Priced risk in corporate bonds

Alexander Dickerson a, Philippe Mueller b, Cesare Robotti

(JFE, 2023.08)

石宛青

（武汉大学金融系）

2022 年 12 月 26 日

Motivation

- For the most part,risk factors for corporate bonds are typically derived from term structures of interest rates or bond liquidity and default risk.
- Recent studies document strong empirical support for multifactor models that explain the cross-sectional variation in corporate bond expected excess returns.
- This paper revisit the main findings of a series of prominent papers on corporate bond pricing.
- literatures： Bai,Bali,Wen(2019)
  - BBW argue that the downside (DRF), credit (CRF), and liquidity (LRF) risk factors are not spanned by existing factors (including MKTB， FF3).

Question

1. replication BBW?
    - publicly available DRF, CRF, and LRF are not properly constructed and suffer from lead/lag errors over extended portions of their sample period.
    - truncating both tails of MKTB as in BBW, reduces its risk premium and favors alternative factors in multivariate tests.
2. replication other traded/nontraded factors?
    - lack of incremental pricing ability for all of the newly proposed bond factors
    - liquidity as the only marginal exception

Contribution

- lack of incremental pricing ability for all of the newly proposed bond factors
  - BBW four-factor model has become a de facto benchmark
  - traded factors:
    - BBW:MKTB,DRF (downside),LRF(ILLIQ), CRF(credit)
    - CAPM(MKTS);DEFTERM(DEF,TERM);HKM and HKMSF(He et al.,2017)
  - nontraded factors: great empirical support for systematic volatility, liquidity, macroeconomic uncertainty, and long-run consumption risk (Chung et al.,2019; Lin et al.,2011; Bali et al.,2021; Elkamhi et al,2023)
- highlights several statistical issues that are frequently overlooked in empirical asset pricing.

Data

- July 2002-Dec 2016, 31,348 bonds issued by 3792 firms, 861,524 observations
- database:Enhanced TRACE & FISD
- clean:
  1. Remove bonds that are not publicly traded in the U.S. market.
  2. Remove bonds that are classified as structured notes, mortgage backed or asset backed, agency backed, equity linked or convertible;
  3. Remove bonds that have a floating coupon rate
  4. Remove bonds that have less than one year remaining until maturity;
  5. Remove all intraday transactions for which the trade price is less than $5 or greater than $1,000.
  6. Eliminate all bond transactions that are labelled as when-issued, lockedin, or have special sales conditions, and that have more than a two-day settlement;
  7. Remove transaction records that are cancelled and adjust records that are subsequently corrected or reversed.
  8. Remove intraday transaction records that have trading volume less than $10,000.

Design

- Replicated vs. original BBW factors.
- 严格按照 BBW 所述方法构建因子，唯一不同的是，不对债券超额收益缩尾
  1. MKTB weighted by bond amounts outstanding.
  2. DRF:abs(historical 5% Value at Risk (VaR) from monthly returns in past 36 months (minimum of 24m), sort 5×5 according to ratings and VaR5.
  3. LRF:ILLIQ $= -Covt(p_{i,t,d}, p_{i,t,d+1})$, sort 5×5 according to ratings and ILLIQ.
  4. CRF： ew average return on 3 ‘credit portfolios’ :$CRF_{VaR}, CRF_{ILLIQ}, CRF_{REV}$.

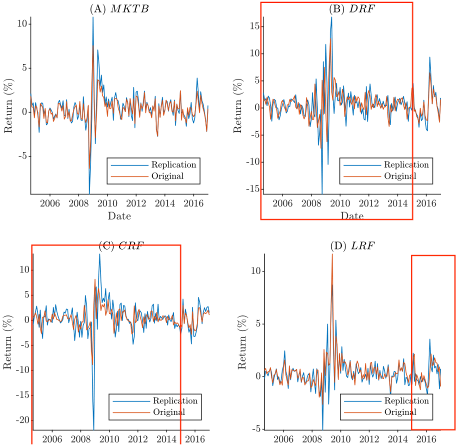
Design

- Replicate Additional traded-factor models factors
  1. CAPM:vw stock market excess return (MKTS), obtain from French's webpage
  2. DEFTERM:DEF:dif of long-term corporate bonds and government bonds.TERM :return dif between long-term government bonds and the one-month T-Bill
  3. HKM and HKMSF(He et al.,2017): intermediary capital models,vw excess return of New York Fed's primary dealer sector (CPTLT) and the stock market factor
- Summary statistics, mean-variance frontiers, and Sharpe ratios
- Goodness-of-fit measures and risk premia:OLS、GLS
- 5 portfolios sorted on bond rating, 5 on maturity, 10 on credit spread, and the 12 FF industry portfolios, N = 32

Design

- Nontraded factors and the cross-section of corporate bond returns
  1. MACRO:MKTB+monthly change in the macroeconomic uncertainty index, UNC
  2. LIQPS and LIQAM:FF3 stock market factors (market, MKTS, size, SMB, and value, HML)+Aggregate liquidity PS (LIQPS model) or the AM (LIQAM model)
  3. VOLPS and VOLAM:FF3 stock factors+DEF +TERM+(PS or AM)+the first dif in the CBOE VIX (VIX).
  4. HKMNT:MKTS+nontraded intermediary capital risk factor (CPTL).
  5. Long-run consumption risk model (LRC),separate analysis
- model comparison tests with factor mimicking portfolios——10 traded factor
- Goodness-of-fit measures and risk premia： OLS、GLS
- Bond-level analysis： FM ——traded、Nontraded

Results: The BBW four-factor model



- a lead error in the original DRF and CRF factors; a lag error in LRF
- the negative return are much more attenuated than for the replicated factors

Results： The BBW four-factor model

Panel A: Original factors

	Mean	SD	Median	Min	5th	25th	75th	95th	Max
MKTB	0.333	1.381	0.410	−6.365	−1.298	−0.467	0.987	2.299	7.568
DRF	0.694	2.381	0.595	−7.430	−2.451	−0.553	1.722	4.462	12.789
CRF	0.431	1.876	0.327	−8.839	−2.354	−0.429	1.357	3.089	8.194
LRF	0.491	1.418	0.321	−2.629	−0.936	−0.243	0.938	2.230	11.660

Panel B: Replicated factors

	Mean	SD	Median	Min	5th	25th	75th	95th	Max
MKTB	0.469	1.892	0.495	−9.292	−1.856	−0.460	1.310	2.832	10.809
DRF	0.673	3.355	0.633	−15.895	−3.436	−0.618	1.702	4.724	16.768
CRF	0.508	3.411	0.531	−21.908	−3.402	−0.889	2.174	4.950	13.233
LRF	0.361	1.470	0.269	−5.078	−1.447	−0.295	0.759	2.461	8.719

Panel C: Pairwise correlations across factors

	C.1: Original-replicated				C.2: Original (corrected)-replicated			
	MKTB	*DRF*	*CRF*	*LRF*	*MKTB*	*DRF*	*CRF*	*LRF*
MKTB	0.939				0.939			
DRF		0.264				0.931		
CRF			0.445				0.948	
LRF				0.829				0.880

Panel D: Pairwise correlations across factors

	D.1: Original				D.2: Replicated			
	MKTB	*DRF*	*CRF*	*LRF*	*MKTB*	*DRF*	*CRF*	*LRF*
MKTB	1	0.284	0.455	0.470	1	0.785	0.455	0.618
DRF		1	0.424	0.319		1	0.381	0.803
CRF			1	0.352			1	0.411
LRF				1				1

- correlations between LRF/DRF and MKTB are higher in the replication.

Results: Summary statistics and Sharpe ratios

Panel A: Factor statistics and squared Sharpe ratios

	MKTB	*DRF*	*CRF*	*LRF*	*DEF*	*TERM*	*MKTS*	*CPTLT*
Mean	0.469	0.673	0.508	0.361	0.020	0.478	0.675	0.502
P值	[0.009]	[0.023]	[0.163]	[0.015]	[0.907]	[0.064]	[0.073]	[0.463]
Alpha	–	0.020	0.123	0.135	−0.313	0.307	0.156	−0.149
	–	[0.932]	[0.681]	[0.130]	[0.038]	[0.261]	[0.622]	[0.789]
Sh^2	0.054	0.033	0.015	0.052	−0.007	0.014	0.019	−0.002
	[0.002]	[0.014]	[0.069]	[0.003]	[0.911]	[0.077]	[0.048]	[0.381]
SD	1.898	3.366	3.422	1.475	2.172	3.308	4.176	7.024

Panel B: Model squared Sharpe ratios

	BBW	DEFTERM	HKM
Sh^2	0.053	0.014	0.023
	[0.015]	[0.126]	[0.061]

Panel C: Differences in model squared Sharpe ratios

	CAPM	HKMSF	HKM	DEFTERM	BBW
CAPMB	0.035	0.055	0.031	0.040	0.001
	[0.358]	[0.229]	[0.417]	[0.363]	[0.216]
CAPM		0.021	−0.004	0.005	−0.034
		[0.067]	[0.198]	[0.892]	[0.446]
HKMSF			−0.025	−0.015	−0.055
			[0.032]	[0.120]	[0.293]
HKM				0.009	−0.030
				[0.808]	[0.512]
DEFTERM					−0.039
					[0.445]

- after adjust market risk, DRF、CRF、LRF not statistically diff from 0
- MKTB yields the highest bias-adjusted squared Sharpe ratio

Results： Goodness-of-fit measures and risk premia

Panel A: Price of beta risk (OLS)

	CAPMB		BBW					DEFTERM			CAPM		HKMSF		HKM		
	$\hat{\gamma}_0$	$\hat{\gamma}_{MKTB}$	$\hat{\gamma}_0$	$\hat{\gamma}_{MKTB}$	$\hat{\gamma}_{DRF}$	$\hat{\gamma}_{CRF}$	$\hat{\gamma}_{LRF}$	$\hat{\gamma}_0$	$\hat{\gamma}_{DEF}$	$\hat{\gamma}_{TERM}$	$\hat{\gamma}_0$	$\hat{\gamma}_{MKTS}$	$\hat{\gamma}_0$	$\hat{\gamma}_{CPTLT}$	$\hat{\gamma}_0$	$\hat{\gamma}_{MKTS}$	$\hat{\gamma}_{CPTLT}$
Estimate	0.01	0.48	0.13	0.35	0.38	0.55	−0.02	0.18	0.57	−0.36	0.25	0.98	0.30	1.71	0.17	1.23	0.56
t-stat$_c$	(0.05)	(1.83)	(1.54)	(1.74)	(1.22)	(1.51)	(−0.09)	(2.82)	(1.57)	(−0.75)	(1.93)	(1.56)	(2.32)	(1.50)	(1.42)	(1.75)	(0.44)
t-stat$_m$	(0.05)	(1.80)	(1.38)	(1.60)	(1.16)	(1.48)	(−0.06)	(2.84)	(1.54)	(−0.80)	(1.94)	(1.56)	(2.32)	(1.49)	(1.34)	(1.78)	(0.37)
R^2	0.888		0.927					0.839			0.876		0.851		0.896		
	[0.591]		[0.444]					[0.307]			[0.500]		[0.397]		[0.600]		

原假设：R方=1

Panel B: Price of beta risk (GLS)

	CAPMB		BBW					DEFTERM			CAPM		HKMSF		HKM		
	$\hat{\gamma}_0$	$\hat{\gamma}_{MKTB}$	$\hat{\gamma}_0$	$\hat{\gamma}_{MKTB}$	$\hat{\gamma}_{DRF}$	$\hat{\gamma}_{CRF}$	$\hat{\gamma}_{LRF}$	$\hat{\gamma}_0$	$\hat{\gamma}_{DEF}$	$\hat{\gamma}_{TERM}$	$\hat{\gamma}_0$	$\hat{\gamma}_{MKTS}$	$\hat{\gamma}_0$	$\hat{\gamma}_{CPTLT}$	$\hat{\gamma}_0$	$\hat{\gamma}_{MKTS}$	$\hat{\gamma}_{CPTLT}$
Estimate	0.02	0.46	0.02	0.45	0.47	0.55	0.41	0.02	0.15	0.22	0.03	0.15	0.03	0.39	0.03	0.10	0.45
t-stat$_c$	(0.64)	(2.46)	(0.67)	(2.43)	(1.57)	(1.52)	(2.41)	(0.96)	(0.73)	(0.78)	(1.09)	(0.31)	(1.17)	(0.44)	(1.19)	(0.21)	(0.49)
t-stat$_m$	(0.60)	(2.49)	(0.69)	(2.43)	(1.54)	(1.52)	(2.37)	(0.92)	(0.70)	(0.76)	(1.04)	(0.29)	(1.07)	(0.41)	(1.12)	(0.20)	(0.46)
R^2	0.097		0.185					0.026			0.002		0.004		0.006		
	[0.002]		[0.003]					[0.000]			[0.000]		[0.000]		[0.000]		

Panel C: Price of covariance risk (OLS)

	CAPMB		BBW					DEFTERM			CAPM		HKMSF		HKM		
	$\hat{\lambda}_0$	$\hat{\lambda}_{MKTB}$	$\hat{\lambda}_0$	$\hat{\lambda}_{MKTB}$	$\hat{\lambda}_{DRF}$	$\hat{\lambda}_{CRF}$	$\hat{\lambda}_{LRF}$	$\hat{\lambda}_0$	$\hat{\lambda}_{DEF}$	$\hat{\lambda}_{TERM}$	$\hat{\lambda}_0$	$\hat{\lambda}_{MKTS}$	$\hat{\lambda}_0$	$\hat{\lambda}_{CPTLT}$	$\hat{\lambda}_0$	$\hat{\lambda}_{MKTS}$	$\hat{\lambda}_{CPTLT}$
Estimate	0.01	13.53	0.13	9.83	5.43	4.31	−23.02	0.18	12.48	0.34	0.25	5.64	0.30	3.50	0.17	16.65	−6.96
t-stat$_c$	(0.05)	(1.41)	(1.54)	(0.70)	(0.41)	(1.07)	(−0.82)	(2.82)	(1.61)	(0.10)	(1.93)	(1.35)	(2.32)	(1.43)	(1.42)	(1.47)	(−1.04)
t-stat$_m$	(0.05)	(1.39)	(1.38)	(0.62)	(0.30)	(1.01)	(−0.52)	(2.84)	(1.49)	(0.10)	(1.94)	(1.35)	(2.32)	(1.42)	(1.34)	(1.23)	(−0.81)

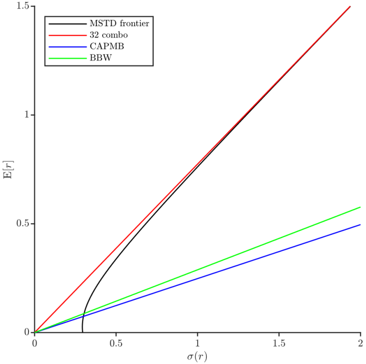
Panel D: Price of covariance risk (GLS)

	CAPMB		BBW					DEFTERM			CAPM		HKMSF		HKM		
	$\hat{\lambda}_0$	$\hat{\lambda}_{MKTB}$	$\hat{\lambda}_0$	$\hat{\lambda}_{MKTB}$	$\hat{\lambda}_{DRF}$	$\hat{\lambda}_{CRF}$	$\hat{\lambda}_{LRF}$	$\hat{\lambda}_0$	$\hat{\lambda}_{DEF}$	$\hat{\lambda}_{TERM}$	$\hat{\lambda}_0$	$\hat{\lambda}_{MKTS}$	$\hat{\lambda}_0$	$\hat{\lambda}_{CPTLT}$	$\hat{\lambda}_0$	$\hat{\lambda}_{MKTS}$	$\hat{\lambda}_{CPTLT}$
Estimate	0.02	12.82	0.02	18.63	−15.59	0.08	32.68	0.02	5.60	3.69	0.03	0.88	0.03	0.80	0.03	−2.08	1.94
t-stat$_c$	(0.64)	(1.81)	(0.67)	(1.45)	(−1.67)	(0.02)	(2.84)	(0.96)	(1.17)	(1.30)	(1.09)	(0.30)	(1.17)	(0.43)	(1.19)	(−0.37)	(0.54)
t-stat$_m$	(0.60)	(1.82)	(0.69)	(1.40)	(−1.69)	(0.02)	(2.85)	(0.92)	(1.12)	(1.27)	(1.04)	(0.28)	(1.07)	(0.41)	(1.12)	(−0.31)	(0.46)

Panel E: Differences in CSR R^2s

	OLS					GLS				
	BBW	DEFTERM	CAPM	HKMSF	HKM	BBW	DEFTERM	CAPM	HKMSF	HKM
CAPMB	−0.038	0.049	0.012	0.037	−0.008	−0.088	0.071	0.095	0.093	0.091
	[0.816]	[0.471]	[0.923]	[0.803]	[0.929]	[0.265]	[0.149]	[0.112]	[0.112]	[0.141]
BBW		0.088	0.050	0.076	0.031		0.159	0.183	0.181	0.179
		[0.301]	[0.577]	[0.516]	[0.527]		[0.112]	[0.081]	[0.079]	[0.087]
DEFTERM			−0.037	−0.012	−0.057			0.024	0.022	0.020
			[0.791]	[0.940]	[0.618]			[0.352]	[0.449]	[0.541]
CAPM				0.025	0.020				−0.002	−0.004

Results: Goodness-of-fit measures and risk premia



- BBW and CAPMB perform about the same in terms of the Sharpe ratio
- both BBW and CAPMB are very far from achieving mean-variance efficiency

Results： Nontraded-factor models

Panel A: Mimicking portfolio statistics and squared Sharpe ratios						
	MKTB	*UNCM*	*CPTLM*	*PSM*	*AMM*	*VIXM*
Mean	0.469	−0.303	0.369	−0.094	0.147	−0.497
	[0.009]	[0.042]	[0.579]	[0.592]	[0.411]	[0.117]
Alpha	–	−0.084	−0.164	−0.268	−0.052	0.105
	–	[0.411]	[0.758]	[0.177]	[0.761]	[0.692]
Sh^2	0.054	0.064	−0.007	−0.057	−0.013	0.023
	[0.002]	[0.004]	[0.478]	[0.505]	[0.372]	[0.077]
SD	1.898	1.284	6.367	1.718	2.021	3.438
Panel B: Model squared Sharpe ratios						
	MACRO	HKMNT	LIQPS	LIQAM	VOLPS	VOLAM
Sh^2	0.047	0.028	0.057	0.032	−0.048	−0.056
	[0.006]	[0.048]	[0.052]	[0.053]	[0.084]	[0.065]
Panel C: Differences in model squared Sharpe ratios						
	MACRO	HKMNT	LIQPS	LIQAM	VOLPS	VOLAM
CAPMB	0.007	0.025	−0.003	0.021	0.102	0.109
	[0.411]	[0.539]	[0.959]	[0.662]	[0.089]	[0.019]

Panel D: Mimicking portfolio statistics for long-run consumption R = [MKTB, DRF, CRF, LRF, MKTS, SMB,

maturity & credit： 3X2 EJN basis assets DMR basis assets HML, DEF, TERM, CPTLT

	EJN basis assets		DMR basis assets	
	2004:08–2016:12	1984:03–2019:12	2004:08–2016:12	1984:03–2019:12
Mean	−0.019	0.533	0.150	0.457
se_{EJN}	(0.196)	(0.061)	(0.213)	(0.075)
se_{DMR}	(0.325)	(0.238)	(0.665)	(0.155)
Alpha	−0.250	0.247	−0.053	0.213
se_{EJN}	(0.216)	(0.058)	(0.230)	(0.084)
se_{DMR}	(0.316)	(0.223)	(0.746)	(0.150)

- Sharpe ratio :not better than CAPMB

Results: Nontraded-factor models

Panel A: Price of beta risk (OLS)

	MACRO			HKMNT			LIQPS			LIQAM			VOLPS			VOLAM		
	$\hat\gamma_0$	$\hat\gamma_{MKTB}$	$\hat\gamma_{UNC}$	$\hat\gamma_0$	$\hat\gamma_{MKTS}$	$\hat\gamma_{CPTL}$	$\hat\gamma_0$	$\hat\gamma_{MKTS}$	$\hat\gamma_{PS}$	$\hat\gamma_0$	$\hat\gamma_{MKTS}$	$\hat\gamma_{AM}$	$\hat\gamma_0$	$\hat\gamma_{MKTS}$	$\hat\gamma_{VIX}$	$\hat\gamma_0$	$\hat\gamma_{MKTS}$	$\hat\gamma_{VIX}$
Estimate	0.09	0.39	−0.36	0.16	1.21	0.48	0.17	0.77	−0.64	0.20	1.10	−0.33	0.18	0.77	−0.40	0.20	0.97	−0.86
t-stat$_c$	(0.90)	(2.09)	(−1.11)	(1.59)	(1.65)	(0.42)	(2.31)	(1.30)	(−1.60)	(2.38)	(1.54)	(−0.83)	(2.17)	(1.00)	(−0.42)	(2.44)	(1.14)	(−0.71)
t-stat$_m$	(0.89)	(2.03)	(−1.09)	(1.73)	(1.61)	(0.39)	(2.36)	(1.28)	(−1.50)	(2.45)	(1.44)	(−0.79)	(2.20)	(0.95)	(−0.39)	(2.52)	(1.13)	(−0.61)
R^2	0.911			0.891			0.956			0.948			0.956			0.953		
	[0.450]			[0.583]			[0.570]			[0.545]			[0.428]			[0.396]		

Panel B: Price of beta risk (GLS)

	MACRO			HKMNT			LIQPS			LIQAM			VOLPS			VOLAM		
	$\hat\gamma_0$	$\hat\gamma_{MKTB}$	$\hat\gamma_{UNC}$	$\hat\gamma_0$	$\hat\gamma_{MKTS}$	$\hat\gamma_{CPTL}$	$\hat\gamma_0$	$\hat\gamma_{MKTS}$	$\hat\gamma_{PS}$	$\hat\gamma_0$	$\hat\gamma_{MKTS}$	$\hat\gamma_{AM}$	$\hat\gamma_0$	$\hat\gamma_{MKTS}$	$\hat\gamma_{VIX}$	$\hat\gamma_0$	$\hat\gamma_{MKTS}$	$\hat\gamma_{VIX}$
Estimate	0.01	0.46	−0.15	0.03	0.07	0.73	0.03	0.24	−0.15	0.02	0.19	0.34	0.02	0.18	−0.50	0.02	0.19	−0.40
t-stat$_c$	(0.60)	(2.48)	(−0.48)	(1.28)	(0.14)	(0.75)	(1.12)	(0.47)	(−0.46)	(0.95)	(0.39)	(1.25)	(0.93)	(0.36)	(−0.97)	(0.90)	(0.38)	(−0.77)
t-stat$_m$	(0.57)	(2.52)	(−0.46)	(1.23)	(0.13)	(0.62)	(1.10)	(0.44)	(−0.35)	(0.88)	(0.35)	(1.13)	(0.88)	(0.33)	(−0.94)	(0.82)	(0.34)	(−0.70)
R^2	0.098			0.012			0.093			0.099			0.104			0.100		
	[0.001]			[0.000]			[0.001]			[0.000]			[0.001]			[0.000]		

Panel C: Price of covariance risk (OLS)

	MACRO			HKMNT			LIQPS			LIQAM			VOLPS			VOLAM		
	$\hat\lambda_0$	$\hat\lambda_{MKTB}$	$\hat\lambda_{UNC}$	$\hat\lambda_0$	$\hat\lambda_{MKTS}$	$\hat\lambda_{CPTL}$	$\hat\lambda_0$	$\hat\lambda_{MKTS}$	$\hat\lambda_{PS}$	$\hat\lambda_0$	$\hat\lambda_{MKTS}$	$\hat\lambda_{AM}$	$\hat\lambda_0$	$\hat\lambda_{MKTS}$	$\hat\lambda_{VIX}$	$\hat\lambda_0$	$\hat\lambda_{MKTS}$	$\hat\lambda_{VIX}$
Estimate	0.09	7.96	−6.26	0.16	13.04	−4.95	0.17	−4.87	−7.57	0.20	0.05	−6.95	0.18	−4.83	0.05	0.20	−4.56	−9.76
t-stat$_c$	(0.90)	(1.32)	(−0.56)	(1.59)	(1.23)	(−0.83)	(2.31)	(−0.74)	(−1.72)	(2.38)	(0.01)	(−1.05)	(2.17)	(−0.36)	(0.00)	(2.44)	(−0.33)	(−0.51)
t-stat$_m$	(0.89)	(1.23)	(−0.54)	(1.73)	(1.10)	(−0.72)	(2.36)	(−0.76)	(−1.71)	(2.45)	(0.01)	(−1.02)	(2.20)	(−0.35)	(0.00)	(2.52)	(−0.31)	(−0.44)

Panel D: Price of covariance risk (GLS)

	MACRO			HKMNT			LIQPS			LIQAM			VOLPS			VOLAM		
	$\hat\lambda_0$	$\hat\lambda_{MKTB}$	$\hat\lambda_{UNC}$	$\hat\lambda_0$	$\hat\lambda_{MKTS}$	$\hat\lambda_{CPTL}$	$\hat\lambda_0$	$\hat\lambda_{MKTS}$	$\hat\lambda_{PS}$	$\hat\lambda_0$	$\hat\lambda_{MKTS}$	$\hat\lambda_{AM}$	$\hat\lambda_0$	$\hat\lambda_{MKTS}$	$\hat\lambda_{VIX}$	$\hat\lambda_0$	$\hat\lambda_{MKTS}$	$\hat\lambda_{VIX}$
Estimate	0.01	13.92	2.31	0.03	−3.55	3.22	0.03	−3.48	−2.45	0.02	−3.05	3.69	0.02	−6.13	−3.83	0.02	−3.89	−1.52
t-stat$_c$	(0.60)	(2.27)	(0.23)	(1.28)	(−0.68)	(0.86)	(1.12)	(−0.89)	(−0.79)	(0.95)	(−0.65)	(0.76)	(0.93)	(−1.49)	(−0.80)	(0.90)	(−0.79)	(−0.24)
t-stat$_m$	(0.57)	(2.40)	(0.22)	(1.23)	(−0.51)	(0.64)	(1.10)	(−0.70)	(−0.59)	(0.88)	(−0.56)	(0.67)	(0.88)	(−1.10)	(−0.74)	(0.82)	(−0.61)	(−0.19)

Panel E: Differences in CSR R^2s

	OLS						GLS					
	MACRO	HKMNT	LIQPS	LIQAM	VOLPS	VOLAM	MACRO	HKMNT	LIQPS	LIQAM	VOLPS	VOLAM
CAPMB	−0.022	−0.003	−0.067	−0.060	−0.067	−0.065	−0.001	0.085	0.004	−0.002	−0.007	−0.003
	[0.589]	[0.976]	[0.372]	[0.409]	[0.371]	[0.389]	[0.828]	[0.194]	[0.965]	[0.979]	[0.931]	[0.972]

- Sharpe ratio :not better than CAPMB

Results： Bond-level analysis:FM

Panel A: Price of beta risk for traded-factor models

	CAPMB		BBW					DEFTERM			CAPM		HKMSF		HKM		
	$\hat{\gamma}_0$	$\hat{\gamma}_{MKTB}$	$\hat{\gamma}_0$	$\boxed{\hat{\gamma}_{MKTB}}$	$\hat{\gamma}_{DRF}$	$\hat{\gamma}_{CRF}$	$\boxed{\hat{\gamma}_{LRF}}$	$\hat{\gamma}_0$	$\hat{\gamma}_{DEF}$	$\hat{\gamma}_{TERM}$	$\hat{\gamma}_0$	$\hat{\gamma}_{MKTS}$	$\hat{\gamma}_0$	$\hat{\gamma}_{CPTLT}$	$\hat{\gamma}_0$	$\hat{\gamma}_{MKTS}$	$\hat{\gamma}_{CPTLT}$
Estimate	0.00	0.54	0.10	0.36	0.04	0.40	0.15	0.07	0.43	0.62	0.14	1.73	0.21	3.00	−0.47	3.98	−2.57
t-stat$_{FM}$	(0.02)	(1.54)	(1.11)	(1.97)	(0.18)	(0.75)	(2.03)	(0.69)	(1.23)	(1.82)	(1.16)	(1.43)	(1.91)	(1.40)	(−1.01)	(1.47)	(−1.20)
Adj. R^2	0.058		0.111					0.079			0.069		0.062		0.034		
Obs.	321,280		321,280					321,280			321,280		321,280		321,280		

Panel B: Price of covariance risk for traded-factor models

	CAPMB		BBW					DEFTERM			CAPM		HKMSF		HKM		
	$\hat{\lambda}_0$	$\hat{\lambda}_{MKTB}$	$\hat{\lambda}_0$	$\hat{\lambda}_{MKTB}$	$\hat{\lambda}_{DRF}$	$\hat{\lambda}_{CRF}$	$\boxed{\hat{\lambda}_{LRF}}$	$\hat{\lambda}_0$	$\hat{\lambda}_{DEF}$	$\hat{\lambda}_{TERM}$	$\hat{\lambda}_0$	$\hat{\lambda}_{MKTS}$	$\hat{\lambda}_0$	$\hat{\lambda}_{CPTLT}$	$\hat{\lambda}_0$	$\hat{\lambda}_{MKTS}$	$\hat{\lambda}_{CPTLT}$
Estimate	0.04	12.25	0.16	−0.64	1.08	4.37	6.49	0.30	9.23	−2.81	0.15	8.48	0.23	5.04	0.15	5.39	2.18
t-stat$_{FM}$	(0.37)	(1.51)	(1.85)	(−0.21)	(0.72)	(1.12)	(1.84)	(2.57)	(1.39)	(−0.71)	(1.31)	(1.42)	(2.01)	(1.38)	(1.28)	(1.48)	(1.02)
Adj. R^2	0.051		0.105					0.089			0.066		0.060		0.072		
Obs.	321,280		321,280					321,280			321,280		321,280		321,280		

Panel C: Price of beta risk for nontraded-factor models

	MACRO			HKMNT			LIQPS			LIQAM			VOLPS			VOLAM		
	$\hat{\gamma}_0$	$\hat{\gamma}_{MKTB}$	$\hat{\gamma}_{UNC}$	$\hat{\gamma}_0$	$\hat{\gamma}_{MKTS}$	$\hat{\gamma}_{CPTL}$	$\hat{\gamma}_0$	$\hat{\gamma}_{MKTS}$	$\hat{\gamma}_{PS}$	$\hat{\gamma}_0$	$\hat{\gamma}_{MKTS}$	$\hat{\gamma}_{AM}$	$\hat{\gamma}_0$	$\hat{\gamma}_{MKTS}$	$\hat{\gamma}_{VIX}$	$\hat{\gamma}_0$	$\hat{\gamma}_{MKTS}$	$\hat{\gamma}_{VIX}$
Estimate	0.04	0.44	−0.80	−0.21	2.82	−2.53	0.14	1.31	−2.92	−0.05	2.68	−0.71	0.06	2.76	0.18	0.44	1.80	0.04
t-stat$_{FM}$	(0.17)	(1.24)	(−1.31)	(−0.79)	(1.52)	(−1.19)	(1.15)	(1.34)	(−1.25)	(−0.33)	(1.73)	(−0.79)	(0.48)	(1.71)	(0.28)	(1.76)	(1.59)	(0.05)
Adj. R^2	0.051			0.056			0.099			0.103			0.088			0.087		
Obs.	321,280			321,280			321,280			321,280			321,280			321,280		

Panel D: Price of covariance risk for nontraded-factor models

	MACRO			HKMNT			LIQPS			LIQAM			VOLPS			VOLAM		
	$\hat{\lambda}_0$	$\hat{\lambda}_{MKTB}$	$\hat{\lambda}_{UNC}$	$\hat{\lambda}_0$	$\hat{\lambda}_{MKTS}$	$\hat{\lambda}_{CPTL}$	$\hat{\lambda}_0$	$\hat{\lambda}_{MKTS}$	$\boxed{\hat{\lambda}_{PS}}$	$\hat{\lambda}_0$	$\hat{\lambda}_{MKTS}$	$\hat{\lambda}_{AM}$	$\hat{\lambda}_0$	$\hat{\lambda}_{MKTS}$	$\hat{\lambda}_{VIX}$	$\hat{\lambda}_0$	$\hat{\lambda}_{MKTS}$	$\hat{\lambda}_{VIX}$
Estimate	−0.08	3.45	−20.38	0.03	4.79	4.75	0.03	3.77	9.98	0.33	4.01	−7.77	0.02	3.93	−0.04	0.26	3.87	−1.36
t-stat$_{FM}$	(−0.36)	(0.75)	(−1.52)	(0.18)	(1.22)	(1.49)	(0.21)	(1.40)	(1.96)	(2.67)	(1.41)	(−1.17)	(0.19)	(1.44)	(−0.02)	(1.68)	(1.39)	(−0.69)
Adj. R^2	0.071			0.074			0.114			0.113			0.116			0.115		
Obs.	321,280			321,280			321,280			321,280			321,280			321,280		

- same as portfolios level

Conclusion

- Overall, robust evidence for common factor pricing in corporate bonds remains elusive.

实证资产定价需注意的问题

- 数据滞后处理、前瞻性问题
- 缩尾是否必要?
- 模型设定问题：OLS 的 R^2 存在问题——改用 GLS
- 估计误差

Thanks!