The Impact of Tenant Diversification on Commercial Mortgage Spreads and Default Rates

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Agenda

- Motivation, Literature Review, and Main Findings
- Data and Empirical Analysis
- Conclusion

Motivation

- Traditional portfolio theory dictates that a greater degree of diversification leads to a greater amount of safety for investors.
- Commercial real estate
  - Tenant Diversification Benefit: Potentially less risky cash flows
  - Tenant Diversification Drawbacks:
    - Large tenants typically more stable and creditworthy
    - Difficult to screen/monitor many small tenants

Research Questions

- Do lenders reward diversified properties with lower mortgage spreads?

- Do default rates differ for diversified and undiversified properties?

Literature Review

- The tenant characteristics and the structure of tenant portfolios are important in assessing the riskiness of commercial mortgages. For example,
  - Colwell and Munneke (JRER, 1998): note that a landlord adds value to a portfolio of leases by bringing together a diverse group of tenants.
  - Ciochetti, Yongheng, Lee, Shilling, Rui (JREFE, 2003): acknowledge that the credit quality of tenants influences default risk.
  - Grovenstein, Harding, Sirmans, Thebpanya, Turnbull (JHE, 2005): points out that lenders consider current tenants and lease structure as part of the risk in commercial mortgage lending.
  - Titman, Tompaidis and Tsyplakov (REE, 2005): study about the determinants of credit spread on commercial mortgages.

- In addition to providing diversification benefits to a property owner's cash flow stream, having multiple tenants in a given property may allow provide firms with positive business externalities. For example,
  - Wheaton (REE, 2000): Research finds that stores in shopping centers or business districts generate sales or business traffic externalities amongst themselves.
  - Brueckner (JREFE, 1993), Colwell and Munneke (JRER, 1998), and Cho and Shilling (REE, 2007) build theoretical models incorporating sales externalities
  - Pashigian and Gould (REStat, 1998): Large anchor properties receive rent subsidies whereas smaller stores pay rent premiums.
  - Gould, Pashigian and Prendergast (Journal of Law and Economics, 2005): Anchor stores occupy over 58% of the total leasable space in a mall, but they only pay 10% of the total rent collected by the developer.

- Bank loan portfolios and monitoring cost
  - Acharya, Hasan and Saunders (JB, 2006): Diversification deteriorates monitoring effectiveness.
  - Mercieca, Schaeck and Wolfe (JBF, 2007): Higher loan concentration reduces the risk of insolvency and enables small banks to monitor more effectively.
  - Berger, Hasan and Zhou (JBF, 2010): Diversification increases monitoring costs and reduces profits.
  - Tabak, Fazio and Cajueiro (JBF, 2011): Loan portfolio concentration increases bank returns and reduces default risk, indicating that loan concentration may increase monitoring efficiency.

Main Findings

- Mortgage Spreads
  - Properties with low to moderate levels of tenant diversification have spreads that are up to 5.8 basis points lower than mortgages on single-tenant properties.
  - Discount disappears if largest tenant's lease expires before mortgage matures.
  - No discount for properties with a large amount of tenant diversification.

- Mortgage Default Rates
  - As tenant diversification increases, default rates increase

Data

- Data from Trepp Datafeed, which contains data on commercial mortgages that have been securitized
- Loan, tenant, and property characteristics measured at (or close to) time of origination
- Because we examine the degree with which tenant diversification impacts commercial mortgage spreads and default rates, sample is restricted to office (OF), retail (RT), and warehouse/industrial (WH/IN) properties
- Our final dataset consists of 34,277 loans with originations that span from January 1998 to March of 2012.

- Data collected/variables calculated
  - Spread = Mortgage interest rate – maturity matched Treasury Rate
  - Property value
  - LTV
  - NOI/property value
  - Amortization rate = $1 - \textit{balloon balance} / \text{original } \textit{loan balance}$
  - Occupancy rate
  - Property age
  - Years to loan maturity
  - Property type
  - Maturity date of loan

  - % of square footage occupied by largest tenant
  - Expiration date of largest tenant's lease

Variables of interest

- Tenant diversification: % of square footage occupied by largest lessee (L1%) used to create diversification dummies

Largest Tenant % Square Footage (L1%)	Level of Tenant Diversification
$0 \leq L1\% < 20$	Extreme
$20 \leq L1\% < 40$	High
$40 \leq L1\% < 60$	Moderate
$60 \leq L1\% < 80$	Low
$80 \leq L1\% < 100$	Very Low
$L1\% = 100$	None

- % of square footage occupied by largest lessee (L1%) used to create diversification dummies

  $D(0 \leq L1\% < 20)$
  $D(20 \leq L1\% < 40)$
  $D(40 \leq L1\% < 60)$
  $D(60 \leq L1\% < 80)$
  $D(80 \leq L1\% < 100)$

- We create lease rollover dummy
  - D(L1 Rollover): indicating that the largest tenant's lease expires before the mortgage on the property

  This is interacted with diversification dummies

Summary Statistics

Top Lessee % Sq. Ft.	Level Of Tenant Diversif.	N	% Sample	Spread (%)	Property Value (mil)	NOI/ Property Value	LTV	Amort. Rate	Occ. Rate (%)	Property Age	Years to Loan Maturity	Top Lessee % Sq. Ft.	Fraction Top Lessee Rollover
[0,20)	Extreme	7,980	23.28	1.591	30.02	0.0771	0.68	0.15	93.12	24.73	9.68	13.74	0.87
[20,40)	High	10,829	31.59	1.584	21.03	0.0769	0.69	0.15	95.25	22.51	9.80	28.91	0.80
[40,60)	Moderate	5,445	15.89	1.587	15.97	0.0772	0.70	0.16	96.89	21.13	9.89	49.06	0.68
[60,80)	Low	2,591	7.56	1.580	14.57	0.0767	0.69	0.16	97.65	19.53	9.89	68.45	0.54
[80,100)	Very Low	817	2.38	1.544	22.30	0.0765	0.68	0.17	98.71	23.66	9.99	88.46	0.52
100	None	6,615	19.30	1.540	12.03	0.0744	0.67	0.20	99.94	16.37	10.14	100.00	0.38
Any	Any	34,277	100.00	1.576	20.12	0.0765	0.68	0.16	96.18	21.43	9.86	46.71	0.69

Observations

(1) completely undiversified properties have the lowest average spread and extremely diversified properties have the highest average spread.

(2) it appears that spreads tend to increase as tenant diversification increases.

(3) borrowers appear to be getting punished for higher levels of tenant diversification.

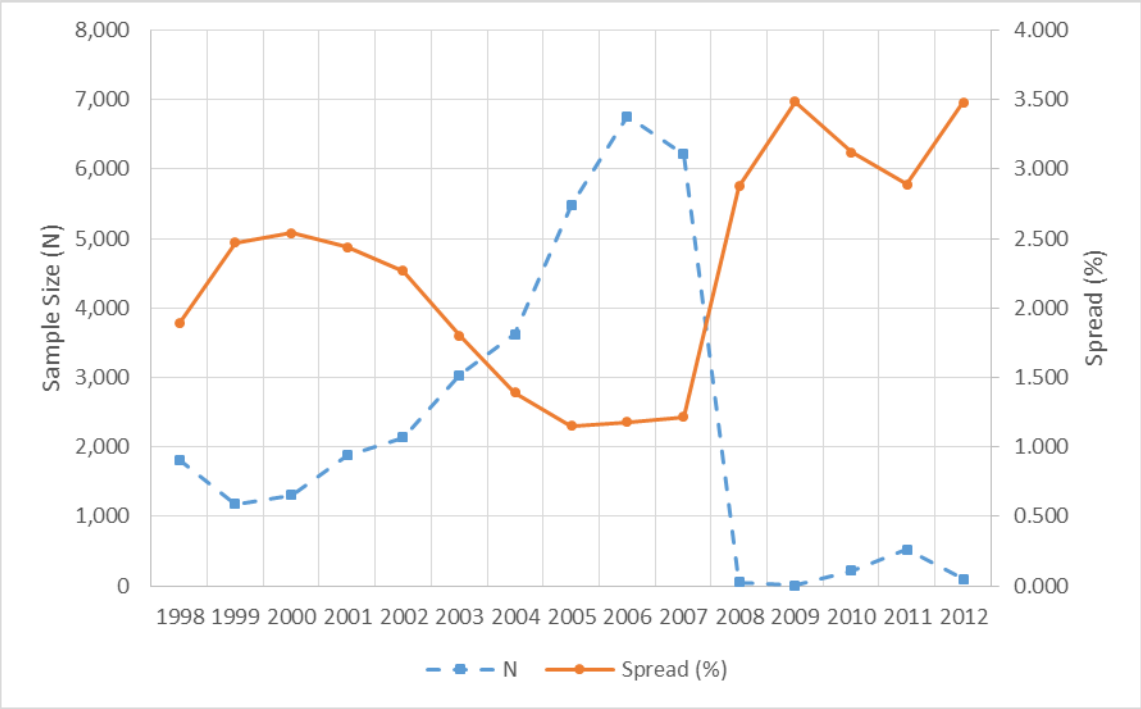
(4) the most diversified properties tend to have the highest property values, while completely undiversified properties have the lowest property values.

(5) On average, completely undiversified properties are younger than other properties and tend to have the lowest ratio of NOI to property value, the lowest LTV, the highest amortization rate, and the longest time to loan maturity.

(6) extremely diversified properties are older than other properties on average and have higher average ratios of NOI to property value. They also have the lowest amortization rate and the lowest occupancy rate, and their loans tend to mature more quickly

(7) For 87 percent of extremely diversified properties, the largest tenant's lease expires before the mortgage matures.

The sample size and average spread for all loans in each year



Spread Model

- Model closely follows Titman, Tompaidis, and Tsyplakov (REE, 2005)

$$Spread = Intercept + \sum_i l_i \times largest\ lessee\ relatve\ size\ dummy_i + \sum_i c_i \times property\ characteristic_i + \sum_i m_i \times mortgage\ characteristic_i + \sum_i t_i \times prop\ type\ dummy\ variable_i + \sum_i y_i \times time\ dummy\ variable_i + \varepsilon.$$

Spread Results without Rollover Dummy

Dependent Variable = Commercial Mortgage Spread (%)				
Variable	Coefficient Estimate	t-stat	Coefficient Estimate	t-stat
D(0 ≤ L1% < 20)	-0.0059	(-0.4252)	-0.0054	(-0.3959)
D(20 ≤ L1% < 40)	-0.0100	(-0.7828)	-0.0099	(-0.7889)
D(40 ≤ L1% < 60)	-0.0319	(-2.3045)	-0.0322	(-2.3563)
D(60 ≤ L1% < 80)	-0.0348	(-2.1538)	-0.0366	(-2.3158)
D(80 ≤ L1% < 100)	-0.0274	(-1.3373)	-0.0296	(-1.4287)
Log(Property Value)	-0.1022	(-17.0886)	-0.1042	(-16.6400)
D(0% ≤ LTV < 40%)	-0.0514	(-1.4030)		
D(40% ≤ LTV < 50%)	-0.0861	(-2.4375)		
D(50% ≤ LTV < 60%)	-0.0568	(-3.1977)		
D(60% ≤ LTV < 70%)	0.0513	(3.5495)		
D(70% ≤ LTV < 80%)	0.0511	(4.0666)		
LTV			0.4024	(3.7749)
D(LTV ≥ 70%)			-0.0211	(-1.9902)
NOI / Prop Value	2.1422	(2.9870)	2.0821	(2.9012)
Amortization Rate	-0.2766	(-4.7929)	-0.2759	(-4.7285)
Occupancy Rate	-0.0014	(-2.4888)	-0.0014	(-2.5222)
Log(Property Age)	0.0231	(6.8014)	0.0236	(6.7394)
Years to Maturity	-0.0358	(-6.1200)	-0.0357	(-6.0821)
Type = IN/WH	-0.0048	(-0.4777)	-0.0025	(-0.2491)
Type = OF	0.0278	(4.1710)	0.0299	(4.4678)
Quarter Fixed Effects	Yes		Yes	
N	34,277		34,277	
R^2	0.1374		0.1329	

Spread Results with Rollover Dummy

Dependent Variable = Commercial Mortgage Spread (%)				
Variable	Coefficient Estimate	t-stat	Coefficient Estimate	t-stat
D(0 ≤ L1% < 20)	0.0206	(0.9013)	0.0200	(0.8706)
D(0 ≤ L1% < 20) × D(L1 Rollover)	-0.0296	(-1.3882)	-0.0278	(-1.2739)
D(20 ≤ L1% < 40)	-0.0148	(-0.9074)	-0.0156	(-0.9639)
D(20 ≤ L1% < 40) × D(L1 Rollover)	0.0070	(0.5155)	0.0086	(0.6375)
D(40 ≤ L1% < 60)	-0.0575	(-3.3041)	-0.0583	(-3.3748)
D(40 ≤ L1% < 60) × D(L1 Rollover)	0.0389	(3.3488)	0.0404	(3.5400)
D(60 ≤ L1% < 80)	-0.0447	(-2.2164)	-0.0480	(-2.3789)
D(60 ≤ L1% < 80) × D(L1 Rollover)	0.0199	(1.0907)	0.0235	(1.2737)
D(80 ≤ L1% < 100)	-0.0158	(-0.5816)	-0.0189	(-0.6945)
D(80 ≤ L1% < 100) × D(L1 Rollover)	-0.0203	(-0.6458)	-0.0174	(-0.5539)
D(L1% = 100) × D(L1 Rollover)	0.0031	(0.1838)	0.0046	(0.2739)
Log(Property Value)	-0.1020	(-16.9962)	-0.1039	(-16.6800)
D(0% ≤ LTV < 40%)	-0.0521	(-1.4148)		
D(40% ≤ LTV < 50%)	-0.0875	(-2.4790)		
D(50% ≤ LTV < 60%)	-0.0577	(-3.2432)		
D(60% ≤ LTV < 70%)	0.0505	(3.5317)		
D(70% ≤ LTV < 80%)	0.0508	(4.0895)		
LTV			0.4053	(3.7855)
D(LTV ≥ 70%)			-0.0209	(-1.9874)
NOI / Prop Value	2.1405	(2.9969)	2.0758	(2.9038)
Amortization Rate	-0.2780	(-4.8678)	-0.2769	(-4.7959)
Occupancy Rate	-0.0015	(-2.5715)	-0.0015	(-2.6119)
Log(Property Age)	0.0229	(6.7656)	0.0233	(6.7071)
Years to Maturity	-0.0359	(-6.1206)	-0.0359	(-6.0937)
Type = IN/WH	-0.0065	(-0.6133)	-0.0045	(-0.4294)
Type = OF	0.0263	(4.0594)	0.0281	(4.3050)
Quarter Fixed Effects	Yes		Yes	
N	34,277		34,277	
R^2	0.1378		0.1334	

Spread Regressions for Pre-Crises Period

Dependent Variable = Commercial Mortgage Spread (%)				
Variable	Coefficient Estimate	t-stat	Coefficient Estimate	t-stat
D(0 ≤ L1% < 20)	-0.0054	(-0.3793)	-0.0048	(-0.3463)
D(20 ≤ L1% < 40)	-0.0090	(-0.6970)	-0.0092	(-0.7110)
D(40 ≤ L1% < 60)	-0.0321	(-2.2756)	-0.0324	(-2.3235)
D(60 ≤ L1% < 80)	-0.0341	(-2.0828)	-0.0358	(-2.2384)
D(80 ≤ L1% < 100)	-0.0271	(-1.3031)	-0.0295	(-1.3990)
Log(Property Value)	-0.1018	(-16.5571)	-0.1038	(-16.0911)
D(0% ≤ LTV < 40%)	-0.0367	(-1.0081)		
D(40% ≤ LTV < 50%)	-0.0840	(-2.3134)		
D(50% ≤ LTV < 60%)	-0.0499	(-2.7473)		
D(60% ≤ LTV < 70%)	0.0521	(3.5647)		
D(70% ≤ LTV < 80%)	0.0523	(4.1381)		
LTV			0.3711	(3.4400)
D(LTV ≥ 70%)			-0.0181	(-1.7051)
NOI / Prop Value	2.2243	(3.0252)	2.1611	(2.9367)
Amortization Rate	-0.3056	(-5.2301)	-0.3052	(-5.1633)
Occupancy Rate	-0.0014	(-2.3353)	-0.0014	(-2.3526)
Log(Property Age)	0.0235	(6.7888)	0.0240	(6.6947)
Years to Maturity	-0.0315	(-5.4692)	-0.0314	(-5.4363)
Type = IN/WH	-0.0071	(-0.6930)	-0.0048	(-0.4693)
Type = OF	0.0258	(3.8627)	0.0279	(4.1510)
Quarter Fixed Effects	Yes		Yes	
N	33,394		33,394	
R^2	0.1340		0.1297	

Tenant Diversification and Mortgage Default

- Characteristics at origination used to predict eventual default
- Logistic model
  - Dependent variable: Default dummy = 1 if loan eventually goes 90+ days delinquent, 0 otherwise
  - Independent variables
    - Tenant diversification dummies
    - LTV
    - NOI/Property Value
    - Occupancy rate
    - Property age
    - Years to loan maturity
    - DSCR
    - Maturity matched Treasury rate
    - Property type dummies
    - Census division dummies to control property location

Panel A: Summary Statistics by Eventual Loan Delinquency

Eventual 90+ Day Delinquency	N	Top Lessee % Sq. Ft.	Property Value (mil)	LTV (%)	Fraction with LTV ≥ 70%	NOI/ Property Value (%)	Occupancy Rate (%)	Property Age	Years to Loan Maturity	DSCR
0	27,464	47.81	21.44	68.01	0.53	7.57	96.23	21.57	9.87	1.64
1	3,569	37.60	17.01	72.79	0.73	7.47	95.06	19.19	9.73	1.52
All	31,033	46.64	20.93	68.56	0.55	7.56	96.09	21.29	9.85	1.63

Panel B: Summary Statistics by Largest Lessee % Sq. Footage

Top Lessee % Sq. Ft.	N	Fraction Eventual 90+ Days Delinq.	Top Lessee % Sq. Ft.	Property Value (mil)	LTV (%)	Fraction with LTV ≥ 70%	NOI/ Property Value (%)	Occupancy Rate (%)	Property Age	Years to Loan Maturity	DSCR
[0,20)	7,260	0.14	13.69	31.12	68.11	0.54	7.63	92.99	24.64	9.69	1.68
[20,40)	9,825	0.14	28.88	22.02	69.20	0.58	7.60	95.14	22.35	9.80	1.63
[40,60)	4,881	0.12	49.05	16.71	69.70	0.60	7.62	96.82	21.06	9.89	1.59
[60,80)	2,327	0.10	68.45	15.18	69.48	0.59	7.58	97.56	19.55	9.88	1.59
[80,100)	722	0.07	88.33	22.94	68.17	0.55	7.56	98.65	23.54	9.98	1.65
100	6,018	0.06	100.00	12.24	66.84	0.46	7.35	99.93	16.13	10.09	1.59

Default Results

Variable	Time Period: 1/1998-3/2012 Coefficient Estimate	Odds Ratio	Z-stat	Time Period: 1/1998-12/2007 Coefficient Estimate	Odds Ratio	Z-stat
D(0 ≤ L1% < 20)	1.0995	3.0028	(7.8649)	1.0804	2.9459	(7.7059)
D(20 ≤ L1% < 40)	1.0159	2.7617	(8.2036)	0.9862	2.6810	(8.0056)
D(40 ≤ L1% < 60)	0.8106	2.2493	(8.1957)	0.7847	2.1918	(8.2534)
D(60 ≤ L1% < 80)	0.5870	1.7987	(5.6495)	0.5686	1.7659	(5.5832)
D(80 ≤ L1% < 100)	0.2479	1.2814	(1.1940)	0.2185	1.2441	(1.0637)
Log(Property Value)	-0.1285	0.8794	(-4.7546)	-0.0463	0.9548	(-1.9584)
LTV (%)	0.0637	1.0657	(13.1151)	0.0396	1.0404	(7.5296)
D(LTV ≥ 70%)	-0.0608	0.9410	(-0.8766)	-0.0471	0.9540	(-0.6558)
NOI/Prop Value (%)	-0.2618	0.7697	(-8.2768)	0.1152	1.1220	(3.4427)
Occupancy Rate	-0.0091	0.9909	(-2.6512)	-0.0085	0.9916	(-2.4808)
Log(Property Age)	-0.0729	0.9297	(-3.8721)	-0.1094	0.8964	(-6.1763)
Years to Maturity	-0.0593	0.9424	(-4.2258)	-0.0618	0.9401	(-4.2491)
DSCR	-0.1118	0.8942	(-1.2125)	-0.6869	0.5032	(-8.1088)
Maturity Matched Treasury Bond Rate	0.3255	1.3847	(4.2980)	0.1998	1.2212	(1.9258)
Prop Type = IN/WH	0.1787	1.1957	(3.0838)	0.0875	1.0914	(1.4859)
Prop Type = OF	0.3827	1.4662	(8.2318)	0.3210	1.3785	(6.8991)
Division = East North Central	0.5201	1.6823	(6.5152)	0.5316	1.7017	(6.3589)
Division = East South Central	0.1625	1.1764	(1.5638)	0.1324	1.1415	(1.2078)
Division = Middle Atlantic	-0.0938	0.9105	(-0.7586)	-0.0025	0.9975	(-0.0206)
Division = Mountain	0.6790	1.9718	(8.3093)	0.7685	2.1566	(9.6725)
Division = New England	-0.1934	0.8242	(-1.1942)	-0.0592	0.9425	(-0.3914)
Division = Pacific	-0.2247	0.7987	(-1.5006)	-0.0554	0.9461	(-0.3804)
Division = South Atlantic	0.1427	1.1534	(1.4041)	0.2092	1.2327	(2.0890)
Division = West North Central	0.1112	1.1176	(0.9130)	0.0722	1.0749	(0.6073)
Quarter Dummies		No			Yes	
N		31,033			30,179	
Pseudo R-Square		0.0834			0.0965	

Conclusion

- Tenant diversification results in small spread discount for moderate levels of diversification.
  - Discount exists only when largest tenant's lease does not expire before mortgage matures.
- Higher tenant diversification results in higher default rates.
- Limitations:
  - Our default analysis indicates that mortgages on properties with a single large tenant are the least likely to default. However, it is probably the case the only tenant of a completely undiversified property is very credit-worthy, so lenders and property owners are easily able to identify the quality of the single tenant.
  - Because we do not have access to data on the credit quality of tenants in a property, we are unable to examine the impact of tenant credit riskiness in this paper.