

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Big Picture

- "*What is a university worth?*" – Page 1, Sentence 1

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- What universities **do** have is traded debt!
- **This paper:** Reverse standard Merton (1974) logic!
  - Credit spreads $\Rightarrow$ "equity" value of university
  - Connects \$ value of issuer to policy questions (e.g. tax cuts, visa restrictions)

Paper in a Nutshell

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- **(Some) Results:**
  - Yale \$151B, Harvard \$151B, Stanford \$135B
    - "*Comparable to McDonald's and Intel*"
  - University "index" is 2–4% of CRSP market cap
  - DiD: Valuations move around big shocks (e.g., loan repayment freeze)

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- **Overall Impression:**
  - Creative question that I have not seen asked before
  - Transparent, model-based approach
  - Impressive use of (largely) easy-to-access data; Others will use it!

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- **Plan for today:**
  - How much of a bond's spread is informative about the the residual value?

(0) Warm up: The methodology through a Black–Scholes-Merton lens

(i) Model: Sharpen the interpretation of the variance risk premium (λ_V)

(ii) Empirics: Is the tax-adjusted spread over Treasuries a *default* spread?

(iii) More external validation

Step 0: Black–Scholes–Merton in One Slide

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- No S for a university. But a bond price gives a spread s and a bond volatility σ^B

$$\underbrace{s_{i,t}}_{\text{Observed}} = s(X_{i,t},V_{i,t};\Theta), \qquad \underbrace{\sigma^B_{i,t}}_{\text{Observed}} = \sigma^B(X_{i,t},V_{i,t};\Theta) \quad \Longrightarrow \quad (X_{i,t},V_{i,t}) \Rightarrow S_{i,t}$$

  - Why not plain Merton? The credit spread puzzle (Jones et al. (1984), ...)

Step 0: From Black–Scholes to Stochastic Volatility

- Du et al. (2019): Variance is stochastic (Heston, 1993) **and** priced

$$dV_t = \kappa(\theta - V_t)\,dt + \sigma\sqrt{V_t}\,dW_{2,t}$$

  - θ denotes long-run variance under $\mathbb{P}$-measure
  - θ^* denotes long-run variance under $\mathbb{Q}$-measure
    - $\mathbb{Q}$ mapped to $\mathbb{P}$ via: $\kappa^* = \kappa + \sigma\lambda_V, \quad \theta^* = \frac{\kappa\theta}{\kappa^*}$

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- Risky bond = Risk-free bond - Put(Assets)
  - Higher $\sigma^{\mathbb{Q}} \rightarrow$ Put option $\uparrow \rightarrow$ Bond $\downarrow \rightarrow$ Spread $\uparrow$
  - The wedge $\theta^* - \theta$ (not expected default losses) helps to generate the spread
  - How may this impact the measurement of a university's "equity"?

Comment 1: What Does λ_V Measure?

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  - One moment and one parameter per rating group g; Exactly identified

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Rating	AAA	AA	A	BBB	HY
λ_V (Table 4)	-8.9	-7.5	-5.9	-6.4	-1.4
$\theta^*/\theta = \kappa/\kappa^*$	$3.0\times$	$2.3\times$	$1.8\times$	$1.9\times$	$1.1\times$
$\sqrt{\theta^*}$ (physical $\sqrt{\theta} = 29\%$)	50%	44%	39%	40%	31%
λ_D (Table 4)	-0.58	-0.37	-0.13	-0.20	$+0.56$

- Here $3\times$ for AAA, $1.1\times$ for HY; *Decreasing* in credit risk
  - Pattern also fits liquidity and convenience yield (Feldhütter and Schaefer, 2018)?

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	1-year spread	10-year spread
Diffusive risk only, $\lambda_V = 0$	0 bps	84 bps
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- The paper pools 2–8y bonds into one average spread per rating to find λ_V
  - The average *level* cannot distinguish LT defaults from ST non-default components
- Suppose $s^{\text{Obs}} = s^{\text{Default}}(\lambda_V) + s^{\text{Liquidity}} + s^{\text{Convenience}}$
  - E.g., the Treasury convenience yield is largest at short maturities (Nagel, 2016)
- Model sets $s^{\text{Liquidity}} = s^{\text{Convenience}} = 0$; λ_V may become "catch all" parameter

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- Can we design a test with "overidentifiyng" restrictions?
  - I.e., are differences in λ_V consistent with anything beyond default?
  - Ideal: One λ_V can explain most maturity x rating differences
  - Less ideal: Different λ_V's are needed to explain different groups of bonds
    - Would provide hints that additional features are needed in the model
    - E.g. Jump risk at short maturities?

Comment 1: Exploit the Term Structure Within Ratings

- **Test 1: Rating-specific parameters**

▸ Test 2: One λ_V

  - Choose $\lambda_V^{(g)}$ to match the *average* spread within rating g
  - Then ask whether the model also matches the *term structure*

Example 1: Systematic pricing errors

A-rated: $\lambda_V = -5.9$

	2–3y	3–5y	5–8y
Data	45	60	75
Model	15	55	85
Error	$+30$	$+5$	-10

BBB-rated: $\lambda_V = -6.4$

	2–3y	3–5y	5–8y
Data	95	125	167
Model	65	120	177
Error	$+30$	$+5$	-10

- Average spreads fit, but errors are systematically related to maturity
  - Model understates the short end and overstates the long end
  - Suggests a missing maturity-dependent spread component

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Example 2: Pricing errors look like noise

A-rated: $\lambda_V = -5.9$

	2–3y	3–5y	5–8y
Data	45	60	75
Model	43	64	73
Error	$+2$	-4	$+2$

BBB-rated: $\lambda_V = -6.4$

	2–3y	3–5y	5–8y
Data	95	125	167
Model	98	121	168
Error	-3	$+4$	-1

- Average spreads fit and pricing errors show no systematic maturity pattern
  - Errors are small and fluctuate around zero
  - Much more consistent with the model's term-structure implications

Comment 2: What Is in the "Credit Spread"?

- Gross up the tax-exempt yield by *top statutory* rate $\bar{\tau} = 41\%$; Subtract Treasuries

$$\hat{s} = \frac{y^*}{1 - \bar{\tau}} - y^{Tsy}$$

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- If the marginal muni investor is taxed at $\tau^m \neq \bar{\tau}$ ...
  - E.g., Trzcinka (1982), Green (1993), Longstaff (2011), Garrett et al. (2023), ...
- ... and demands a liquidity premium ℓ and default spread c

$$y^* = (1-\tau^m)\,(y^{Tsy} + c) + \ell$$

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$$y^* = (1-\tau^m)\,(y^{Tsy} + c) + \ell$$

- If we assume $\tau^m = 25\%$ and define $\phi \equiv (1-\tau^m)/(1-\bar{\tau}) = 1.27$, then

$$\hat{s} = \underbrace{\phi\, c}_{\text{Default, } 27\% \text{ too big}} + \underbrace{(\phi-1)\, y^{Tsy}}_{\text{Level of Treasury yields}} + \underbrace{\ell/(1-\bar{\tau})}_{\text{Liquidity, } 70\% \text{ too big}} \neq c$$

Comment 2: A Worked Example

- Consider a university with:
  - A true default spread of $c = 40$ bps
  - Liquidity premium of $\ell = 20$ bps
  - Marginal tax rate of $\tau^m = 25\%$

	Treasury yield 1%	Treasury yield 4%
Tax-exempt yield y^*		
Paper's spread input $\hat{s}$		
Default, ϕc		
Treasury level, $(\phi - 1)\, y^{Tsy}$		
Liquidity, $\ell/(1 - \bar{\tau})$		

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Tax-exempt yield y^*	1.25%	
Paper's spread input $\hat{s}$	**112 bps**	
Default, ϕc	51	
Treasury level, $(\phi - 1)\, y^{Tsy}$	27	
Liquidity, $\ell/(1 - \bar{\tau})$	34	

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	Treasury yield 1%	Treasury yield 4%
Tax-exempt yield y^*	1.25%	3.50%
Paper's spread input $\hat{s}$	**112 bps**	**193 bps**
Default, ϕc	51	51
Treasury level, $(\phi - 1)\, y^{Tsy}$	27	108
Liquidity, $\ell/(1 - \bar{\tau})$	34	34

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- The true default spread never changed, yet $\hat{s}$ rose by 81 bps
- The inversion reads the 81 bps as the university moving toward its boundary
  - $\Rightarrow$ Decline in equity value and M/B $\downarrow$; Explains time-series dynamics in Figure 6?

Comment 2: Solutions?

- Authors are aware of this but face a difficult tradeoff:
  - "*This method differs from Schwert (2017), who use the swap rate as a benchmark. Since our sample includes highly rated and liquid bonds issued by universities such as Harvard and Yale (both of which are AAA-rated), we would end up with negative credit spreads if we used the swap rate as a benchmark . . . Thus, we use the Treasury yield to calibrate [λ] and estimate the model.*" – Page 20

- Sensitivity to alternative benchmarks

  (i) AAA tax-exempt curve: Eliminates most tax issues; Some default concerns remain

  (ii) Swap curve: No convenience yield or default risk; Tax issues remain

- My view: Spread ≤ 0 for elite universities $\Rightarrow$ Not enough default risk to invert
  - Drop them to obtain more defensible (?) values for the other ≈ 280 universities

Comment 3: Validate the Inversion Where Equity Is Observable

- Run the analysis (spread and bond vol in, equity out) on TRACE
  - Does the exact procedure applied to, e.g., Intel's bonds deliver Intel's equity?
    - This is different from the validation exercise in Appendix Figure A3
- **Overview:**
  - Obtain bond volatility from TRACE transaction prices, exactly as for universities
    - Use Schwert (2017) daily prices, maturity-weighted issuer aggregate
    - Spread over the same benchmark; No tax gross-up needed
  - Invert (X, V) from the two equations; $S = X - F(B + DWL)$
    - Here, $F =$ book debt from Compustat
  - Compare S with CRSP market capitalization
  - Compare implied V with realized or option-implied asset volatility
- How close do we get in a setting where S is reliably measured?

Comment 3: Identification

- Quick (and final) pivot from SDFs to DiDs
  - Events largely coincide with common muni shocks:
    - March 2020 liquidity crisis (Bernhardt et al.; Li et al., 2021; 2024)
    - April 2025 tariff selloff and threat to the tax exemption
  - Only a few treated clusters make inference difficult
    - E.g., Conley and Taber (2011), Ferman and Pinto (2019), ...
- Alternative approaches?

Comment 3: Identification

- Athletic success (Final Four, top-20 football)
  - Raises applications, applicant quality, and donations (e.g., Pope and Pope (2009))



North Carolina
2017 NCAA champions



Iowa
2024 Big Ten tournament



Indiana
2025 CFP national champions

Comment 3: Identification

- Large (unexpected?) donations

Institution	Donor	Gift ($M)
Johns Hopkins University	Bloomberg Philanthropies	1,000
Albert Einstein College of Medicine	Ruth Gottesman	1,000
Columbia University	Roy & Diana Vagelos	400
Cornell University	David Duffield	372
Washington University in St. Louis	Bursky Family Foundation	200
University of Southern California	Mark & Mary Stevens	200
Howard University	Bloomberg Philanthropies	175
Meharry Medical College	Bloomberg Philanthropies	175
Morehouse School of Medicine	Bloomberg Philanthropies	175
Santa Clara University	Mark & Mary Stevens	175
Case Western Reserve University	Mandel Foundation	125
Drexel University	Anonymous	113
University of Chicago	Konstantin Sokolov	100
Fordham University	Maurice & Carolyn Cunniffe	100

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  - Only a few treated clusters make inference difficult
    - E.g., Conley and Taber (2011), Ferman and Pinto (2019), ...
- Alternative approaches?
  - Idiosyncratic shocks with a known cash-flow channel that do not coincide with aggregate muni shocks
    - Mirrors the event-study analysis around bankruptcy
    - Do yields move in the way that we would expect?

Smaller Comments

- Inversion also requires bond volatility. Bond volatility is measured using raw bond returns. Should it instead be measured using duration-adjusted returns to isolate the credit-risk component?

- Can you report solver diagnostics and months / universities for which the algorithm does not converge? Does this happen often or rarely?

- "*[Higher turnover] suggests . . . not driven primarily by a liquidity premium*" (p. 14): Turnover is not the price of liquidity; retail muni round trips cost 1–2% (Harris and Piwowar (2006), Green et al. (2007))
  - There are many proxies for liquidity. Do they agree or disagree? E.g., Schwert (2017)

Smaller Comments

- For the "typical" university, how sensitive is the model to the assumption of the calibration parameters drawn from Du et al. (2019)
  - I.e., corporations are not universities, so do small changes in these assumptions impact implied equity values? Hopefully insensitive!
- By pinning λ_D to the long-term SR, it seems as though IG bond investors *pay* to bear diffusive risk $\lambda_D < 0$? Dislike firm value increasing... Intuition?
- In terms of the potential tax-induced distortions, document how large the wedge (ϕ) may be
  - Regression of $\hat{s}$ on y^{TSY} with issuer fixed effects $\approx (\phi - 1)$

Conclusion

- Creative question, valuable data, transparent method
- Structural models are useful for hedge ratios and *changes* (Schaefer and Strebulaev, 2008); Levels of a levered residual are a much taller order
- Main suggestions:
  - (a) Dig into the values / implications of λ_V
  - (b) Isolate the default component of spreads before inverting
  - (c) Validate the inversion where equity is observable
  - (d) Identification: Exploit idiosyncratic shocks
- Thanks for the opportunity to discuss this paper!

Comment 1: One λ_V for All Ratings

- **Test 2: Constant parameter across all ratings**

Back to Test 1

  - Stop giving each rating its own λ_V; pick one for every group
  - Everything else (leverage, volatility, and X_D) stays the same

Systematic pricing errors

	AAA	AA	A	BBB	HY
Data	33	44	66	129	514
Model	8	18	40	104	489
Error	+25	+26	+26	+25	+125

Common component missing across ratings

Pricing errors look like noise

	AAA	AA	A	BBB	HY
Data	33	44	66	129	514
Model	31	47	65	125	516
Error	+2	−3	+1	+4	−2

No systematic pattern across ratings

- The cross-sectional pattern of pricing errors is informative
  - Systematic errors across ratings $\Rightarrow$ one λ_V cannot explain the cross section
  - Small, irregular errors $\Rightarrow$ cross section is more consistent with a common λ_V

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