Intermediaries and the Pricing of Indivisible Assets

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Abstract: Intermediaries in financial markets are ubiquitous, but their role has hardly been studied in the markets for alternative assets. We study the pricing of commercial real estate transactions and the role of brokers therein. We analyze 104,998 transactions of U.S. office buildings and employ a hedonic model to generate predicted prices for each transaction. We investigate how the presence of sell-side brokers affects over- and underpricing relative to these predictions for different types of clients, and we study the pricing process from the initial asking price to the final transaction price.

We find no association with broker presence and higher sales prices, even in cases when the seller and the broker are from the same parent company. When we compare broker added value for experienced and inexperienced clients, we find that brokers add significantly more value for the former, especially when they face competition.

For a subset of the transaction sample, we observe that broker presence is associated with more underpricing in the asking price compared to deals without one. The subsequent price revision during the negotiation and sale process does not fully compensate this. When a broker represents a seller from his own firm, we find stronger underpricing in the ask, but a price revision that is so large that the final deal price is above the predicted price. This markedly contradicts the findings from the IPO literature, where more initial underpricing is found to coincide with higher underpricing in the final listing price.

1 Introduction

Information asymmetries constitute a major market friction for investors. Retaining an intermediary is viewed as a solution to this problem, especially in markets for illiquid assets that are not (yet) traded on public markets. However, as the potential for an intermediary to create value for the client goes up, so does the potential conflict of interest between client and intermediary. The literature has demonstrated that intermediaries are willing and able to take advantage of their superior informational position. The typical intermediaries studied in the finance literature are investment banks who act as underwriters in initial public offerings or as advisors in M&A markets. In contrast, this paper analyses the performance of real estate brokers acting as advisors to sellers of commercial real estate.[1]

The commercial real estate market is an interesting venue to study the role of intermediaries for several reasons. First, its size. In 2019, transaction volume in the U.S. commercial property industry amounted to more than USD 560 billion.[2] To put this into perspective, the transaction volume in the U.S. merger and acquisition market was USD 1,584 billion in the same year.[3]

The second reason lies in the richness of transaction categories. We can compare transactions that are arranged with and without the services of a broker, we observe clients that do deals with and without a broker, and transactions that a broker arranged for a seller from the same parent company. Using these categories of transactions, we are able to investigate in more detail the contribution of the intermediary in the price setting process of a deal and the final pricing outcome than is possible in the IPO market, were all transactions are intermediated and none are done for the corporation the intermediary is affiliated with.

Third, the indivisibility of commercial real estate assets modify the setup in interesting ways when compared to the equity market. In an IPO a buyer can bid below her reservation price, since she can make the same investment once the stock is listed on the stock market. The investment into a specific commercial real asset cannot be done in a secondary market. This changes the bidding process of the buyer, making it more important for buyers to reveal their reservation prices, so likely leading to differences in the pricing process as compared to IPOs.

Fourth, that fact the asset is not traded on public markets makes it hard for a client to observe deal mispricing, as there are no subsequent sales to compare the

[1] Commercial real estate brokers play a much larger role on the sell side of the market than on the buy side. In the CoStar database we employ, the frequency of observations including sell-side brokers is seven times higher than buy-side brokers.

[2] As estimated by Real Capital Analytics, retrieved from: https://www.cbre.us/about/media-center/rca-us-2019.

[3] As documented by Statista, retrieved from: https://www.statista.com/statistics/520938/value-of-manda-deals-usa/ .

deal outcome with. This makes it much more difficult for the broker's client to see whether she left money on the table in a deal.

The task of the sell-side commercial real estate broker can be compared to the task of the underwriter consortium in an IPO transaction and we borrow ideas from that literature to set up our empirical strategy investigating the impact of hiring a real estate broker on the pricing outcome of the transaction. The first step in the analysis is to determine the average pricing outcome for transactions that were advised by a broker and compare it to transactions that were not. The IPO literature firmly established the empirical phenomenon that issues are on average underpriced (Hanley, 1993). Our contribution to that literature has three components.

First, we compare pricing outcomes for transactions done with and without broker involvement, as well as intermediated deals for outside clients and clients from the broker's own parent company. Second, we study the broker-client relationship, and analyze whether broker added-value depends on the size and sophistication of the client and the extent to which the broker competes for the client. Third, we analyze price-setting patterns, and look at the role of broker involvement in the asking price, the subsequent price revision and the final transaction price.

Our findings can be summarized as follows. First, we find no pricing impact of using a real estate broker for the average client, no matter whether it involves an outside client or one from the same parent company as the broker. This points to an efficiently priced market where informed traders do not easily achieve better deals. Second, in a next step we establish whether the pricing performance differs across client categories. This analysis is inspired by the results from the IPO literature where it is shown that the underpricing phenomenon is largely driven by issues that had a positive offer price revision (Ritter, 2011). One explanation for this phenomenon is that underwriters do not correct the low price expectations of the issuers and funnel underpriced shares to their largest clients (see Jenkinson, Jones, and Suntheim, 2018), i.e., the intermediary does not correct the biased expectations of the client when it would matter the most. In our benchmark results a broker has a negative price impact for a small and inexperienced client whereas this impact turns positive for large and experienced clients. Third, we find that the broker impact differs for experienced client if they are small or large. We therefore investigate the impact on the pricing outcome if a large client has one or multiple broker relationships. We find a positive impact on the pricing outcome if the client has multiple broker relationships, indicating that providing a competitive incentive is important for the performance of the client.

We finally analyze the dynamics of the pricing process. Using insights on price setting from the IPO literature, we analyze the setting of the asking price in a transaction. We conjecture that the broker does not correct the low pricing expectation of the client and sets the ask below the expected transaction price, which in turn leads

to a transaction price that is above the asking price, but may be below the price predicted by our hedonic model, as the subsequent price revision can be too small to fully correct the underpricing in the ask. Our findings show that this is indeed the result for transactions that brokers do for outside clients. However, if we look at the pricing process for the transactions brokers do for sellers from their own parent company, we find a substantially larger underpricing in the ask, but with a subsequent offer price revision that is so large that it more than corrects the initial underpricing, leading to a transaction price above the hedonic benchmark, on average. This finding constitutes a major difference in the price setting mechanism in commercial real estate compared to equity markets.

All our findings are robust to using alternative specifications of the hedonic model.

This paper proceeds as follows. We first discuss our research questions and method in more detail in Section 2, after which we provide details on sources and data. Section 4 presents the results, and Section 5 provides conclusions and a discussion of the practical implications of our results

2 Empirical Strategy

To analyze the impact of broker activity on transaction prices we need to compare the price of the transaction to a suitable benchmark. As there is no liquid market in which the buildings in our dataset are priced frequently, we lean on a model to set up this benchmark price, and rely on the existing literature using hedonic pricing models to analyze real estate prices (see, e.g. Rosen, 1974) to determine the benchmark price with which to compare the observed transaction prices. In the Rosen (1974) model the transaction price of a real asset is determined by its physical characteristics and location, as well as the market circumstances at the time of the transaction.

This gives the following model:

$$\ln(P_{ijt}) = \alpha + X'_{ijt}\beta + \nu_j + \mu_t + \varepsilon_{it} \tag{1}$$

where P_{ijt} is the price per square foot of building i at location j at time t, α is a constant, β is a $K \times 1$ vector of parameters, X_{ijt} is a $1 \times K$ vector of building and transaction characteristics, ν_j are location dummies, μ_t is a year-quarter dummy taking care of market circumstances at the time of a transaction, and ε_{it} is the residual. We follow the literature (see, e.g., Wheaton and Torto, 1994; Eichholtz, Kok, and Quigley, 2010, 2013; Brounen and Kok, 2011) and estimate the hedonic model using the natural logarithm of the price per square foot on the left hand side. As a robustness exercise we investigate the impact of using a model in levels on our results in Section 5.

We compute the benchmark log-price $\widehat{\ln(P_{ijt})}$ using the estimated parameters from an OLS regression, i.e.,

$$\widehat{\ln(P_{ijt})} = \widehat{\alpha} + X'_{it}\widehat{\beta} + \widehat{\nu_j} + \widehat{\mu_t}. \tag{2}$$

The concept underlying the estimation of the benchmark price is that the hedonic pricing model is used to estimate the fundamental value of each building. As in Rosen (1974) this value is a function of the asset's attributes and market conditions, but is independent of the buyer, seller, or the involved intermediary. This is why we choose the two-step procedure for our analysis by first estimating a benchmark price and then looking at over- and underpricing relative to that price for deals with different kinds of brokerage involvement.

Given our benchmark price we construct a measure of price deviation as an outcome variable of interest, which is defined as

$$U_{ijt} = \ln P_{ijt} - \widehat{\ln(P_{ijt})} \tag{3}$$

and is equal to $\hat{\varepsilon_{ijt}}$. Since we compute the difference between prices in logs, this measure can be interpreted as a return. If the observed transaction price is below the benchmark price from the hedonic pricing model we consider the transaction to be underpriced. In contrast, if the transaction price is above the benchmark, the transaction is overpriced.

A two-step approach is also used in Edmans, García, and Norly (2007) to estimate the impact of sports sentiment on stock returns, but this approach is in contrast with, for example, the literature analyzing IPO deals, where the IPO price is compared to the market price at the end of the first trading day. In principle, such a model-free benchmark would be preferable to the model-based inference we rely on for our analysis. However, we consider our procedure - which is standard in the commercial real estate literature - to produce informative results. First, the valuation of real estate assets is less complex than the valuation of corporations, since buildings carry fewer real options than firms, which makes the use of a hedonic pricing model suitable. Second, we are not interested in the price level per se, but in the differences between the deviations of the transaction price and the benchmark for deals that differ in terms of the specific broker involvement. This is akin to a difference-in-difference setup and our estimation is accurate if the bias in pricing induced by the model is equal for both sets of deals. Third, the focus of our analysis is a comparison of the pricing performance under different broker-client settings. We analyze, among others, the sell-side of deals where a broker is retained by an outside client and compare it to deals in which he acts on behalf of a seller from his own firm. If the bias in the pricing model is different for deals with and without a broker, this difference should be the same in both of these cases.

Our first analysis is centered around the impact of the presence of a commercial real estate broker on the pricing of a transaction. We would expect that a sell-side broker would be associated with a higher sales price, i.e., a positive price deviation from the prediction of the hedonic model.

The subsequent analysis focuses on the pricing process in the commercial real estate market. Based on the IPO literature we know that the determination of the initial asking price has a large impact on the level of underpricing of the transaction. An information-theoretical explanation for this observation is that if the investor has superior information regarding the value of the company she needs to be compensated for truthfully revealing that the asking price is too low. An explanation that is based on a conflict of interest between the investment bank and the issuer assumes that the investment bank does not correct the low price expectation of the investor ex-ante and overcompensates the investor for the information revelation by underpricing the issue more than necessary. In both cases the issuing company leaves money on the table if the asking price is set below the equilibrium level.[4]

The real estate market differs from the IPO market in an important aspect, which is that the asset is not divided and an investor is either successful in acquiring the asset or not. This differs from the IPO process where an investor does not have to bid the reservation price since she can buy the stocks the next day on the secondary market. We therefore construct two further variables of interest. The first relates the asking price to the benchmark price from the hedonic pricing model. It is defined as

$$UA_{ijt} = \ln(A_{ijt}) - \widehat{\ln(P_{ijt})} \tag{4}$$

where UA_{ijt} is the deviation from the fundamental value in the ask, $\ln(A_{ijt})$ is the natural logarithm of the asking price per square foot, and $\widehat{\ln(P_{ijt})}$ is the benchmark price. If the asking price is set below the expected transaction price we consider the ask to underprice the building. Again, we use the differences in logs so that the measure can be interpreted in a return dimension.

The second variable of interest relates the ask to the observed transaction price, defined as:

$$R_{ijt} = \ln(P_{ijt}) - \ln(A_{ijt}) \tag{5}$$

where R_{ijt} measures the price revision from the ask to the transaction price. These two additional outcome variables allow us to shed light on the pricing process in

[4]This line of reasoning is based on the vast literature on IPO pricing. For an overview of this literature see Ritter (2011). Studies that document the information theoretical channel for IPO underpricing are, e.g., Bajo, Chemmanur, Simonyan, and Tehranian (2016) and Hanley and Hoberg (2010), among others. For studies that document the impact of conflicts of interest in IPO transactions see, e.g., Jenkinson, Jones, and Suntheim (2018) and Chang, Chiang, Qian, and Ritter (2016), among others.

the commercial real estate market and let us compare the process to stock market transactions. If the results from the IPO literature apply to commercial real estate we would expect that a more underpriced ask is related to more subsequent underpricing (i.e., the price revision is insufficient to push the price up to the model-implied expectation).

3 Data

To investigate the effect of brokers on the pricing of commercial real estate traded in U.S. markets, we concentrate our analysis on one property type: office buildings. The office sector is one of the largest in commercial real estate, both in terms of deal volume and total dollar value.[5] To create our sample of office deals, we retrieve the universe of U.S. commercial office transactions valued over USD 500,000 provided by CoStar for the period between Q1-2000 and Q3-2016 (CoStar Realty Information Inc., 2016). CoStar maintains a comprehensive database with verified commercial assets in the U.S. market, providing extensive geographic and historic coverage. CoStar provides information for 159,637 office transactions for that period, but we can employ only a subset of that for our study. We need to have complete brokerage and ownership information including location data, and we exclude any non-arms-length transactions. In addition, we restrict the sample to the most prevalent sale conditions to control for deal attributes that may influence the outcome of the transaction. This leads to a set of 104,998 transactions that are used in our analysis.

Figure 1 shows the geographical distribution for the sample by U.S. Core Based Statistical Area (CBSA). The geographic coverage of the sample is quite extensive, including observations in 239 CBSAs. The map in Figure 1 shows that the important office markets in the U.S. are all represented. As the map shows, most transaction occur in the large property markets on the East and West coasts, but we also observe many transactions in markets such as Atlanta, Chicago, Denver, and Phoenix.

3.1 Descriptive Statistics

Table 1 summarizes the average building attributes for the assets included in the sample. Column (1) of Table 1 displays characteristics for the full sample. The buildings we study command an average transaction price of USD 9.74 million, or

[5]Based on the CoStar database, NAREIT estimated the total value of the office sector to be USD 2.5 trillion in 2018 (https://www.reit.com/data-research/research/nareit-research/estimating-size-commercial-real-estate-market-us). For the same year, RCA estimated deal volume in the office market to be some USD 135 billion (https://svncornerstone.com/wp-content/uploads/2019/02/2018-Year-RCA-Big-Picture.pdf).

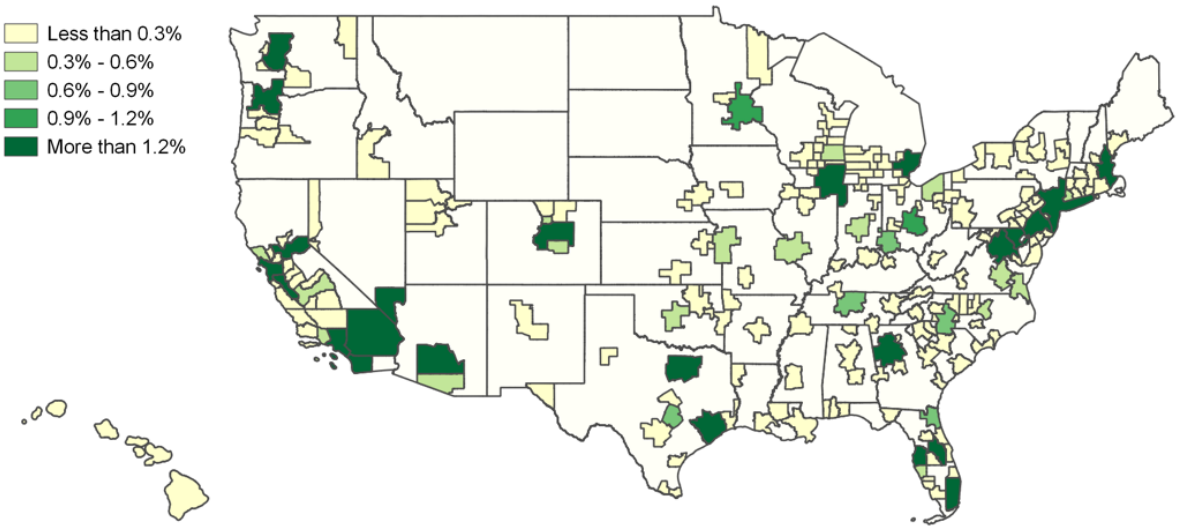

Figure 1: Geographical Distribution of the Transactions

NOTE: The share of observations in the sample is depicted by Core Based Statistical Area (CBSA) and based on the amount of observations in the CBSA relative to the total number of observations in the sample. Hawaii is enlarged for visibility. The state of Alaska is included in the estimation as well, but is excluded from the figure. The share of observations in Alaska and its corresponding CBSA, Anchorage, is 0.02%.

USD 198 per square foot. On average, the office buildings in the sample span over 54,000 square feet, divided over more than 3 stories on a parcel of over 3 acres.

Most buildings hold the quality designation "Class B", with 36 percent of the sample designated as "Class C", and only 12 percent as "Class A" office space. In addition, most buildings are constructed in the 1980s, representing 29% of the sample. Besides these buildings' primary function as offices, they sometimes also have a secondary function. The most common one is medical, which is the case for some 17% of the buildings in the sample. The other secondary building functions are all very rare.

Interestingly, 38% of the transactions in the sample have specific sales conditions, or rather sales complications, some of which could create impediments for a smooth transaction process. Examples are portfolio sales, sales in which the buyer is under pressure due to tax incentives, or sales of properties that are vacant or in need of redevelopment.

Table 1: Descriptive Statistics

	Transaction Price			Asking Price		
	Full sample	No Broker	Sell Broker	Full sample	No Broker	Sell Broker
Price (million dollars)	9.736	6.976	16.421	2.503	2.803	2.579
	(40.814)	(31.305)	(58.315)	(15.605)	(23.451)	(19.994)
Price (dollar per sq. ft.)	198.300	212.929	192.916	188.097	181.562	180.173
	(253.933)	(348.184)	(200.499)	(173.763)	(186.048)	(161.276)
Asking price (million dollars)				2.796	3.085	2.873
				(15.713)	(23.436)	(19.880)
Asking price (dollar per sq. ft.)				175.653	168.339	164.827
				(158.119)	(159.797)	(152.667)
Size (thousand sq. ft.)	54.622	45.276	80.002	22.993	23.394	24.742
	(120.550)	(111.167)	(153.686)	(49.669)	(62.990)	(56.488)
Land area (acres)	3.294	2.655	3.579	1.612	1.394	1.797
	(136.076)	(35.765)	(11.231)	(9.515)	(2.510)	(13.851)
Stories (number)	3.335	3.071	4.177	2.280	2.428	2.345
	(4.858)	(4.491)	(6.119)	(2.637)	(3.319)	(2.786)
Stories(percent)						
Low ($\leq$5)	88.305	89.887	82.727	95.618	95.125	95.070
Medium (6-10)	6.291	5.543	8.879	2.416	2.382	2.834
High (>10)	5.405	4.569	8.394	1.965	2.493	2.096
Building class (percent)						
Class A	12.373	8.983	20.187	3.122	4.100	3.915
Class B	52.099	46.885	53.790	56.008	51.357	55.377
Class C	35.528	44.132	26.022	40.870	44.543	40.708
Secondary type (percent)						
Industrial live/work unit	0.176	0.178	0.176	0.255	0.166	0.254

Table 1: Descriptive Statistics *(continued)*

	Transaction Price			Asking Price		
	Full sample	No Broker	Sell Broker	Full sample	No Broker	Sell Broker
Loft/creative space	1.334	1.294	1.292	1.760	1.884	1.632
Medical	16.850	20.006	13.734	19.738	19.945	19.720
Office live/work unit	0.909	0.985	0.832	1.487	1.274	1.599
Office/residential	1.971	2.582	1.509	2.358	3.158	2.228
Telecom hotel/data hosting	0.267	0.189	0.343	0.170	0.166	0.176
Construction vintage (percent)						
Pre-1950	14.788	18.300	12.178	15.522	17.285	16.025
1950-1959	4.831	6.122	3.611	5.467	5.983	5.294
1960-1969	8.027	9.108	6.695	8.442	8.310	8.404
1970-1979	13.767	13.600	12.609	13.110	12.299	12.639
1980-1989	28.765	24.606	31.694	23.383	21.385	23.084
1990-1999	11.607	10.998	13.063	11.037	11.302	11.239
2000-2009	17.193	16.143	18.883	21.748	21.551	21.826
Post-2010	1.023	1.124	1.267	1.291	1.884	1.489
Sale condition (percent)						
Portfolio sale	21.351	16.079	30.443	0.156	0.277	0.132
Downleg 1031 Exchange	1.921	0.840	1.106	0.947	0.332	0.364
Upleg 1031 Exchange	3.236	1.230	1.947	1.653	0.499	0.684
High vacancy property	3.707	1.756	5.473	4.502	2.604	4.147
REO sale	3.074	1.542	4.417	5.905	4.266	5.768
Investment triple net	2.420	1.352	3.122	1.769	0.554	1.853
Purchase by tenant	2.466	4.224	1.216	1.586	3.823	1.434
Sale and leaseback	2.216	1.781	2.306	2.032	1.053	1.544
Redevelopment project	1.661	1.773	1.613	1.653	1.939	1.864
Deferred maintenance	1.588	0.685	1.484	2.550	1.108	1.698

Table 1: Descriptive Statistics *(continued)*

	Transaction Price			Asking Price		
	Full sample	No Broker	Sell Broker	Full sample	No Broker	Sell Broker
Partial interest transfer	0.805	1.720	0.469	0.080	0.388	0.055
Auction sale	0.711	0.545	1.219	0.335	0.886	0.375
Debt assumption	0.778	0.520	1.374	0.201	0.222	0.243
Ground lease	0.886	0.832	1.096	0.152	0.111	0.176
Distress sale	0.659	0.660	0.636	0.585	0.942	0.485
Any sale condition	38.023	29.626	45.362	20.824	16.731	18.099
Observations	104,998	35,935	31,738	22,388	1,805	9,067

NOTE: This table shows the descriptive statistics for the buildings in our sample. We present either the averages or the percentages for the variables named in the first column. The numbers in brackets indicate the standard deviations. We present the descriptive statistics for the full sample (Column 2), for the sample where no broker was used (Column 3), and transactions that used a selling broker (Column 4).

The remaining columns of Table 1 show these statistics for subsamples based on different kinds of brokerage involvement in the transaction. We look at transactions in which no broker is present, and at transactions with a listing broker. We exclude transactions with a broker on both sides of the deal, since we are interested in comparing the outcome of a transaction with a broker to a transaction without one.

Looking at the sizes of these subsamples, we observe that deals without broker involvement are about equally frequent as transaction with a listing broker. Moreover, the numbers show that buildings involving only a listing broker tend to be considerably larger and have a higher price per square foot than deals without broker involvement. Listing brokers are more often involved in A-rated office buildings, on average. In addition, if sales conditions apply in a transaction, the likelihood of broker presence is higher: 42% of the transactions in which listing brokers play a role have sale conditions, compared to just over 27% for sales that do not involve a broker.

Looking at specific sales conditions, we observe that portfolio deals are quite common, and that brokerage involvement in these transactions is frequent. The same holds, albeit to a lesser extent, for the so called upleg of a 1031 exchange. A 1031 exchange is a transaction in which an investor receives a tax deferment on capital gains if the proceeds of that sale are reinvested (exchanged) in another property within a certain time period (180 days). The upleg of that exchange is the purchase of the new property, which involves time pressure for the buyer, and buying brokers are common in these deals. For high-vacancy properties, which are relatively hard to sell, we observe a more frequent presence of listing brokers to facilitate the sale.

Table 2: Hedonic Model

	Full	Ask	Client
Log building size	-0.260	-0.317	-0.208
(thousand square feet)	(-109.787)	(-67.082)	(-57.690)
Log land area	0.064	0.069	0.045
(acres)	(32.893)	(18.176)	(15.337)
Number of stories (1=yes)			
Medium (6-10)	0.154	0.097	0.124
	(20.347)	(4.454)	(11.554)
High (>10)	0.389	0.471	0.326
	(38.875)	(15.483)	(22.937)
Building Class (1=yes)			
Class A	0.462	0.445	0.438
	(63.528)	(21.508)	(41.050)
Class B	0.079	0.088	0.072
	(19.781)	(12.445)	(11.521)
Secondary type (1=yes)			
Industrial live/work unit	-0.124	-0.105	-0.117

Table 2: Hedonic Model *(continued)*

	Full	Ask	Client
	(-3.397)	(-1.813)	(-2.474)
Loft/creative space	-0.007	0.031	-0.018
	(-0.535)	(1.383)	(-0.946)
Medical	0.145	0.142	0.180
	(33.534)	(18.581)	(27.235)
Office live/work unit	0.053	0.009	0.017
	(3.245)	(0.381)	(0.725)
Office/residential	0.045	0.055	0.055
	(3.969)	(2.735)	(3.085)
Telecom hotel/data hosting	0.044	-0.180	-0.051
	(1.466)	(-2.589)	(-1.250)
Construction vintage (1=yes)			
1950-1959	0.002	-0.041	-0.025
	(0.239)	(-2.770)	(-1.836)
1960-1969	-0.054	-0.058	-0.062
	(-7.443)	(-4.383)	(-5.373)
1970-1979	-0.033	-0.063	-0.062
	(-4.943)	(-5.025)	(-5.896)
1980-1989	0.059	0.037	0.020
	(9.413)	(3.202)	(2.012)
1990-1999	0.209	0.162	0.178
	(28.182)	(11.896)	(15.974)
2000-2009	0.332	0.297	0.325
	(45.699)	(23.006)	(30.120)
Post-2010	0.623	0.531	0.568
	(37.294)	(18.436)	(27.344)
Sale condition (1=yes)			
Portfolio sale	-0.049	-0.002	-0.021
	(-11.834)	(-0.029)	(-3.701)
Downleg 1031 exchange	0.017	-0.003	0.003
	(1.475)	(-0.099)	(0.153)
Upleg 1031 exchange	0.056	0.144	0.077
	(6.282)	(6.257)	(4.343)
High vacancy property	-0.348	-0.207	-0.332
	(-41.472)	(-14.646)	(-35.861)
REO sale	-0.392	-0.314	-0.345
	(-42.223)	(-24.735)	(-34.665)
Investment triple net	0.296	0.467	0.430
	(29.361)	(20.685)	(29.680)
Purchase by tenant	0.061	0.064	0.080
	(6.220)	(2.763)	(4.422)
Sale and leaseback	0.127	0.077	0.107

Table 2: Hedonic Model *(continued)*

	Full	Ask	Client
	(12.206)	(3.834)	(7.473)
Redevelopment project	0.028	-0.013	-0.063
	(2.267)	(-0.564)	(-4.043)
Deferred maintenance	-0.226	-0.178	-0.195
	(-18.504)	(-9.840)	(-12.804)
Partial interest transfer	0.158	0.766	0.234
	(9.021)	(7.735)	(6.533)
Auction sale	-0.319	-0.321	-0.305
	(-17.380)	(-6.498)	(-13.815)
Debt assumption	0.199	0.338	0.158
	(11.156)	(5.097)	(7.595)
Ground lease	-0.037	-0.123	-0.020
	(-2.216)	(-1.644)	(-0.836)
Distress sale	-0.231	-0.248	-0.204
	(-12.292)	(-6.612)	(-7.843)
R-squared	0.592	0.740	0.700
Adj. R-squared	0.583	0.713	0.683
Quarter-year fixed effects	Yes	Yes	Yes
Submarket fixed effects	Yes	Yes	Yes
Observations	104,998	22,388	41,583

NOTE: This table shows the estimation results for the hedonic model. Column (1) shows the estimation results for the full sample. Column (2) shows the results for the sample that includes an ask price. Column (3) shows hedonic coefficients for deals without broker involvement. Quarter-year and submarket fixed effects are not reported. t-Stats are in brackets.

4 Results

This section provides the results of our analyses regarding broker added value and price-setting effects. However, we start our presentation with the results from the hedonic pricing model that we employ to estimate benchmark prices for the observed transactions.

4.1 The Hedonic Model

Table 2 summarizes the results of the hedonic pricing model. Column (1) provides the estimation results using all transactions in our sample. Relatively, larger building sell for less, whereas land area has a positive impact on price per square foot. Not surprisingly, higher quality – "Class A" and "B" – buildings sell for more as compared to "Class C" office buildings. Moreover, newer and taller buildings have a higher transaction price per square foot relative to older and shorter buildings. In addition, the price per square foot is influenced significantly by various sale conditions and/or characteristics relating to the rental situation. For example, a transaction earmarked as a "redevelopment project" or "investment triple net" leads to a markedly higher price per square foot, whereas an asset categorized as "high vacancy" or "real estate owned" sells for significantly less. The estimation in Column (1), which uses all transactions in the dataset, explains 58% of the variation in price per square foot.

The explanatory power and the magnitude and significance of the coefficients included in our benchmark model are in line with the existing literature employing hedonic pricing models to predict transaction prices of commercial real estate (see, e.g., Eichholtz, Kok, and Quigley, 2010; Fuerst and McAllister, 2011; Ling, Naranjo, and Petrova, 2018).[6]

Column (2) presents the estimation results of our benchmark model using a subset of transactions for which the asking price is known, and Column (3) displays the estimation results for office transactions without involvement of a brokerage firm. The economic and statistical significance of the included building attributes is similar across the three presented benchmark models. However, the explanatory power of the estimations presented in the second and third column is considerably higher than the model including all usable office transactions in the first column.

4.2 Broker Presence and Deal Pricing

Our first point of interest is the impact of sell-side broker presence on deal pricing. Concerning pricing deviation as the outcome variable, it is clearly in the interests of the seller that the outcome variable is as large as possible, as this indicates overpricing. To investigate this question we use the following regression model:

$$U_{ijt} = \alpha_0 + \alpha_1 C_{ijt} + \alpha_2 O_{ijt} + X'_{it}\beta + \nu_j + \mu_t + \varepsilon_{ijt} \tag{6}$$

[6] Fuerst and McAllister (2011) note that accurately controlling for spatial and locational differences between assets is key when applying a hedonic pricing model to commercial real estate. The authors suggest using submarkets as defined by market experts rather than arbitrarily defined location clusters, as this should more accurately reflect differences in office submarket density at the metropolitan and national level, and we include submarket fixed effects in all the estimations presented in Table 2.

with U_{ijt} denoting the price deviation computed using Equation (3). C_{ijt} denotes a dummy variable that is set to one when the deal was intermediated by a broker for an outside client - i.e. a client not from the same parent company as the broker. O_{ijt} is a dummy that is set to one for deals that a broker intermediated for a seller from his own parent company. Both dummies are only set to one if no broker was active on the buy side, and are zero if the deal was done without any broker involvement. This setup yields as a treatment the involvement of a broker either on behalf of an outside client or on behalf of the own company and the comparison group concerns deals where no broker was involved at all.

The first specification of the model uses this setup without further controls. In this case we can interpret the constant as the price deviation observed for the comparison group. Since our pricing benchmark is based on a hedonic model it could be the case that differences in building and market characteristics for transactions with and without a broker have an impact on the estimated price deviations. To guard against the possibility that our conclusions result from these differences we also estimate versions of the model that include quarter-year dummies μ_t, location dummies ν_j, and building and transaction characteristics X_{it}.

Clients pay for brokerage services, and brokers may add value by connecting the seller with a buyer who has a higher willingness to pay, by better negotiating skills, and/or though having relevant knowledge of the asset and its market the client has less access to. So we would expect an increase in the transaction price when a broker is involved, and would therefore expect the parameters α_1 and α_2 to be positive.

The results of this analysis are shown in Table 3. Columns (1) through (4) of Table 3 all tell the same story. We observe that neither the constant nor the client coefficient are statistically significant, implying that using a broker in the transaction has no positive price impact for the client when compared to transactions that do not involve a broker at all. Of course, the absence of statistical significance is not in itself proof of the absence of an effect, but we also find that the client coefficient is only 0.003, which, if statistically significant, would imply that deals involving a broker on the sell side are 0.3% more expensive than deals done by clients themselves, which is economically negligible, especially when compared to brokerage fees in commercial real estate markets, which are typically in the 2 to 5% range.

The immediate next question is whether the real estate broker lacks the ability to deliver a better pricing performance, or that something else is going on. The estimation results of the row "Own Firm" in Table 3 give an answer to this issue. We see that the parameters do not differ economically and statistically from zero, no matter which specification we look at. This implies that deals in which a broker works for a seller from his own company command a price in line with the hedonic benchmark as is the case when the broker would work for an average outside client. This result contrasts with the findings in the residential brokerage literature, which

Table 3: Price Deviation

Dep. Var.	Price Deviation			
	(1)	(2)	(3)	(4)
Client	0.003	0.003	0.003	0.002
	(0.959)	(0.887)	(0.818)	(0.620)
Own Firm	0.002	0.002	0.003	0.003
	(0.158)	(0.138)	(0.172)	(0.213)
Cons.	-0.001	0.003	0.003	0.005
	(-0.493)	(0.198)	(0.148)	(0.251)
Quarter-year fixed effects	No	Yes	Yes	Yes
Submarket fixed effects	No	No	Yes	Yes
Other Controls	No	No	No	Yes
Observations	99,567	99,567	99,567	99,567

NOTE: This table shows the estimation result based on the model given by

$$U_{ijt} = \alpha_0 + \alpha_1 C_{ijt} + \alpha_2 O_{ijt} + X'_{it}\beta + \nu_j + \mu_t + \varepsilon_{ijt}$$

with estimation results for α_1 shown in the line denoted "Client," α_2 shown in the line denoted "Own Firm," and α_0 shown in the line "Cons." Specification (1) shows the estimation results where only a constant and the investor dummy are included. Specification (2) shows the results when time dummies are added to the setup in Specification (1). Specification (3) shows the results when market dummies are added to the setup in Specification (2). Specification (4) shows the results when additional building controls are added to the setup in Specification (3). t-Stats are in brackets.

point to higher sales prices for brokers' own homes compared to the homes of clients (see Geltner, Kluger, and Miller, 1991; Rutherford, Springer, and Yavas, 2005; Levitt and Syverson, 2008).

This evidence is consistent with the broker having no systematic effect on the price outcome of the transaction, which points to a loss net of brokerage fees. In addition, our results suggest that the market for commercial real estate is competitive and that the hedonic model provides a reasonable estimate for the expected price that is hard to beat.

4.3 The Broker-Client Relationship

The next question we want to investigate is whether the performance of the broker depends on the client he works for. The motivation for this analysis stems, apart from the obvious interest in the heterogeneity of effects, from the prior literature on intermediaries in financial markets. For example, the IPO literature shows that the intermediary does not correct the pricing expectations of an inexperienced client if these expectations are too low. Another relevant finding is in the study by Bodnaruk, Massa, and Simonov (2009) for the M&A market. They show that investment banks having a stake in the target take advantage of the inexperienced bidders they are advising. Interestingly, these effects vanish in case the bidder has prior experience in the M&A market. We therefore expect to find different outcomes for clients depending on their experience in the commercial real estate market. Furthermore, we are interested to see whether clients can rely on the business relationship with the broker instead of building transaction experience on their own to get satisfactory deal pricing. In other words, does the pricing performance of the broker depend on the intensity of the business relationship with the client? Last, we want to look at the role of competitive pressure: do clients that regularly retain different brokerage houses get different deal pricing than those who stick with one broker?

To this end, we first categorize brokerage clients into groups along two dimensions: experienced and inexperienced clients, and clients having a large or a small business relationship with a broker. We do this in two different ways. The first way is to use the number of transactions in our dataset. We determine the experience of the client by counting the number of all transactions in the sample made by these clients, both purchases and sales, and classify a client as experienced when the number of transactions is higher than the median number of transactions of all clients. To determine whether a client has a large or a small business relationship with a brokerage house we count the number of transactions the client has with each brokerage firm she has used. We determine a client to have a large business relationship with a broker if the number of transaction the client has with a particular broker is higher than the median number of transactions all clients have with this broker. In addition to

using the number of transactions we also use transaction dollar volume, with the categorization proceeding in the same fashion.

To investigate this question we use the following regression model:

$$\begin{aligned} U_{ijt} =& \alpha_0 + \alpha_1 B_{ijt} + \alpha_2 BO_{ijt} + \alpha_3 E_{ijt} + \alpha_4 BE_{ijt} + \alpha_5 L_{ijt} + \alpha_6 BL_{ijt} \\ &+ X'_{it}\beta + \nu_j + \mu_t + \varepsilon_{ijt}, \end{aligned} \tag{7}$$

with U_{ijt} denoting the price deviation computed using Equation (3), B_{ijt} denoting a dummy that is set to one if the transaction was intermediated by a broker, BO_{ijt} the interaction between a dummy that is one if the transaction was done for a seller from the broker's own firm and the broker dummy, E_{ijt} a dummy that is one if the transaction was done by an experienced client, BE_{ijt} the interaction between the experience and the broker dummy, L_{ijt} a dummy that is one if the client has a large business relationship with the broker, and BL_{ijt} an interaction between the large client dummy and the broker dummy. All other variables are the same as in the models given in Equations (3) and (6).

Several points are worth mentioning before discussing the estimation results. First, since the sample for this analysis consists only of a subset of the transactions we re-estimate the hedonic model of Equation (3), using this subset to determine the benchmark price for this analysis with the results given in Column (4) of Table 2. Second, we estimate the effects of using a broker for experienced / less experienced and small / large clients with the control being a small inexperienced client who does not retain a broker. All effects are relative to this category and not relative to the average transaction without a broker, as in Section 4.2.

Table 4: Price Deviation: Sell-Side Broker

Dep. Var.	A: Price Deviation			
	(1)	(2)	(3)	(4)
Broker	-0.015	-0.015	-0.016	-0.015
	(-2.267)	(-2.268)	(-2.202)	(-2.086)
Own Firm Inter.	0.055	0.055	0.060	0.057
	(2.454)	(2.453)	(2.485)	(2.364)
Exper. Client	-0.009	-0.009	-0.005	0.008
	(-1.101)	(-1.085)	(-0.536)	(0.870)
Exper. Client Inter.	0.078	0.078	0.086	0.096
	(7.051)	(7.048)	(7.267)	(7.936)
Large Client	0.014	0.014	0.014	0.023
	(1.491)	(1.508)	(1.340)	(2.196)
Large Client Inter.	-0.031	-0.032	-0.029	-0.027
	(-2.632)	(-2.624)	(-2.239)	(-2.094)

Table 4: Hedonic Model *(continued)*

Dep. Var.	A: Price Deviation			
	(1)	(2)	(3)	(4)
Cons.	-0.013	-0.024	-0.027	-0.014
	(-3.053)	(-0.111)	(-0.117)	(-0.060)
	B: Outcome Tests			
Own	0.040	0.040	0.045	0.042
	(1.811)	(1.809)	(1.852)	(1.761)
L/E	0.032	0.032	0.042	0.053
	(4.016)	(3.979)	(4.587)	(5.711)
Own-L/E	0.009	0.008	0.003	-0.011
	(0.361)	(0.357)	(0.115)	(-0.427)
S/E	0.063	0.063	0.071	0.081
	(7.079)	(7.051)	(7.294)	(8.162)
Own-S/E	-0.023	-0.023	-0.026	-0.038
	(-0.953)	(-0.958)	(-1.005)	(-1.472)
Quarter-year fixed effects	No	Yes	Yes	Yes
Submarket fixed effects	No	No	Yes	Yes
Other Controls	No	No	No	Yes
Observations	39,561	39,561	39,561	39,561

NOTE: This table shows the estimation result based on the model given by

$$\begin{aligned} U_{ijt} =& \alpha_0 + \alpha_1 B_{ijt} + \alpha_2 BO_{ijt} + \alpha_3 E_{ijt} + \alpha_4 BE_{ijt} + \alpha_5 L_{ijt} + \alpha_6 BL_{ijt} \\ & + X'_{it}\beta + \nu_j + \mu_t + \varepsilon_{ijt} \end{aligned}$$

Panel (A) shows the estimation results for the parameters with α_1 shown in the line denoted "Broker," α_2 shown in the line denoted "Own Firm Inter.," α_3 shown in the line denoted "Exper. Client," α_4 shown in the line denoted "Exper. Client Inter.," α_5 shown in the line denoted "Large Client," α_6 shown in the line denoted "Large Client Inter.," and α_0 shown in the line "Cons."
Panel (B) shows the results of the test on linear combinations of the parameters. The line denoted by "Own" shows the impact of the broker for in-house clients, the line "L/E" shows the broker impact for large and experienced clients, the line "Own-L/E" shows the difference of the broker impact for in-house and large and experienced clients, the line "S/E" shows the broker impact for small and experienced clients, and the line "Own-S/E" shows the difference on outcomes for in-house and small and experienced clients.
Specification (1) shows the estimation results where only a constant and the investor dummy are included. Specification (2) shows the results when time dummies

are added to the setup in Specification (1). Specification (3) shows the results when market dummies are added to the setup in Specification (2). Specification (4) shows the results when additional building controls are added to the setup in Specification (3). t-Stats are in brackets.

The results of this exercise can be found in Table 4. Panel A of the table shows the estimated α-parameters of the model. The first result of interest is that we find differing pricing impacts of broker involvement for different client categories. The impact of the broker for the small and inexperienced clients is given by the parameters in the row "Broker" in Table 9. We see that the parameter is negative and statistically significant, which implies that using a broker leads to a lower price in transactions where help of an expert would be needed the most, as this is the client category that is most likely to suffer from the adverse consequences of information asymmetry. The magnitude of the parameter implies a decrease in value of about 162 thousand USD ($0.015 \cdot 198.3 \cdot \$54,622$) for the average building in our dataset.

Regarding broker impact for the other client categories we turn to Panel B of Table 4, which shows the results for tests of linear combinations of the model parameters. For example, the broker effect for a small and experienced client is given by $\alpha_1 + \alpha_4$ and is shown in the row denoted by "S/E" in Panel B of Table 4. We see that for transactions of small experienced clients the marginal impact of the broker is an increase in the price per square foot of 6.3 % - 8.1 %, depending on the model used. These effects are statistically and economically significant as they imply an increase in the transaction price of about 682 - 877 thousand USD for the average building in our dataset. In contrast, for a large and experienced client – results shown in row "L/E" – we see a smaller impact of 3.2% - 5.3%. To put these results into perspective, we show the marginal impact of the broker for deals he intermediates for a seller from the own parent company in line "Own" of Panel B in Table 4. We see a positive price impact of 4.0% - 4.5%, which is significant at the 10% level. The lines "Own-L/E" and "Own-S/E" test for the difference in the impacts for outside clients relative to in-house clients. We see no statistically significant difference, implying that the effects we observe for more sophisticated clients as compared to small and inexperienced ones are indistinguishable from the performance the broker achieves for transactions for these in-house clients.

These findings are consistent with the notion that the intermediary does have expert knowledge and skills that is salient in obtaining favorable pricing results for specific clients. However, he does not seem to correct the low price expectations of inexperienced clients, which is also a feature we observe for intermediary involvement in the equity markets. It is interesting to see that this effect gets reversed if the client is experienced in commercial real estate transactions. This is consistent with the notion that experienced monitoring capabilities are necessary to get the broker to perform at his capabilities. This, however, defies somewhat the purpose of an intermediary as a solution to the information asymmetry friction, since we find

that the intermediary only performs well when the information asymmetries are not large.

The next set of analyses presented in Table 4 concern the intensity of the broker-client business relationship. Here, it is interesting to see that brokers perform better for clients they do not do a lot of business with compared to clients with which they have a more intensive business relationship. This can be seen by the negative broker-large client interaction effect shown in Panel A of the table. This finding is consistent with the notion that the broker performs at his best when the business relationship is not very intense, making it less clear if the client will stay with the broker for future transactions. It can also be due to a weakening of monitoring activities by the client once the business relationship gets stronger.

To disentangle these two possibilities we investigate whether the brokers' pricing outcomes differ between cases in which large clients maintain business relationships with one broker and with multiple brokers. The underlying idea would be that using multiple brokers leads to a competitive situation that could increase the monitoring costs of the client. This leads to the hypothesis that an increase in pricing performance for the situation in which the client maintains multiple business relationships with brokers would be due to an increase in competition for business on part of the broker and not in increasing monitoring capabilities on part of the client, since the client needs to monitor more brokers in that case.

Table 5: Price Deviation: Sell-Side Broker

Dep. Var.	A: Price Deviation			
	(1)	(2)	(3)	(4)
Broker	-0.015	-0.015	-0.015	-0.014
	(-2.267)	(-2.277)	(-2.141)	(-2.013)
Exper. Client	-0.009	-0.008	-0.004	0.008
	(-1.101)	(-1.069)	(-0.503)	(0.939)
Exper. Client Inter.	0.078	0.078	0.086	0.096
	(7.051)	(7.039)	(7.238)	(7.938)
Large Client	0.014	0.014	0.014	0.023
	(1.491)	(1.490)	(1.369)	(2.250)
Large Client Inter.	-0.059	-0.059	-0.066	-0.075
	(-3.676)	(-3.690)	(-3.715)	(-4.185)
Large Clinet Mul. Inter.	0.034	0.035	0.046	0.059
	(2.683)	(2.718)	(3.163)	(4.034)
Cons.	-0.013	-0.026	-0.032	-0.026
	(-3.053)	(-0.118)	(-0.137)	(-0.112)
	Panel B: Outcome Tests			

Table 5: Hedonic Model *(continued)*

Dep. Var.	A: Price Deviation			
	(1)	(2)	(3)	(4)
L/E 1B	0.004	0.004	0.005	0.007
	(0.332)	(0.301)	(0.348)	(0.451)
L/E MB	0.039	0.039	0.051	0.066
	(4.725)	(4.688)	(5.379)	(6.730)
Quarter-year fixed effects	No	Yes	Yes	Yes
Submarket fixed effects	No	No	Yes	Yes
Other Controls	No	No	No	Yes
Observations	39,138	39,138	39,138	39,138

NOTE: This table shows the estimation result based on the model given by

$$\begin{aligned} U_{ijt} =& \alpha_0 + \alpha_1 B_{ijt} + \alpha_2 E_{ijt} + \alpha_3 BE_{ijt} + \alpha_4 L_{ijt} + \alpha_5 BL_{ijt} + \alpha_6 BLM_{ijt} \\ & + X'_{it}\beta + \nu_j + \mu_t + \varepsilon_{ijt} \end{aligned}$$

Panel (A) shows the estimation results for the parameters with α_1 shown in the line denoted "Broker," α_2 shown in the line denoted "Exper. Client," α_3 is shown in the line denoted "Exper. Client Inter.," α_5 is shown in the line denoted "Large Client," α_5 is shown in the line denoted "Large Client Inter.," α_6 is shown in the line denoted "Large Clinet Mul. Inter." and α_0 shown in the line "Cons."
Panel (B) shows the results of the test on linear combinations of the parameters. The line denoted by "L/E 1B" shows the broker impact for large and experienced clients when the relationship is exclusive with one broker, the line "L/E MB" shows the broker impact if the client has a business relationship with multiple brokers.
Specification (1) shows the estimation results where only a constant and the investor dummy are included. Specification (2) shows the results when time dummies are added to the setup in Specification (1). Specification (3) shows the results when market dummies are added to the setup in Specification (2). Specification (4) shows the results when additional building controls are added to the setup in Specification (3). t-Stats are in brackets.

We therefore change the model setup to:

$$\begin{aligned} U_{ijt} =& \alpha_0 + \alpha_1 B_{ijt} + \alpha_2 E_{ijt} + \alpha_3 BE_{ijt} + \alpha_4 L_{ijt} + \alpha_5 BL_{ijt} + \alpha_6 BLM_{ijt} \\ & + X'_{it}\beta + \nu_j + \mu_t + \varepsilon_{ijt}, \end{aligned} \tag{8}$$

where BLM_{ijt} is a triple interaction effect for the broker's pricing outcome for large clients doing business with multiple brokers. We estimate this model using only observations with outside clients, since the own company has only one business

relationship by default and including in-house clients would mask the effect we are aiming to identify.

The results of this analysis can be found in Table 5. The estimation results for the triple interaction term are positive and statistically significant for the model in Column (4) of the table. It is interesting to see that the pricing contribution of broker presence is zero for a large experienced client in case the client has only one broker relationship. This effect can be seen in the line "L/E 1B" in Panel B of Table 5. The effect is given by the linear combination $\alpha_1 + \alpha_3 + \alpha_5$ and is found to be zero across all specifications. However, the marginal contribution of the broker is positive, and statistically and economically significant when large experienced clients maintain multiple brokerage relationships. We observe a pricing effect of 3.4% to 5.9%, which translates to 367 - 538 thousand USD for the average building in our dataset.

So overall, we find that commercial real estate brokers are able to deliver deal pricing that is favorable for their clients. However, they do not seem to perform at their best in case there is no competitive pressure to do so, even for clients who are experienced market participants. As shown in Tables 13 and 14 of Appendix A, these results are robust to measuring the client size by using the value of transactions.

4.4 The Price-Setting Process: From Asking Price to Transaction Price

We now turn to the pricing process in commercial real estate markets. We are interested in the setting of the asking price and the role of brokers therein, as well as the subsequent price revision to get to the final transaction price. The determination of the asking price is an important factor in the price-finding process. As shown for IPOs, setting an ask that is too low leads to large subsequent underpricing of a share issue: transactions that start out with a low initial price range turn out to be the most underpriced issues. In a nutshell, this can be due to two reasons. First, it can be compensation for the investors to signal to the issuer that the initial asking price is too low. Second, it can be due to conflicts of interest between the investment bank and the issuer, which leads to an asking price and subsequent price revision that are both too low.

To investigate the pricing process in commercial real estate transactions, we therefore first compare the asking price to our model-based benchmark price, and subsequently analyze the price revision from the ask to the transaction price. Since we observe asking prices only for a subset of deals, we re-estimate the hedonic model using only these observations. By this we ensure that our findings are not driven by differences in characteristics between deals for which our dataset contains an asking price and deals for which it doesn't.

Our analysis uses the following setup:

$$UA_{ijt} = \alpha_0 + \alpha_1 C_{ijt} + \alpha_2 O_{ijt} + X'_{it}\beta + \nu_j + \mu_t + \varepsilon_{ijt}, \tag{9}$$

with UA_{ijt} denoting the deviation of the asking price from the benchmark as defined in Equation (4) and the remaining parameters following the setup of Equation (6).

Table 6: Price Deviation in Ask

Dep. Var.	Price Deviation			
	(1)	(2)	(3)	(4)
Client	-0.057	-0.063	-0.066	-0.049
	(-4.980)	(-5.482)	(-6.387)	(-5.334)
Own Firm	-0.315	-0.303	-0.191	-0.127
	(-5.966)	(-5.766)	(-4.675)	(-3.715)
Cons.	-0.085	0.063	-0.280	0.393
	(-12.310)	(5.486)	(-2.092)	(2.457)
Quarter-year fixed effects	No	Yes	Yes	Yes
Submarket fixed effects	No	No	Yes	Yes
Other Controls	No	No	No	Yes
Observations	21,500	21,500	21,500	21,500

NOTE: This table shows the estimation result based on the model given by

$$UA_{ijt} = \alpha_0 + \alpha_1 C_{ijt} + \alpha_2 O_{ijt} + X'_{it}\beta + \nu_j + \mu_t + \varepsilon_{ijt}$$

with α_1 shown in the line denoted "Client," α_2 is shown in the line denoted "Own Firm," and α_0 shown in the line "Cons." Specification (1) shows the estimation results where only a constant and the investor dummy are included. Specification (2) shows the results when time dummies are added to the setup in Specification (1). Specification (3) shows the results when market dummies are added to the setup in Specification (2). Specification (4) shows the results when additional building controls are added to the setup in Specification (3). t-Stats are in brackets.

The results of this exercise can be found in Table 6. Column (1) shows the results for the model that only contains the dummy variables and we therefore can interpret the constant as the outcome for the deals done without using the services of a broker. This constant implies that the asking price for deals without a sell-side broker is set roughly 8.5% below the benchmark expectation. When a broker is

present, we see that the asking price for outside clients is roughly 5.7% further below the benchmark, when compared to the deals done without the retention of a broker. What is most interesting to see, however, is that the discount in the ask for the deals an average broker does for in-house clients is considerably larger. The estimation result in column (1) estimates a discount of about 31.5 % in addition to the asking price discount on deals that do not involve a broker. If we control for building characteristics, time, and market dummies the discounts in the asking price reduce to 4.9% for outside clients and 12.7% for own-company deals when compared to deals that do not use a broker. The surprising result from this analysis is that the asking price for deals that an average broker does for in-house clients is set lowest in comparison with all other deals. Given that low initial price setting in IPOs lead to worse deal outcomes, we would have expected the opposite result here. One explanation for the results show in Table 6 is that real estate market participants would expect on average to be negotiated up in the revision process that leads from the asking price to the transaction price. That is why we now turn to the role of broker involvement in the price revision.

Table 12 provides the results for the price revision process. We use the following setup for the analysis

$$R_{ijt} = \alpha_0 + \alpha_1 C_{ijt} + \alpha_2 O_{ijt} + X'_{it}\beta + \nu_j + \mu_t + \varepsilon_{ijt} \tag{10}$$

with R_{ijt} denotes the deviation of the ask price from the benchmark as described in Equation (5) and the remaining parameters follow the setup of Equation (6).

The results in Table 7 show a second fundamental difference between IPOs and commercial real estate transactions: we find that deals for in-house clients – which also have the lowest asking price – have the highest price revision. So much larger, in fact, that the underpricing in the ask is more than compensated. This can be seen in Table 7, where we see that the parameters for the own firm are positive and in larger than in Table 6. This suggests that the broker manages to correct the underpricing in the ask without incurring any information revelation costs.

This last result constitutes an important deviation from the literature on IPOs. One important difference in investing into real estate and the stock market is that the asset is not divisible and, therefore, there is no market after the sale where the investment can be made at the equilibrium price. This means that an investor in an IPO does not need to reveal information about her reservation price upfront, but can instead try to acquire the stocks at the low ask, and, in case she does not get the stocks at that price, invest at the equilibrium price when the stocks get traded on the capital markets. This implies that the investor needs to be compensated to reveal her reservation price. In real estate markets, on the other hand, there is only one buying opportunity for the whole building. This implies that the investor needs to revel her reservation price in the bidding process in order to invest into

Table 7: Price Revision

Dep. Var.	Price Revision			
	(1)	(2)	(3)	(4)
Client	0.047	0.052	0.053	0.036
	(4.001)	(4.473)	(5.032)	(3.817)
Own Firm	0.361	0.349	0.241	0.178
	(6.594)	(6.408)	(5.552)	(4.765)
Cons.	0.088	-0.052	0.269	-0.400
	(12.600)	(-4.476)	(4.160)	(-4.227)
Quarter-year fixed effects	No	Yes	Yes	Yes
Submarket fixed effects	No	No	Yes	Yes
Other Controls	No	No	No	Yes
Observations	21,500	21,500	21,500	21,500

NOTE: This table shows the estimation result based on the model given by

$$R_{ijt} = \alpha_0 + \alpha_1 C_{ijt} + \alpha_2 O_{ijt} + X'_{it}\beta + \nu_j + \mu_t + \varepsilon_{ijt}$$

with α_1 shown in the line denoted "Client," α_2 is shown in the line denoted "Own Firm," and α_0 shown in the line "Cons." Specification (1) shows the estimation results where only a constant and the investor dummy are included. Specification (2) shows the results when time dummies are added to the setup in Specification (1). Specification (3) shows the results when market dummies are added to the setup in Specification (2). Specification (4) shows the results when additional building controls are added to the setup in Specification (3). t-Stats are in brackets.

the building of her choice. It is interesting to see that the asking price is below the transaction price and real estate brokers manage to induce a price revision process that completely compensates the low asking price when they advise sellers from their own firm. However this price-finding process is less successful if the client is an outside entity.

5 Robustness: Model in Levels

To investigate the impact of the functional form of the benchmark model we estimate the model given in Equation (1) with the price in levels on the left hand side. With this modification the outcome is measured in USD per square foot and not as a percentage of the transaction price. The results of the estimation can be found in Table 15, which is shown in Appendix B.

The change in the functional form of the benchmark model does not change the main conclusions but has some interesting impact on the results. First, we find a negative broker impact for the average outside client. As can be seen in Table 8, the coefficient for the client is negative and statistically significant across all model specifications. If the broker acts on behalf of in-house clients we find no pricing effect, as in the model setup discussed in Section 4.2. Since the negative impact on the outcome of an outside client is model dependent, we do not interpret the impact of the broker as value destroying for the average outside client. However, the different model setup does not change the conclusion of an overall zero impact of brokerage services on the pricing performance in a sale.

Table 9: Price Deviation: Sell-Side Broker

Dep. Var.	A: Price Deviation			
	(1)	(2)	(3)	(4)
Broker	1.340	1.332	1.429	1.617
	(0.715)	(0.708)	(0.702)	(0.792)
Own Firm Inter.	9.753	9.729	10.785	9.990
	(1.549)	(1.540)	(1.585)	(1.463)
Exper. Client	3.860	3.907	5.176	7.901
	(1.306)	(1.341)	(1.653)	(2.505)
Exper. Client Inter.	10.019	9.949	11.461	13.320
	(2.537)	(2.531)	(2.632)	(2.877)
Large Client	0.241	0.149	-0.478	1.030
	(0.072)	(0.044)	(-0.135)	(0.275)
Large Client Inter.	-7.823	-7.728	-7.485	-7.207
	(-1.725)	(-1.683)	(-1.495)	(-1.434)

Table 9: Hedonic Model *(continued)*

Dep. Var.	A: Price Deviation			
	(1)	(2)	(3)	(4)
Cons.	-5.148	-6.713	-10.684	-6.898
	(-4.309)	(-0.159)	(-0.225)	(-0.142)
	Panel B: Outcome Tests			
Own	11.092	11.061	12.214	11.607
	(1.776)	(1.767)	(1.798)	(1.703)
L/E	3.536	3.553	5.404	7.730
	(1.214)	(1.208)	(1.731)	(2.271)
Own-L/E	7.556	7.508	6.810	3.877
	(1.097)	(1.087)	(0.905)	(0.499)
S/E	11.359	11.281	12.889	14.936
	(3.268)	(3.256)	(3.247)	(3.469)
Own-S/E	-0.266	-0.220	-0.675	-3.330
	(-0.037)	(-0.031)	(-0.086)	(-0.411)
Quarter-year fixed effects	No	Yes	Yes	Yes
Submarket fixed effects	No	No	Yes	Yes
Other Controls	No	No	No	Yes
Observations	39,561	39,561	39,561	39,561

NOTE: This table shows the estimation result based on the model given by

$$U_{ijt} = \alpha_0 + \alpha_1 B_{ijt} + \alpha_2 BO_{ijt} + \alpha_3 E_{ijt} + \alpha_4 BE_{ijt} + \alpha_5 L_{ijt} + \alpha_6 BL_{ijt} + X'_{it}\beta + \nu_j + \mu_t + \varepsilon_{ijt}$$

Panel (A) shows the estimation results for the parameters with α_1 shown in the line denoted "Broker," α_2 shown in the line denoted "Own Firm Inter.," α_3 shown in the line denoted "Exper. Client," α_4 shown in the line denoted "Exper. Client Inter.," α_5 shown in the line denoted "Large Client," α_6 shown in the line denoted "Large Client Inter.," and α_0 shown in the line "Cons." The setup differs from Section 4.2 in that U_{ijt} is measured in USD instead of percentages.
Panel (B) shows the results of the test on linear combinations of the parameters. The line denoted by "Own" shows the impact of the broker for in-house clients, the line "L/E" shows the broker impact for large and experienced clients, the line "Own-L/E" shows the difference of the broker impact for in-house and large

Table 8: Price Deviation: Sell-Side Broker

Dep. Var.	Price Deviation			
	(1)	(2)	(3)	(4)
Client	-3.938	-4.169	-4.537	-4.909
	(-2.922)	(-2.666)	(-2.679)	(-2.878)
Own Firm	-0.085	-0.413	-0.666	-0.592
	(-0.010)	(-0.047)	(-0.066)	(-0.059)
Cons.	1.298	1.582	1.584	1.685
	(1.387)	(0.419)	(0.424)	(0.263)
Quarter-year fixed effects	No	Yes	Yes	Yes
Submarket fixed effects	No	No	Yes	Yes
Other Controls	No	No	No	Yes
Observations	99,567	99,567	99,567	99,567

NOTE: This table shows the estimation result based on the model given by

$$U_{ijt} = \alpha_0 + \alpha_1 C_{ijt} + \alpha_2 O_{ijt} + X'_{it}\beta + \nu_j + \mu_t + \varepsilon_{ijt}$$

with estimation results for α_1 shown in the line denoted "Client," α_2 shown in the line denoted "Own Firm," and α_0 shown in the line "Cons." The setup differs from Section 4.2 in that U_{ijt} is measured in USD instead of percentages.
Specification (1) shows the estimation results where only a constant and the investor dummy are included. Specification (2) shows the results when time dummies are added to the setup in Specification (1). Specification (3) shows the results when market dummies are added to the setup in Specification (2). Specification (4) shows the results when additional building controls are added to the setup in Specification (3). t-Stats are in brackets.

and experienced clients, the line "S/E" shows the broker impact for small and experienced clients, and the line "Own-S/E" shows the difference on outcomes for in-house and small and experienced clients.
Specification (1) shows the estimation results where only a constant and the investor dummy are included. Specification (2) shows the results when time dummies are added to the setup in Specification (1). Specification (3) shows the results when market dummies are added to the setup in Specification (2). Specification (4) shows the results when additional building controls are added to the setup in Specification (3). t-Stats are in brackets.

Second, concerning the differences in broker performance across client categories we find the same pattern as in Section 4.3. As can be seen in Table 9 we find no broker impact for small inexperienced clients. However, we find large positive impacts for experienced clients. In addition, we see also in this setup that the impact for large experienced clients is smaller than for small experienced clients. Table 10 shows that this effect is concentrated in large clients that have an exclusive broker relation, with clients that have business relations with multiple brokers receiving better pricing outcomes.

Table 10: Price Deviation: Sell-Side Broker

Dep. Var.	A: Price Deviation			
	(1)	(2)	(3)	(4)
Broker	1.340	1.338	1.533	1.735
	(0.715)	(0.711)	(0.753)	(0.848)
Exper. Client	3.860	3.932	5.229	7.989
	(1.306)	(1.350)	(1.669)	(2.530)
Exper. Client Inter.	10.019	9.936	11.385	13.284
	(2.537)	(2.528)	(2.612)	(2.859)
Large Client	0.241	0.107	-0.445	1.066
	(0.072)	(0.032)	(-0.125)	(0.285)
Large Client Inter.	-11.714	-11.672	-12.747	-14.659
	(-2.405)	(-2.380)	(-2.329)	(-2.574)
Large Clinet Mul. Inter.	4.861	4.982	6.610	9.437
	(1.277)	(1.319)	(1.655)	(2.269)
Cons.	-5.148	-6.967	-11.531	-9.632
	(-4.309)	(-0.165)	(-0.242)	(-0.200)
	Panel B: Outcome Tests			
L/E 1B	-0.355	-0.398	0.171	0.360
	(-0.104)	(-0.116)	(0.045)	(0.093)

Table 10: Hedonic Model *(continued)*

Dep. Var.	A: Price Deviation			
	(1)	(2)	(3)	(4)
L/E MB	4.506	4.584	6.781	9.796
	(1.385)	(1.400)	(1.976)	(2.578)
Quarter-year fixed effects	No	Yes	Yes	Yes
Submarket fixed effects	No	No	Yes	Yes
Other Controls	No	No	No	Yes
Observations	39,138	39,138	39,138	39,138

NOTE: This table shows the estimation result based on the model given by

$$U_{ijt} = \alpha_0 + \alpha_1 B_{ijt} + \alpha_2 E_{ijt} + \alpha_3 BE_{ijt} + \alpha_4 L_{ijt} + \alpha_5 BL_{ijt} + \alpha_6 BLM_{ijt} + X'_{it}\beta + \nu_j + \mu_t + \varepsilon_{ijt}$$

Panel (A) shows the estimation results for the parameters with α_1 shown in the line denoted "Broker," α_2 shown in the line denoted "Exper. Client," α_3 is shown in the line denoted "Exper. Client Inter.," α_5 is shown in the line denoted "Large Client," α_5 is shown in the line denoted "Large Client Inter.," α_6 is shown in the line denoted "Large Clinet Mul. Inter." and α_0 shown in the line "Cons." The setup differs from Section 4.2 in that U_{ijt} is measured in USD instead of percentages.
Panel (B) shows the results of the test on linear combinations of the parameters. The line denoted by "L/E 1B" shows the broker impact for large and experienced clients when the relationship is exclusive with one broker, the line "L/E MB" shows the broker impact if the client has a business relationship with multiple brokers.
Specification (1) shows the estimation results where only a constant and the investor dummy are included. Specification (2) shows the results when time dummies are added to the setup in Specification (1). Specification (3) shows the results when market dummies are added to the setup in Specification (2). Specification (4) shows the results when additional building controls are added to the setup in Specification (3). t-Stats are in brackets.

Third, we find the same pattern when looking at the price-setting process as in Section 4.4. As can be seen in Table 11 the asking price is set significantly lower for outside clients as well as for in-house clients of the broker, when compared to deals that are done without the services of a broker. We also find the pattern that deals for in-house clients post significantly lower asks than deals for outside clients. Finally, Table 12 shows that the price revisions are positive and imply that low-balling the asking price does not lead to significantly underpriced transactions, as found in the IPO literature.

Table 11: Price Deviation in Ask

Dep. Var.	Price Deviation			
	(1)	(2)	(3)	(4)
Client	-7.801	-8.247	-9.002	-6.801
	(-4.123)	(-4.314)	(-4.799)	(-3.880)
Own Firm	-40.343	-38.981	-21.260	-13.089
	(-5.153)	(-4.969)	(-3.284)	(-2.289)
Cons.	-7.713	8.251	-18.663	86.816
	(-6.382)	(4.316)	(-1.361)	(4.771)
Quarter-year fixed effects	No	Yes	Yes	Yes
Submarket fixed effects	No	No	Yes	Yes
Other Controls	No	No	No	Yes
Observations	21,500	21,500	21,500	21,500

NOTE: This table shows the estimation result based on the model given by

$$UA_{ijt} = \alpha_0 + \alpha_1 C_{ijt} + \alpha_2 O_{ijt} + X'_{it}\beta + \nu_j + \mu_t + \varepsilon_{ijt}$$

with α_1 shown in the line denoted "Client", α_2 is shown in the line denoted "Own Firm", and α_0 shown in the line "Cons." The setup differs from Section 4.2 in that UA_{ijt} is measured in USD instead of percentages.
Specification (1) shows the estimation results where only a constant and the investor dummy are included. Specification (2) shows the results when time dummies are added to the setup in Specification (1). Specification (3) shows the results when market dummies are added to the setup in Specification (2). Specification (4) shows the results when additional building controls are added to the setup in Specification (3). t-Stats are in brackets.

Table 12: Price Revision

Dep. Var.	Price Revision			
	(1)	(2)	(3)	(4)
Client	5.466	5.866	6.169	3.977
	(2.841)	(3.062)	(3.268)	(2.166)
Own Firm	47.073	45.737	28.729	20.558
	(6.430)	(6.235)	(4.574)	(3.562)
Cons.	8.419	-5.870	20.076	-84.799
	(6.485)	(-3.064)	(2.855)	(-9.825)
Quarter-year fixed effects	No	Yes	Yes	Yes
Submarket fixed effects	No	No	Yes	Yes
Other Controls	No	No	No	Yes
Observations	21,500	21,500	21,500	21,500

NOTE: This table shows the estimation result based on the model given by

$$R_{ijt} = \alpha_0 + \alpha_1 C_{ijt} + \alpha_2 O_{ijt} + X'_{it}\beta + \nu_j + \mu_t + \varepsilon_{ijt}$$

with α_1 shown in the line denoted "Client", α_2 is shown in the line denoted "Own Firm", and α_0 shown in the line "Cons." The setup differs from Section 4.2 in that R_{ijt} is measured in USD instead of percentages.
Specification (1) shows the estimation results where only a constant and the investor dummy are included. Specification (2) shows the results when time dummies are added to the setup in Specification (1). Specification (3) shows the results when market dummies are added to the setup in Specification (2). Specification (4) shows the results when additional building controls are added to the setup in Specification (3). t-Stats are in brackets.

6 Discussion and Conclusion

To the best of our knowledge, this paper is the first to analyze the effects of commercial real estate brokers on pricing outcomes in different client settings. We look both at sell-side brokers, and analyze the difference in outcomes between deals with and without a broker, deals for experienced and less experienced clients in different competitive settings, deals for third-party clients and for in-house clients, and the role of broker involvement in the price-setting process, from asking price to final deal price.

Our analysis leads us to the following conclusions. We find that sell-side brokers do not provide superior pricing outcomes for the average client, even if that client is from the same parent company as the broker. This result contrasts with the findings from studies analysing the residential reals estate market, which find that broker-client conflicts are salient for deal pricing outcomes in commercial real estate (i.e. Geltner, Kluger, and Miller, 1991; Rutherford, Springer, and Yavas, 2005; Levitt and Syverson, 2008).

We also show that broker added value depends on the market experience of the client. Experienced clients who retain a broker get statistically and economically better deal pricing than clients who go on their own: the effect ranges between 3.2% and 8.1% depending on client size, or up to USD 877.000 for the average building in our sample. On the other hand, small inexperienced clients get worse deal pricing than our hedonic benchmark, with an average USD 162.000 for the buildings in our sample.

The latter type of clients who do less transactions with a specific brokerage firm are less likely to do many deals, have less resources, and likely face more information asymmetry. Brokers seem to exploit this.

In addition, we find that large clients who have business relationships with more than one broker achieve a higher selling price when compared to large clients who deal exclusively with one broker. This shows that competitive forces can incentivize the brokers to perform at their best.

Our final set of results relates to the price setting process in commercial real estate deals. We generally find that asking prices are lower than the final transactions price, and we also find that broker presence is salient in the initial price setting and in the revision that is the result of the sales and negotiation process. Comparing deals with and without a sell-side broker, we observe larger discount relative to the hedonic benchmark for the former than for the latter. And while that also holds for the subsequent price revision, this is not enough to fully compensate the initial discount. Except, that is, when the broker works on behalf of a seller from his own parent company. In that case, the discount in the ask is even lower, but the revision is so large that the resulting sales price is significantly higher than the prediction

from the hedonic model.

This latter result is surprising and differs markedly from the price setting mechanism found in the investment banking literature for IPOs, where lo initial pricing tends to go hand in hand with large underpricing.

Our results have clear practical implications. First, broker presence in a deal seems not to help the clients who most need it. Large clients retaining a broker get better deal outcomes, but small inexperienced clients do not. They seem to be better off without the services of a broker. Second, since transaction prices are higher than asking prices the price-finding process differs from the standard IPO setup, i.e., being negotiated up does not mean that the seller is leaving money on the table. It seems that the goal of setting the asking price is to get competing bids that will lead to free information revelation for the seller. Finally, when hiring an intermediary, a client needs to keep paying attention to the transaction process, and to keep competitive pressure on her brokers by not dealing exclusively with one brokerage firm.

A Different Definitions of Client Size

This Section shows further results for the analysis based on the benchmark model using only transactions that were intermediated by a broker.

Table 13: Price Deviation: Sell-Side Broker, Value

Dep. Var.	A: Price Deviation			
	(1)	(2)	(3)	(4)
Broker	-0.025	-0.024	-0.029	-0.030
	(-3.474)	(-3.384)	(-3.703)	(-4.028)
Own Firm Inter.	0.102	0.103	0.112	0.116
	(4.343)	(4.380)	(4.444)	(4.735)
Exper. Client	-0.053	-0.052	-0.048	-0.009
	(-8.295)	(-8.146)	(-6.910)	(-1.216)
Exper. Client Inter.	0.027	0.027	0.038	0.067
	(2.885)	(2.822)	(3.753)	(6.576)
Large Client	0.162	0.165	0.187	0.255
	(25.452)	(25.766)	(27.342)	(34.414)
Large Client Inter.	0.032	0.031	0.037	0.049
	(3.405)	(3.315)	(3.678)	(4.887)
Cons.	-0.067	-0.102	-0.104	0.030
	(-3.053)	(-0.111)	(-0.117)	(-0.060)
	Outcome Tests			
Own	0.077	0.079	0.083	0.086
	(3.311)	(3.378)	(3.320)	(3.515)
L/E	0.035	0.034	0.047	0.086
	(5.413)	(5.241)	(6.438)	(11.271)
Own - L/E	0.043	0.045	0.037	0.000
	(1.753)	(1.844)	(1.393)	(0.004)
S/E	0.002	0.003	0.010	0.037
	(0.268)	(0.275)	(0.984)	(3.769)
Own - S/E	0.075	0.076	0.073	0.049
	(3.032)	(3.088)	(2.772)	(1.890)
Quarter-year fixed effects	No	Yes	Yes	Yes
Submarket fixed effets	No	No	Yes	Yes
Other Controls	No	No	No	Yes
Observations	39,519	39,519	39,519	39,519

NOTE: This table shows the estimation result based on the model given by

$$U_{ijt} = \alpha_0 + \alpha_1 B_{ijt} + \alpha_2 BO_{ijt} + \alpha_3 E_{ijt} + \alpha_4 BE_{ijt} + \alpha_5 L_{ijt} + \alpha_6 BL_{ijt} + X'_{it}\beta + \nu_j + \mu_t + \varepsilon_{ijt}$$

Panel (A) shows the estimation results for the parameters with α_1 shown in the line denoted "Broker," α_2 shown in the line denoted "Own Firm Inter.," α_3 shown in the line denoted "Exper. Client," α_4 shown in the line denoted "Exper. Client Inter.," α_5 shown in the line denoted "Large Client," α_6 shown in the line denoted "Large Client Inter.," and α_0 shown in the line "Cons."
Panel (B) shows the results of the test on linear combinations of the parameters. The line denoted by "Own" shows the impact of the broker for in-house clients, the line "L/E" shows the broker impact for large and experienced clients, the line "Own-L/E" shows the difference of the broker impact for in-house and large and experienced clients, the line "S/E" shows the broker impact for small and experienced clients, and the line "Own-S/E" shows the difference on outcomes for in-house and small and experienced clients.
Specification (1) shows the estimation results where only a constant and the investor dummy are included. Specification (2) shows the results when time dummies are added to the setup in Specification (1). Specification (3) shows the results when market dummies are added to the setup in Specification (2). Specification (4) shows the results when additional building controls are added to the setup in Specification (3). t-Stats are in brackets.

Table 14: Price Deviation: Sell-Side Broker, Value

Dep. Var.	A: Price Deviation			
	(1)	(2)	(3)	(4)
Broker	-0.023	-0.022	-0.024	-0.021
	(-3.111)	(-3.026)	(-2.989)	(-2.726)
Exper. Client	-0.053	-0.052	-0.048	-0.008
	(-8.295)	(-8.131)	(-6.861)	(-1.036)
Exper. Client Inter.	0.021	0.021	0.027	0.044
	(2.068)	(1.996)	(2.437)	(4.042)
Large Client	0.162	0.165	0.188	0.256
	(25.452)	(25.753)	(27.393)	(34.448)
Large Client Inter.	0.026	0.025	0.023	0.022
	(2.475)	(2.394)	(2.112)	(2.055)

Table 14: Hedonic Model *(continued)*

Dep. Var.	A: Price Deviation			
	(1)	(2)	(3)	(4)
Large Clinet Mul. Inter.	0.015	0.015	0.028	0.059
	(1.643)	(1.664)	(2.850)	(5.786)
Cons.	-0.067	-0.100	-0.103	0.026
	(-14.635)	(-0.445)	(-0.436)	(0.104)
	Panel B: Outcome Tests			
L/E 1B	0.024	0.023	0.026	0.046
	(2.590)	(2.481)	(2.607)	(4.462)
L/E MB	0.039	0.038	0.054	0.104
	(5.752)	(5.571)	(7.074)	(12.617)
Quarter-year effects	No	Yes	Yes	Yes
Submarket fixed effects	No	No	Yes	Yes
Other Controls	No	No	No	Yes
Observations	39,138	39,138	39,138	39,138

NOTE: This table shows the estimation result based on the model given by

$$U_{ijt} = \alpha_0 + \alpha_1 B_{ijt} + \alpha_2 E_{ijt} + \alpha_3 BE_{ijt} + \alpha_4 L_{ijt} + \alpha_5 BL_{ijt} + \alpha_6 BLM_{ijt} + X'_{it}\beta + \nu_j + \mu_t + \varepsilon_{ijt}$$

Panel (A) shows the estimation results for the parameters with α_1 shown in the line denoted "Broker," α_2 shown in the line denoted "Exper. Client," α_3 is shown in the line denoted "Exper. Client Inter.," α_5 is shown in the line denoted "Large Client," α_5 is shown in the line denoted "Large Client Inter.," α_6 is shown in the line denoted "Large Clinet Mul. Inter." and α_0 shown in the line "Cons." The setup differs from Section 4.2 in that U_{ijt} is measured in USD instead of percentages.
Panel (B) shows the results of the test on linear combinations of the parameters. The line denoted by "L/E 1B" shows the broker impact for large and experienced clients when the relationship is exclusive with one broker, the line "L/E MB" shows the broker impact if the client has a business relationship with multiple brokers.
Specification (1) shows the estimation results where only a constant and the investor dummy are included. Specification (2) shows

the results when time dummies are added to the setup in Specification (1). Specification (3) shows the results when market dummies are added to the setup in Specification (2). Specification (4) shows the results when additional building controls are added to the setup in Specification (3). t-Stats are in brackets.

B Adjusting the Benchmark: Additional Results

This Section shows further results for the analysis based on the benchmark model using the price level as left hand side variable.

Table 15: Hedonic Model

	Full	Ask	Client
Log building size	-46.481	-47.142	-35.035
(thousand square feet)	(-44.323)	(-35.219)	(-27.298)
Log land area	14.374	13.292	10.060
(acres)	(16.633)	(12.425)	(9.534)
Number of stories (1=yes)			
Medium (6-10)	37.663	36.884	25.156
	(11.241)	(5.964)	(6.584)
High (>10)	72.006	110.650	51.069
	(16.253)	(12.839)	(10.085)
Building Class (1=yes)			
Class A	69.153	82.265	74.246
	(21.482)	(14.027)	(19.523)
Class B	7.608	11.586	11.040
	(4.303)	(5.801)	(4.989)
Secondary type (1=yes)			
Industrial live/work unit	-21.419	-3.706	-21.367
	(-1.321)	(-0.226)	(-1.263)
Loft/creative space	5.226	5.895	-12.955
	(0.858)	(0.922)	(-1.880)
Medical	26.457	24.636	32.151
	(13.777)	(11.356)	(13.645)
Office live/work unit	19.278	0.510	1.286
	(2.658)	(0.073)	(0.156)
Office/residential	12.202	8.977	4.287
	(2.421)	(1.590)	(0.672)
Telecom hotel/data hosting	3.415	-23.777	-26.538
	(0.259)	(-1.208)	(-1.837)
Construction vintage (1=yes)			
1950-1959	-0.241	-3.032	-5.901
	(-0.065)	(-0.715)	(-1.237)
1960-1969	-13.605	-20.719	-19.978
	(-4.224)	(-5.514)	(-4.893)
1970-1979	-15.858	-21.076	-18.513
	(-5.315)	(-5.926)	(-4.974)
1980-1989	-5.729	-13.388	-13.047
	(-2.059)	(-4.044)	(-3.769)
1990-1999	16.191	4.684	10.769

Table 15: Hedonic Model *(continued)*

	Full	Ask	Client
	(4.921)	(1.211)	(2.706)
2000-2009	44.312	27.252	38.121
	(13.789)	(7.443)	(9.916)
Post-2010	140.089	98.248	119.331
	(18.947)	(12.034)	(16.123)
Sale condition (1=yes)			
Portfolio sale	-3.594	-4.015	-1.961
	(-1.949)	(-0.195)	(-0.949)
Downleg 1031 exchange	-3.014	-6.657	-7.059
	(-0.597)	(-0.784)	(-0.879)
Upleg 1031 exchange	7.915	28.064	13.255
	(2.001)	(4.308)	(2.107)
High vacancy property	-42.328	-19.109	-39.394
	(-11.406)	(-4.776)	(-11.954)
REO sale	-50.465	-33.584	-38.108
	(-12.268)	(-9.330)	(-10.735)
Investment triple net	47.911	82.024	78.777
	(10.740)	(12.821)	(15.262)
Purchase by tenant	7.909	3.070	22.128
	(1.813)	(0.469)	(3.433)
Sale and leaseback	16.779	2.644	13.883
	(3.654)	(0.463)	(2.711)
Redevelopment project	67.634	23.601	33.238
	(12.527)	(3.624)	(5.958)
Deferred maintenance	-31.327	-24.093	-28.388
	(-5.787)	(-4.691)	(-5.234)
Partial interest transfer	127.219	181.214	72.812
	(16.376)	(6.460)	(5.698)
Auction sale	-30.539	-16.078	-27.814
	(-3.752)	(-1.150)	(-3.539)
Debt assumption	27.819	54.525	23.552
	(3.528)	(2.905)	(3.172)
Ground lease	5.195	-35.349	-23.375
	(0.705)	(-1.668)	(-2.756)
Distress sale	-23.448	-32.936	-30.468
	(-2.813)	(-3.095)	(-3.292)
R-squared	0.302	0.602	0.515
Adj. R-squared	0.287	0.562	0.488
Quarter-year fixed effects	Yes	Yes	Yes
Submarket fixed effects	Yes	Yes	Yes
Observations	104,998	22,388	41,583

NOTE: This table shows the estimation results for the hedonic model. Column (1) shows the estimation results for the full sample. Column (2) shows the results for the sample that includes an ask price. Column (3) shows hedonic coefficients for deals without broker involvement. Quarter-year and market fixed effects are not reported. t-Stats are in brackets.

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