Bargaining over Leasing Contracts: Strong by Privilege but Weak by Risk Aversion*

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Abstract

Many business transactions rely on contracts specifying transfers, making it difficult to observe how power imbalances shape agreed terms. This study introduces a bargaining model that recovers each party's position from observed contract terms and applies it to tenant lease agreements in shopping malls. I find that when the mall holds a stronger bargaining position, it tends to forgo higher fixed rent in favor of contracts that generate more variable rent. At the same time, at such lower sales levels, recovering sufficient rent through variable components becomes difficult, making privileged mall managers more risk-averse. Simulation results show that even without accounting for changes in risk attitudes, fairer bargainings do not necessarily reduce total rent. Furthermore, when risk attitude shifts are considered, a sharp increase in variable rent could nearly triple total rent.

JEL Classification Codes: C71; C78; L81; R32; R33.

Keywords: Contracting; Nash Bargaining; Renegotiation; Shopping Center; Tenancy; Tenant.

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1 Introduction

Fair trading practices have long been recognized as essential for driving economic growth and promoting societal welfare. Regulatory authorities across various jurisdictions must use transparent criteria to identify and address unfair trade practices, particularly in today's increasingly complex business arrangements. Certain contractual provisions, often rooted in longstanding trading customs—such as resale price maintenance (RPM), tying and bundling, and exclusive contracts—are frequently cited as indicators of unfair trade. Another concern arises when regulatory bodies scrutinize mergers in highly concentrated markets, where enhanced market power may erode consumer surplus through elevated markups.

However, a power imbalance that leads to unfair trade does not always manifest in specific contractual clauses or measurable markups. Because these provisions are regulated, firms tend to avoid them, and in many real-world business contexts, transactions are not limited to one-off price deals. In long-term relationships, for instance, parties often adopt share contracts to distribute risk. It remains unclear how power imbalances influence such contract designs, and there is limited empirical analysis on this matter. Furthermore, with the rise of platform companies, it has become increasingly difficult to gauge a firm's market power by merely examining prices or markups in a given market. Exploring how power imbalances unfold within broader transfer schemes is not just an academic pursuit, but also an urgent practical concern.

In this paper, I present a model for analyzing bargaining over contract, using shopping mall tenant contracts as a concrete example. I use actual contract and sales data to estimate a model examining how power balance affects contract structure. First, I find that when the mall holds a stronger bargaining position, it tends to forgo higher fixed rent in favor of contracts that generate more variable rent. This is because such malls can reject tenants' optimistic earnings estimates. However, at such lower sales levels, recovering sufficient rent through variable components becomes difficult, making privileged mall managers more risk-averse. Then, such mall managers also want to increase fixed component. Since a mall's bargaining position affects contract terms in such opposing ways, the result of implementation of more fair trade practices remains an empirical question. This paper simulates the impact of fairer bargaining conditions enforced by authorities on total rent and its composition. The results show that even without accounting for changes in risk attitudes, fairer bargainings do not necessarily reduce total rent. Furthermore, when risk attitude shifts are considered, a sharp increase in variable rent could nearly triple total rent.

Leasing contracts in shopping malls provide an ideal context for applying this model. First, unfair trade practices involving shopping mall tenancy agreements have led to numerous disputes handled by regulatory authorities worldwide, reflecting their growing practical significance. See Appendix A for recent and classic examples. Second, all tenancy contracts are established as bilateral agreements directly between the shopping mall and the tenants in the retail spaces. There is no need to explicitly account for intermediaries or consider landlord-specific heterogeneity.[1] Third, the renewal contract offer to the tenant is not a take-it-or-leave-it manner but bargained through time-consuming renewal negotiation, which naturally requires me to consider the power balance of the involved parties. Lastly, there is sufficient variation in leasing contracts: they are not selected from a pre-existing templates.

My dataset spans roughly six years of operations at two shopping malls and covers tenant-level details such as daily sales, customer counts, floor area, and active leasing contracts. I also use meeting minutes, including those with prospective and incumbent tenants, to measure search intensity for new tenants and identify initial offer details in renewal contract negotiation. As a preliminary step, I examine how power balance, which is proxied by past realized sales, relates to contract renewals. Simple regressions suggest that tenants with higher past sales are both more likely to receive renewal offers and face higher expected rents. Although performance does play a role, its exact influence on contract structure is unclear. To clarify this mechanism, I need an economic model that can recover the realized bargaining positions.

The model has two stages: first, whether to renew the leasing contract, and second, negotiating the contract if it is renewed. I present them in reverse order. The bargaining over the contract is modeled as a two-stage sequential process: in the first stage, the mall's management and the tenant negotiate the earnings estimate; in the second stage, the mall's representative and the tenant negotiate the leasing contract based on that agreed-upon forecast. The solution concept is a *Nash-in-Nash solution*, in which the bargaining in the first stage takes into account the anticipated outcome of the second

[1] Intermediary itself is an independent research topic in urban, real estate economics: see for example Robles-Garcia (2019).

stage. In this framework, bargaining power is defined separately at each negotiation table. Consequently, the model primitives include the two ratios of bargaining power for the respective bargaining stages and the utility functions of both the mall side and the tenant side, which jointly determine the bargaining problem.

The above bargaining game is only held when the mall representative decides to renew the leasing contract with the existing tenant. The additional model primitive introduced here is the value of outside option. When the value of outside option is higher than the expected gain of having a renewal negotiation, the mall side offers a renewal to the tenant. Otherwise, the tenant must exit from the mall.

I parametrize the model to estimate it. Both the mall's representative and the tenant's agent have CRRA utility functions, but with different degrees of risk aversion. The mall's management has misaligned preference than its representative in that it tends to rely on past sales when discussing the earnings estimate: I introduce a parameter to capture how strongly it does so. In the first stage, the ratio of bargaining power is modeled in a log-linear form as a function of covariates: such as realized sales. In the second stage, this ratio is assumed to be the inverse of their risk aversion ratio. The value of outside option is specified linearly with respect to covariates, including the mall's search intensity. I assume a joint distribution for the disturbances affecting the first-stage bargaining power ratio and the value of outside option. The estimation is carried out as a Tobit model, subject to constraints ensuring that the observed leasing terms match the Nash bargaining solution.

The model is identified due to the separation of the parameters into two sets. The first set, common across all tenants, includes the mall's risk aversion and the marginal effects of covariates on bargaining-power ratios. The second set is tenant-specific, which includes the endogenously determined earnings estimate and the tenant's risk aversion. We identify the common parameters by looking at how the decision to continue the lease is made, under assumptions that keep the tenant-specific parameters from affecting this decision. Once those common parameters are identified, we then identify the tenant-specific parameters using the conditions of the Nash solution. Specifically, for each tenant and the mall, we derive a surplus expression that yields two conditions: from these two conditions, we identify the two parameters that satisfy them.

The estimation results are summarized from two perspectives: the decomposition of bargaining power and contract variations due to shifts in power balance. First, Mall

0 holds a stronger position in bargaining over earnings estimates than Mall 1, aligning with its higher sales potential in a high-traffic area. However, in risk-sharing bargaining, Mall 0 is weaker due to greater risk aversion. Bargaining power over earnings estimates also depends on past performance: for example, tenants with higher sales per unit area have stronger positions. These time-varying effects are significant, altering certainty equivalence by about 10% of actual surplus of mall, though the impact varies by tenant. Second, when the mall has greater bargaining power in earnings estimation, the fixed rent component decreases due to lower expected earnings. Meanwhile, the more risk-averse Mall 0 incorporates past sales variance into contract terms.

Given these estimation results, the impact of enforcing fair trade practices between the mall and its tenants on rent levels and composition remains an empirical question. I simulate counterfactual contracts for tenants in Mall 0 under two scenarios: (1) the bargaining position in earnings estimation is shaped in the same mechanism as in Mall 1, which is less privileged, and (2) in addition to this adjustment, Mall 0's risk aversion aligns with that of Mall 1. The results show that fairer trade does not necessarily reduce rent in either case. Moreover, in the second scenario, where contracts involve greater risk-taking, total rent could triple due to a sharp increase in commission-based components. This highlights the need for regulators to consider the endogenous adjustment of risk attitudes when assessing the impact of fair trade policies.

Related literature This research stands in the literature of empirical bargaining. Specifically, this study follows one type of the empirical bargaining literature which adopts the Nash bargaining solution or the Nash-in-Nash solution to describe the equilibrium. For a comprehensive overview of this strand of literature, see the recent survey by Lee, Whinston and Yurukoglu (2021).[2] My model differs from the typical ones of this literature in two respects. First, rather than focusing on a simple tariff, I consider a complex contract splitting the surplus.[3] Second, I introduce an unobserved component into the

[2]Another type of empirical bargaining studies involves building specific structural models of bargaining problems to include particular information structures or unique dynamics. Sieg (2000); Watanabe (2005); Silveira (2017) analyze dispute resolution, Larsen (2020) studies bilateral bargaining over the price of used cars, Ambrus, Chaney and Salitskiy (2018) investigates delays in bargaining over captives ransomed from pirates, and Merlo and Wilson (1995); Merlo and Tang (2012) propose general frameworks for stochastic sequential bargaining applied to various fields.

[3]One exception is a theoretical study Kihlstrom and Roth (1982). They analyze a bargaining over insurance contracts, demonstrating that the risk attitudes of both parties influence the bargaining outcome.

agreement, along with a valid identification strategy. Such unobserved component, which is also subject to negotiation, has not been incorporated in existing empirical studies.

One of the main goal of the empirical bargaining literature is elucidating the sources of bargaining power. Building on the theoretical work of Rubinstein (1982, 1985), which identifies the discount factor as a key determinant of bargaining power, several empirical studies have examined the construction of bargaining power such as Backus et al. (2020). In this context, this study finds that past performance is an important determinant of bargaining power and finds out the time-varying nature of it as a source of variation.[4]

Lastly, this research contributes to the studies on tenant leasing in shopping malls. The optimal form of contract is the classical issue as an application of the principal-agent model: affine contract form is rationalized as a treatment for the moral hazard problem(Benjamin, Boyle and Sirmans, 1992; Brueckner, 1993; Lee, 1995; Wheaton, 2000; Monden, Takashima and Zennyo, 2021). In my data, I observe a new but typical contract form which has the threshold where the commission rate changes. As an empirical study, Gould, Pashigian and Prendergast (2005) focus on the team problem in a shopping mall: they use rent data to identify the existence of preferential treatment for *anchor tenants*, who attract neighbors to the mall and induce higher spending at other stores. Due to the data limitation, there are no previous studies using panel data to analyze the leasing contract based on a structural model.

2 Tenant leasing in a shopping mall

I describe the details of leasing operations in the shopping mall industry. The specific practices, industry norms, and typical processes mentioned here are based on information obtained through interviews with leasing officers at the shopping mall management company, which provided the data used in this study, as well as real estate professionals involved in the data provision.

[4]The literature of incomplete contract also considers the situation where a contract, which is an outcome of a bargaining, is affected by past performance and actions, such as investment. Joskow (1987, 1990) consider the impact of relationship-specific investments on contract terms. More recent empirical research has highlighted several critical factors in renegotiation outcomes, such as the liquidation value in the context of debt contracts (Benmelech and Bergman, 2008) and broadly defined outside options (Gagnepain, Ivaldi and Martimort, 2013; Ater et al., 2022). In contrast to these studies, my empirical setting does not involve incomplete contracts; instead, it focuses on the direct changes in bargaining strength driven by past performance.

2.1 Operations in shopping mall management

A shopping mall refers to a commercial complex managed by a real estate company, generating revenue through the rents paid by its tenants. Since the number of tenants directly impacts foot traffic, the management company of shopping malls typically aims to house a large number of tenants, striving to keep commercial spaces fully occupied. While the number and types of tenants vary depending on each mall's operational strategy, they usually feature a mix of small to medium-sized tenants, such as restaurants, apparel brands, and specialty stores, alongside larger tenants like multiplex cinemas, bookstores, and supermarkets.

The operations of the shopping mall can be understood in three distinct phases: the search for new tenants, the negotiation and signing of lease agreements, and the ongoing relationship maintenance after tenants have moved in. First, the company continuously scouts for potential tenants, targeting existing stores in the vicinity or promising retail businesses, thereby maintaining a pool of prospective tenants. Whenever a new shopping mall opens or a vacancy arises due to the existing tenant, the manager taps into this pool to secure and sign contracts with new tenants. For the negotiation phase, the lease agreements are not off-the-shelf contracts but rather are the result of lengthy negotiations between the shopping mall side and the tenant side. Even after a tenant has moved in, the shopping mall management company conducts regular meetings with tenants to share business updates and discuss local market conditions. Additionally, it takes the actions such as conducting mystery shopping evaluations to assess customer service and share the results with the tenants. These steps are part of the continuous effort to foster a positive and ongoing relationship with the tenants and to monitor the tenants' effort on sales promotion.

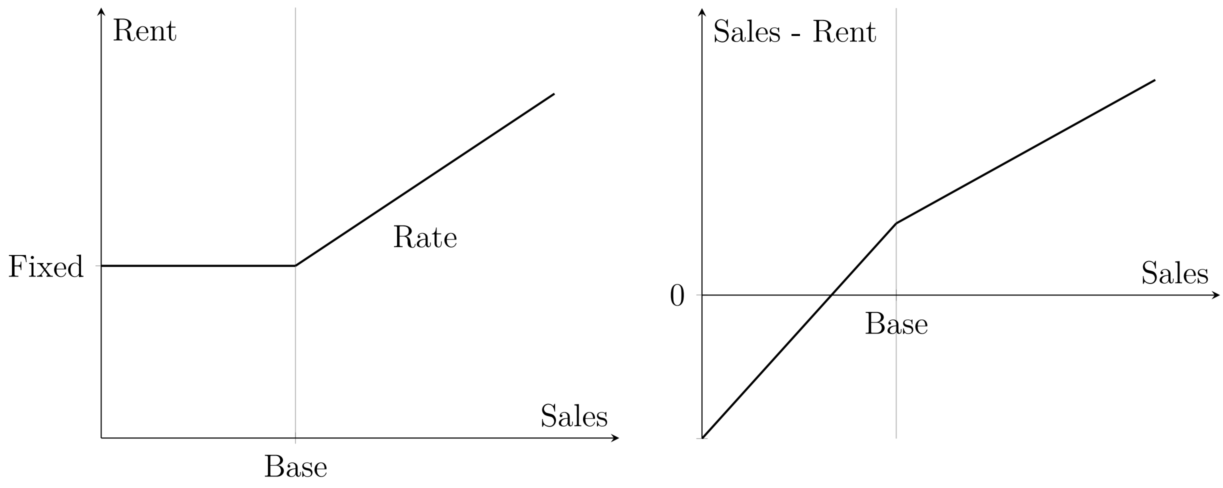
I focus on the renewal negotiation with existing tenants, rather than negotiations at the timing of entry. By this focus, I partially avoid the concern for asymmetric information between the involved parties. The process of renegotiation typically begins six months to a year before the ongoing lease term ends. In most cases, the shopping mall side initiates the process by informing the tenant whether they wish to terminate the lease or propose a renewal. If the termination is requested, the tenant generally has little room to oppose it. If a renewal is proposed, negotiations over the terms of the new lease commence. While the end of the current lease serves as the deadline, most negotiations conclude well in advance.

The negotiation including renewal ones is a delegated task from the viewpoint of the shopping mall side: the real estate company delegates the management of a shopping mall to a *manager* and, at the same time, the manager must rely on subordinates due to the large number of tenants. Hence, any negotiation is typically led by a younger field staff member, who sits at the table to discuss the detailed contract terms. Hereafter, I call these staff by *representative*. The tenant side also have the representative who sits down the negotiation tables. The renewal negotiations typically proceed with weekly meetings, where each representative takes the proposed terms back to their head offices for consideration before reconvening the following week with responses. Given that these representatives are typically not assigned to the same tenants beyond the typical lease length, it is reasonable to assume they do not engage in dynamic considerations with future renegotiations in mind.

The renewal negotiation is typically over the lease period, restoration obligations upon exiting, and rent.[5] Among them, rent negotiations often involve intense conflict between the parties. Typically, the monthly rent includes not only the fixed amount of rent but also the commission component as I explain the detail form in Section 2.2. Hence, the negotiation over monthly rent is considered as a bargaining over the set of such functions. The primary challenge lies in the difficulty in agreeing on future sales expectation. Interviews with field representatives revealed that once an earnings estimate is agreed, determining the rent becomes relatively straightforward, guided by market norms and each party's risk attitude. It is also noteworthy that moral hazard issue was not mentioned as the primal motive for having a commission component in the rent structure. I check the existence of such agency problem in the current context in Appendix C.4 and cannot find strong evidence of it. Hence, in this study, I only focus on risk sharing motive when specifying the detail form of the rent structure.[6]

[5]For most tenants, excluding those with a special status in the mall, such as cinemas, the lease period and restoration obligations are generally set according to the industry norms because these two points do not cause severe conflict or disagreement between the two parties. From the tenant's perspective, once the costs of renovations have been amortized, the lease period becomes less of a concern. Regarding restoration obligations upon exiting, the standard principle is that tenants bear the cost of returning the space to its original condition.

[6]While I do not find the evidence of moral hazard problem in the current situation, my framework can be applied to the situation where the principal faces an agency problem when contracting. Several set of researches analyze the bargaining over contracts when there is an agency problem: for example, Pitchford (1998); Balkenborg (2001); Demougin and Helm (2006); Yao (2012); Li, Xiao and Yao (2013). If I describe the bargaining problem according to these models, it is possible to include moral hazard in my framework.



(a) Share of Shopping Mall

(b) Share of Tenant

Figure 1. How Sales is Shared with Shopping Mall and Tenant

Note: The most common rent structure specifying the amount paid to the shopping mall and the corresponding monetary amount retained by the tenant. When sales fall below threshold, the rent remains fixed, but once sales exceed it, rent increases in proportion to sales.

Lastly, the renewal negotiation is closely related to the shopping mall's efforts to search for new tenants. Fundamentally, the intensity of these search activities is determined endogenously by the mall's current business conditions and the surrounding environment. During renewal negotiation, it is common practice for the mall to specifically target the commercial space in question and actively market it to potential tenants within its pool. This strategy is expected not only to provide leverage in negotiations with the existing tenant but also as a contingency plan in case the negotiations fall through. Thus, the extent of new tenant search efforts is strongly influenced by the particular commercial space undergoing renewal negotiation.

2.2 Rent structure

The monthly rent is determined by a variant of share contract. The most common contract is characterized by three components: *Fixed*, *Base*, and *Rate*. The monthly rent is set to Fixed until the monthly sales exceeds Base and after that point, the rent increases at Rate. The existence of Base is the primal deviation from the usual linear contracts. I call this type of contract by *mixed-type contract* to emphasize that this contract takes the mixed form of the fixed payment contract and the linear contract.

In Figure 1, I show how the monthly sales yielded by the retail space is shared with the tenant and the shopping mall under a mixed-type contract. Panel 1a shows the monthly rent paid to the shopping mall for various monthly sales and Panel 1b shows the corresponding monetary remaining for the tenant side. The mixed-type contract yields a convex payment function to the shopping mall side and concave profit function to the tenant side. The prevalence of this mixed-type contract in the leasing contract already indicates the desire for risk-sharing of both sides.[7] In general, given a projected sales, tenants prefer a perfectly commission-based contract, while the mall seeks to maximize fixed amount of rent. The adopted rent structure is a commercially customary solution to this fundamental conflict over the entailed risk of the rent.[8]

The presence of Base is a significant difference compared to the well-known affine contracts. In practice, the existence of Base plays a crucial role in lease negotiations because many tenants impose certain constraints on Fixed: such as a cap on the percentage of fixed amount of rent to their sales. Negotiating with tenants over these company policies can be time-consuming. Therefore, while Fixed is also a negotiable object, the primary focus in negotiation over rent structure is on the combination of Base and Rate which balances the risks associated with sales fluctuations.

3 Data

My data covers two shopping malls, both managed by the same real estate company, for six years from 2017 to 2023. These malls are located in the western region in Japan but are geographically somewhat distant from each other, and each managed by different managers.[9] One is situated in the downtown area of a city, while the other is located in the suburbs. In this paper, I refer to the former as *Mall 0* and the latter as *Mall 1.* Mall 0 was built at 2011 and Mall 1 was built at 2009.

[7]Some studies suggest that similar contract forms, such as affine or linear contracts, can be optimal even when the parties involved are not risk-averse. For instance, Bhattacharyya and Lafontaine (1995) examines the situation of double moral hazard, while Innes (1990) considers limited liability as a rationale in the context of debt contracts. In this study, based on professional interviews, I assume a setting where both parties are risk-averse agents to introduce a motive for risk-sharing.

[8]In this study, I do not question the optimality of this functional form for the rent structure. While Lee (1995) explores the optimal rent structure in the shopping mall industry, the current kinked rent structure does not emerge as a result in his analysis. Further investigation is needed to understand the rationale behind this functional form.

[9]The two shopping malls are located 12.32 km apart in a straight line. They are situated in different prefectures, and more importantly, each mall is adjacent to the central station of its respective region. In Japan, commercial areas are typically defined with the train station as the focal point. From the company's perspective, these malls are considered to belong to distinct commercial zones, and so each is managed independently by separate managers.

My dataset falls into three categories: performance data, data on contract terms and the meeting minutes about the negotiation process. I begin by describing the first category. For any given day covered by my data, it includes the area for every shop present in the two shopping malls on that day and the shop identity.[10] Although my data includes temporary shops, such as seasonal event spaces, their areas are recorded as zero. My analysis focuses on shops with a positive area value, which I refer to as *tenants*. For each tenant, I observe daily performance measures: daily realized sales and the number of purchasing customers. In the main analysis that follows, I aggregate the performance measures for all tenants on a monthly basis; specifically, I calculate each tenant's monthly sales and monthly customer count by summing their daily figures. Because this data is used to determine monthly rent, it is highly reliable.

The second category of my data records the contract terms under which each tenant operated each month. These terms specify the rent structure and contract duration in months. For the rent structure, the data captures the values of Fixed, Base, and Rate for tenants under a mixed-type contract, and the corresponding set of parameters for tenants operating under other forms of rent structure.[11] Based on the contract duration, I can identify the timing of renewals. For later use, I introduce the concept of *contract number*. For each tenant, the initial contract in my dataset is assigned a contract number of 0, which increases by 1 with each subsequent renewal.[12] Thus, the contract data itself is structured as a panel data, with tenants as the identifiers and the contract number serving as the time variable. Hereafter, I refer the pair of tenant and its contract number by *contract*.

As the third category of my data set, I have access to the records of meeting minutes documented by the shopping mall side for meetings with both potential and incumbent tenants. Every meeting minutes is categorized by the primary objective of the meeting, with the main categories being "New Tenant Search" and "Renewal Negotiation." All records are dated and include detailed notes for each meeting. However, not all discussions or offers are documented, as some of these conversations, particularly those conducted over the phone, are not directly recorded in the minutes. I use this meeting data to

[10] A limitation of my data is the absence of information on floor location and distance from the main entrance—factors likely to impact the value of retail space.

[11] See Appendix B.1 for details on non-mixed-type contracts.

[12] It is important to note that my data does not cover the opening periods of the shopping malls. Therefore, even if the contract number is 0, it does not necessarily imply that the contract is the initial agreement made when the tenant first entered the shopping mall.

analyze the following two aspects: the initial offer made by the shopping mall and the intensity of search behavior. The initial offer is almost always recorded in the minutes, which typically includes the form of a list detailing Fixed, Base, and Rate. I quantify the intensity of the shopping mall's search efforts by counting the number of "New Tenant Search" meetings each month.

3.1 Descriptive statistics

In total, my data cover 619 contracts. As shown in Figure A.1, these contracts are qualitatively grouped based on the form of the leasing contract into eight distinct groups. In my main analysis, I focus on the most observed type of contract: that is, *mixed-type contract* which composes 72% of all the contracts, in total 443 contracts.[13] The number of tenants operating under mixed-type contracts is 226.

Table 1 shows the descriptive statistics of the contract and tenant level variables. The tenants vary significantly in scale, as seen in their sales, sales per unit area, and customer counts. This variation naturally suggests that tenants with a substantial presence in the mall are likely to hold a stronger negotiating position. The monthly rent is non-negligible from the view point of tenants: the rent-to-sales ratio reaches the 75th percentile at 16%. Moreover, the variable portion of rent, namely the rent collected through the rate beyond the base, is also a significant factor for tenants. On average, about 20% of the total rent is collected through this commission component. Indeed, it is not uncommon for monthly sales to exceed the base: there is a 55% probability that sales will surpass this base, triggering rent collection via the commission rate.

There is considerable variation in the detail form of rent structure. Even after normalizing the values with respect to unit area, both Fixed and Base differ across mixed-type contracts. Generally, Base is set to be roughly 10 times Fixed[14]. Rate is kept low, around 1%, reflecting the interaction between these parameters: as discussed in Section 2, there is a trade-off between Rate and Base. Setting a relatively lower Base value may allow for a lower Rate in some cases.[15] For this mixed-type contract, the average contract duration

[13]As explained in Section 2, perfect-commission contract and fixed-rent contract are considered as special treatment for special tenants. Dual-kinked contract is also adapted to the larger-sized tenants relative to the tenants with mixed-type contracts.

[14]This rule of thumb is frequently noted in meeting minutes.

[15]See Appendix C.1 for more detail discussion about the interactions. In particular, I cannot find the obvious trade offs between the values of Fixed and Base between the value of Rate in simple scatter plots. In Section 6.2, I further look into this point to identify the expected trade offs between Base and

	Mean	Std	Min	25%	50%	75%	Max
Performance and rent							
Avg. Monthly Sales	11.60	33.01	0.00	3.62	5.64	9.18	387.01
Avg. Monthly Sales per Area	0.07	0.05	0.00	0.04	0.06	0.08	0.57
Avg. Monthly Customer	4864.63	8402.25	0.00	703.00	2091.00	5320.32	91333.25
Avg. Monthly Rent	0.93	1.67	0.02	0.38	0.56	0.91	23.57
Avg. Ratio of Rent to Sales	–	–	0.01	0.09	0.12	0.16	–
Avg. Variable Rent / Total Rent	0.19	0.19	0.00	0.02	0.14	0.31	0.89
Prob. of Sales over Base	0.55	0.36	0.00	0.17	0.67	0.88	1.00
Contract term							
Fixed per Area	5.26	4.11	0.15	2.74	4.51	6.05	27.69
Base per Area	62.02	43.25	3.22	42.36	54.78	60.50	435.57
Rate (%)	0.91	0.30	0.20	0.80	1.00	1.00	3.50
Duration (days)	1830.17	1190.69	150.00	1079.00	1740.00	2159.00	4493.00
Tenant level variables							
# of Renewals	1.00	0.74	0.00	1.00	1.00	2.00	3.00
Area (m^2)	165.21	305.68	16.86	64.93	103.59	157.46	3864.31

Table 1. Descriptive Statistics of Contract and Tenant Level Variables

Note: All monetary values in the Performance and rent panel are scaled by $1,000,000$ JPY. All monetary values in the Contract term panel are scaled by $1,000$ JPY. The mean and maximum values for "Rent over Sales Mean" are not reported due to infinite values in some instances. Because there are some months when tenants yield zero sales, the ratio of rent to sales can be infinite. Therefore, I exclude the mean, standard deviation, and maximum for this variable. By 'Avg.' and 'Prob.', I mean that these numbers are the monthly averages of the variables observed during the contract period. For contract level variables, I focus on the mixed-type contracts and the number of samples is 443. For tenant level variables, I focus on the tenants operating under mixed-type contract and the number of samples is 226.

is 1,830 days. Given that this duration is longer than the typical personnel cycle, the representative can be viewed as a myopic agent—that is, they do not take future renewals into account during negotiations.

3.2 Motivating observations

I present preliminary analyses that motivate the structure of my model. In Section 3.2.1, I show that each tenant's monthly sales are subject to risk, and both tenants and the mall take this risk into account when establishing a leasing contract. In Section 3.2.2, I argue that the contract term and the continuation decision reflect the performance that has actually been realized. These gross effects an existence of the relationship between the position in the negotiation and the agreed-upon contracts.

rate.

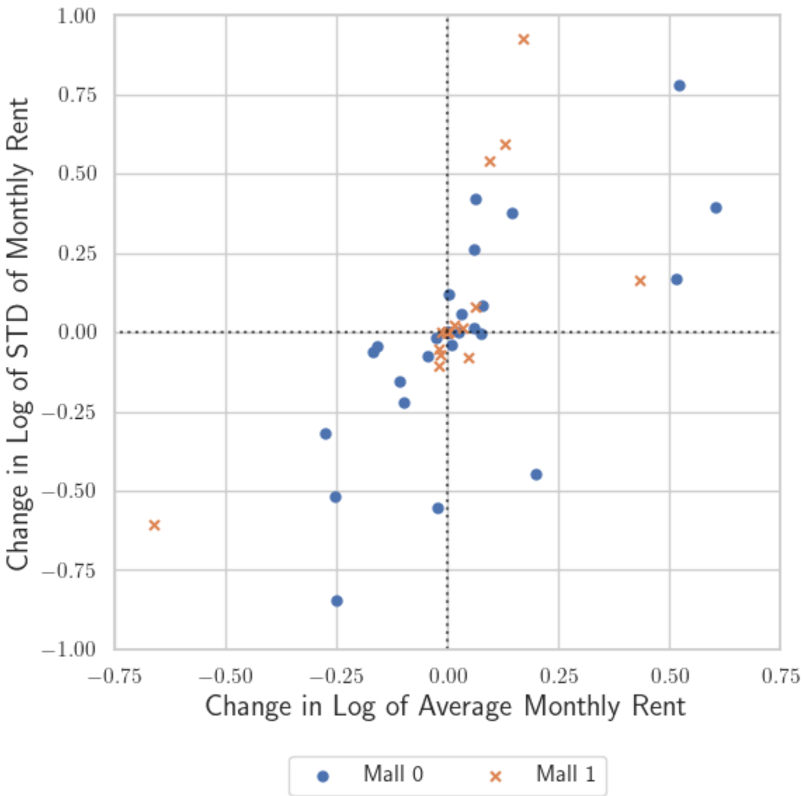


Figure 2. Change in Average and Std of Log of Monthly Rent

Note: The average and the standard deviation of the monthly rents is computed using the realized sales during the ongoing contract period for the ongoing contract and the next contract. The scatter plots show the difference of them by malls.

3.2.1 Risk and risk attitudes

I use i for a contract and t for a month. Consider the following regression:

$$\text{Sales}_{it} = \gamma_0 1\left\{i \in \text{ mall }_0\right\} + \gamma_{\text{month }} + \gamma_{\text{year }} + \text{FE}_i + \varepsilon_{it},$$

where the left-hand side variable is monthly sales per unit area. The estimated standard error of the disturbance is 0.90 million JPY, indicating considerable volatility in realized sales relative to sales per unit area. This stochastic volatility is referred to as *risk*.

In this high-risk environment, both parties—the shopping mall and the tenant—seem to be risk-averse agents. Figure 2 provides direct evidence of their risk attitudes. For all contracts, I calculate the average monthly rent and the standard deviation of monthly rents. For any tenant with two successive contracts, I calculate the changes in both the average monthly rent and the standard deviation of monthly rents. Figure 2 plots these

Dep. Var.	(1) Exit	(2) Exit	(3) Exit	(4) Rent Increase	(5) Rent Increase	(6) Rent Increase
Avg. Sales	-1.50e-09			0.000944*		
	(9.78e-10)			(0.000536)		
Avg. Sales per Area		-1.02e-08			0.00341***	
		(7.19e-09)			(0.000601)	
Avg. Pct. from Bottom			-0.00406***			1258.5***
			(0.000614)			(202.6)
fixed	-5.77e-08**	-5.90e-08**	-3.79e-08	0.161***	0.160***	0.160***
	(2.63e-08)	(2.53e-08)	(2.40e-08)	(0.0253)	(0.0255)	(0.0251)
rate2	0.000108**	0.000119**	0.0000360	80.85***	67.87***	94.43***
	(0.0000541)	(0.0000513)	(0.0000499)	(12.01)	(9.701)	(11.99)
area	0.000401	-0.0000225	-0.000190	1560.5***	1802.5***	1918.0***
	(0.000311)	(0.000148)	(0.000169)	(237.2)	(306.5)	(319.8)
N	285	285	285	11820	11820	11820
adj. R^2	0.021	0.018	0.145	0.384	0.383	0.392

Table 2. External and Internal Margin and Past Performance

Note: For all six regressions, I control for the mall's identity as its dummy variable. Additionally, in the last three columns, I control for the realized monthly rent and include dummy variables for months and years. The sample size in the first three columns, 285 contracts, is smaller than the total of 443 contracts because recent contracts have not yet undergone renewal negotiations during the data period due to their distant expiration dates and so I cannot decide if they will exit or not. The asterisks indicate levels of statistical significance: *p<0.1; **p<0.05; ***p<0.01.

changes as pairs on a plane. As shown, rent structure changes largely fall into one of two categories: (1) higher rent with greater risk or (2) lower rent with less risk. This trade-off between rent level and risk demonstrates a risk-sharing motive in lease contract negotiations.

3.2.2 Past performance affects renewal outcome

I confirm that renewal outcomes are influenced by past performance. To measure performance, I use three metrics: average sales, average sales per unit area, and the percentile rank (from the bottom) of average sales per unit area within the shopping mall. I then conduct regression analyses in which the covariates consist of these three performance metrics and contract terms. The dependent variables are (1) a dummy variable indicating whether the tenant exits and (2) the increase in the amount of rent incurred by the change in contract terms, which is named *rent increase*.[16]

[16] Rent increase is constructed as follows: for each month, I calculate the current rent based on the ongoing rent structure and a counterfactual rent based on the rent structure of the next contract period for the same tenant. I then compute the monthly increment of the counterfactual rent over the current rent, defining this as rent increase.

Table 2 summarizes the results. As shown in the first three columns, the relative performance measure reduces tenant exits, reflecting the stronger bargaining position of tenants with higher sales. The last three columns show that better performance leads to an increase in counterfactual rent in the following period.[17] This effect contrasts with the external margin, emphasizing an alternative pathway. In Appendix C.5, I explore additional factors that may drive changes in contract terms and demonstrate that there are no apparent systematic patterns beyond the performance-based influences described above.

4 Model and solution

This section describes the model used in the main empirical analysis. Because I focus on a pair of a shopping mall and a tenant, I do not include the subscript to indicate the mall and tenant's identity.

Figure 3 shows the model flow. Let X represent the vector containing performance measures and relevant covariates observed in the last contract period. Based on this, the shopping mall management company determines the search intensity for the target retail space, denoted by d. Given these two factors, the value of outside options for the shopping mall, represented by ψ, is determined. ψ captures the expected amount of rent collected by the new tenant.

The shopping mall's representative for the tenant decides whether to terminate or renew the ongoing contract. Let I denote the initial level of wealth of the shopping mall, which is observed as the total rent revenue from other retail spaces within the same mall. Using ψ and I, the monetary gain from opting for the outside option is defined as $cI + \psi$, where c is a parameter capturing the sales externality generated by the tenant.[18] This value is compared with the expected gain from entering into renewal negotiations to make a decision. Note that the exit offer to the tenant is non-negotiable: the tenant must leave the mall if termination is proposed. This assumption is empirically validated in Appendix C.6.

[17] A potential caveat of this regression analysis is the unobserved heterogeneity in negotiation strategies. For example, if the initial offer strategies differ by mall, this could lead to variations in negotiation outcomes. In Appendix C.3, I address this concern, demonstrating that negotiation outcomes may still vary even when initial offers by shopping mall are controlled for.

[18] For example, anchor tenants in a shopping mall attract numerous customers, benefiting other tenants. This positive externality is reflected in the parameter c.

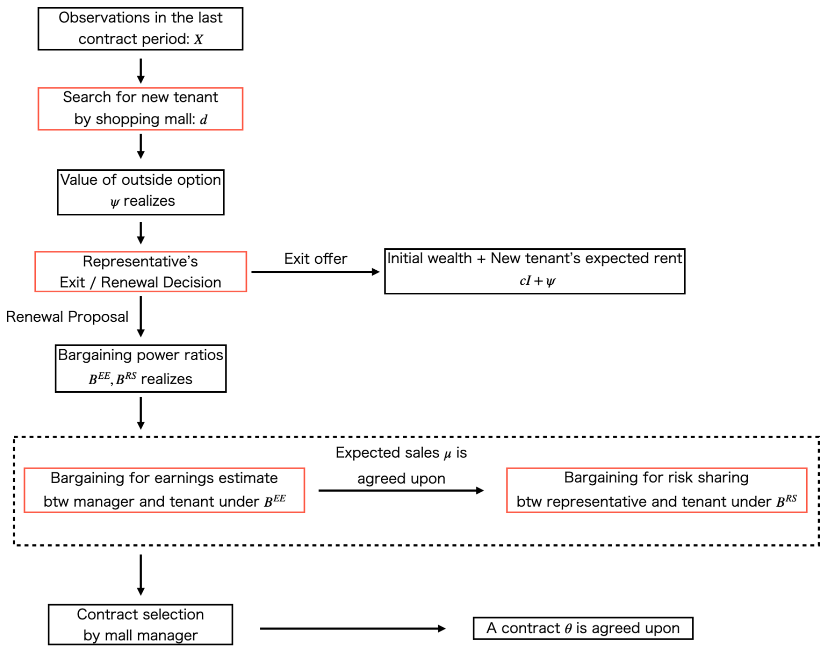


Figure 3. Model Overview

If the renewal offer is made, the shopping mall and the tenant begin negotiating the terms of a new leasing contract for the next period. This process consists of two stages: the first is a bargaining game between the two parties to establish an equilibrium set of contracts, and the second is the contract selection by the shopping mall manager, choosing one contract from this set. Introducing contract selection rule is necessary due to the redundancy in the contract space, as discussed below.

When it comes to the renewal negotiation, there are two negotiable objects: the earnings estimate and the leasing contract in the next contract period. I introduce a two-stage sequential bargaining model where these two objects are bargained sequentially. The first stage is referred to as *bargaining for earnings estimate* where the mall manager and the tenant side pick a earnings estimate to fix a sales distribution. Let S denote sales, and assume S follows a Gaussian distribution with known variance but μ remains unknown to the parties at the beginning of the negotiation. In the bargaining for earnings estimate, some μ is picked as a solution of a bargaining game. The second stage is referred to as *bargaining for risk sharing* where the representative of the mall and the tenant discuss the detail contract term under risk sharing motive given the agreed upon sales distribution. Note that I clearly distinguish the roles on the shopping mall side. There are two agents in this side: the manager, denoted by M, and the representative assigned to the tenant, denoted by R. As shown below, this division of authority is supported as the optimal institutional design of the shopping mall side.

Assumption 1. *S follows a Gaussian distribution with known variance: $S \sim N(\mu, \sigma^2)$.*

Model primitives I denote a rent structure as follows, $R(S;\theta)$ where $\theta \in \Theta$ represents the parameters and Θ is the parameter space of mixed-type contract: $\theta = (f, b, r) \in \mathbb{R}^3_+$, f is Fixed, b is Base and r is Rate of a mixed-type contract. Given θ, the rent is computed as follows:

$$R(S;\theta) = f + r \times \max\{0, S - b\}.$$

In addition to the manger, M, and the representative, R, I use T to denote the tenant side. Both the tenant and the representative assigned to the tenant are risk-averse agents, each with a CRRA utility function, but with different levels of risk aversion:

$$U_R(S;\theta) = -e^{-\rho_R(I+R(S;\theta))}$$

$$U_T(S;\theta) = -e^{-\rho_T(S-R(S;\theta))},$$

where ρ_R and ρ_T represent the risk aversion parameters. Note that the initial wealth of the tenant side for this retail space is assumed to be zero. For later use, let $V_R(x) \equiv -e^{-\rho_R x}$ and $V_T(x) \equiv -e^{-\rho_T x}$.

In contrast to the representative, the manager of the mall takes the past information into consideration when evaluating a renewal contract and earnings estimate. Due to the typical intractability of incomplete information bargaining game, I introduce a simple preference structure capturing the stickiness to the realized information. Let $\hat{u}_R \equiv U_R\left(\hat{\mu}(X);\hat{\theta}\right)$ where $\hat{\mu}(X)$ is the average earnings in the past contract period and $\hat{\theta}$ denotes the last contract terms. I refer to it as *reference utility.* For any pair (μ, θ) and given one set of covariates X, the manager's preference structure is specified as follows:

$$U_M(\mu, \theta; X) \equiv \mathbb{E}_{S\sim N(\mu,\sigma^2)}\left[U_R(S;\theta)\right] - \lambda\left(\mathbb{E}_{S\sim N(\mu,\sigma^2)}\left[U_R(S;\theta)\right] - \hat{u}_R\right)^2 \qquad (1)$$

This utility is maximized when $\mathbb{E}_{S\sim N(\mu,\sigma^2)}\left[U_R(S;\theta)\right] = \hat{u}_R + \frac{1}{2\lambda}$. Hence, this preference structure simply states that the manager of the mall takes "reference utility ($\hat{u}_R$) + bias term $(\frac{1}{2\lambda})$" as the best plausible utility level and deviation from this point reduces her utility.

I adopt a cooperative approach to solve the model, implying that the bargaining powers are not an equilibrium outcome but rather primitives of the model. As my model has two-stage sequential bargaining, I introduce separate bargaining powers for the two problems. Since the solution is determined just by the ratio of the bargaining powers, I use B as the ratio of the bargaining power of the shopping mall side to the one of the tenant side. For the first bargaining for earnings estimate, I denote the ratio as B^{EE}, and for the second bargaining for risk sharing, I denote it as B^{RS}.

I assume that B^{RS} is the inverse ratio of the risk aversion parameters. This assumption coincides with the classical analysis on the relationship between the risk attitude and the bargaining power: the more risk averse agent has less bargaining strength in the bargaining (Sobel, 1981; Roth and Rothblum, 1982). From practical point of view, as mentioned in Section 2, the bargaining over the contract is for risk sharing given one distribution of the sales and so it is natural that the risk aversions mainly drives the bargaining powers.

Assumption 2. $B^{RS} = \frac{\rho_T}{\rho_R}$

Given the above primitives, I solve the model in the reverse order. In Subsection 4.1, I formally describe the bargaining problems in the renewal negotiation, including their bargaining frontiers and the solution to determine the set of equilibrium contracts. In Section 4.2, given the problem for the above continuing tenant, I model how the representative decides whether a tenant should continue to exist. In Section 4.3, I describe the determination of the search intensity and the according value of outside option.

4.1 Renewal negotiation

This stage is composed of a two-stage sequential bargaining. As a solution concept, I adopt *Nash-in-Nash* solution: where the first stage bargaining is resolved under the expectation of the solution of the second stage bargaining.[19] Hence, I present the two problems in reverse order. In Sections 4.1.1 and 4.1.2, I specify the bargaining problem, which includes the bargaining set and the break-up point, and the Nash bargaining

[19] This sequential approach to interrelated bargaining problems is, for example, employed in Crawford and Yurukoglu (2012) as an instance of the Nash-in-Nash solution.

solution under a given ratio of bargaining powers for the two negotiations. In Section 4.1.3, I examine the validity of this solution concept. Specifically, I argue that the optimal institutional design leads to a separation of authority between the manager and the negotiation representative.

4.1.1 Bargaining for risk sharing

At this bargaining table, the parties involved are the mall's representative, R, and the tenant, T. From the outset, the earnings estimate, μ, has already been determined as the bargaining outcome at the first bargaining table. Given the distribution of future sales, $N(\mu, \sigma^2)$, their task now is to negotiate over the set of contract terms, Θ, to allocate the risk between themselves.

Bargaining set I define the bargaining set based on a subset of contract terms, denoted by $\tilde{\Theta} \subset \Theta$. Given a breakup point $(d_R, d_T) \in \mathbb{R}^2$, the bargaining set $BS\left(\tilde{\Theta}, (d_R, d_T)\right)$ represents the set of expected utilities attainable by a contract in $\tilde{\Theta}$ that also dominates the breakup point:

$$BS\left(\tilde{\Theta}, (d_R, d_T)\right) \equiv \{(x, y) \in \mathbb{R}^2 \mid x \geq d_R, y \geq d_T, x = \mathbb{E}\left[U_R(S;\theta)\right] - q_R,$$
$$y = \mathbb{E}\left[U_T(S;\theta)\right] - q_T, (q_R, q_T) \in \mathbb{R}^2_+, \theta \in \tilde{\Theta}\}.$$

The corresponding bargaining frontier is denoted by $BF(\tilde{\Theta})$, and the function expressing this frontier is denoted by $F(\cdot;\tilde{\Theta})$.

Because the mixed-type contract involves the maximization operator, directly characterizing the bargaining set is challenging. To derive the bargaining set induced by the mixed-type contract, I consider an auxiliary problem where the agents negotiate over affine contracts. Let $\Theta_r = \{(f, b, r) \in \Theta_o \mid b = 0\}$. Given a particular $\theta_r \in \Theta_r$, an affine rent structure is specified as $R(S;\theta_r) = f + rS$. I can then demonstrate that the bargaining set in this auxiliary problem is equivalent to the bargaining set in the original problem.

Lemma 1. *Under Assumption 1,* $BS\left(\Theta, (d_R, d_T)\right) = BS\left(\Theta_r, (d_R, d_T)\right)$.

Proof. See Appendix D. □

Hence, the bargaining frontier of this auxiliary problem is identical to that of the bargaining problem involving mixed-type contracts. The bargaining frontier is obtained by maximizing the tenant's expected utility, subject to the constraint that the negotiation representative's expected utility remains above a certain threshold level. I can derive a tractable expression of the bargaining frontier, as stated in Lemma 2.

Lemma 2. *I define cutoffs as follows:*

$$c_1 \equiv V_R\left(I + \frac{\mu^2}{2\sigma^2\rho_R} - \frac{1}{2\sigma^2\rho_R}\left(\frac{\rho_T+\rho_R}{\rho_T}\right)^2\left(\mu - \sigma^2\frac{\rho_T\rho_R}{\rho_T+\rho_R}\right)^2\right)$$
$$c_2 \equiv V_R\left(I + \frac{\mu^2}{2\sigma^2\rho_R} - \frac{1}{2\sigma^2\rho_R}\left(\mu - \sigma^2\frac{\rho_T\rho_R}{\rho_T+\rho_R}\right)^2\right)$$

Then, under Assumption 1, the Pareto frontier for the auxiliary problem is obtained as follows:

$$F(u_R;\Theta_r) = \begin{cases} V_T\left(J + \frac{\mu^2}{2\sigma^2\rho_T}\right) & \text{if } u_R < c_1 \\ V_T\left(J + (1-r^\star(u_R))\mu - \frac{\sigma^2}{2}\rho_T(1-r^\star(u_R))^2\right) & \text{if } c_1 \leq u_R < c_2 \\ V_T\left(J + I + \mu - \frac{\sigma^2}{2}\frac{\rho_T\rho_R}{\rho_T+\rho_R} + \frac{1}{\rho_R}\ln(-u_R)\right) & \text{otherwise} \end{cases}$$

where

$$r^\star(u_R) = \begin{cases} \frac{\mu - \sqrt{\mu^2 + 2\sigma^2\rho_R\left(I + \frac{1}{\rho_R}\ln(-u_R)\right)}}{\sigma^2\rho_R} & \text{if } \frac{\mu}{\sigma^2} > \frac{\rho_T\rho_R}{\rho_T+\rho_R} \\ \frac{\mu + \sqrt{\mu^2 + 2\sigma^2\rho_R\left(I + \frac{1}{\rho_R}\ln(-u_R)\right)}}{\sigma^2\rho_R} & \text{otherwise} \end{cases}$$

Proof. See Appendix D. □

I can compute the corresponding contract terms at every point on the frontier. The case where $c_1 \leq u_R \leq c_2$ corresponds to the scenario where $f = 0$: in other words, within this range, the contract term on the frontier is a perfect commission contract. This is illustrated in Figure 4, which shows two Pareto frontiers—one for perfect commission contracts and another for affine contracts under a specific set of parameter values. For the region where u_R is small, the affine contract is dominated by the perfect commission contract. Hereafter, I assume that R's utility at the breakup point is above c_2, which

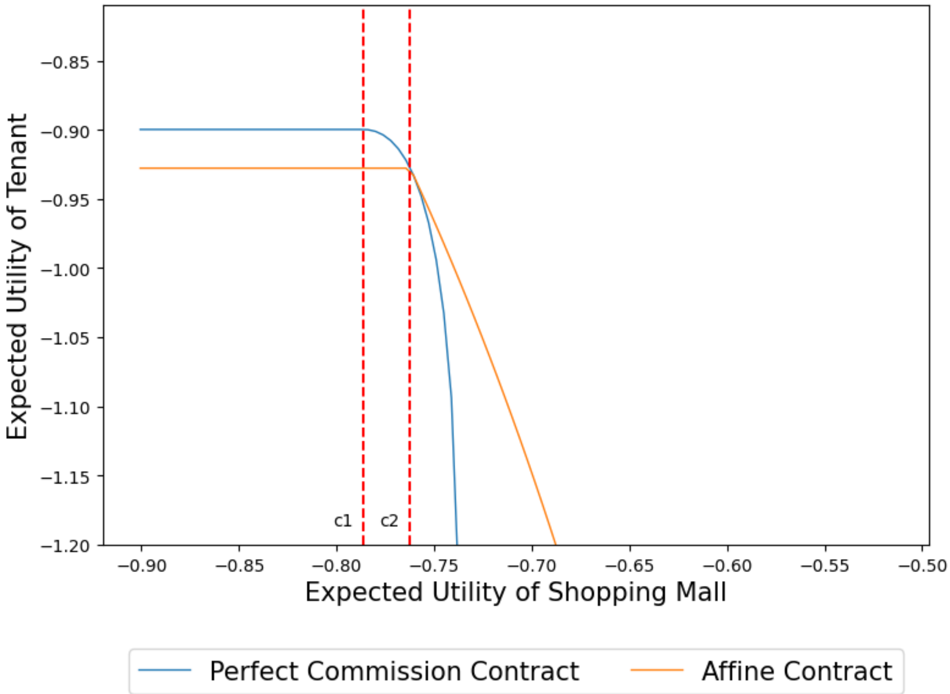


Figure 4. Pareto Frontiers for Perfect Commission Contracts and Affine Contracts

Note: Setting is as follows: $I = 1.0, J = 0.0, \sigma^2 = 2.0, \mu = 1.5$. The risk aversions are set to $\rho_M = 0.2$ and $\rho_T = 0.5$.

implies that the corresponding bargaining frontier is obtained as the orange line in Figure 4.[20]

Assumption 3. $d_R > c_2$

Proposition 1. *Under Assumption 1 and Assumption 3, the bargaining frontier is represented as follows:*

$$F(u_R) = -e^{-\rho_T\left(I+\mu-\frac{\rho_T\rho_R}{\rho_T+\rho_R}\frac{\sigma^2}{2}\right)}(-u_R)^{-\frac{\rho_T}{\rho_R}}. \tag{2}$$

Lastly I specify the breakup point $(d_R, d_T) = (V_R(cI), V_T(0))$. For the shopping mall, this assumption implies that the outside option at the time of termination, denoted by ψ, is no longer available once renewal negotiations begin.[21] If negotiations fail, the shopping

[20] Another possible assumption to ensure the bargaining frontier takes the orange line is assuming that μ is sufficiently high that there is no region where the perfect commission contract dominates the affine ones. Both assumptions assume that the retail space in the negotiation has good sales potential which can be naturally assumed given the fact that the renewal contract occurs only for the tenants selected by the shopping mall.

[21] I assume that the potential entrants secured at the timing of the termination decision have already entered the other retail space because the negotiation takes much time until reaching the agreement.

mall just collects rent from other tenants, adjusted by the constant c, which reflects the externality among tenants as previously noted. For tenants, since most of them operate only one location within the shopping area, it is reasonable to assume that the breakup point results in no gain.

Assumption 4. *$d_R = V_R(cI)$ for some positive constant c and $d_T = V_T(0)$.*

Nash bargaining solution The generalized Nash bargaining solution is characterized as the point where the slope of the bargaining frontier equals the slope of the generalized Nash product. In the current case, using (2), this condition is described in Proposition 2.

Proposition 2. *For any contract term $\theta \in \Theta$ obtained in the Nash bargaining solution when the bargaining power ratio is B^{RS} and the utilities at the breakup point are (d_R, d_T), the following condition is satisfied*

$$B^{RS}\frac{\mathbb{E}\left[U_T(S;\theta)\right] - d_T}{\mathbb{E}\left[U_T(S;\theta)\right]} = \frac{\rho_T}{\rho_R}\frac{\mathbb{E}\left[U_R(S;\theta)\right] - d_R}{\mathbb{E}\left[U_R(S;\theta)\right]}.$$

Under Assumption 2, we have the following condition

$$\frac{\mathbb{E}\left[U_T(S;\theta)\right] - d_T}{\mathbb{E}\left[U_T(S;\theta)\right]} = \frac{\mathbb{E}\left[U_R(S;\theta)\right] - d_R}{\mathbb{E}\left[U_R(S;\theta)\right]}. \tag{3}$$

It is noteworthy that the model is incomplete in the sense that there is a set of equilibrium mixed-type contracts and I do not assume any selection mechanism among them. This point is clearly shown in Lemma 1: for any mixed-type contract, there always is a counter part in affine contract which is also included in the space of mixed-type contracts.

Hereafter, I use $u_R(\mu)$ and $u_T(\mu)$ to denote the expected surplus attained in the equilibrium when μ is the mean of future sales under Assumption 2. By combining (2) and (3), I have the explicit form of them: where $\varrho = \frac{\rho_T\rho_R}{\rho_T+\rho_R}$,

$$\begin{aligned} u_R(\mu) &= -e^{-\varrho\left((c+1)I - \varrho\frac{\sigma^2}{2}\right)}e^{-\varrho\mu} \\ u_T(\mu) &= -e^{-\rho_T\left(I - \varrho\frac{\sigma^2}{2}\right) + \frac{\rho_T^2}{\rho_T+\rho_R}\left((c+1)I - \varrho\frac{\sigma^2}{2}\right)}e^{-\varrho\mu} \end{aligned} \tag{4}$$

From (4), it is easy to check that both expected surplus of R and T at the equilibrium increase with μ. This implies that the preferences of R and T are aligned in the sense that both of them prefer higher μ when making a contract. This is the direct cause of the authority division of the shopping mall side as I discuss in Section 4.1.3.

Corollary 1. $\frac{\partial}{\partial\mu}u_R(\mu) > 0$ *and* $\frac{\partial}{\partial\mu}u_T(\mu) > 0$.

4.1.2 Bargaining for earnings estimate

At this bargaining table, the two parties negotiate over the earnings estimate, μ, where the whole space of it is set to $\mathcal{M} \equiv \mathbb{R}_{++}$.

Bargaining set The utility of M is specified in (1). Using this, the utility of M given one μ and the contract term θ is set according to the solution of the following bargaining for risk sharing, denoted by $u_M(\mu)$, is specified as follows:

$$u_M(\mu) = u_R(\mu) - \lambda\left(u_R(\mu) - \hat{u}_R\right)^2.$$

Hence, the bargaining set is a subset of the locus of the pair of expected surplus $(u_M(\mu), u_T(\mu))$ by moving μ within $\mathcal{M}$:

$$\left\{(u_M(\mu), u_T(\mu)) \mid \mu \in \mathcal{M},\ u_M(\mu) \geq d_M,\ u_T(\mu) \geq d_T\right\}.$$

The utility of the manager at the breakup point is $d_M = V_R(cI) - \lambda(V_R(cI) - \hat{u}_R)$ and the same one of the tenant is $d_T = V_T(0)$ as in the case of bargaining for risk sharing.

When I use $F^{EE}(u_M)$ as a function representing the bargaining frontier of this set, $F^{EE}(u_M)$ is a concave decreasing function until some value of $u_M(\underline{\mu})$. This assures there is a conflict between the mall manager and the tenant side. In other words, T is presenting its sales potential to convince M, who believes that there is no benefit in raising the projected sales if it deviates from the reference point.

Lemma 3. $F^{EE}(u_M)$ *is a concave function for* $u_M < u_M(\underline{\mu})$ *where* $\underline{\mu}$ *is some value within* $\mathcal{M}$.

Proof. See Appendix D. □

Nash bargaining solution I present the characterization of the Nash bargaining solution in Proposition 3. As I mentioned above, u_R and u_T represent the surplus split in the following bargaining for risk sharing when μ is set to the Nash bargaining solution of the bargaining for effort enforcement.

Proposition 3. *At the Nash bargaining solution, the following equation holds:*

$$B^{EE} = -\frac{1-\lambda\left(u_R + d_R - 2\hat{u}_R\right)}{1-2\lambda\left(u_R - \hat{u}_R\right)}\frac{u_T}{d_T}\frac{d_R}{u_R},$$

where $\hat{u}_R$ is the reference utility.

Proof. See Appendix D. □

Furthermore, under Assumption 2, I can compute the shopping mall manager's expected surplus in equilibrium, which is used in the estimation process. For later use, I define a function to represent this equilibrium expected surplus as it depends on the bargaining power ratio: specifically, the right-hand side of Corollary 2 is defined as the function $u_R(B^{EE})$.

Corollary 2. *Under Assumption 2,*

$$u_R = \frac{\left(1+2\lambda\hat{u}_R\right)\left(1+B^{EE}\right) - \lambda d_R}{\lambda\left(1+2B^{EE}\right)}.$$

Proof. See Appendix D. □

4.1.3 Optimal institutional design

The structure of two-stage sequential bargaining is grounded in the optimal institutional design of the shopping mall side. If R is allowed to set μ without considering the past information such as $\hat{u}_R$, R and T tend to overestimate future expected sales because they prefer the higher expected sales as shown in Corollary 1. To prevent this situation, the shopping mall strategically divides authority as follows: the risk-sharing decision is delegated to the representative, R, while decision regarding the earnings estimate is handled by the manager, M.[22]

[22] This division of authority is also related to the classical assumption of delegated bargaining agents which works as a "microfoundation" for Nash-in-Nash solution. Although Collard-Wexler, Gowrisankaran and Lee (2019) provide another rationale of the Nash-in-Nash solution, it requires shrinking the time between bargaining periods. This is usually not the case in bargaining between firms.

4.2 Continuing decision

Let ψ denote the monetary value of the outside option for the targeted retail space. This captures the expected amount of rent collected from the new tenant. In this section ψ is given and I will explain how ψ is determined in Section 4.3.

The continuation decision is made in the following flow. First, ψ are realized, and then the representative computes the expected surplus that would be obtained in the renewal negotiation. If the expected surplus is smaller than $U_R(cI + \psi)$, the exit offer is made. Otherwise, both parties proceed to the renewal negotiation stage, and B^{EE} realizes. After this realization of the bargaining powers, the negotiation is resolved as outlined in Section 4.1. In other words, the continuation decision is made if and only if

$$\mathbb{E}\left[u_R\left(B^{EE}\right) \mid \psi\right] > -e^{-\rho_R(cI+\psi)}.$$

The expectation is taken with respect to the bargaining power ratio, B^{EE}, which is not fully known to the representative due to the information gap between the manager.

4.3 Search intensity

I describe how the value of outside option, ψ, is determined through the search behavior of the shopping mall management company. Note that I do not introduce a behavioral model describing the decision about the search intensity. Instead, I just specify the correlation structure between the search intensity and the value of the outside option to treat the endogeneity concern in the following empirical analysis.

In general, the value of the outside option is affected by the market demand for the retail space: in the local tenant leasing market, any vacant or occupied retail space is sought after by potential service providers. In the current case, each retail space in a shopping mall is also in demand by potential tenants, and this demand essentially constitutes the value of the outside option. Hence, I consider there are two components to determine the value of ψ: information regarding the retail space, denoted by $\tilde{\psi}$, and search intensity of the shopping mall, denoted by d.[23] I consider the following linear

[23]Note that as discussed in Section 2, the search by the shopping mall is separately conducted for every retail spaces.

model for the monetary value of the outside option:

$$\psi = \tilde{\psi} + \beta_o d.$$

5 Empirical strategy

The target of the estimation are categorized into four sets: (1) the parameters built into the model, e.g. risk aversions of the shopping mall and the tenants, (2) the parameters governing the bargaining power ratio, (3) the parameters relevant to the value of outside options and the search intensity, and (4) the distribution of unobserved disturbances. In Section 5.1, I introduce the definition of variables and the parameterized model. In Section 5.2, I describe how I estimate the parameters.

5.1 Parametrization

I use i to denote a tenant and k to denote a shopping mall. An ongoing contract between tenant i and mall k is indexed by contract number τ, starting from 1. Each contract has a duration in months, denoted by $T_{ik\tau}$. The monthly performance of tenant i in mall k during month t is represented by $\tilde{X}_{ikt}$ for all $t \in 1, \ldots, T_{ik\tau}$. For an ongoing contract, I measure its performance as the average monthly performance, denoted by $X_{ik\tau}$: in other words, $X_{ik\tau} =\equiv \frac{1}{T_{ik\tau}} \sum_{t=1}^{T_{ik\tau}} \tilde{X}_{ikt}$. Additionally, I calculate the monthly average of basic characteristics of the shopping mall and its tenants, such as the tenant's area and the total number of tenants in the mall, for use in the estimation.

The variables, in addition to the covariates mentioned above, are defined as follows: the initial wealth of shopping mall k when negotiating with tenant i for a new contract with contract number τ is represented by the average of the total monthly rents collected from other tenants in the mall during the period of the previous contract, $\tau - 1$. The term $\mu_{ik\tau}$ denotes the earnings estimate agreed upon by tenant i and mall k for the contract with contract number τ. Similarly, $\sigma^2_{ik\tau}$ represents the variance of the sales, which is considered stable over time. Therefore, $\sigma^2_{ik\tau}$ is set to the estimated variance from past sales data, denoted as $\hat{\sigma}^2_{ik\tau-1}$. The observed contract term is also indexed by (i, k, τ).

Note that the following parametrization applies independently to each shopping mall. The estimation is conducted separately for each shopping mall, meaning that all model parameters explained below take on distinct values for the two shopping malls included in the data. However, to avoid confusion in notation, we do not explicitly indicate that the parameters depend on the mall index k.

Built-in parameters I use ρ^k to denote the risk preference parameter of shopping mall k. For tenants, ρ_{ik} represents the risk preference parameter of tenant i in shopping mall k. I assume that this risk aversion does not change over time but can depend on the shopping mall which the tenant belongs to. Additionally, c_k denotes the coefficient associated with the initial wealth when calculating the wealth at the breakup point.

Parameters for balance of bargaining powers I parameterize the logarithm of the ratio of bargaining powers in the bargaining for earnings estimate as a linear function of a vector γ:

$$\ln B_{ik\tau}^{EE} = \mathbf{X}_{ik\tau}' \gamma + \varepsilon_{ik\tau}^{EE},$$

where $\mathbf{X}_{ik\tau}$ is the vector of the covariates defined above, and $\varepsilon_{ik\tau}^{EE}$ is an exogenous disturbance to the balance of bargaining power. The distributional assumption of $\varepsilon_{ik\tau}^{EE}$ will be specified later in conjunction with the other disturbance terms.

In my analysis, there are three covariates specific to the tenant: *tenant area*, *previous sales per unit area*, and *previous sales ranking per unit area*. Additionally, there are four variables related to the shopping mall: *previous total mall sales*, *total number of tenants*, *total number of customers*, and *monthly new tenant searches*.

Parameters for the value of outside options For each contract, I denote the value of outside option for the shopping mall by $\psi_{ik\tau}$ and the value excluding the increment from search behavior by $\tilde{\psi}_{ik\tau}$, as specified in Section 4.3. I consider two components of $\tilde{\psi}_{ik\tau}$: public information about the value of the retail space, observable by the researcher and denoted by $\mathbf{Z}_{ik\tau}$, and the unobserved demand for the retail space, denoted by $\varepsilon_{ik\tau}^{o}$. I assume a linear structure: $\tilde{\psi}_{ik\tau} = \mathbf{Z}_{ik\tau}' \gamma_o^{\psi} + \varepsilon_{ik\tau}^{o}$. The public information includes the shopping mall's total sales, total number of customers, total number of tenants, and space size—all of which are monthly averages observed during the contract period.

For the search intensity, $d_{ik\tau}$, I take care of the endogeneity concern: knowledge of a better outside option might reduce the incentive to engage in search behavior. For this purpose, I decompose the search intensity into two parts:

$$d_{ik\tau} = \tilde{d}_{ik\tau} + d_{ex,ik\tau},$$

where $\tilde{d}_{ik\tau}$ is the base line of the search intensity and $d_{ex,ik\tau}$ is some exogeneous shifter of the search intensity.

I assume that the basic search intensity, $\tilde{d}_{ik\tau}$, is composed of two terms: the observed component $\mathbf{Z}_{ik\tau}$ and an unobserved component, denoted by $\nu^o_{ik\tau}$. I assume a linear structure: $\tilde{d}_{ik\tau} = \mathbf{Z}'_{ik\tau}\gamma^d_o + \nu^o_{ik\tau}$. When $\mathbf{W}_{ik\tau}$ is a vector of instrumental variables, I assume a linear structure: $d_{ex,ik\tau} = \mathbf{W}'_{ik\tau}\delta$. Thus, the search intensity is expressed as follows:

$$d_{ik\tau} = \mathbf{Z}'_{ik\tau}\gamma^d_o + \mathbf{W}'_{ik\tau}\delta + \nu^o_{ik\tau}. \tag{5}$$

Lastly, I allow the unobserved terms, $\varepsilon^o_{ik\tau}$ and $\nu^o_{ik\tau}$, to be correlated and then $\tilde{\psi}_{ik\tau}$ and $\tilde{d}_{ik\tau}$ are not independent even when conditioned on the observable variables, $\mathbf{Z}_{ik\tau}$. Specifically, I assume that $\varepsilon^o_{ik\tau} = \kappa\nu^o_{ik\tau} + \tilde{\varepsilon}^o_{ik\tau}$ for some constant κ where $\tilde{\varepsilon}^o_{ik\tau}$ is an exogeneous disturbance.

As components of the exogenous shifter for search intensity, $d_{ex,ik\tau}$, I propose using realized sales and the number of customers in the retail space as instrumental variables. The rationale for this choice is that this information is confidential between the shopping mall and the tenant and is not accessible to potential tenants. As a direct measure of search behavior, I use the number of meetings held to search for new tenants. Since it is not possible to observe which meeting corresponds to which retail space, I compute the average number of monthly meetings for new tenant searches throughout the contract period. For $d_{ik\tau}$, I use the logarithm of this average value.

Parameters for disturbances In order to account for the selection of continuing tenants, I introduce a joint distribution for the unobserved disturbances in the balance of bargaining powers and the value of the outside option. For each contract, there are two random terms: $(\varepsilon^{EE}_{ik\tau}, \tilde{\varepsilon}^o_{ik\tau})$, where the former represents the random element in bargaining power ratio and the latter represents the disturbance in the value of the outside option. I assume that these terms are independently drawn for every contracts from a bivariate Gaussian distribution: $(\varepsilon^{EE}_{ik\tau}, \tilde{\varepsilon}^o_{ik\tau}) \sim N(0, \Sigma)$, where Σ is the estimation target.

5.2 Estimation and identification

The estimation consists of two steps: in the first step, the search intensity stage is estimated using the control function approach, and in the second step, the remaining parameters are estimated using maximum likelihood estimation under equilibrium constraints. Remember that, as I mentioned above, the estimation is conducted separately for the two shopping malls.

First step I adopt the control function approach (Petrin and Train, 2010; Wooldridge, 2015). I first regress (5) to obtain estimates of ν^o: this regression is conducted separately for the two malls. Then, in the subsequent structural estimation, I include the estimated $\hat{\nu}^o$ as a covariate in the model for the monetary value of the outside option: in other words, I use the following expression for the value of outside option

$$\psi_{ik\tau} = \mathbf{Z}'_{ik\tau}\gamma_o^{\psi} + \beta_o d_{ik\tau} + \kappa\hat{\nu}^o_{ik\tau} + \tilde{\varepsilon}^o_{ik\tau}.$$

This ensures that the variation in d, given the control variables and $\hat{\nu}^o$, arises from the exogenous variables $\mathbf{W}_{ik\tau}$. This exogenous variation allows us to identify β_o.[24]

Second step For each renewal negotiation, I observe the continuation decision, denoted by $\chi_{ik\tau} \in \{0, 1\}$, where $\chi_{ik\tau} = 1$ indicates continuation. I also observe the new terms of the leasing contract, $(f, b, r)_{ik\tau}$, which takes the value ϕ when $\chi_{ik\tau} = 0$; the set of covariates affecting the balance of bargaining power and the value of outside options, $\mathbf{X}_{ik\tau}$ and $\mathbf{Z}_{ik\tau}$; and the initial wealth of the shopping mall, $I_{ik\tau}$. I represent the tuple comprising these elements as $\mathcal{D}_{ik\tau} \equiv (\chi_{ik\tau}, (f, b, r)_{ik\tau}, \mathbf{X}_{ik\tau}, \mathbf{Z}_{ik\tau}, I_{ik\tau})$. Regarding the parameters, for a given shopping mall k, the complete set of parameters of interest is denoted by $\xi_k \equiv \left(\gamma, \gamma_o^{\psi}, \beta_o, \kappa, \Sigma, c, \lambda, \rho_k, \{\rho_{ik}\}_i\right)$.[25]

Since the new contract terms are unobserved in termination cases, the likelihood can be constructed similarly to a Tobit model: for termination cases, the likelihood represents the probability of a termination offer, while for renewal cases, it is the density of observing the new contract terms given that a renewal offer has been offered to the tenant. I write

[24] The similar usage of control function approach in structural estimation can be found in Agarwal (2015).

[25] Except for the risk aversions of both parties, I do not include the subscript k from the expressions. However, remember that all parameters can take distinct values for the two malls.

the likelihood function of both case by $L(\mathcal{D}_{ik\tau}; \xi_k)$.[26] The objective function for shopping mall k is the log-likelihood function of all observations within the mall k:

$$LL(\xi_k) = \sum_{(i,\tau)} \ln L(\mathcal{D}_{ik\tau}; \xi_k).$$

For each shopping mall, I maximize this objective function under the constraint that all the equilibrium surplus split attained in the observed renewal contract constitutes the Nash bargaining solution in the bargaining for risk sharing.[27] Hence, the estimator is one example of MPEC introduced by Su and Judd (2012). I try 500 estimations with different initial values which are sampled from the feasible regions and pick the estimate which attains the highest likelihood.

Identification Other than the risk aversion of the tenant, ρ_{ik}, and the endogeneous variable $\mu_{ik\tau}$, the parameters common across tenants are identified by the variation of the continuation decisions within a mall. The separation of $\mu_{ik\tau}$ is allowed because the bargaining power ratio B^{EE}, which determines $\mu_{ik\tau}$, is model primitive in the cooperative approach and I can directly parametrize it. The separation of ρ_{ik} is due to Assumption 2: the ratio of risk aversions cancels out with the bargaining power ratio, and the path through which ρ_{ik} would otherwise directly influence the equilibrium surplus split is eliminated.

Given the above identification of the parameters common across tenants, the remaining ρ_{ik} and $\mu_{ik\tau}$ are identified by the condition of the Nash bargaining solution. Equation 4 specifies the equilibrium surplus splits. For every renewal contracts, I can directly simulate the left hand sides using ρ_{ik} and $\mu_{ik\tau}$. Hence, the system has only two unknown variables. By solving the system, I identify the two parameters.[28]

[26] The detail form of the likelihood function is shown in Appendix E.

[27] As explained in Appendix E, the constraint that the surplus split satisfies the condition of the Nash bargaining solution in the bargaining for earnings estimate is automatically satisfied when constructing the likelihood function.

[28] In practical estimation, I set a risk aversion of a tenant for all the observed contracts. This setting stabilize the estimation whereas it is not necessary from the viewpoint of identification.

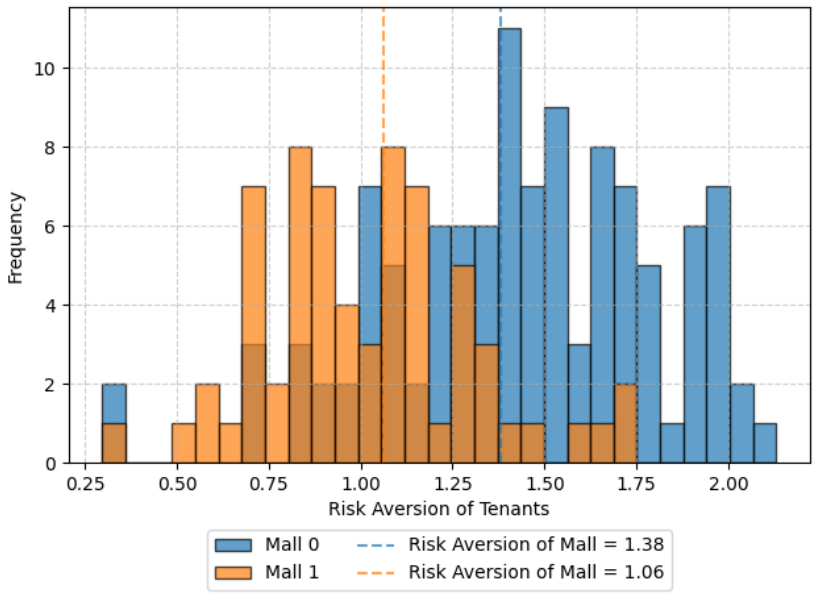


Figure 5. Histogram of Risk Aversions of Tenants by Malls

Note: Blue bars represent the tenants in mall 0 and orange bars represent the tenants in Mall 1. Along with the histograms of the estimated risk aversions of tenants, the dotted lines represent the estimated risk aversions of the two malls. The current value of risk aversion is obtained when I scale the rent by 1 billion JPY.

6 Results

I review the estimation results and the following counterfactual simulations. In Section 6.1, I present the estimated parameter values. Additionally, based on the estimation results, I clarify how the bargaining power ratio changes over time. In Section 6.2, based on the estimation results, I estimate the contract selection rules for the two malls. In Section 6.3, I conduct simulation analysis to examine how the terms of contract are affected in the fairer trade practices.

6.1 Decomposition of bargaining power ratio

Bargaining power ratios: Mall 0 is more privileged but more risk averse I begin by examining the estimates of risk aversion. Figure 5 presents histograms of the estimated risk aversion for each tenant. The dotted line represents the risk aversion of the shopping malls. The ranges of the estimated risk aversions are almost overlapping, which is expected since the tenants are not significantly different across malls. The risk aversion levels of the shopping malls fall within these ranges, being nearly equal to the

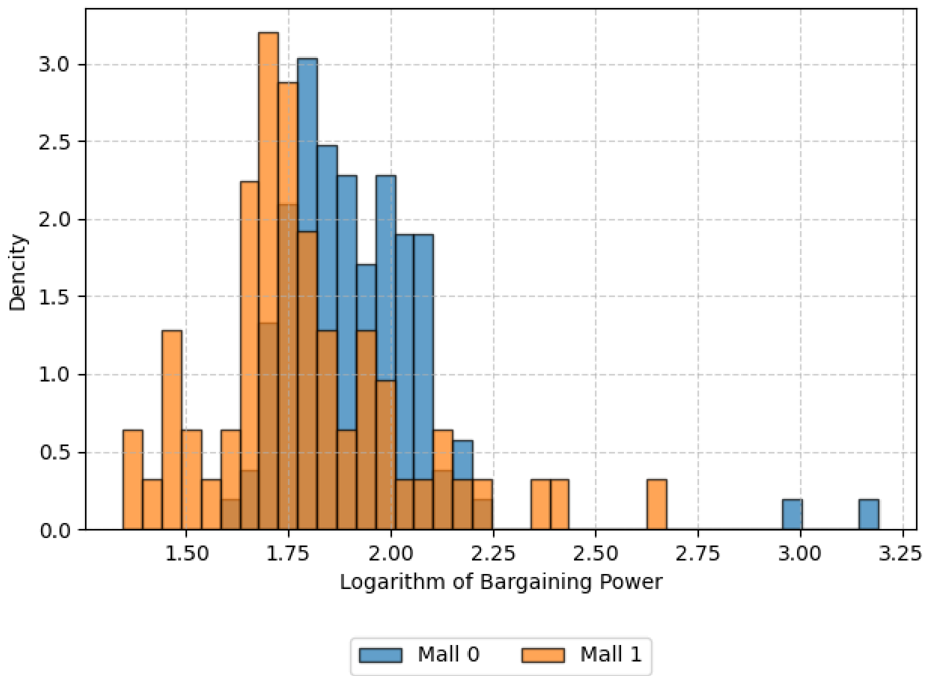


Figure 6. Histograms of Log of Bargaining Power Ratios for Earnings Estimate by Malls

Note: Blue bars represent the tenants in mall 0 and orange bars represent the tenants in Mall 1.

medians of the risk aversions of the tenants within each shopping mall. The two shopping malls are estimated to have different levels of risk aversion. Specifically, the manager of Mall 0 is more risk averse than one of Mall 1. This implies that, in the bargaining for risk sharing, Mall 0 stands in a relatively weaker position than Mall 1.

The model also allows us to assess the bargaining power ratio in bargaining for earnings estimate. This is informative another dimension of the bargaining positions. Figure 6 presents histograms of the logarithm of the balance of bargaining power for each tenant and the shopping mall to which they belong. Mall 0 exhibits a higher proportion of larger values compared to Mall 1, indicating that Mall 0 tends to hold a relatively stronger position in the bargaining for earnings estimate. [29]

The mall with greater bargaining power in earnings estimation holds a weaker position in risk-sharing bargaining due to its higher risk aversion. This relationship aligns with the disparity in potential between the two malls. Mall 0, situated in a high-traffic downtown

[29]The histogram of the corresponding value of earnings estimate are plotted in Figure A.3. In most cases, the earnings estimate is set higher than the observed averages while they do not increase as the realized average of sales rises. The earnings estimate tends to be set around a mall-specific constant: among the samples depicted in Figure A.3, the mean of the earnings estimate is 0.039 for Mall 0 and 0.019 for Mall 1.

area, exerts greater market influence than suburban Mall 1, likely explaining its stronger position in earnings estimation. Given this advantage, the earnings estimate is set at relatively lower values, as tenants are unable to persuade the mall manager to adopt higher estimates. Consequently, the mall cannot expect substantial rent from the commission component and instead prioritizes collecting a fixed rental amount, demonstrating a more risk-averse approach. Ultimately, privilege, as reflected in a higher B^{EE}, may lead to greater risk aversion, resulting in a lower B^{RS}.

Estimates of parameters common across tenants The estimates of the interesting parameters are summarized in Table A.1. First, I examine the parameters related to the balance of bargaining power. The higher a tenant's relative rank in terms of sales per unit area within the shopping mall, the more the balance of bargaining power shifts unfavorably for the mall. This dependence on the past performance measure raises the time-varying bargaining powers. As for the mall specific variables, the bargaining power of the mall strengthens when the number of tenants and the number of customers making purchases in the mall increase. About the tenant specific variation, larger store areas is correlated with a stronger position against the mall. All of these trends align straightforwardly with expectations.[30]

Regarding the parameter associated with the value of outside options, I find that increased tenant search intensity reduces the value of outside options. At first glance, this result may appear counterintuitive. However, it could be driven by the longer negotiation processes with potential entrants. When a shopping mall engages in more negotiations with prospective tenants, tenants can have ample opportunity to demonstrate their productivity.[31]

As for the disturbance structure, the estimates indicate a negative correlation between the error term in the value of outside options and the error term in the balance of bargaining power in the bargaining for earnings estimate. This suggests that retail spaces

[30] A natural question is whether the directly observed rank of tenants is a valid variable affecting the balance of bargaining power. It is well known that, in a shopping mall, certain types of tenants generate externalities that influence the number of customers and the sales of nearby tenants. A well-known example is anchor tenants, as studied in Gould, Pashigian and Prendergast (2005). In Appendix C, I explore such latent potential among tenants have influenced the balance of bargaining powers.

[31] Figure A.2 supports the hypothesis that longer negotiations benefit the tenant. Specifically, in renewal negotiations, focusing on cases that begin with an offer requiring some increase in the expected amount of rent, negotiations that do not result in such an offer tend to take longer. This suggests that extended negotiations work in favor of the tenant, as they are more likely to secure a better contract through discussions.

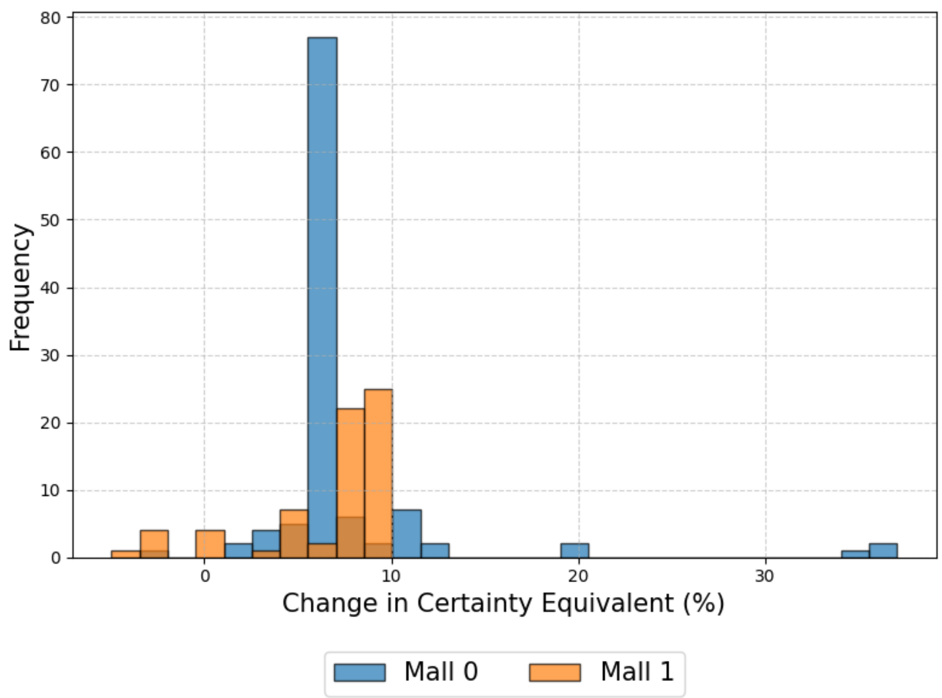


Figure 7. Change in Certainty Equivalence Relative to the Actual Surplus

Note: Blue bars represent the tenants in mall 0 and orange bars represent the tenants in Mall 1. These percentages are computed relative to the actually realized mall surplus.

with higher unobserved demand tend to be leased to tenants in stronger bargaining positions relative to the mall. This finding can be interpreted as evidence of selection: more desirable retail spaces are assigned to more stronger tenants.

Quantification of time-varying nature of bargaining positions I quantify the influence of the time-varying components of the balance of bargaining powers in the bargaining for earnings estimate. To measure the impact, I consider a counterfactual scenario where the balance of bargaining power remains constant over time. Using the estimated parameters, I calculate the counterfactual surplus split between the shopping mall and its tenants. By comparing this with the realized surplus split, I demonstrate how significantly the change in bargaining power over time affects this situation.

Specifically, when computing the expected value of logarithm of balance of bargaining power in the counterfactual scenario, I only include the constant term, the dependence on risk aversion, and fixed variables such as area. I then compute the surplus split and its certainty equivalent for the shopping mall under this counterfactual steady balance of bargaining power. Figure 7 shows the resulting change in the certainty equivalent of

Mall	(1) Both	(2) Mall 0	(3) Mall 1	(4) Mall 0	(5) Mall 1	(6) Mall 0	(7) Mall 1
Base	-0.000000661	0.000131	-0.000575	-0.000691	0.00307	-0.000517	0.00227***
	(0.000605)	(0.000670)	(0.00166)	(0.00200)	(0.00266)	(0.000785)	(0.000737)
Contract Number				0.00777*	-0.00545	0.00804	-0.00120
				(0.00453)	(0.00494)	(0.00488)	(0.00238)
Area				0.000183	0.000210	0.000149	0.000109
				(0.000319)	(0.000243)	(0.000114)	(0.000227)
Avg. Sales				-0.00106	-0.00296	0.00197***	0.00428***
				(0.000942)	(0.00292)	(0.000626)	(0.00116)
Var. Sales				0.00191	-0.0105	0.00123	-0.00277
				(0.00241)	(0.00640)	(0.000933)	(0.00297)
$\ln B^{EE}$						-0.0495***	-0.0330**
						(0.0164)	(0.0160)
$\ln B^{RS}$						0.124***	0.102***
						(0.0170)	(0.0140)
N	152	90	62	90	62	90	62
adj. R^2	-0.007	-0.011	-0.014	-0.015	0.072	0.702	0.852

Table 3. Tradeoff between Rate and Base

Note: Standard errors in parentheses. * p<0.1, ** p<0.05, and *** p<0.01. In all columns, the dependent variable is Rate (%). The number of samples change by which mall is used. Base is measured in the unit of 1 million JPY. The average and variance of the sales are computed by the realized sales in the last contract period.

the surplus splits compared to the actual situation. In this measure, the influence of past performance ranges from 0% to around 30%, with most changes concentrated around $5 \sim 10\%$.[32] This simulation also indicates that the change is almost always positive for both Mall 0 and Mall 1. In other words, as the balance of bargaining power adjusts over time, the shopping mall's strength at the bargaining table decreases.

6.2 Inspection of contract terms

Importance of controlling for bargaining power ratio To begin with, I insist that the balance of bargaining power affects the contract terms in critical way. Its importance is easily highlighted when checking the interrelationship between contract terms. As discussed in Section 2, Base and Rate should be positively correlated because the lower rate is often traded off with the higher threshold value. Table 3 presents several regression analysis about the relationship between the value of Rate and Base: where I regress Rate

[32]Figure A.4 presents the change in surplus in percentage terms for both Mall 0 and Mall 1, based on the realized surplus. The change is relatively small, from 0% to 8%.

on Base and set of covariates. In contrast to the anecdotes, the first five columns show no significant positive relationship between them.

However, when I account for the estimated balance of bargaining powers for earnings estimate and risk sharing in the last two columns, I observe that Mall 1 compensates a lower Rate with a lower Base. Additionally, for both shopping malls, the positive coefficients associated with average sales align with intuition: higher tenant sales lead to a higher Rate, given the same Base value. Moreover, the fit of the model, measured by the adjusted R squared, significantly improves in the last two columns, which also indicates the importance of controlling the balance of bargaining powers when analyzing the determination of terms of contract.

Empirical analysis on contract selection rule Based on the importance of controlling for bargaining power ratios when inspecting the contract terms, I leverage the estimation results to examine how the balance of bargaining powers between parties and the other covariates like sales performance shapes the detail contract terms. Due to the model's incompleteness regarding the combination of contract terms, analyzing these determinants corresponds to investigating the "contract selection rule", which is assumed to be common for all the tenants in the same mall. I use a Seemingly Unrelated Regression (SUR) model to estimate the contract selection rule. The outcome variables are the contract terms, including Fixed, Base, and Rate, all of which are expressed in logarithmic form. The regressors include the bargaining power ratio in the two bargaining tables, along with other covariates such as contract number, average sales in the previous period, and the variance of sales in the previous period.

The estimation results are summarized in Table A.2 for Mall 0 and Table A.3 for Mall 1. A common pattern observed is that the Base decreases when the shopping mall holds a stronger position, which is typically accompanied by a reduction in the Rate and Fixed. The rationale behind these patterns are as follows. When the mall is weaker in the bargaining for earnings estimate, the mall is likely to accept the opinion of the tenants: i.e., the earnings estimate is set to the higher value. This improvement in the future earnings naturally allows the higher amount of fixed amount of rent. At the same time, this increase in the fixed component is in exchange for the smaller probability of yielding commission component by leveling up Base. This compensation makes the higher earnings estimate look beneficial to the tenant. These results indicate that it is an empirical question how the total amount of rent and its variance will change in the different power balance.

The bargaining power ratio for risk sharing, denoted as B^{RS} and set to the inverse of risk aversions, increases Rate in both malls. This is because a more risk-averse tenant dislikes the fixed component of rent and is more likely to accept an increase in the variable component in exchange for a reduction in the fixed component.

Interestingly, the two malls appear to adopt different contract selection rules in particular regarding the use of realized sales history. Given the two balances of bargaining powers, Mall 0 tends to set a higher Fixed when sales are more volatile, whereas this higher Fixed is in exchange for a higher Base. In contrast, Mall 1's contracts do not account for sales variance. Instead, the level of sales is reflected in the contract terms: higher average sales lead to a higher Base and a higher Rate. Furthermore, the coefficients associated with the contract number indicate the basic strategy for contract adjustments over time. Mall 0 starts with a low Rate and gradually increases it over time while keeping the Fixed steady, whereas Mall 1 gradually increases the Fixed while maintaining a steady Rate.

The difference in contract selection rules aligns with the risk attitudes of the two malls. The more risk-averse mall, Mall 0, emphasizes the fixed component of rent at the beginning and responds sensitively to sales fluctuations when renewing contract terms. In contrast, the less risk-averse mall, Mall 1, focuses on the commission component of rent and does not react to fluctuations but instead reflects only the level of realized sales. I believe this correspondence arises because the contract selection rule itself is shaped by the mall manager's risk attitude. Therefore, when simulating counterfactual contracts under different levels of risk aversion, it is crucial to adjust the contract selection rule accordingly.

6.3 Counterfactual simulation of fair trade

I consider the following situation: the regulatory authority considers Mall 0, which is located in high-traffic area, potentially abuses its privilege to enforce its opinion on the tenants in it when making a contract. Through warnings and investigations, the regulatory authority tries to secure the more fair trade practice by inducing the more balanced relationship between tenants. As stated above, it is an empirical question how the total amount of rent and its variance will change after such intervention into the power balance.

Further complications may arise from the mall manager's potential response to this intervention: the mall manager of Mall 0 may become less risk-averse. As stated in Section 6.1, this inverse relationship between the risk aversion and the bargaining position in the earnings estimation is supported by the estimation results. Furthermore, as discussed in Section 6.2, this shift in risk aversion is accompanied by a change in the contract selection rule: all else equal, the mall manager becomes more willing to take risks when forming contracts by allowing a larger portion of the rent to be based on the commission component. These unexpected changes will also affect both the total rent amount and its variance.

I simulate three counterfactual cases for contract terms and rent collection in Mall 0. Case 1 aims to replicate the actual contracts and rent collection in Mall 0. In this case, I set $B^{EE}_{ik\tau}$ to the recovered values and compute the contract terms using the estimated contract selection rule of Mall 0. This serves as a validation of the estimation results. Case 2 simulates the expected outcomes of an intervention by the authorities. Specifically, the intervention imposes the same rule for generating B^{EE} in Mall 0 as in Mall 1. That is, the counterfactual logarithm of $B^{EE}_{ik\tau}$ in Mall 0 is set to $\mathbf{X}'_{ik\tau}\hat{\gamma}^1$, where $\hat{\gamma}^1$ is the estimate obtained from Mall 1's data.[33] Risk aversion and the contract selection rule remain unchanged. In Case 3, I assess the effects of adjusting Mall 0's manager's risk attitude. In addition to the change in $B^{EE}_{ik\tau}$ as in Case 2, the manager's risk aversion level is set to that of Mall 1's manager, and the contract selection rule is also aligned with that of Mall 1. Details of the counterfactual simulation procedure are provided in Appendix C.8.

Simulation results First of all, I examine the reduction in $B^{EE}_{ik\tau}$ by imposing Mall 1's method of constructing bargaining power in earnings estimation. Although the absolute values themselves have no inherent meaning, I report the average values of $\ln B^{EE}$ for the three cases: Case 1 is 1.897, Case 2 is 1.649, and Case 3 is 1.513. Thus, in both counterfactual cases, the intervention is expected to reduce the mall's bargaining power.

Figure 8 summarizes the simulation results. The left panel presents the simulated monthly rents for the three cases as a percentage of the actual rent collected in the same month in Mall 0. The right panel displays the share of the commission component in the total rent for each month in the dataset across the three cases. The blue line with circle markers represents the results of Case 1. Since the line remains close to 100% across all

[33] I omit the mean-zero disturbance term when computing the logarithm of B^{EE}. In other words, I use the expected value of $\ln B^{EE}$ in this counterfactual simulation.

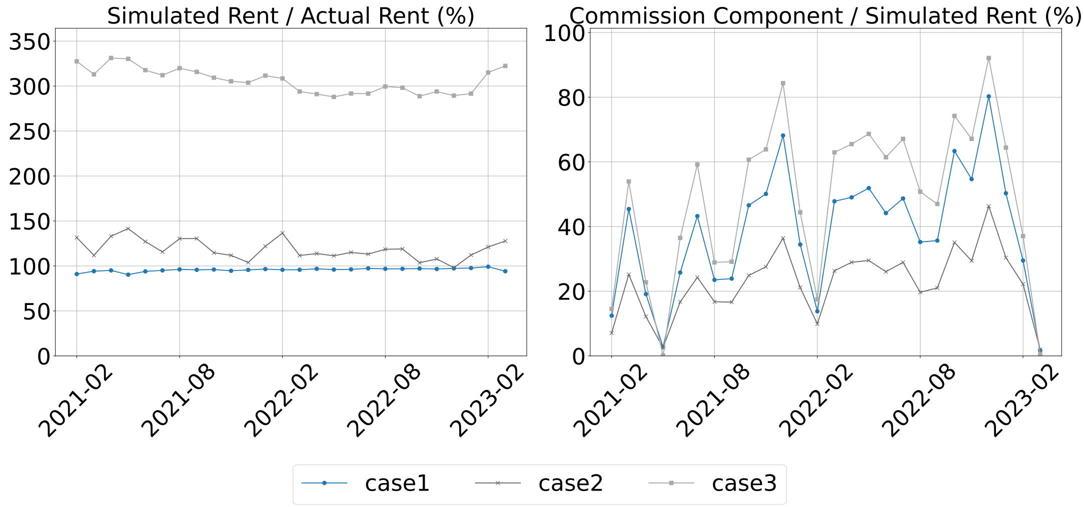


Figure 8. Monthly Rents and Share of Commission Component

Note: Case 1 simulates the observed contract terms, shown in blue with circle markers. Case 2 simulates a fairer scenario, depicted in thick gray with cross markers. Case 3 simulates a fairer scenario with Mall 0's risk attitude adjusted, shown in light gray with square markers. The left panel displays monthly rent for the three cases as a percentage of actual rent, while the right panel illustrates the share of the commission-based component in rent for each case.

months, the estimation aligns well with the data: in other words, Case 1 nearly replicates the actual rent collection.

The first finding is that Case 2 increases the total rent collected in Mall 0 in comparison with Case 1. As highlighted in the right panel, this increase is primarily driven by a rise in the fixed component of rent. As mentioned earlier, a decrease in $B^{EE}_{ik\tau}$ leads to a higher earnings estimate, often allowing for a higher fixed rent component in exchange for a higher base rent. Under the current setting, this adjustment results in a higher total rent and a greater share of the fixed component. Although the decrease in $B^{EE}_{ik\tau}$ increases tenant surplus, it is natural for the authority to consider these observable changes suggest that the current case should not be the target of intervention.

The second finding is that the adjustment in risk aversion by the manager of Mall 0 significantly increases the total rent collected. In comparison with Case 1, the collected rent is nearly three times higher each month throughout the period. As highlighted in the right panel, this increase is driven by a shift toward more commission-based contracts: Case 3 frequently shows that over 50% of the rent comes from the commission component. Although, as stated above, the current setting assumes no intervention by the authorities to begin with, such an intervention could lead to an unexpectedly adverse outcome from the tenant's perspective: a substantial increase in rent collection. This result underscores the need for authorities to consider the potential adjustment in risk attitudes following an intervention before implementing any policy measures.

7 Conclusion

This study proposes a model of bargaining over contracts where payments are determined not by a one-time price but by a share-based agreement. I apply this model to shopping mall tenant contracts, where monthly rent includes both a fixed and a commission-based component. Using actual contract and sales data, I estimate the model to decompose the sources of bargaining power between malls and tenants and to identify contract patterns arising from power imbalances. The results reveal complex effects of fair trade enforcement on rent levels and composition. Notably, when the mall manager's risk attitude adjusts to a fairer setting, total rent could triple, despite a decrease in the share of fixed component.

The retail space leasing agreements analyzed in this paper are just one example, and the central point of this study—namely, that a more detailed empirical investigation of contract terms can be achieved by considering the power balance between the parties—applies to a wide range of cases. In the literature, insurance contracts are frequently studied, but there are numerous other cases, such as leasing agreements or contracts between sports players and teams, where the contents of the contracts are diverse and difficult to handle in empirical research. Exploring these types of contracts is one potential future direction. When considering such extensions, it might become essential to incorporate moral hazard into the model. Whereas the importance of power dynamics between parties under moral hazard is already well recognized in the theoretical literature, the findings of this study suggest that this aspect must also be seriously considered in empirical research.

Another issue that this paper does not address is the team problem. In shopping malls, sports teams, and even regular companies, it is common to make contracts with multiple agents simultaneously. When these contracts are interrelated through externalities, rather than being independent, adjusting contract terms to manage incentives becomes more complex. In fact, some papers, such as Gould, Pashigian and Prendergast (2005), have pointed out the existence of the team problem in shopping malls leasing operation. It is natural that the Nash-in-Nash framework could be a valuable tool for analyzing such situations.

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A Examples of Unfair Lease Contracts in Shopping Malls

This section summarizes reported cases in which shopping mall operators exerted strong bargaining power against their tenants, leading to alleged unfair or anti-competitive lease contracts. Several jurisdictions and their corresponding regulatory responses are highlighted. Unfair lease contracts in this context typically refer to contractual clauses or negotiation practices that either constrain tenants' freedom to operate, impose burdensome costs, or hinder competition in a manner deemed excessive or abusive by relevant competition authorities.

A.1 United States

FTC Antitrust Actions (Exclusivity Clauses) In the 1970s, the U.S. Federal Trade Commission (FTC) took action against shopping center developers and anchor tenants for lease clauses that stifled competition. Notably, consent decrees (e.g. Tysons Corner Regional Shopping Center case, 1975) barred major department store anchors from using exclusivity provisions to block competitors. These orders prohibited anchors from excluding rival department stores or discount retailers, setting quotas on tenant types, limiting what products other stores could sell, or imposing restrictions like rights of first refusal and bans on certain advertising.[34] The FTC recognized such restrictive covenants as unfair methods of competition, and developers/anchors agreed to remove them. These early cases set a precedent that overly restrictive mall leases can violate antitrust laws.

Recent FTC Intervention While outright antitrust cases involving malls are less common in recent years, the FTC will act if a mall's contracts threaten competition. For example, in 2010 the FTC challenged Simon Property Group's acquisition of a rival outlet mall operator. To settle the charges, Simon had to modify tenant leases and drop anti-competitive clauses. The FTC's order required Simon to remove "radius" restrictions that prevented its retail tenants from opening stores in other nearby outlet centers.[35] By forcing Simon to strike these clauses (and divest some properties), the FTC preserved

[34] See, for example, *Shopping center legal update* published by International Council of Shopping Centers: `https://x.gd/zRPRz`

[35] See `https://x.gd/Pjt8e`.

competition, ensuring tenants could open new shops in competing outlet malls. This illustrates that if a dominant mall owner uses lease terms to lock in tenants or keep out rivals, U.S. regulators may intervene.

Tenant Lawsuits Tenants themselves have also fought back via litigation when mall owners imposed harmful changes. A landmark case was Lord & Taylor vs. White Flint Mall (Maryland). The mall's owner sought to redevelop and effectively close an aging mall, despite a contractual obligation to keep it operating as an enclosed shopping center until 2040. Lord & Taylor, an anchor tenant, sued for breach of contract. In 2015 a jury awarded the retailer $31 million in damages, agreeing the mall's redevelopment violated the lease agreement.[36] This case shows that courts will enforce lease terms and penalize landlords for unilateral changes that harm a tenant's bargained-for rights. It served as a cautionary tale for developers to honor lease conditions and not force changes on tenants without consent.

A.2 European Union

In the EU, shopping mall lease clauses have come under scrutiny for anti-competitive effects, but each case is judged on its facts. An example is the Maxima Latvija case (Court of Justice of the EU, 2015), which examined a clause giving an anchor supermarket the right to approve any new competing tenants in the mall.[37] The court held that such a clause is not automatically illegal under EU competition law. Instead, authorities must assess its actual market impact. The judgment set a two-stage test: (1) determine if the clause significantly closes off the market to new entrants (e.g. other retailers), and (2) if so, whether the clause's duration and market context make the foreclosure appreciable. In other words, mall lease exclusivity clauses are not per se unlawful in the EU, but they can be deemed anti-competitive if they materially hinder access for competitors. This approach, echoed by EU regulators and guidance in member states, means an anchor-tenant veto or exclusivity arrangement could violate Article 101 TFEU if it appreciably reduces retail competition in the area.

[36] See, for example, `https://x.gd/w4TAC` for a report on this issue.

[37] The case is listed in `https://x.gd/EuSbh`. And you can find a report on this case by Wolters Kluwer `https://x.gd/KReCa`

A.3 Japan

In Japan, the Antimonopoly Act bans "unfair trade practices," including abuse of superior bargaining position by powerful companies in dealings with weaker parties. This provision often applies to large retailers or mall operators versus their tenants or suppliers. A recent example is the case of Atre, a shopping mall operator (JR East subsidiary). In 2024–2025, Atre unilaterally changed its contracts to require mall tenants to shoulder a portion of the costs for JR East's customer reward program ("JRE Points"). Around 800 tenant shops were told their lease terms would change so that from April 2025 they must pay part of the point system operating expenses.[38] The Japan Fair Trade Commission (JFTC) investigated and concluded that Atre's one-sided imposition of new fees without consulting tenants likely constituted an abuse of its superior position – an unfair trade practice under the law. In response, Atre scrapped the plan before implementation, and the JFTC announced it would issue a formal warning to Atre. (A warning indicates the JFTC found a probable violation; while no fine was imposed in this instance, it puts the company on notice.) The JFTC criticized the fact that Atre, as the dominant party, unilaterally pressed a disadvantageous contract change onto dependent tenants. This case highlights Japan's regulatory stance: forcing contract terms that unfairly shift costs or burdens to weaker business partners is illegal.

A.4 South Korea

In South Korea, the Fair Trade Commission (KFTC) actively polices large retail landlords under the Large Retailers Act and competition law. A notable recent enforcement (November 2023) penalized four major outlet mall operators – Lotte Shopping, Shinsegae Simon, Hyundai Department Store, and Han Moo Shopping – for unfairly forcing tenants to pay promotion costs. According to the KFTC, these companies organized big sales events in 2019–2020 and passed on a total of ₩588 million (≈$420,000) in marketing expenses to their store tenants without prior agreement.[39] Hundreds of tenant shops were told to bear part of the discounts and advertising costs for events like "Members Day" sales, even though the events were planned by the mall owners themselves. The antitrust agency found this practice illegal because the tenants had not consented in advance and essentially had no choice but to pay. In response, the KFTC imposed fines totaling ₩648

[38] Several news site reported this issue : for example, you can find it in `https://x.gd/N3eyb`.

[39] You can find a report on this issue in `https://x.gd/kdDin`.

million on the four firms (Lotte received the largest fine). An official noted it was the first crackdown on such cost-shifting in landlord-tenant dealings, signaling that the industry's top players were put on notice. The KFTC emphasized that shifting financial burdens to tenants unilaterally is a clear breach of fair trade law. They stated that in these cases tenants were "de facto forced" to accept the mall's demands. Following the sanctions, the KFTC vowed to step up monitoring of major shopping centers to protect tenant rights. This action in Korea aligns with a broader principle: large shopping mall operators must not leverage their power to impose unfair fees or terms on the small retailers operating within their facilities.

A.5 Singapore

Singapore has moved to address long-standing complaints from retail tenants about one-sided lease terms in shopping centers. For years, small retailers in Singapore lamented that leasing deals heavily favor landlords (e.g. lock-in periods, arbitrary rent formulas, tenants bearing legal fees). In response, the government in 2021 introduced a Fair Tenancy Industry Code of Conduct, with plans to give it legal force.[40] The code, developed by a committee of landlords and tenants, lays out principles to eliminate unfair contract terms in retail leases. For example, it mandates transparent, single-formula rent structures: a landlord cannot charge rent using two formulas and pick the higher result, which had been common practice. Previously, many mall leases had both a base rent + percentage of gross sales clause and a pure percentage-of-sales clause, with tenants paying whichever amount was greater. The code now requires using one formula or the other, preventing an unfair scenario where the tenant always ends up paying the maximum.

The code also balances termination rights: a landlord may terminate a lease early only for substantial redevelopment of the property, and tenants are granted the ability to early-terminate if they lose their franchise or go insolvent – situations outside the tenant's control. This corrects the prior imbalance where landlords could break a lease with minimal cause, while tenants were effectively locked in for the full term. Another provision is that the landlord must bear the legal costs of preparing the lease document unless the tenant requests non-standard alterations), since historically even though the landlord drafted the contract, the tenant had to pay for it.

These guidelines were initially voluntary, but the Singapore government stated it

[40] I refer a report on this issue: `https://x.gd/qEWWf`.

would legislate them to ensure compliance. A Fair Tenancy Act is expected to enshrine these rules, making the code binding. In the interim, a Fair Tenancy Industry Committee was set up to monitor adoption and mediate disputes. Notably, during the COVID-19 pandemic, an alliance of over 700 retailers came together to demand better terms, which added momentum to these reforms. The outcome in Singapore is a significant shift toward regulating mall lease contracts: ensuring they are negotiated on more equal footing and preventing landlords from unilaterally imposing harsh conditions. It demonstrates a public-private effort to standardize fairer leases, in lieu of adversarial litigation – essentially preempting "unfair contract" abuses through a mix of industry agreement and government mandate.

B Additional explanations, figures and tables

B.1 General rent structures

The general form of rent structure is defined by a set of parameters: *Fixed*, which represents the fixed amount of rent; a set of *Base*'s, which are the set of thresholds at which the commission rate changes; and a set of *Rate*'s, which are the commission rate applicable between these thresholds. A rent structure with K kinks is characterized by $K+2$ bases and $K+1$ rates. I denote the bases by Base_i for $i = 0, 1, \cdots, K+1$, and the rates by Rate_i for $i = 1, 2, \cdots$, where $\text{Base}_0 = 0$ and $\text{Base}_{K+1} = \infty$. Based on them, the rent is computed as follows

$$
\begin{aligned}
\text{Rent} =& \text{Fixed} \\
&+ \sum_{i=1} 1\left\{Sales \in [\text{Base}_{i-1}, \text{Base}_i]\right\} \\
&\times \left\{\text{Rate}_i \times (\text{Sales} - \text{Base}_{i-1}) + \sum_{j=1}^{i-1} \text{Rate}_j \times (\text{Base}_j - \text{Base}_{i-1})\right\}.
\end{aligned}
$$

.

I have a total of 619 contracts. As shown in Figure A.1, these contracts are qualitatively grouped based on the values of the parameters—Fixed, Bases, and Rates—into eight distinct groups, with the number of contracts in each group indicated at each leaf of the figure. I name the four major types of contracts: perfect-commission contract, fixed-rent contract, mixed-type contract, and dual-kinked contract.

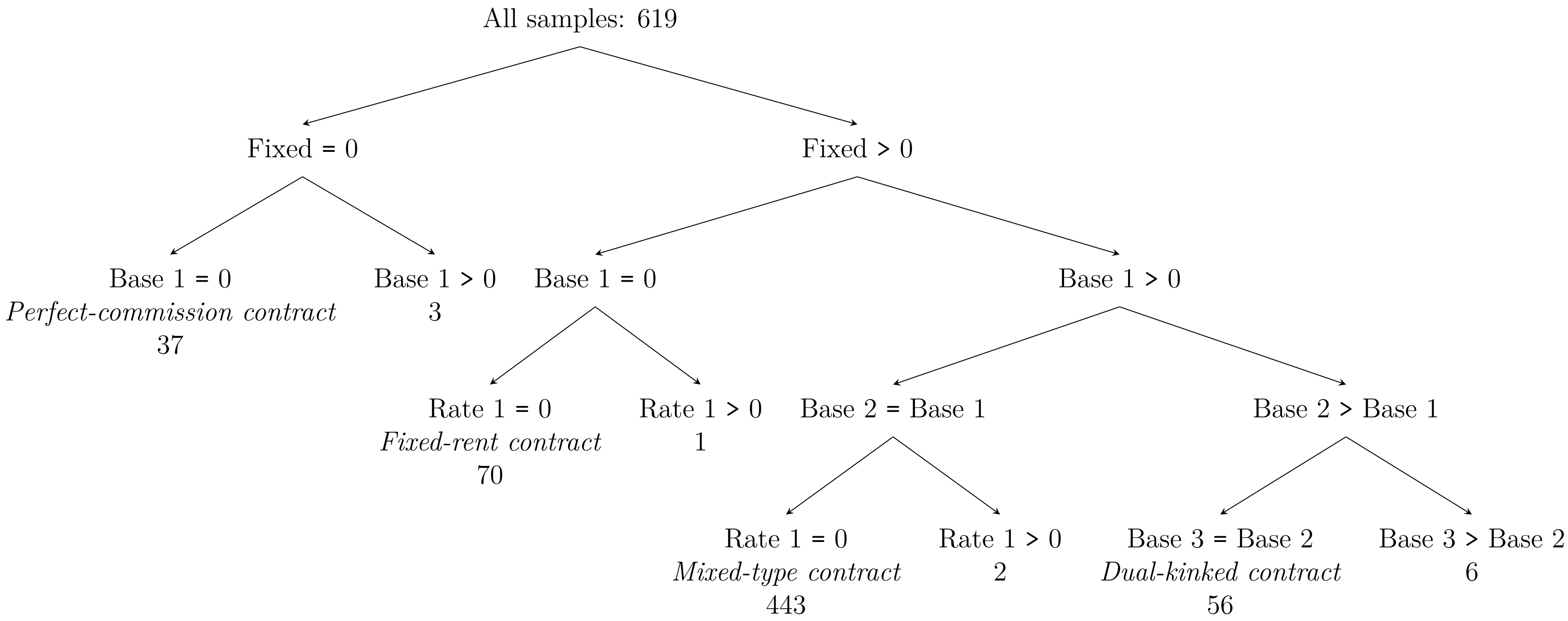

Figure A.1. Group of Contracts

Note: This figure illustrates the hierarchical structure of contracts across 618 samples. The tree splits samples based on Fixed, Bases and Rates, with nested conditions on additional variables (Base 1, Base 2, Base 3, and Rate 1). Each branch represents distinct contract groups, showing how various base and rate parameters define the segmentation. The numbers on each node represent the number of contracts in each subgroup.

	Mall 0	Mall 1
Panel 1: Built-in parameters		
ρ_M	1.381	1.062
	(0.000)	(0.000)
ρ_i^{exit}	1.816	2.285
	(0.000)	(0.000)
Panel 2: Balance of bargaining powers		
constant	−0.196	0.327
	(0.000)	(0.000)
Log # of Tenants	0.209	0.270
	(0.000)	(0.000)
Log Total Customer	0.205	0.103
	(0.000)	(0.000)
Observed rank (% from the Above)	0.758	0.067
	(0.000)	(0.000)
Area	−0.434	−0.503
	(0.000)	(0.000)
Panel 3: Value of outside options		
constant	−0.423	−0.298
	(0.000)	(0.000)
Log new tenant search	−0.049	−0.102
	(0.000)	(0.000)
Residual in First Stage	0.100	0.409
	(0.000)	(0.000)
Panel 4: Disturbance		
σ_o	0.000	0.016
	(0.000)	(0.000)
σ_u	0.002	0.007
	(0.000)	(0.000)
Correlation	−0.317	−0.828
	(0.000)	(0.000)

Table A.1. Estimates of the Structural Model by Malls

	(1)			(2)			(3)		
	Rate	Base	Fixed	Rate	Base	Fixed	Rate	Base	Fixed
Contract Number	0.00840*	-0.354	-0.0250	0.00782*	-0.0735	0.00493	0.00807***	-0.0602	0.00526
	(0.00435)	(0.339)	(0.0486)	(0.00455)	(0.292)	(0.0463)	(0.00244)	(0.286)	(0.0454)
Area	0.0000762	0.134***	0.00923***	0.000120	0.0921***	0.00459***	0.000105	0.0857***	0.00468***
	(0.000111)	(0.00863)	(0.00124)	(0.000160)	(0.0103)	(0.00163)	(0.0000901)	(0.0106)	(0.00168)
Avg. Sales				-0.00102	-0.0573	0.000418	0.00204***	-0.135	0.00922
				(0.00114)	(0.0729)	(0.0116)	(0.000720)	(0.0843)	(0.0134)
Var. Sales				0.00147	0.631***	0.0574***	0.000881	0.671***	0.0552**
				(0.00215)	(0.137)	(0.0218)	(0.00116)	(0.136)	(0.0216)
$\ln B^{EE}$							-0.0480***	-2.987*	-0.0569
							(0.0136)	(1.590)	(0.253)
$\ln B^{RS}$							0.125***	-2.154	0.341
							(0.0121)	(1.416)	(0.225)
N	90	90	90	90	90	90	90	90	90

Table A.2. Estimation results of contract selection rule (Mall 0)

		(1)			(2)			(3)	
	Rate	Base	Fixed	Rate	Base	Fixed	Rate	Base	Fixed
Contract Number	0.000532	-0.477	0.0494	-0.00494	0.164	0.0910	-0.000441	0.335	0.144***
	(0.00615)	(0.433)	(0.0611)	(0.00612)	(0.326)	(0.0595)	(0.00254)	(0.320)	(0.0535)
Area	-0.0000297	0.0773***	0.00558***	0.000353*	0.0466***	0.00501***	0.000121	0.00507	-0.00616*
	(0.000157)	(0.0110)	(0.00156)	(0.000189)	(0.0101)	(0.00184)	(0.000157)	(0.0198)	(0.00330)
Avg. Sales				-0.00152	0.469***	0.0161	0.00533***	0.461***	0.0274
				(0.00217)	(0.115)	(0.0211)	(0.000962)	(0.121)	(0.0202)
Var. Sales				-0.0115	-0.346	-0.0422	-0.00307	-0.130	0.0299
				(0.00769)	(0.410)	(0.0749)	(0.00321)	(0.404)	(0.0675)
$\ln B^{EE}$							-0.0400***	-3.086**	-0.874***
							(0.0101)	(1.275)	(0.213)
$\ln B^{RS}$							0.0985***	-1.350	-0.157
							(0.00789)	(0.994)	(0.166)
N	62	62	62	62	62	62	62	62	62

Table A.3. Estimation results of contract selection rule (Mall 1)

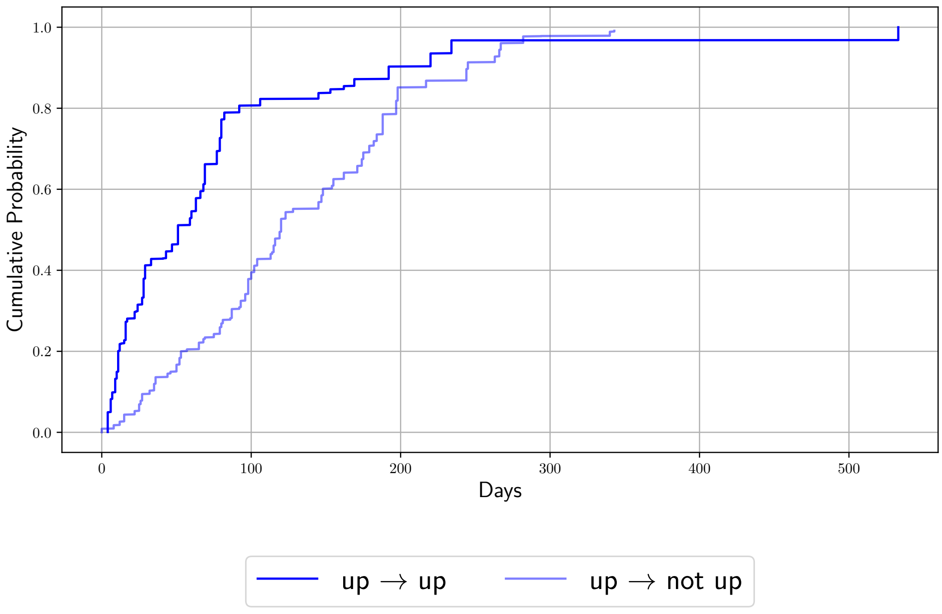

Figure A.2. Empirical Cumulative Distribution Functions of Length of Negotiations

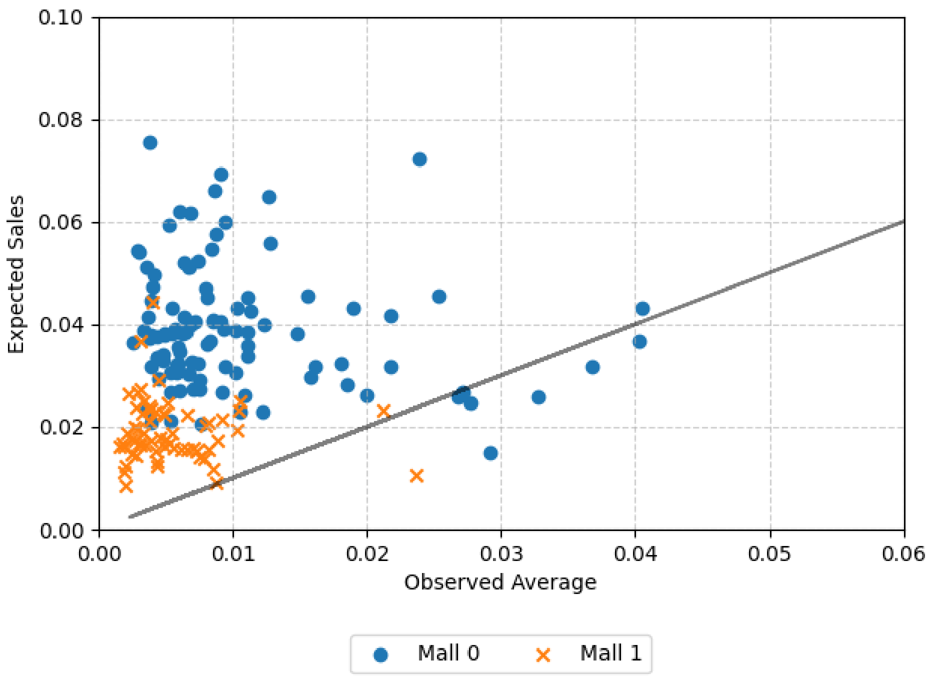

Figure A.3. Observed Average Sales vs Expected Sales by Mall

Note: Each dot represents a contract. Black line is 45 degree line. The scale of both horizontal and vertical axis is set to 1 billion JPY. This scale is chosen to avoid the overflow when I compute the exponential terms in the model. This figure removes the outliers which are located outside of the the range: 6 samples for Mall 0, and 3 samples for Mall 1.

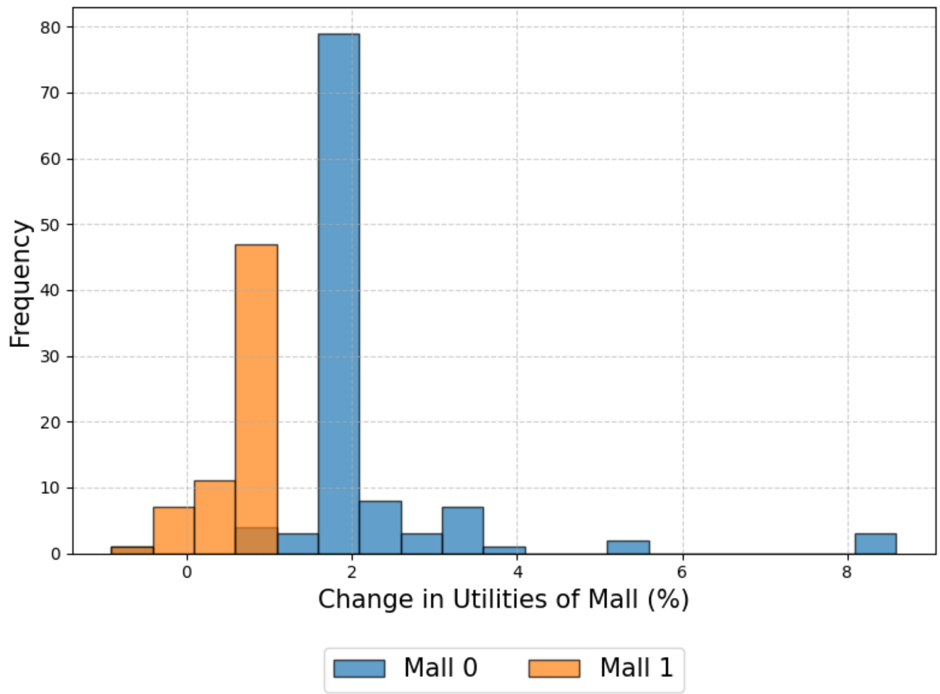

Figure A.4. Change in Surplus (%)

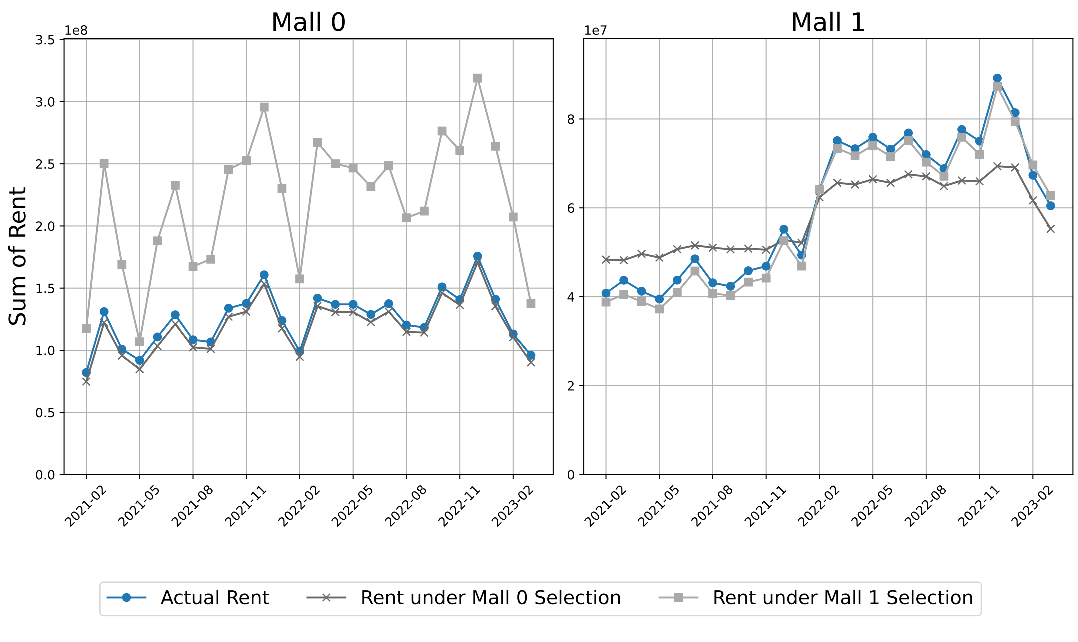

Figure A.5. Simulated Total Monthly Rents and Actual Rents

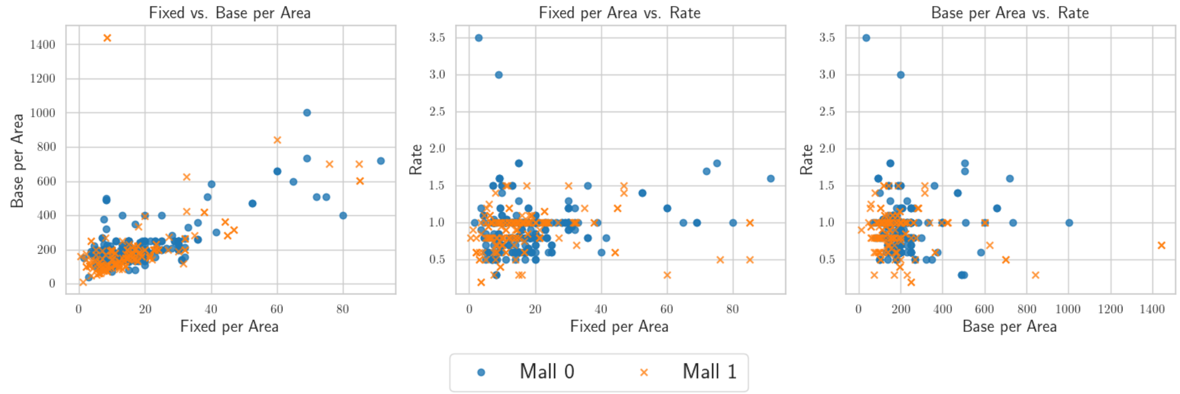

Figure A.6. Scatter Plots of Parameters of Mixed-type Contract

Note: "Fixed per Area" and "Base per Area" is scaled by 1,000 JPY. "Rate" is percentile scale. Blue circle represents the sample in Mall 0 and orange cross represents the sample in Mall 1.

C Additional analysis

C.1 Interaction between the parameters of rent structure

The scatter plots in Figure A.6 illustrate the interrelationships among the three parameters. Fixed and Base show a positive correlation, which is expected since shopping malls aim to increase the likelihood of earning commission from tenants with a lower Fixed value. In contrast, no clear relationship is observed between Rate and either Fixed or Base, even though they should be positively correlated based on the roles of Base and Rate, as discussed in Section 2. In Appendix C.2, I further verify that these variations cannot be fully attributed to fixed differences between the shopping malls or their tenants by focusing on brands that are common to both shopping malls.

C.2 Variation within common brands

The observed variation in the rent structures cannot be fully attributed to fixed differences in preferences between the shopping malls or their tenants. When analyzing common brands in both malls, as summarized in Table A.4, the rent structure distributions appear comparable: where the contract type is numerated according to the order of leaves in Figure A.1 from the left. This suggests that the mall-specific factors do not significantly influence the rent structures for these brands. Moreover, for common tenants, the parameters of the rent structures vary between the two shopping malls. Figure A.7 illustrates the parameters of the mixed-type contracts across both malls, highlighting these differences.

Contract Type	1	2	3	5	6	7	8
Mall 0	2	0	10	58	2	1	2
Mall 1	7	1	11	44	0	7	0

Table A.4. Distribution of Rent Structures of Common Brands by Malls

Note: This table shows the distribution of rent structures for common brands across Mall 0 and Mall 1. The contract types are listed from 1 to 8, which are indexed according to the leaves in Figure A.1.

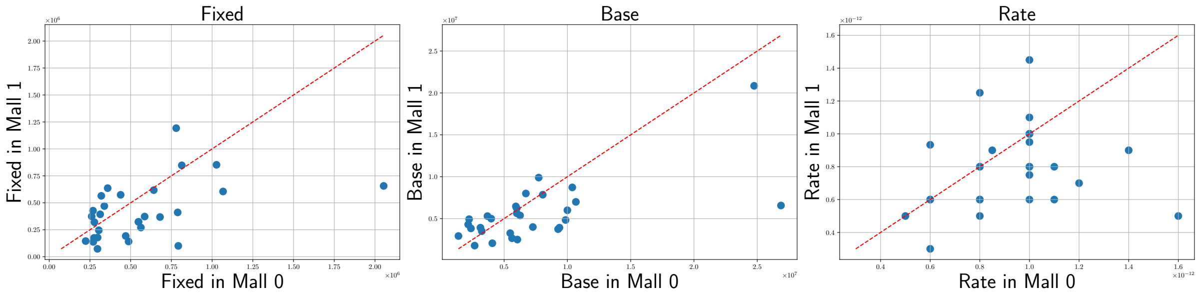

Figure A.7. Difference in Contracts of Common Tenants by Malls

Note: Comparison of the parameters of a contract between Mall 0 and Mall 1. The figure consists of three scatter plots, each comparing the Fixed, Bases, and Rates of common tenants across the two malls. The horizontal axis represents the values for Mall 0, while the vertical axis represents the corresponding values for Mall 1. The plots demonstrate how similar or different the contract parameters are for the same brands in the two malls.

C.3 Potential factor: initial offer

One potential caveat of the regression analysis of Table 2 is that I cannot control the negotiation process. Here, I use meeting minutes data to partially treat this point and show that the past performance affects the internal margins even when controlling for the initial offer.

To analyze each renewal negotiation, I introduce a method to represent qualitative changes from the ongoing contract terms. When a set of parameters of a mixed-type contract is given, by checking the change in the amount of rent, the relationship from the ongoing ones is classified into the following four groups: *same* refers to the case where all three parameters are the same; *up* indicates the case where the new mixed-type contract increases the expected rent—such as when the fixed increases, the base decreases, the rate increases, or combinations of these changes; *down* represents the opposite of the case

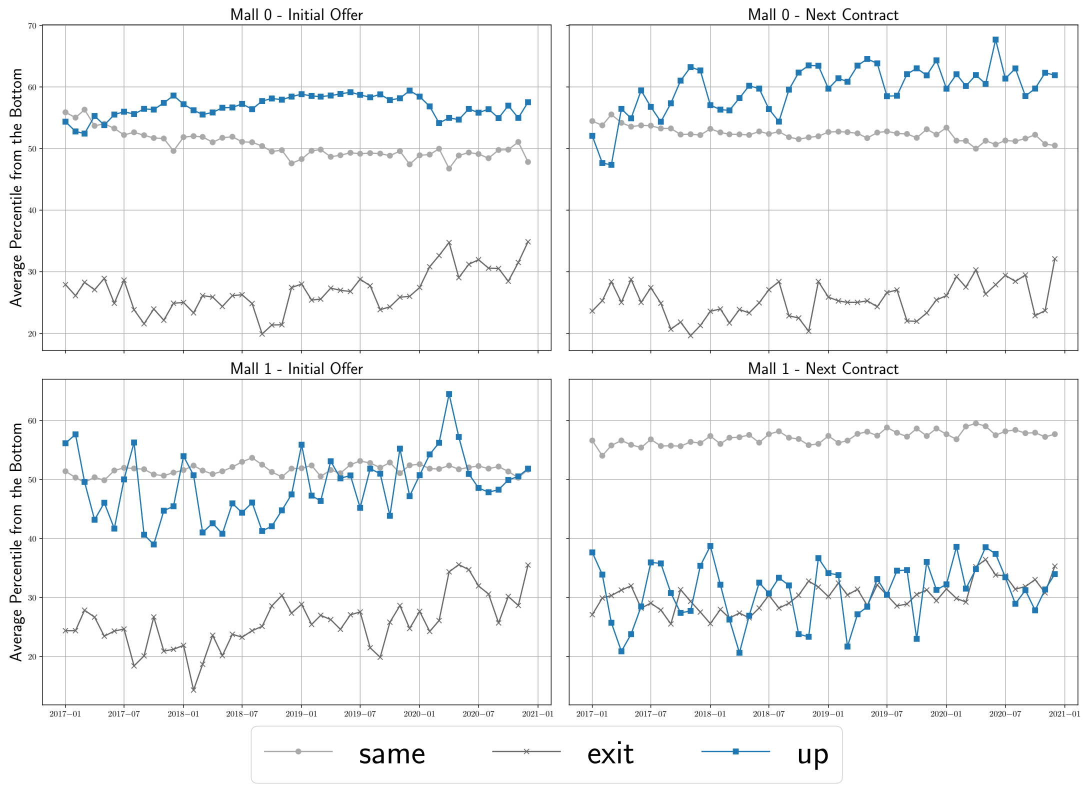

Figure A.8. Average Monthly Rank of Sales per Area by Initial Offer and Next Contract

Note: The top plot shows the average sales per area ranking in Mall 0, while the bottom plot represents Mall 1. Each plot tracks the changes in average rankings over time, distinguishing between tenants' initial offer and their next contract (same, exit, or up). The vertical axis represents the average rank of sales per area, with lower values indicating higher ranks, and the horizontal axis covers the years 2017 to 2021, which is before the throughout renewal of both shopping malls.

of up; and *updown* refers to cases combining both upward and downward adjustments, such as when the rate increases while the fixed component decreases.

Based on the above categorization, I again find an evidence that the change in contract terms reflect the past performance. Figure A.8 presents four panels depicting the monthly trajectories of tenants' average ranks of sales per area within the shopping mall, categorized by the type of initial offer and the next contract. The upper two panels correspond to Mall 0, while the lower two panels represent Mall 1. In the left panels, tenants are categorized by their initial offers in the renewal negotiation, and in the right panels, they are grouped by the type of the next contract. For Mall 1, tenants who received an up offer were ranked similarly to those whose initial offer was "same". However, when examining the next contract, the up offer was agreed only with tenants ranked similarly to those exiting the shopping mall who is obviously worse performers. At the same time, for Mall 0, I do not find the similar patterns.

	(1) Level	(2) Diff	(3) Diff / Change
Rate	-0.063	-0.049	-0.180
	(0.219)	(0.222)	(0.374)
Base	0.069	0.000	0.000
	(0.206)	(0.000)	(0.000)
Fixed	2.839**	0.000	0.000
	(1.319)	(0.000)	(0.000)
Observations	197	197	156
Adjusted R^2	0.992	0.964	0.967

Table A.5. Effects on Performance

Note: This table presents the estimated effects of the Rate, Base, and Fixed components on performance across three models: (1) Level, (2) Diff, and (3) Diff/Change. Coefficients indicate the impact of each variable, with standard errors in parentheses. Values shown as 0.000 are not precisely zero; they are simply very small numbers. The asterisks indicate levels of statistical significance: *p<0.1; **p<0.05; ***p<0.01.

Figure A.8 suggests that changes in contracts reflect performance in some way, but from this alone, I cannot understand the paths and the reasons. It is natural to think that it affects bargaining strength, but that is not necessarily the case. This is because I am not capturing the benefits of contract changes due to changes in risk entailed with it. Even if the amount of rent increases, if the contract also significantly increases the variance of the rent, such changes may not be desirable for a risk-averse shopping mall. Furthermore, it is concerning that the patterns between Mall 0 and Mall 1 are clearly different. I cannot distinguish whether this is because each mall reacts differently in how they change contracts based on attributes like past sales, or because each mall has its own tendencies in the contracts they use—for example, changes that increase the amount may not be a significant issue in Mall 0. Reflecting these concerns, in my main analysis, I build a structural model and estimate it to clarify the determinants of the terms of contract and their changes.

C.4 Moral hazard issue

I check the existence of *moral hazard*. For this purpose, I analyze if the contract terms influence on the performance of the tenants. My analysis focuses on tenants who have experienced at least one renewal in my dataset and have had mixed-type contracts in both successive leases. For these samples, I regress the average monthly sales during a lease period on the parameters of the mixed-type while including covariates such as past average sales, the total sales of the shopping mall, and the parameters of the previous contract.

Table A.5 presents the regression results: Column (1) shows the result when the dependent variable is the level of average sales, Column (2) displays the result of the first difference version of the Column (1), and Column (3) shows the result when I focus on samples where the contracts differed between the two successive leases. The significant influence of Fixed observed in the first column disappears when differences are considered. This suggests the possibility of selection: higher Fixed value is set for tenants expected to achieve higher sales. In contrast, I do not observe any indication of moral hazard: such as higher rates leading to reduced effort from tenants. Furthermore, as discussed in Section 2, the shopping mall can directly monitor tenant efforts through daily consumer interactions and conducts mystery surveys to assess service quality, sharing the results with tenants. This point also reduces the likelihood of moral hazard in this context.

C.5 Analysis on systematic change in contract terms

Here, I consider what drives changes in contract terms in more detail. One potential factor is a change in the tenant's potential as a retailer. For example, a longer tenure in the same shopping mall may help a tenant build a loyal customer base, potentially increasing expected sales with each successive contract number. Consequently, the "appropriate" contract terms might also change. This aspect is examined in Figure A.9, which presents box plots of sales, rent, and their values per unit area for each contract number. The distribution of sales and rent does not show a clear trend as the contract number increases. In this sense, the fundamental aspects of a tenant, such as their sales potential, appear to remain consistent over time.

If a tenant's sales potential does not change significantly over time, what determines contract terms? To begin with, it is challenging to identify any clear descriptive patterns in the change in the terms of contract. Regarding changes over time, Figure A.10 presents box plots of the mixed-type contract parameters against the contract number. Here no obvious patterns emerge in the changes of the parameters themselves.[41][42] These

[41] Remember that, as shown in Figure A.6, even among the parameters of a single mixed-type contract, the expected relationships are not visibly apparent.

[42] As shown in the lower middle panel of Figure A.10, the ratio of months in which sales exceed the base remains almost unchanged over time. This suggests the difficulty of accurately forecasting future sales.

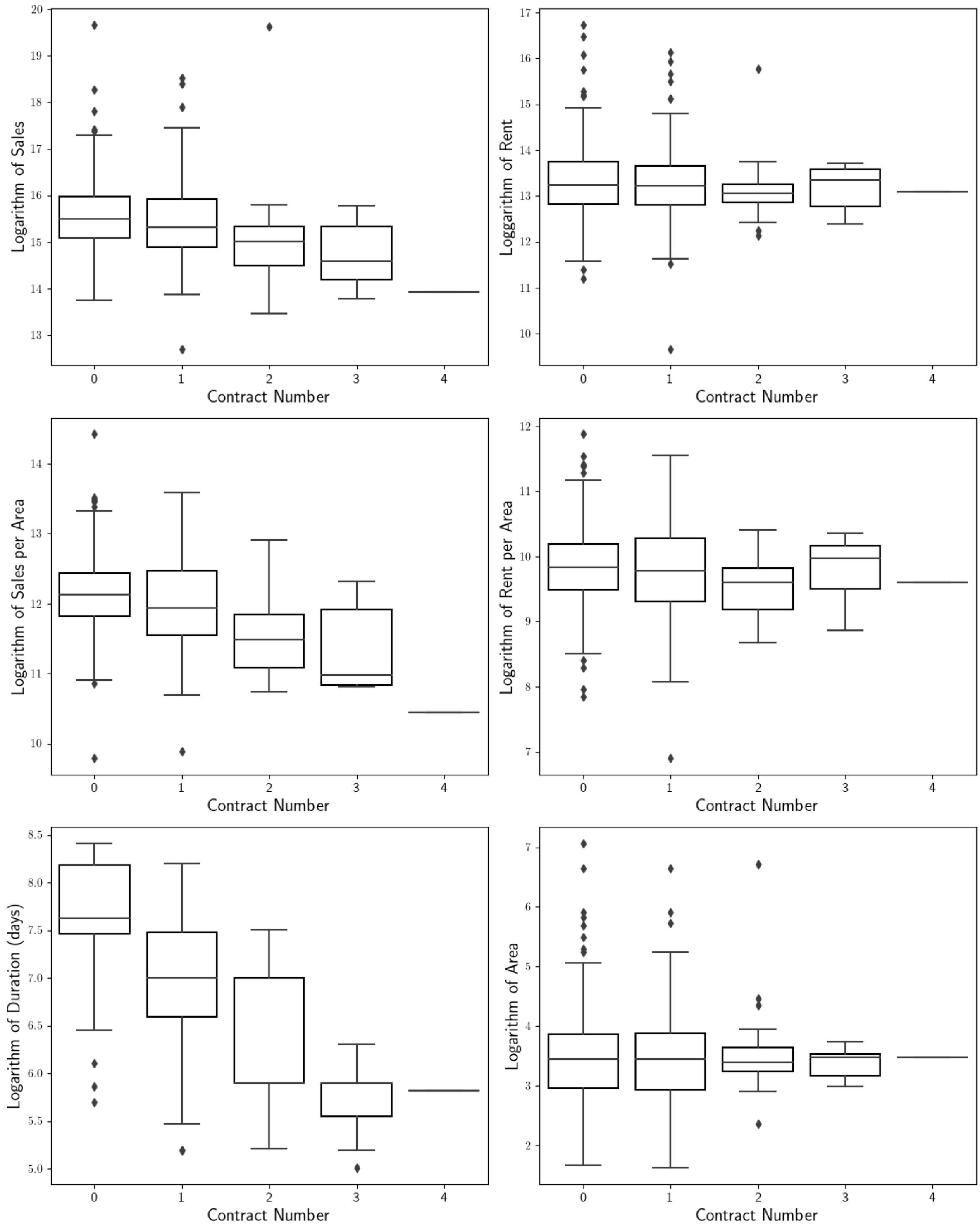

Figure A.9. Box Plots of Performance Measures and Characteristics

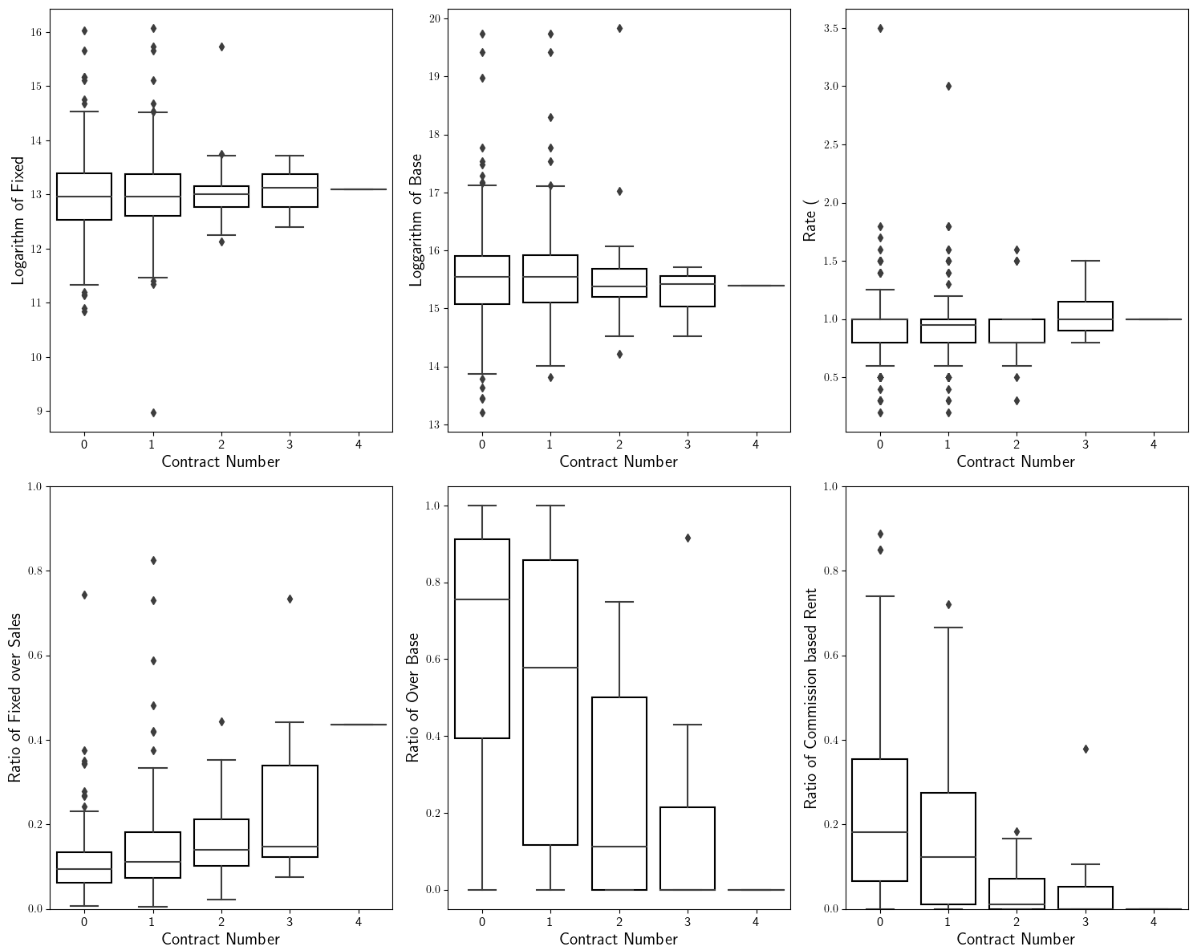

Figure A.10. Dynamic Change in Terms of Contract

observations suggest that I need to control the relevant situations in order to identify the determinants of the contract terms and their changes. At this point, I need to care about the presence of confounding factors, particularly the bargaining strength during negotiations which likely plays a significant role in these decisions.

C.6 Exist decision

Table A.6 shows the results of categorizing the initial offers observed in the meeting minutes and the negotiation results, termed the *Next contracts*. Note that *exit* denotes an offer for the tenant to exit.

First, I find that, on average, shopping malls prefer to make some changes to the

Unforeseen factors, such as shifts in commercial trends, play a dominant role, making it challenging for the shopping mall to learn about a tenant's sales potential and achieve uncertainty resolution during renewal negotiations.

Initial Offer \ Next Contract	**exit**	**same**	**up**	**down**	**updown**	**TOTAL**
exit	52	3	1	2	2	60
same	15	137	11	13	13	189
up	6	60	49	5	6	126
down	5	6	5	11	5	32
updown	1	1	3	5	9	19
TOTAL	79	207	69	36	35	426

Table A.6. Initial Offer and Resulting Contract

Note: The table presents the relationship between the first initial offer (rows) and the resulting contract type (columns). Both the initial offer and the resulting contracts are categorized into five groups: exit, same, up, down, and updown. The numbers in the cells indicate the count of contracts corresponding to each combination of initial offer and resulting contract.

contract terms. In the initial offers, the proportion of "same" contracts, excluding exits, is 51.64%. I also see that exit offers are not very negotiable; 86.67% of exit offers actually result in an exit. Furthermore, among the negotiations that resulted in an exit, 65.82% were due to exit offers, and only 7.38% resulted in an exit among the negotiations starting with some category except exit. Offers other than exit are negotiable, with the proportion where the initial offer and the next contract belong to the same category being 56.28%. Particularly, in cases where the initial offer is "up," excluding cases that resulted in an exit, the next contract is "same" in 50% of the samples. Looking only at the next contract, among samples where the next contract is not exit, the proportion that settled on "same" is 59.65%, indicating that the majority remain persistent over time. My data indicates that the involved parties intend some form of change in the contract terms whereas the terms actually appear persistent when comparing the current contract with the next one[43].

C.7 Misperception about balance of bargaining powers

Due to externalities between tenants, sales or sales per unit area may not accurately reflect a tenant's true sales potential. Specifically, one professional noted: "Certain types of tenants seem to have a unique ability to draw in customers, but not all of those customers make purchases at that tenant. Some may only window shop and then be

[43]This persistence in contract terms was also observed in existing literature, such as in Lafontaine and Shaw (1999)

reminded to buy something from a different tenant. While I typically rely on sales per unit area to assess tenant performance, I am interested in capturing this kind of underlying potential if possible." In this section, I use a simple decomposition method to recover such a true potential of the tenants and then check if the estimated balance of bargaining powers reflect them.

To avoid the complexity introduced by differences in the average spend per customer, I use the number of customers as a performance measure. The number of customers (x_{ikt}) is modeled as follows:

$$x_{ikt} = \delta_i + \sum_{j \neq i, j \in \mathcal{T}_{kt}} \alpha_{ij} \delta_j + \varepsilon_{ikt},$$

where:

- δ_i: baseline customer drawing power of tenant i
- α_{ij}: the proportion of customers who visit tenant j and also stop by tenant i for some reason
- ε_{ikt}: disturbance term

When I assume that α is constant, the first equation is

$$x_{ikt} = \delta_i + \alpha \sum_{j \neq i, j \in \mathcal{T}_{kt}} \delta_j + \varepsilon_{ikt}.$$

For any pair (i, j) in Mall k, I have the following equation for the difference of the two number of customers:

$$x_{ikt} - x_{jkt} = (\delta_i - \delta_j)(1 - \alpha) + \varepsilon_{ikt} - \varepsilon_{jkt}.$$

When there are more than four tenants, I can identify and estimate $(1 - \alpha)\delta_i$ for all the tenants. This is enough to determine the relative rank of the tenants based on this "true customer drawing power."

To estimate the decomposition above, I rely on the number of customers aggregated weekly for each tenant. Using weekly-aggregated data increases the sample size, which is a challenge in any fixed-effect model. I rank the tenants within each shopping mall based on the recovered value of $(1 - \alpha)\delta_i$.

	(1)	(2)	(3)	(4)
Potential (% from the Bottom)	-0.110*	-0.0791	0.0109	0.0218
	(0.0660)	(0.0696)	(0.0726)	(0.0745)
ln B	-0.0473	-0.0601	-0.455***	-0.479***
	(0.114)	(0.110)	(0.119)	(0.116)
Contract Number	0.0499*	0.0942*	0.0165	0.0418
	(0.0261)	(0.0477)	(0.0224)	(0.0362)
N	152	152	152	152
adj. R^2	0.184	0.216	0.456	0.468
Mall controls		√		√
Tenant controls			√	√

Standard errors in parentheses

* p<0.1, ** p<0.05, *** p<0.01

Table A.7. Bargaining Powers and True Potential

In my main analysis, I regress the estimated balance of bargaining power on this rank. Specifically, I calculate the percentile rank of each tenant within a shopping mall, starting from the bottom, and use it as an independent variable in the regression. The regression results are summarized in Table A.7. When controlling the covariates relevant with the tenant and the shopping mall itself, which are described in my main analysis section, the true potential is not correlated with the estimated balance of bargaining powers as shown in the first row.

This indicates that the shopping mall's concern is valid. They cannot rely on the "true potential" of tenants when defining the balance of powers with them. One possible future direction is to analyze the counterfactual scenario when they can use this true potential when determining the power balance.

C.8 Detail procedure of counterfactual analysis

Here I describe the detail procedure of the estimation of the selection mechanism and the subsequent counterfactual analysis.

When estimating the selection mechanism, I basically follow the same SUR model which generates Table A.2 and Table A.3. I have the two deviations. First, I use the logarithm values of Fixed, Base, and Rate as the dependent variables in the SUR model. This assures the non-negativity of the simulated values of them. Second, I add several set of covariates in addition to the covariates used in Table A.2 and Table A.3. Specifically, I add the polynomial terms of the balance of bargaining powers and the year dummy variable[44]. This inclusion is to make the estimated selection mechanism fit well to the actual amount of rent.

When simulating counterfactual rent structures, I first use the estimated parameters from the SUR model to recover the expected values of the logarithms of Fixed, Base, and Rate. Next, using the estimated variance-covariance matrix, I simulate 100 error terms for each of the three values to generate the simulated rent structures. For each simulated rent structure, I compute the counterfactual rent based on the actual sales history, and then average these values to determine the counterfactual rent collected for each month.

[44]This variables takes binary values: before 2022 or after 2022. This is because my data period is 2021, 2022, and the beginning two months of 2023.

D Proofs

Lemma 4. *For any affine contract (f, r), the expected utility of T and R are written as follows:*

$$\mathbb{E}\left[V_T\left(-f+(1-r)S\right)\right] = -e^{-\rho_T\left(-f+(1-r)\mu-\frac{\sigma^2}{2}(1-r)\rho_T\right)}$$

and

$$\mathbb{E}\left[V_R\left(I+f+rS\right)\right] = -e^{-\rho_R\left(I+f+r\mu-\frac{\sigma^2}{2}\rho_R\right)}.$$

Proof. For R,

$$\begin{aligned}\mathbb{E}\left[V_R(I+f+rS)\right] &= e^{-\rho_R(I+f)}\mathbb{E}\left[-e^{-\rho_R rS}\right] \\ &= -e^{-\rho_R(I+f)}e^{-\rho_R(r\mu-\frac{\sigma^2r^2}{2}\rho_R)} = V_R\left((I+f+r\mu-\frac{\sigma^2r^2}{2}\rho_R\right).\end{aligned}$$

For tenant side, from the same computation, I get the result. □

Proof of Lemma 1 Pick a mixed-type contract (f, b, r). By Lemma 4, what I want to show is that the following equalities hold for some pair $(\tilde{f}, \tilde{r})$:

$$\begin{cases} EU_T(f,b,r) \equiv \mathbb{E}\left[V_T\left(S-f-r\max\{0,S-b\}\right)\right] = -e^{-\rho_T\left(-\tilde{f}+(1-\tilde{r})\mu-\frac{\sigma^2}{2}(1-\tilde{r})\rho_T\right)} \\ EU_R(f,b,r) \equiv \mathbb{E}\left[V_R\left(I+f+r\max\{0,S-b\}\right)\right] = -e^{-\rho_R\left(I+\tilde{f}+\tilde{r}\mu-\frac{\sigma^2}{2}\rho_R\right)} \end{cases}$$

From the above equations, if there is such an affine contract, I have

$$-\frac{\sigma^2}{2}(\rho_T+\rho_R)\left(\tilde{r}-\frac{\rho_T}{\rho_T+\rho_R}\right)^2 + I + \mu - \frac{\sigma^2}{2}\frac{\rho_T\rho_R}{\rho_T+\rho_R} + \frac{1}{\rho_T}\ln(-EU_T) + \frac{1}{\rho_R}\ln(-EU_R) = 0.$$

Hence, if the above quadratic equation with respect to $\tilde{r}$ has at least one solution, I can determine a $\tilde{r}$ and the corresponding $\tilde{f}$ is also determined by the initial equations.

As the worst case, I think about the case of $I = 0$. I argue that the following term must be positive for all the triplet of (f, b, r):

$$\mu - \frac{\sigma^2}{2}\frac{\rho_T\rho_R}{\rho_T+\rho_R} + \frac{1}{\rho_T}\ln(-EU_T(f,b,r)) + \frac{1}{\rho_R}\ln(-EU_R(f,b,r)).$$

I can remove the fixed component from the above:

$$\mu - \frac{\sigma^2}{2}\frac{\rho_T\rho_R}{\rho_T+\rho_R} + \frac{1}{\rho_T}\ln\mathbb{E}\left[e^{-\rho_T(S-r\max\{0,S-b\})}\right] + \frac{1}{\rho_R}\ln\mathbb{E}\left[e^{-\rho_R(r\max\{0,S-b\})}\right]. \quad (6)$$

I firs show that (6) is positive for all r when $b\to\infty$:

$$\mu - \frac{\sigma^2}{2}\frac{\rho_T\rho_R}{\rho_T+\rho_R} + \frac{1}{\rho_T}\ln\mathbb{E}\left[e^{-\rho_T S}\right] = \frac{\sigma^2}{2}\frac{\rho_T^2}{\rho_T+\rho_R} > 0.$$

In the following, I show that (6) is monotonically decreasing with respect to b for any value of r. If so, (6) is always positive for all the mixed-type contract.

This is directly proven by computing the derivative of (6) with respect to b. By simple computation, the sign of the derivative is equal to the sign of the following term:

$$\mathbb{E}\left[\mathbf{1}\{S<b\}e^{-\rho_T S}\right]e^{\rho_R r b}\mathbb{E}\left[\mathbf{1}\{S>b\}e^{-\rho_R r S}\right] - \mathbb{E}\left[\mathbf{1}\{S<b\}\right]e^{-\rho_T r b}\mathbb{E}\left[\mathbf{1}\{S>b\}e^{-\rho_T(1-r)S}\right]$$

The equivalent condition that the above term is negative is

$$\mathbb{E}\left[e^{-\rho_T S}\mid S>b\right] < \mathbb{E}\left[e^{-\rho_T S}\frac{e^{\rho_T(S-b)}}{\mathbb{E}\left[e^{-\rho_R r(S'-b)}\mid S'>b\right]}\mid S>b\right].$$

This condition is true because $e^{\rho_T(S-b)} > 1 \geq e^{-\rho_R(S-b)}$ for all the case where $S>b$.

Proof of Lemma 2 The bargaining frontier is characterized as the solution of the following maximization problem: for some value of u_R,

$$\max_{(f,r)\in\mathbb{R}_+^2} \mathbb{E}\left[e^{-\rho_T(J-f+(1-r)S)}\right]$$
$$\text{s.t. } \mathbb{E}\left[e^{-\rho_R(I+f+rS)}\right] \geq u_R.$$

Here, I directly solve this maximization problem to characterize the bargaining frontier of this problem.

From Lemma 4, the problem is written as follows:

$$\begin{aligned}&\max_{(f,r)\in\mathbb{R}_+^2} -\frac{\sigma^2\rho_T}{2}\left(r-\left(1-\frac{\mu}{\sigma^2\rho_T}\right)\right)^2 - f + \frac{\mu^2}{2\sigma^2\rho_T}\\ &\text{s.t. } -\frac{\sigma^2\rho_R}{2}\left(r-\frac{\mu}{\sigma^2\rho_R}\right)^2 + I + f + \frac{\mu^2}{2\sigma^2\rho_R} + \frac{1}{\rho_R}\ln(-u_R) \geq 0.\end{aligned} \quad (7)$$

I solve this problem in the following sequence: first I fix f and compute the optimal r and the corresponding frontier. then I compute the envelope of the frontier by searching over f. This sequential analysis provides us with the intuition about the connection to the perfect commission contract.

I fix a f. Let $r^\star$ be the optimal value of r and obj be the value of the objective function in (7). Then, by direct calculation, the solution of the above maximization problem is described as follows: there are three cases about the relative size of $\frac{\mu}{\sigma^2}$ with respect to the risk aversions.

1. $\frac{\mu}{\sigma^2} > \rho_T$

   (a) $u_R \leq V_R(I+f)$

$$r^\star = 0,\ obj = \mu - \frac{\sigma^2}{2}\rho_T - f$$

   (b) $V_R(I+f) < u_R \leq V_R\left(I + f + \frac{\mu^2}{2\sigma^2\rho_M}\right)$

$$r^\star = \hat{r}^-,\ obj = -\frac{\sigma^2\rho_T}{2}\left(\hat{r}^- - \left(1 - \frac{\mu}{\sigma^2\rho_T}\right)\right)^2 - f + \frac{\mu^2}{2\sigma^2\rho_T}$$

2. $\rho_T \geq \frac{\mu}{\sigma^2} > \frac{\rho_T\rho_R}{\rho_T+\rho_R}$

   (a) $u_R \leq V_R\left(I + f + \frac{\mu^2}{2\sigma^2\rho_R} - \frac{1}{2\sigma^2\rho_R}\left(\frac{\rho_T+\rho_R}{\rho_T}\right)^2\left(\mu - \sigma^2\frac{\rho_T\rho_R}{\rho_T+\rho_R}\right)\right)$

$$r^\star = 1 - \frac{\mu}{\sigma^2\rho_T},\ obj = -f + \frac{\mu^2}{2\sigma^2\rho_T}$$

   (b) $V_R\left(I + f + \frac{\mu^2}{2\sigma^2\rho_R} - \frac{1}{2\sigma^2\rho_R}\left(\frac{\rho_T+\rho_R}{\rho_T}\right)^2\left(\mu - \sigma^2\frac{\rho_T\rho_R}{\rho_T+\rho_R}\right)\right) < u_R \leq V_R\left(I + f + \frac{\mu^2}{2\sigma^2\rho_R}\right)$

$$r^\star = \hat{r}^-,\ obj = -\frac{\sigma^2\rho_T}{2}\left(\hat{r}^- - \left(1 - \frac{\mu}{\sigma^2\rho_T}\right)\right)^2 - f + \frac{\mu^2}{2\sigma^2\rho_T}$$

3. $\frac{\rho_T\rho_R}{\rho_T+\rho_R} \geq \frac{\mu}{\sigma^2}$

(a) $u_R \le V_R\left(I + f + \frac{\mu^2}{2\sigma^2\rho_R} - \frac{1}{2\sigma^2\rho_R}\left(\frac{\rho_T+\rho_R}{\rho_T}\right)^2\left(\mu - \sigma^2\frac{\rho_T\rho_R}{\rho_T+\rho_R}\right)\right)$

$$r^\star = 1 - \frac{\mu}{\sigma^2\rho_T},\ obj = -f + \frac{\mu^2}{2\sigma^2\rho_T}$$

(b) $V_R\left(I + f + \frac{\mu^2}{2\sigma^2\rho_R} - \frac{1}{2\sigma^2\rho_R}\left(\frac{\rho_T+\rho_R}{\rho_T}\right)^2\left(\mu - \sigma^2\frac{\rho_T\rho_R}{\rho_T+\rho_R}\right)\right) < u_R \le V_R\left(I + f + \frac{\mu^2}{2\sigma^2\rho_R}\right)$

$$r^\star = \hat{r}^+,\ obj = -\frac{\sigma^2\rho_T}{2}\left(\hat{r}^+ - \left(1 - \frac{\mu}{\sigma^2\rho_T}\right)\right)^2 - f + \frac{\mu^2}{2\sigma^2\rho_T}$$

where

$$\hat{r}^- = \frac{\mu - \sqrt{\mu^2 + 2\sigma^2\rho_R\left(I + f + \frac{1}{\rho_R}\ln(-u_R)\right)}}{\sigma^2\rho_R},\ \hat{r}^+ = \frac{\mu + \sqrt{\mu^2 + 2\sigma^2\rho_R\left(I + f + \frac{1}{\rho_R}\ln(-u_R)\right)}}{\sigma^2\rho_R}$$

Based on the above results, for every cases, by envelope theorem, I can characterize the optimal $r^\star$ and $f^\star$ as follows

$$r^\star = \frac{\rho_T}{\rho_T + \rho_R},\ f^\star = -I - \frac{1}{2\sigma^2\rho_R} + \frac{1}{2\sigma^2\rho_R}\left(\mu - \frac{\rho_T\rho_R}{\rho_T+\rho_R}\sigma^2\right)^2 - \frac{1}{\rho_R}\ln(-u_R).$$

This gives the condition where the optimal contract term includes positive fixed component:

$$u_R \ge c_2,$$

where

$$c_2 \equiv V_R\left(I + \frac{\mu^2}{2\sigma^2\rho_R} - \frac{1}{2\sigma^2\rho_R}\left(\mu - \frac{\rho_T\rho_R}{\rho_T+\rho_R}\sigma^2\right)^2\right).$$

And the envelop is directly computed as follows:

$$V_T\left(I + \mu - \frac{\sigma^2}{2}\frac{\rho_T\rho_R}{\rho_T+\rho_R} + \frac{1}{\rho_R}\ln(-u_R)\right).$$

Then, I have to consider the case where $u_R < c_2$: as I have seen above, this corresponds to the case where the optimal contract is a perfect commission contract. The Pareto frontier is characterized by the following maximization problem:

$$\max_{r\in\mathbb{R}_+} \mathbb{E}\left[V_T(J+(1-r)S)\right]$$
$$\text{s.t. } \mathbb{E}\left[V_R(I+rS)\right] \geq u_R.$$

From Lemma 4, I transform the above into the following form:

$$\begin{aligned} &\max_{r\in\mathbb{R}_+} V_T(J+(1-r)\mu-\frac{\sigma^2(1-r)^2}{2}\rho_T) \\ &\text{s.t. } V_R(I+r\mu-\frac{\sigma^2 r^2}{2}\rho_R) \geq u_R. \end{aligned} \tag{8}$$

The objective function is increasing in it input, and so I have the following problem

$$\max_{r\in\mathbb{R}_+} -\frac{\sigma^2\rho_T}{2}r^2+(\sigma^2\rho_T-\mu)r-\frac{\sigma^2\rho_T}{2}+\mu+J$$
$$\text{s.t. } -\frac{\sigma^2\rho_R}{2}r^2+\mu r+I+\frac{1}{\rho_R}\ln(-u_R)\geq 0.$$

I can solve (8) directly. In high sales case, i.e. $\frac{\mu}{\sigma^2} > \rho_T$, depending on the value of u_R, the solution $r^\star(u_R)$ to the problem and the value of the problem, which is written as $u_T^\star(u_R)$, is determined as follows:

$$r^\star(u_R) = \begin{cases} 0 & \text{if } u_R \leq V_R(I) \\ r^-(u_R) & \text{otherwise} \end{cases},$$
$$u_T^\star(u_R) = V_T(J+(1-r^\star(u_R))\mu-\frac{\sigma^2}{2}(1-r^\star(u_R))^2\rho_T),$$

where

$$r_2^-(u_R) \equiv \frac{\mu-\sqrt{\mu^2+2\sigma^2\rho_R\left(I+\frac{1}{\rho_R}\ln(-u_R)\right)}}{\sigma^2\rho_R}.$$

In the cases of upper and lower middle sales, i.e. $\frac{\rho_R}{\rho_R+\rho_T} \leq \frac{\mu}{\sigma^2} \leq \rho_T$, the solutions are obtained as follows:

$$r^\star(u_R) = \begin{cases} 1 - \frac{\mu}{\sigma^2 \rho_T} & \text{if } u_R \le V_R\left(I + \frac{\mu^2}{2\sigma^2\rho_R} - \left(\frac{\rho_T+\rho_R}{\rho_T}\right)^2 \frac{1}{2\sigma^2\rho_R}\left(\mu - \frac{\rho_T\rho_R}{\rho_T+\rho_R}\sigma^2\right)^2\right) \\ r^-(u_R) & \text{otherwise} \end{cases},$$

$$u_T^\star(u_R) = V_T(J + (1 - r^\star(u_R))\mu - \frac{\sigma^2}{2}(1 - r^\star(u_R))^2\rho_T).$$

In the low sales case, i.e. $\frac{\mu}{\sigma^2} \le \frac{\rho_R}{\rho_R+\rho_T}$, the solutions are obtained as follows:

$$r^\star(u_R) = \begin{cases} 1 - \frac{\mu}{\sigma^2 \rho_T} & \text{if } u_R \le V_R\left(I + \frac{\mu^2}{2\sigma^2\rho_R} - \left(\frac{\rho_T+\rho_R}{\rho_T}\right)^2 \frac{1}{2\sigma^2\rho_R}\left(\mu - \frac{\rho_T\rho_R}{\rho_T+\rho_R}\sigma^2\right)^2\right) \\ r^+(u_R) & \text{otherwise} \end{cases},$$

$$u_T^\star(u_R) = V_T(J + (1 - r^\star(u_R))\mu - \frac{\sigma^2}{2}(1 - r^\star(u_R))^2\rho_T),$$

where

$$r^+(u_R) \equiv \frac{\mu + \sqrt{\mu^2 + 2\sigma^2\rho_R\left(I + \frac{1}{\rho_R}\ln(-u_R)\right)}}{\sigma^2\rho_R}.$$

By summarizing this result, I get the claim.

Proof of Lemma 3 To assure there is a conflict between the mall manager and the tenant side, the function $u_R(\mu)$ has to be decreasing with respect to μ at least for some region. In other words, the managerial cost is not negligible and the mall manager does not want to spend additional cost for the tenant's sales. In this model, for any value of λ, such conflict must occur when μ is sufficiently large.

Lemma 5. *For any $\lambda > 0$, there is some $\underline{\mu}$ such that $\frac{d}{d\mu}u_M(\mu) < 0$ when $\mu > \underline{\mu}$.*

Hereafter, I use (u_M, u_T) to represent a point on this frontier and use u_R to represent the expected surplus of the representative achieved in the bargaining for risk sharing under the corresponding value of μ. The frontier is written as a function F^{EE} satisfying $u_T = F^{EE}(u_M)$ for the plausible set of values of u_M. It is easy to show that the bargaining frontier is concave.

According to Corollary 1 and Lemma 5, M and T face a conflict of interest on this bargaining frontier: M prefers the lower μ whereas T prefers the higher μ.

Proof of Proposition 3 First of all, from Proposition 2, I have the explicit locus of the equilibrium surplus splits as follows: when I denote the expected utilities of R and T by u_R and u_T,

$$u_T = \frac{-B^{RS} u_R}{\frac{\rho_T}{\rho_R} d_R + \left(B^{RS} - \frac{\rho_T}{\rho_R}\right) u_R}. \tag{9}$$

Using (9),

$$\begin{aligned}
\frac{\partial u_T}{\partial u_R} &= \frac{-B^{RS} \frac{\rho_T}{\rho_R} d_R}{\left(\frac{\rho_T}{\rho_R} d_R + \left(B^{RS} - \frac{\rho_T}{\rho_R}\right) u_R\right)^2} \\
&= \frac{-B^{RS} u_R}{\frac{\rho_T}{\rho_R} d_R + \left(B^{RS} - \frac{\rho_T}{\rho_R}\right) u_R} \frac{\frac{\rho_T}{\rho_R} \frac{d_R}{u_R}}{\frac{\rho_T}{\rho_R} d_R + \left(B^{RS} - \frac{\rho_T}{\rho_R}\right) u_R} \\
&= \frac{1}{1 + \left(\frac{\rho_R}{\rho_T} B^{RS} - 1\right) \frac{u_R}{d_R}} \frac{u_T}{u_R} \\
&= \frac{u_T - d_T}{u_R - d_R} \frac{u_T}{d_T} \frac{d_R}{u_R}.
\end{aligned}$$

The model indicates $u_M = u_R - \lambda \left(u_R - \hat{u}_R\right)^2$. Let $h(u_M)$ be the value of u_R which satisfies the above equation for a u_M. By implicit function theorem, I have the derivative of h:

$$h'(u_M) = \frac{1}{1 - 2\lambda(u_R - \hat{u}_R)}.$$

Now the condition of Nash bargaining solution is written as follows:

$$\begin{aligned}
\frac{\partial u_T}{\partial u_M} &= -B^{EE} \frac{u_T - d_T}{u_M - d_M} = -B^{EE} \frac{u_T - d_T}{u_R - \lambda \left(u_R - \hat{u}_R\right)^2 - \left(d_R - \lambda \left(d_R - \hat{u}_R\right)^2\right)} \\
&= -B^{EE} \frac{1}{1 - \lambda \left(u_R + d_R - 2\hat{u}_R\right)} \frac{u_T - d_T}{u_R - d_R}.
\end{aligned}$$

By chain rule, I have the following

$$\frac{\partial u_T}{\partial u_M} = \frac{\partial u_T}{\partial u_R} \frac{\partial u_R}{\partial u_M}.$$

This implies that

$$B^{EE} = -\frac{1 - \lambda(u_R + d_R - 2\hat{u}_R)}{1 - 2\lambda(u_R - \hat{u}_R)} \frac{u_T}{d_T} \frac{d_R}{u_R}.$$

Proof of Corollary 2 By Proposition 2 and Proposition 3, I have

$$B^{RS} = \frac{\rho_T}{\rho_R} \frac{(u_R - d_R)(1 - 2\lambda(u_R - \hat{u}_R)) B^{EE}}{(1 - 2\lambda(u_R - \hat{u}_R)) B^{EE} u_R + (1 - \lambda(u_R + d_R - \hat{u}_R)) d_R}.$$

Under Assumption 2, I have

$$u_R = \frac{(1 + 2\lambda\tilde{u}_R)\left(1 + B^{EE}\right) - \lambda d_R}{\lambda(1 + 2B^{EE})}.$$

E Likelihood function

Here, I drop the subscripts i, k and τ from the expression.

I define a function computing the surplus split of the shopping mall given one balance of bargaining powers:

$$u_R\left(\mathbf{X}, \varepsilon^u\right) = u_R(e^{\mathbf{X}'\gamma + \varepsilon^u}),$$

where $u_R(B^{EE})$ is defined as the right hand side of Corollary 2.

The likelihood for a tenant which exits is computed as follows:

$$L\left(\left(\chi = 0, \phi\right), \mathbf{X}, \mathbf{Z}, I; \xi\right) = 1 - Pr\left(\mathbb{E}\left[u_R(\mathbf{X}, \varepsilon^u) \mid \tilde{\varepsilon}^o\right] > -e^{-\rho_k\left(cI + \mathbf{Z}'\gamma_o^{\psi} + \beta_o d + \kappa\hat{\nu}^o + \tilde{\varepsilon}^o\right)}\right),$$

where the probability is taken with $\tilde{\varepsilon}^o$ and the expectation is taken with respect to ε^u. Let $p(\mathbf{X}, \mathbf{Z}, I; \xi)$ be the probability of continuation. Then the frequency estimator for this probability is as follows

$$\hat{p}(\mathbf{X}, \mathbf{Z}, I; \xi) = \frac{1}{L}\sum_l \mathbf{1}\left\{\mathbb{E}\left[u_R(\mathbf{X}, \varepsilon^u) \mid \varepsilon_l^o\right] > -e^{-\rho_k\left(cI + \mathbf{Z}'\gamma_o + \beta_o d + \kappa\hat{\nu}^o + \varepsilon_l^o\right)}\right\}.$$

Then, the likelihood of the exiting tenant is

$$L\left(\left(\chi = 0, \phi\right), \mathbf{X}, \mathbf{Z}, I; \xi\right) = 1 - \hat{p}(\mathbf{X}, \mathbf{Z}, I; \xi).$$

The conditional expected payoff of the renewal contract is computed using the conditional distribution: $\varepsilon^u \mid \tilde{\varepsilon}^o \sim N\left(\rho\sigma_u\frac{\tilde{\varepsilon}^o}{\sigma_o},\ \sigma_u^2(1-\rho^2)\right)$,

$$\mathbb{E}\left[u_R(\mathbf{X}, \varepsilon^u) \mid \tilde{\varepsilon}^o\right] = \int u_R(\mathbf{X}, \varepsilon^u)\frac{1}{\sqrt{2\pi}\sqrt{\sigma_u^2(1-\rho^2)}}e^{-\frac{\left(\varepsilon^u - \rho\sigma_u\frac{\tilde{\varepsilon}^o}{\sigma_o}\right)}{2\sigma_u^2(1-\rho^2)}}\mathrm{d}\varepsilon^u.$$

This value is approximated using simulated draw of conditional ε^u. Let ε_l^u be the simulated sample of ε^u, which is drawn from $N\left(\rho\sigma_u\frac{\tilde{\varepsilon}^o}{\sigma_o},\ \sigma_u^2(1-\rho^2)\right)$. Let L be the total number of simulated draws. Then the above conditional expectation is approximated by the following:

$$\frac{1}{L}\sum_l u_R(\mathbf{X}, \varepsilon_l^u).$$

For the likelihood of a continuing tenant, I use the observed contract terms. First, for some large number L, S_l is the simulated draw of sales from $N\left(\mu_{ik\tau}, \hat{\sigma}^2_{ik\tau}\right)$ for $l \in \{1, \cdots, L\}$, where $\mu_{ik\tau}$ is an endogeneous object which is treated as parameters in our estimation process. Using this simulated sales, the surplus split of the mall side in the renewal contract is directly simulated as follows:

$$u_R = \frac{1}{L} \sum_l -e^{-\rho_k (I + R(S_l;\theta)))}.$$

And the corresponding surplus split of the tenant side, u_T, is computed by the function of the bargaining frontier (2).

Then, using Proposition 3, I can recover the value of the balance of bargaining power for each continuing tenant. This allows us to infer the unobserved component of the balance of bargaining power which ensures that the observed contract terms represent an equilibrium. This recovered value of unobserved term is computed as follows:

$$\hat{\varepsilon}^u \equiv \ln\left(-\frac{1-\lambda\left(u_R + d_R - 2\tilde{u}_R\right)}{1-2\lambda\left(u_R - \tilde{u}_R\right)} \frac{u_T}{c_T} \frac{d_R}{u_R}\right) - \mathbf{X}'\gamma.$$

Based on this expression, the likelihood for a continuing tenant is

$$L\left((\chi = 1, (f, b, r)), \mathbf{X}, \mathbf{Z}, I; \xi\right) = \int_{\mathbb{E}[u_R(\mathbf{X}, \varepsilon^u) | \tilde{\varepsilon}^o] > -e^{-\rho_k \left(cI + \mathbf{Z}'\gamma_o + \beta_o d + \kappa \hat{\nu}^o + \tilde{\varepsilon}^o\right)}} f\left(\hat{\varepsilon}^u \mid \tilde{\varepsilon}^o\right) \times f(\tilde{\varepsilon}^o) \mathrm{d}\tilde{\varepsilon}^o.$$

As the approximation for this term, I use the following object:

$$\frac{1}{L} \sum_l \mathbf{1}\left\{\mathbb{E}\left[u_R(\mathbf{X}, \varepsilon^u) \mid \tilde{\varepsilon}^o_l\right] > -e^{-\rho_k \left(cI + \mathbf{Z}'\gamma_o + \beta_o d + \kappa \hat{\nu}^o + \tilde{\varepsilon}^o_l\right)}\right\} \frac{1}{\sqrt{2\pi}\sqrt{\sigma_u^2(1-\rho^2)}} e^{-\frac{\left(\hat{\varepsilon}^u - \rho\sigma_u \frac{\tilde{\varepsilon}^o_l}{\sigma_o}\right)^2}{2\sigma_u^2(1-\rho^2)}}.$$