Tales from the Vertical City: Access, Amenities, and Agglomeration

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I. Introduction

A. Context:

1. Urban spatial structure…
2. Spatial variation in rents…
3. …all in a vertical setting.
4. Focus on tall commercial buildings.

B. The salience of tall buildings for cities is hard to dispute…

C. Cities are not flat, but urban and real estate economists have acted as if they were.

1. Monocentric model: variable capital to land ratios generate variation within and between cities in building heights.

2. All activity at a particular distance from the city center is treated as taking place at ground level.

3. The standard model thus largely ignores what takes place within a building.

C. This presentation will focus on the vertical structure of cities.

1. The primary focus will be on the tall buildings that make up a city's business district.

2. The analysis is guided by a theoretical model that extends standard economic analysis by considering verticality.

3. A building is truly "long and narrow" in the sense of Solow and Vickrey (1971).

4. The presentation will cover some work that will be presented later in the conference, some planned, and some work that others have started to do in this area.

D. Context revisited:

1. Vertical transportation costs matter.

    a. An IBM (2010) survey shows that an office tenant spends 22.25 minutes in or waiting for elevators in a business day.

    b. Compare this to the median one-way commute of 24 minutes (Rosenthal and Strange, 2011).

2. Office sector matters.

    a. As an asset market: bigger than corporate bonds.

    b. For urban employment: bigger than manufacturing.

E. Novel data allow us to focus on vertical relations.

1. Confidential offering memoranda data (OM) that lay out the tenant stack (tenant locations) of 93 buildings and rents by floor.

2. Commercial rent dataset produced by CompStak Inc. (CS): more buildings, but not entire buildings.

3. Establishment-level Dun and Bradstreet data (D&B): no rents, but firm characteristics.

F. Key conclusions:

1. Verticality matters: pricing and spatial structure vary vertically in ways that standard urban models fail to capture.

2. The vertical rent gradient is non-monotonic: initial sharp decrease above ground floor, then increase ("hockey stick").

3. Meaningful magnitudes: second floor rents roughly 50% lower than first floor; per floor premium of 0.6% per floor afterwards.

4. Some preliminary evidence of agglomeration economies that attenuate with distance.

F. Key conclusions (cont.):

5. Spatial structure is determined by tension between access and amenities.

6. Amenity-oriented establishments (e.g., law firms) locate high.

7. Access-oriented establishments (e.g., retailers) locate low.

G. Literature:

1. Urban spatial structure:

   a. Brueckner (1987) and Duranton and Puga (2015) surveys of theoretical literature following Alonso-Muth-Mills, such as Solow-Vickrey (1971).

   b. Related empirical literature is largely aggregate in approach and residential in focus.

   c. Likewise, urban history, such as Glaeser (2011).

   d. See Duranton and Puga (2015) for discussion of empirical issues.

G. Literature (cont.):

2. Commercial real estate:

a. Financial and macro issues: Geltner et al (2007) and Wheaton and Torto (1988).

b. Leasing: Grenadier (1995).

c. Contracting: Brueckner (1993).

d. Anchor tenants: Konishi and Sandfort (2003), Gould and Pashigian (1998), Gould, Pashigian, and Pendergast (2005).

G. Literature (cont.):

3. Building height:

a. Helsley-Strange (2008): game-theoretic model of skyscraper contests.
b. Barr (2010, 2014) on patterns of building heights.
c. Koster et al (2014) on the relationship of office rents to building heights (but little on what happens within buildings).
d. Ahlfeldt and McMillen (2015) document a robust relationship between building height and land rent.
e. Ahlfeldt and McMillen show that departures are consistent with Helsely-Strange (2008).

H. What we have done so far:

1. Analyze a theoretical model of vertical pricing and allocation of space.

2. Use a range of data sources (OM; CompStak; D&B)…

3. …to estimate the vertical pricing and spatial structure

4. …in a way that shed light on the key forces at work.

5. Future work will focus on agglomeration, among other topics.

6. Other work in this area considers topics such as the determinants of building height and the possible role of skyscraper contests.

II. A short history of tall buildings.

A. Rise of skyscrapers

1. Tallest Buildings 1886.
2. Tallest Buildings c. 1932.
3. Tallest Buildings now (ongoing skyscraper race).
4. Tallest Buildings in Future.

B. What is going on?

1. Responses to technological change:

    a. Elevators (Otis at New York World's Fair, 1854).

    b. Structural steel (Jenney's Home Insurance Bldg., Chicago, 1885).

2. Agglomeration economies at work in a competitive setting?

3. Strategic management of agglomeration economies as in Helsley-Strange (1994)?

4. Contests for prestige, as in Helsley-Strange (2008)? See Ahlfeldt-McMillen (2015) from this conference!

II. A theory of vertical bid rent and spatial structure: sketch.

A. Key forces that determine vertical rents and spatial structure.

1. Vertical transportation costs.

2. Some sort of amenity (but more complicated than simply views as in a residential building): how does height translate to profits.

3. Bid rent will depend on the tradeoff of access and amenities.

4. Thus, the equilibrium pattern of rents will also depend on this tradeoff, as will equilibrium spatial structure.

B. Solution (sketch).

1. Suppose we have two types of tenant, retailers and office employers.

2. In this setup, retailers are *access oriented*, while office employers can be *amenity oriented*.

3. In this situation, we would have an equilibrium where the equilibrium rent relationship will be nonmonotonic, falling initially as one moves above the ground floor and then rising.

4. The access oriented retailers will occupy low floors, while the amenity oriented office employers will occupy high floors.

C. Key implications to test:

1. The vertical rent gradient will be non-monotonic, falling with height at the lowest floors, and later rising at the highest.

2. Retail tenants will occupy the lowest floors, while office tenants will occupy the highest.

3. Vertical spatial structure will depend on amenities and access orientation, with a weaker access orientation and a stronger amenities orientation being associated with the occupancy of a higher floor.

III. Data

A. Three sources.

1. Offering memoranda (OM): 93 tall buildings, 2003-2014, tenant stack and suite level rent.
2. CompStak (CS): more buildings, but not entire buildings.
3. Dun and Bradstreet (D&B): no rent, but characteristics including sales and employment at a site or for the firm, establishment type, corporate status, and risk.

B. OM data.

1. 93 offering memoranda for tall buildings around the United States that were up for sale at various times from 2003 to 2014.

2. Tenant stack and rents.

3. Hand coded!

4. Example: Prudential One in Chicago.

Appendix A: Offering Memo Example -- One Prudential Plaza Stacking Plan

Flr	Tenant	SqFt	Lease Ends	Tenant	SqFt	Lease Ends
41	Plaza Club	7,798	06/06			
40M	AM/FM Ohio, Inc	100	09/06			
40	Vacant	1,860		Multi-Tenant	8,254	
39	Baker & McKenzie LLP	22,503	11/12			
38	Schuyler, Roche & Zwirner	24,082	04/15			
37	Baker & McKenzie LLP	24,017	11/12			
36	Baker & McKenzie LLP	24,068	11/12			
35	Baker & McKenzie LLP	24,148	11/12			
34	Vacant	14,274		Baker & McKenzie LLP	8,917	12/08
33	Baker & McKenzie LLP	23,026	11/12			
32	Baker & McKenzie LLP	22,411	11/12			
31	Baker & McKenzie LLP	22,990	11/12			
30	Baker & McKenzie LLP	21,191	11/12			
29	McGraw-Hill Inc	22,647	11/16			
28	Baker & McKenzie LLP	9,747	11/12	BDO Seidman, LLP	12186	09/11
27	Bonneville International	21,913	05/18			
26	Multi-Tenant	21,742				
25	Baker & McKenzie LLP	22,862	11/12			
24	Peoples Gas Light & Coke	21,803	05/14			
23	Peoples Gas Light & Coke	21,803	05/14			
22	Peoples Gas Light & Coke	21,803	05/14			
21	Peoples Gas Light & Coke	22,862	05/14			
20	Peoples Gas Light & Coke	23,264	05/14			
19	Peoples Gas Light & Coke	21,321	05/14			
18	Peoples Gas Light & Coke	19,917	05/14			
17	Peoples Gas Light & Coke	23,203	05/14			
16	Peoples Gas Light & Coke	23,126	05/14			
15	Atty Regis & Disciplinary Commission	23,125	05/15			

C. CompStak data.

1. Rent and tenant information.

2. More buildings covered, but not entire buildings.

3. More than 100,000 office suites over twelve cities.

4. We work with buildings over 10 stories in 7 cities with good coverage.

D. D&B data.

1. Detailed information on employment and sales at an establishment's site (i.e. suite),

2. Also, establishment type (i.e. single site, branch, headquarters), corporate status (corporation, partnership, sole proprietorship), risk attributes, sales and employment of the overall firm for multi-site companies.

3. Merged with OM and CS data, with match rate of roughly 70%.

Table 1: Summarv Measures
Panel A: Three Data Sources

	Offering Memo (OM)	CompStak (CS)	Dun and Bradstreet Merged with OM Data	Dun and Bradstreet For 5 Industries Not Merged with OM or CS Data[a]
Number of Buildings	93	1,840	93	19,721
Number of Tenant-Suite Obs	5,750	36,733	5,472	57,748
Number of MSAs	18	7	18	12
Time Period for Key Data	2003 - 2014	1999 - 2015	2014	2015

E. Summary statistics.

1. OM: 5,750 tenant-suite observations are spread across 93 buildings in 18 cities.

2. CS: 36, 733 tenant-suite observations are spread across 1,840 buildings in 7 cities.

3. D&B: all establishments in 12 MSAs (New York, Chicago, San Francisco, Los Angeles, Atlanta, Washington DC, Cleveland, Detroit, Dallas, Denver, Houston, and Seattle) in five industries (law, advertising, brokerage, insurance carriers, and agents/brokers/services.

4. D&B: 57,748 tenant-suite observations spread across 19,721 buildings.

Table 1: Summary Measures

Panel B: Industry Composition in Offering Memo Tall Buildings in

	All Floors	Ground Floor and	Floor > 2 and < 40	Floor >= 40
Retail (SIC 52-59)	6.79	32.71	2.34	3.45
FIRE (SIC 60-67)	23.43	10.12	25.74	25.43
Business Services	8.43	7.76	8.62	8.19
Law Offices (SIC	20.31	8.24	20.65	43.10
Eng, Acc, Man (SIC	12.13	2.59	14.00	11.64
All Other Industries	28.91	38.58	28.65	8.19

Panel C: Commercial Rents Per Square Foot ($2014)[a]

	Average	25th	50th	75th
Offering Memo Data	38	22	33	51
CompStak Data	24	3	19	38

F. More summary statistics for OM.

1. Which industries? FIRE 23% and law 20%. Retail 6.8%.

2. Where are the industries?

   a. Ground: retail is 33%.

   b. Floors 3-40, retail is 2%, FIRE is 25.7% and law 20.6%.

   c. Above 40, retail is 3.4%, FIRE 25.4% and law 43%.

G. Summary statistics on rent.

1. Means: OM: $38/sf and CS: $24/sf.

2. Dispersion: OM, 25th, 50th, and 75th percentiles are $22, $33, and $51/sf. CS: $3, $19 and $38/sf.

Table 1: Summary Measures

Panel D: Building Height in Number of Floors[a]

	Average Floor	Median Floor	% Over Floor 30	% Over Floor 60	Minimum Floor	Maximum Floor
By Building						
OM (93)	32.7	28	47.3%	4.3%	16	109
CS (1,840)	21.5	17	21.3%	1.4%	10	109
By Tenant Suite						
OM (5,750)	39.5	34	59.9%	10.5%	16	109
CS (36,733)	30.5	27	47.1%	3.9%	10	109

Panel E: Zipcode Employment in Which CompStak Buildings are Located (in 1,000 units)[a]

	Average	1st Pctl	25th Pctl	50th Pctl	75th Pctl	99 Pctl
By Zipcode (177 zipcodes)	36.65	0.96	18.55	29.16	44.94	142.45
By Tenant Suite (36,689 suites)	85.43	11.72	43.16	78.38	139.26	146.22

IV. Vertical rents

A. Vertical rent gradients: approaches.

1. Log rent/sf regressed on log floor.

2. Log rent/sf regressed on floor.

3. Ground floor and concourse dummies.

4. All rents 2014 dollars.

Table 2: Rent Gradients with Building Fixed Effects[a]

	Offering Memo Data[a]		CompStak Data[c]	
Below ground floor	-0.0425 (-0.25)	-0.3398 (-2.73)	- -	- -
Ground floor	0.5148 (4.99)	0.3160 (2.16)	0.1201 (3.35)	0.0378 (0.92)
Ground Floor X Bldg Height	0.0070 (1.89)	0.0113 (1.91)	0.0069 (4.00)	0.0072 (4.21)
Log(Floor number + k)[b]	0.2854 (2.52)	- -	0.0864 (17.42)	- -
Floor number	- -	0.0173 (2.73)	- -	0.0059 (17.81)
Observations	5,510	5,510	36,733	36,733
Lease quarter Fixed Effects	-	-	Yes	Yes
Building Fixed Effects	93	93	1,842	1,842
R-sq within	0.065	0.106	0.248	0.255

B. Vertical rent gradients: results.

1. Table 2 reports vertical gradients using OM and CS data in a model with building fixed effects.

2. Ground floor premium for a 30 story building: 72% in OM; 33% in CS in log-linear models (columns 2 and 4).

3. Significant and positive floor number coefficients: 1.73% in OM and 0.59% in CS.

4. There must be an amenity, in some sense.

Table 3a: Convex Rent Gradients
(t-ratios based on standard errors clustered at the building level)

	Offering Memo Data			CompStak Data		
	(1)	(2)	(3)	(4)	(5)	(6)
	Floors 3 through 29	Floors 30 through 59	Floors 60 and above	Floors 3 through 29	Floors 30 through 59	Floors 60 and above
PANEL B: Log-Linear						
Floor number	0.0082	0.0033	0.0620	0.0058	0.0068	0.0161
	(4.30)	(0.89)	(362.06)	(17.47)	(7.30)	(4.95)
Observations	3,537	775	146	29,130	4,597	116
Lease quarter Fixed Effects	No	No	No	Yes	Yes	Yes
Building Fixed Effects	93	44	4	1,786	364	18
R-sq within	0.019	0.003	0.090	0.260	0.295	0.708

C. Vertical rent gradients by floor.

1. Table 3a stratifies samples by floors 2-29, 30-59, and 60+.

2. We see smaller coefficients for low floors: 0.82% (OM) and 0.58% (CS) in log-linear models for suites on floors 2-29.

3. Above floor 60, higher coefficients: 6.2% (OM) and 1.6% (CS).

4. In sum: rent varies non-monotonically within buildings, with a hockey stick shape above floor 2.

Table 3b: Vertical Versus Horizontal Rent Gradients Using CompStak Data[a] (t-ratios based on standard errors clustered at the building level)

	Double-Log Models			Log-Linear Models		
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	MSA FE	Bldg FE	OLS	MSA FE	Bldg FE
Building height (floors)	0.0035	0.0020	-	0.0025	0.0011	-
	(1.30)	(2.23)	-	(1.04)	(1.28)	-
Ground floor	-0.3378	0.1889	0.1201	-0.4672	0.0610	0.0328
	(-3.62)	(4.62)	(3.35)	(-4.98)	(1.48)	(0.92)
Ground Floor X Bldg Height	0.0164	0.0070	0.0069	0.0180	0.0075	0.0072
	(5.31)	(3.61)	(4.00)	(6.06)	(3.91)	(4.21)
Log(Floor number + k)[b]	0.0985	0.1168	0.0864	-	-	-
	(4.33)	(13.22)	(17.42)	-	-	-
Floor number	-	-	-	0.0049	0.0073	0.0059
	-	-	-	(3.76)	(13.81)	(17.81)
Log(Zipcode emp in 1,000)	0.7766	0.0939	-	-	-	-
	(11.08)	(4.94)	-	-	-	-
Zipcode emp (1,000s)	-	-	-	0.0120	0.0020	-
	-	-	-	(16.36)	(6.97)	-
Observations	36,689	36,689	36,733	36,733	36,689	36,733
Lease quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
MSA Fixed Effects	No	7	No	No	7	No
Building Fixed Effects	No	No	1,842	No	No	1,842
R-sq within	-	-	0.248	-	-	0.255
R-sq total	0.281	0.889	0.945	0.296	0.892	0.946

D. Vertical and horizontal gradients: introduction

1. Table 3b presents models with controls for zipcode employment.

2. There is evidence in the table consistent with agglomeration economies in office markets.

3. Despite this, nearby agglomeration has little effect on vertical rent gradient.

4. The basic pattern also appears in OLS models and with MSA and building fixed effects.

E. Vertical rents: details.

1. In log-linear models of columns (4)-(6), the ground floor premium for a 50 story building is essentially identical: 43.3%, 43.6%, and 39.3% respectively.

2. The vertical rent gradients are: 0.49%, 0.73%, and 0.59% respectively.

E. Vertical rents: details (cont.).

3. Zipcode employment: adding 1,000 workers increases rent by 1.2% and 0.2% in the double-log and log-linear models.

4. The OLS results mean that adding 10,000 workers corresponds to moving up 24 floors.

5. In the MSA fixed effect model, the effect corresponds to 3 floors.

6. The rent elasticity with respect to zipcode employment is 9.39% in the double-log, MSA fixed effect model.

7. This is larger than estimates of wage effects in Combes et al (2008) and elsewhere.

Table 3c: New York City Rent Gradients Controlling for Building-Level Employment (t-ratios based on standard errors clustered at the building level)

	(1)	(2)	(3)	(4)	(5)
Building height (floors)	-	-	-	0.0029	-
	-	-	-	(1.89)	-
Ground floor	0.0658	0.1392	0.1526	0.2064	0.1994
	(0.81)	(1.74)	(1.89)	(2.47)	(2.64)
Ground Floor X Bldg Height	0.0068	0.0044	0.0035	0.0010	0.0003
	(2.69)	(1.87)	(1.47)	(0.42)	(0.13)
Floor number	0.0122	0.0114	0.0108	0.0091	0.0064
	(11.86)	(11.85)	(11.82)	(14.69)	(15.09)
Zipcode emp (1,000s)	-	0.0030	-	-	-
	-	(8.86)	-	-	-
Zipcode – Bldg emp (1,000s)	-	-	0.0030	0.0029	-
	-	-	(8.64)	(8.40)	-
Building emp (1,000s)	-	-	0.0124	0.0096	-
	-	-	(2.49)	(1.67)	-
Observations	17,973	17,973	17,973	17,973	17,973
Lease quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes
Building Fixed Effects	No	No	No	No	841
R-sq within	-	-	-	-	0.379
R-sq total	0.249	0.339	0.346	0.352	0.752

F. Building employment.

1. Table 3c reports log-linear models with controls for building employment estimated for New York City.

2. The vertical rent gradient is 0.64%, comparable to the results for the whole sample.

3. The vertical rent gradient is not impacted when we add controls for either zipcode or building employment.

4. The effect of building employment on rent is greater than the zipcode effect.

5. This is consistent with results on attenuation, as in Rosenthal and Strange (2003, 2004, 2005, 2008, and 2012).

V. Vertical spatial structure.

A. Two questions:

1. Who locates where?

2. Why?

Figure 1: Vertical Location By Industry

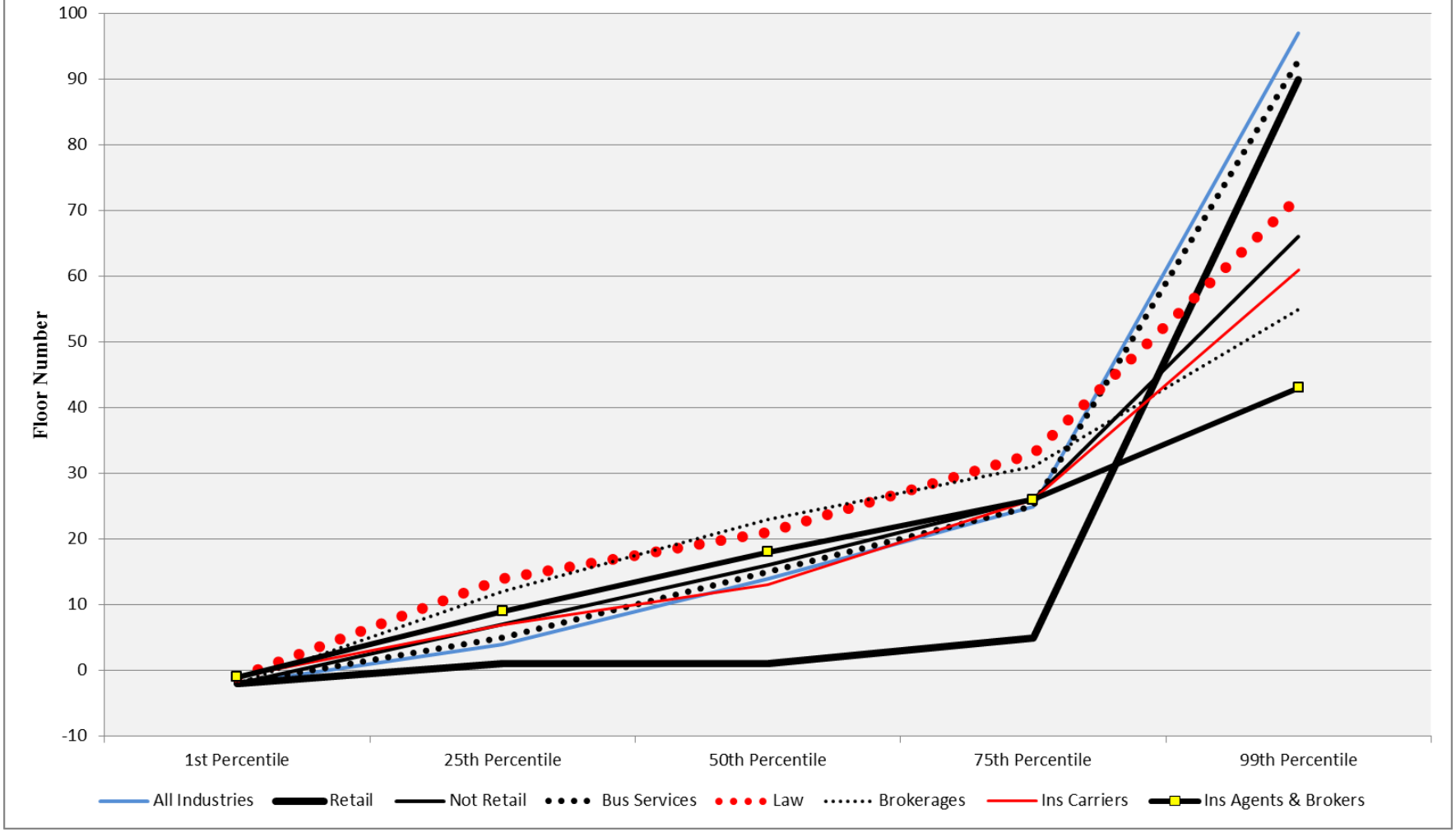

Table 4: Vertical Location By Industry[a]

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	All Industries	Retail (Sic2 52-59)	Not Retail (Not Sic2 52-59)	Business Services (Sic2 73)	Law Offices (Sic2 81)	Brokerage Offices 12 MSAs (SIC 62)	Insurance Carriers 12 MSAs (SIC 63)	Insurance Agents, Brokers & Services
1st Pctl	-2	-2	-2	-2	-1	-2	-1	-1
25th Pctl	4	1	7	5	14	12	7	9
50th Pctl	14	1	16	15	21	23	13	18
75th Pctl	25	5	26	25	33	31	26	26
99th Pctl	97	90	66	93	72	55	61	43
# Obs	5,750	226	2,940	267	643	277	63	76

B. Vertical sorting.

1. Figure 1 plots the vertical distributions of industries that are displayed in Table 4.

2. Retail is concentrated on the ground floor.

3. There is differentiation in how other activities are located within buildings.

4. Law is one activity that is persistently seen on high floors.

C. Mechanisms: access and amenities.

1. What are the characteristics of an establishment associated with the sort of amenity-orientation needed to explain the willingness to pay a premium for high floor suites?

2. Proxies:

   a. Sales-per-worker (establishment level).

   b. Number of workers.

   c. Firm sales.

Table 5: Location by Sales per Worker
(Dependent Variable: Log Floor Number)[a]

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Head Quarters NY MSA	Single Site 12 MSAs[b]	Single Site 12 MSAs[b]	Law Offices 12 MSAs (SIC 81)	Law Offices 12 MSAs (SIC 81)	Advertising Offices 12 MSAs (SIC 7311)	Brokerage Offices 12 MSAs (SIC 62)	Insurance Carriers 12 MSAs (SIC 63)	Insurance Agents, Brokers & Services 12 MSAs (SIC 64)
Log sales/worker at site	-	0.0139	0.0149	0.0463	0.0225	-0.0353	0.0040	-0.0227	-0.0064
	-	(2.01)	(2.00)	(4.61)	(2.21)	(-1.28)	(0.26)	(-1.24)	(-0.43)
Log employment at site	-0.0184	0.0304	0.0169	0.0372	0.0134	0.0065	0.0406	-0.0112	0.0160
	(-1.26)	(6.47)	(5.03)	(6.03)	(3.37)	(0.47)	(4.56)	(-0.58)	(2.35)
Log sales/worker – Firm	0.0062	-	-	-	-	-	-	-	-
	(0.76)	-	-	-	-	-	-	-	-
Log employment – Firm	0.0235	-	-	-	-	-	-	-	-
	(2.04)	-	-	-	-	-	-	-	-
Publicly traded	0.0146	0.5371	0.2265	-	-	-0.2242	0.4196	1.3266	0.6150
	(0.14)	(1.84)	(0.89)	-	-	(-2.88)	(2.49)	(7.13)	(45.89)
Subsidiary	-0.0605	0.0029	-0.0819	0.0523	-0.0244	0.0741	-0.0184	0.0599	0.0501
	(-1.07)	(0.11)	(-2.38)	(0.38)	(-0.18)	(0.85)	(-0.45)	(0.66)	(1.06)
Risk Rating: Low	0.0540	0.0284	0.0003	0.0331	-0.0046	0.0364	0.0450	-0.0216	0.0058
	(1.42)	(2.73)	(0.04)	(2.47)	(-0.45)	(0.67)	(1.30)	(-0.23)	(0.35)
Risk Rating: Medium	0.0130	0.0432	-0.0225	0.0372	-0.0315	0.0547	0.0300	0.0982	0.0456
	(0.21)	(2.41)	(-1.76)	(1.26)	(-1.96)	(0.83)	(0.86)	(0.86)	(1.78)
Observations	4,310	58,389	58,389	36,980	36,980	1,700	6,884	1,268	10,916
Within R-squared	0.003	0.010	-	0.004	-	0.003	0.005	0.014	0.002
Total R-squared	-	-	0.8141	-	0.8207	-	-	-	-
2-digit Industry FE	-	5	5	-	-	-	-	-	-
5-Digit Zipcode FE	215	1,767	-	1,493	-	428	1,001	574	1,460
Building FE	-	-	19,721	-	11,955	-	-	-	-

D. Mechanisms: results.

1. Column (1) of Table 5 shows that larger firms have HQs on higher floors.

2. Columns (2) and (3) estimate models pooled over industries with 2-digit industry and 5-digit zipcode fixed effects.

3. Sales-worker and employment are both positively related to floor.

4. Panel B of Table 5 looks at individual industries.

5. Strongest results for law.

Table 6: Alternate Geographic Fixed Effects
(Dependent Variable: Log Floor Number)[a]

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Pooled Data for Five 2-Digit Single Site Industries in 12 MSAs[b]				Law Offices in 12 MSAs (SIC 81)			
	OLS	MSA Fixed Effects	5-Digit Zip Fixed Effects	Building Fixed Effects	OLS	MSA Fixed Effects	5-Digit Zip Fixed Effects	Building Fixed Effects
Log sales/worker at site	0.0977	0.0635	0.0139	0.0149	0.1635	0.1238	0.0463	0.0225
	(12.11)	(7.42)	(2.01)	(2.00)	(11.35)	(10.02)	(4.61)	(2.21)
Log employment at site	0.0860	0.0842	0.0304	0.0169	0.0873	0.0909	0.0372	0.0134
	(22.88)	(9.22)	(6.47)	(5.03)	(17.34)	(7.36)	(6.03)	(3.37)
Publicly traded	0.7563	0.6450	0.5371	0.2265	-	-	-	-
	(2.90)	(19.53)	(1.84)	(0.89)	-	-	-	-
Subsidiary	0.2242	0.1673	0.0029	-0.0819	0.1712	0.0631	0.0523	-0.0244
	(6.84)	(2.96)	(0.11)	(-2.38)	(1.29)	(0.50)	(0.38)	(-0.18)
Risk Rating: Low	0.0566	0.0679	0.0284	0.0003	0.0835	0.0902	0.0331	-0.0046
	(5.47)	(5.93)	(2.73)	(0.04)	(6.21)	(5.48)	(2.47)	(-0.45)
Risk Rating: Medium	0.1455	0.1076	0.0432	-0.0225	0.1595	0.1178	0.0372	-0.0315
	(10.19)	(4.37)	(2.41)	(-1.76)	(7.95)	(3.14)	(1.26)	(-1.96)
Observations	58,389	58,389	58,389	58,389	36,980	36,980	36,980	36,980
Within R-squared	0.081	0.071	0.010	-	0.014	0.013	0.004	-
Total R-squared	-	-	-	0.814	-	-	-	0.821
2-digit Industry FE	5	5	5	5	-	-	-	-
MSA FE	-	12	-	-	-	12	-	-
5-Digit Zipcode FE	215	-	1,749	-	-	-	1,493	-
Building FE	-	-	-	19,721	-	-	-	11,955

[a] Data are from Dun and Bradstreet. T-ratios in parentheses based on standard errors clustered at the level of the fixed effects.
[b] Includes SIC 62, 63, 64, 7311, 81.

E. Mechanisms: more results.

1. Table 6 reports alternate specifications, including OLS, MSA fixed effects, zipcode fixed effects, and building fixed effects.

2. Coefficients on sales-per-worker and employment shrink as fixed effects focus on individual buildings.

3. Similar results hold for risk and for public/private nature of the enterprise.

4. This is consistent with tenants sorting both between and within buildings.

V. Conclusion.

A. Results.

1. The vertical rent gradient is non-monotonic.

2. Vertical spatial structure is determined by a tension between access costs and various sorts of amenities.

3. Retail use is on low floors (an access-oriented activity), while “trophy” tenants are on high floors (the strongest sort of amenity orientation).

B. Ongoing research deals with agglomeration.

1. A growing line of research has established in various contexts that agglomeration economies seem to be localized in their geographic reach.

2. See, for instance, Rosenthal and Strange (2001, 2003, 2005, 2008), Arzaghi and Henderson (2008), and Baum-Snow (2011).

3. Our results on within-building vs. nearby effects of local employment can be seen in this light.

4. In ongoing work, consider this issue further.