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Predicting the Non-Return of Chonsei Lease Deposits in the Republic of Korea

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Abstract: Chonsei, a Korean housing lease system, enables landlords to acquire direct housing purchase funds without mortgages and offers tenants a cost-effective rental option. However, public concerns have arisen about potential landlord defaults, causing financial distress for tenants. This study examined the risk of non-return of the Chonsei deposit and developed a default prediction model using Chonsei contract data from the Korea Housing and Urban Guarantee Corporation. Starting with the components from Merton's bond pricing model, we included variables that reflect contract-specific factors, macroeconomic conditions, and the Korean Chonsei practices. The findings revealed that higher house price volatility, elevated debt-to-house value, and risk-free interest rates positively correlate with non-return risk. Meanwhile, certain factors, such as longer remaining maturity, favorable macroeconomic conditions, and rising market Chonsei price trends, demonstrated negative correlations with non-return risk. Consequently, a logistic regression-based default prediction model, with eight risk factors that predict the deposit non-return, was suggested. By identifying risk factors and predicting the non-return risk of deposits, this study contributes to an informed policy decision in planning and practicing Chonsei contracts in the Korean housing market.

Keywords: Chonsei; default prediction; non-return of deposit; bond pricing model; underwater risk; rollover risk

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1. Introduction

Chonsei (or Jeonse) is a distinctive Korean lease contract where tenants provide an upfront lump sum deposit, eliminating monthly rent obligations throughout the lease period. The deposit is returned to the tenants at the end of the typical two-year contract. The housing census (Statistics Korea 2021) reported that Chonsei comprises 15.5% of housing tenure types and represents around 40% of the rental housing market in 2020. Notably, Chonsei's characteristic lies in the substantial deposit size relative to the property value, with a deposit-to-house value ratio exceeding 60% over the past decade. Chonsei provides numerous advantages to landlords, offering direct capital for property purchases without resorting to mortgages. From a tenant's perspective, Chonsei is the cost-effective rental housing option to save taxes, interests, and monthly rent burdens compared to owner occupancy or monthly rent (Cho 2006; Ronald and Jin 2015; Yun 2021). However, public concerns have arisen when contemplating the potential repercussions of landlords defaulting on Chonsei contracts. Such defaults could lead to severe consequences for tenants. The Household Financial Welfare Survey by Statistics Korea (2023) revealed that Chonsei deposits constitute approximately 53% of a Chonsei tenant's net assets. Consequently, tenants who fail to recover the deposit could result in significant financial distress.

The Korea Economic Research Institute (2023) announced that Chonsei deposits are estimated to account for approximately 50% of South Korea's GDP in 2022. Despite being landlords' liability, Chonsei deposits are not classified as official household debts. Although South Korea ranked fourth in the household debt-to-GDP ratio at 105.8%, when the Chonsei deposit is included, the ratio increased to 156.8%, placing Korea at the top among 31 OECD countries. This poses the size and impact of the potential economic risk caused by the Chonsei deposit non-return risk. Policymakers, researchers, and practitioners must pay due attention to research on Chonsei deposits focused on the non-return risk to better predict, plan, and design rental housing market stability and household residential welfare.

Despite the gravity and necessity of investigating this issue, few researchers have examined this risk. Scholars have focused on factors influencing deposit sizes. Some scholars (Ambrose and Kim 2003; Bae 2012; Kim and Bae 2015; Moon 2018) explored theoretical models for determining Chonsei prices while considering non-return risk. Others (Min 2021, 2023; Kim 2022) estimated market-wide risk instead of analyzing individual default probabilities. However, no study has examined the risk and constructed a predictive model for the non-return of Chonsei deposits using actual non-returned data.

Therefore, the purpose of this study was to identify the factors that contribute to the non-return risk of Chonsei deposits for individual Chonsei contracts. We employed a step-by-step approach to examine variables. Starting with the components from Merton's (1974) bond pricing model, we included variables that reflected contract-specific characteristics, macroeconomic conditions, and factors associated with Korean Chonsei practice. This study proposed a logistic regression-based default prediction model, identifying eight factors that predict non-return risks within Chonsei. These findings contribute to an informed policy decision in planning and practicing the Chonsei arrangements in the Korean housing market.

2. Literature Review

2.1. Default Nature of Chonsei

Research on the inherent characteristics of Chonsei offers valuable insights into understanding the nature of this housing tenure by presenting diverse significant viewpoints. Bae (2012) argued that a Chonsei contract exhibits similarities to a par bond issued by the landlord. In this case, tenants receive the right to use the property, similar to bond coupons, and can reclaim the principal at maturity. Shin and Kim (2013) contended that a Chonsei contract can be defined as a repurchase agreement, where the landlord borrows from the tenant with the house serving as collateral, while the tenant leases the collateral house at a minimum cost for collateral management. Moon (2018) perceived a Chonsei contract primarily as a mortgage the tenant provides to finance the landlord's housing investment. This author argued that Chonsei can be regarded as an interest-free loan granted by the tenant to the landlord in exchange for the right to use the property. Many scholars (Ambrose and Kim 2003; Bae 2012; Park and Pyun 2020) have contended that Chonsei contracts embody the characteristics of options, particularly when house values decline below Chonsei deposits, prompting landlords to exercise put options, effectively resulting in the non-return of Chonsei deposits. The common thread deduced from the aforementioned studies, with a range of perspectives, is that Chonsei inherently involves the intrinsic risk of default.

2.2. Development of Chonsei in the Korean Context

Since the 1960s, Chonsei has developed as a major housing option to mutually benefit both landlords and tenants, reflecting the changing political and socioeconomic circumstances in Korea (Ambrose and Kim 2003; Ronald and Jin 2015). In times of placing export-oriented industries and infrastructure expansions, rapid urbanization occurred without the support of mortgage finance (Renaud 1989; Kim 2013). This phenomenon persisted until the mid 1990s, with the loan-to-value ratio for housing remaining below 30% (Son 1997). Consequently, the long absence of formalized housing finance led to an alternative financial solution, Chonsei, within the private market (Shin and Kim 2013). From a socioeconomic perspective, the Chonsei system in South Korea has emerged as an indigenous solution that mutually benefits landlords and tenants in the aforementioned underdeveloped mortgage market (Ambrose and Kim 2003; Kim 2004; Hwang et al. 2006;

Ronald and Jin 2015; Oh and Yoon 2019; Jing et al. 2022). Landlords leverage Chonsei deposits as a means to meet diverse credit demands, while tenants reap the advantages of cost-saving benefits by accumulating funds during the contract period for future home acquisitions (Shin and Kim 2013). The Chonsei deposit also serves as a mandatory saving, empowering tenants to envision a future transition to a larger Chonsei house or facilitate their own home purchases (Son 1997).

During the mid 1990s, the Chonsei housing proportion reached its zenith, accounting for 29.7% of all housing units and 67.2% of the paid rental sector, as shown in Table 1. However, the subsequent years witnessed a significant decline, with the percentage diminishing to 15.5%. The gradual decline in Chonsei can be attributed to several factors. The mortgage market has evolved into an advanced financial system (Shin and Kim 2013). Alternative housing options, such as hybrid Chonsei, have been developed due to the cyclic shortage and surplus of Chonsei housing during economic booms and busts (Ronald and Jin 2015; Ryu and Kim 2018). Since the early 2000s, reduced interest rates have diminished Chonsei's appeal for landlords, leading to a preference for monthly rentals that offer better financial returns (Yoon 2003; Kim and You 2021). Nevertheless, the persistence of Chonsei can be explained through several factors. From the landlords' perspective, they perceive Chonsei as having a lower risk of rent default than monthly rent. The lump-sum payment arrangement required for transitioning to monthly rent is not easily attainable. From the tenants' standpoint, Chonsei is regarded as a means of accumulating wealth and a savings mechanism for household assets (Ronald and Jin 2015).

Table 1. Percentage of residence types in Korea (1980–2020).

Year	1980	1985	1990	1995	2000	2005	2010	2015	2020
Owner occupancy	58.6	53.6	49.9	53.3	54.2	55.6	54.2	56.8	57.3
Chonsei	23.9	23.0	27.8	29.7	28.2	22.4	21.7	15.5	15.5
Monthly rent with deposit (hybrid Chonsei)	15.5	10.1	11.0	10.3	10.7	15.1	18.2	20.3	21.0
Monthly rent		9.6	8.2	4.2	4.1	3.8	3.3	2.6	1.9
Free rent or others	2.0	3.7	3.1	2.5	2.8	3.1	2.6	4.8	4.3

Note: Hybrid Chonsei tenants pay 30–70% of the full deposit and monthly rent (Shin and Kim 2013). Source: KOSIS (Korean Statistical Information Service 2022).

2.3. Characteristics of Chonsei and Two Pathways to Non-Return Risk

When considering the magnitude of a Chonsei deposit, a non-return event puts the tenant at significant risk (see Table 2). While legal action can be pursued to recover the deposit, it is a time-consuming and costly process. To mitigate this, guarantee institutions provide the Chonsei deposit refund guarantee (CDRG). This protection serves as a viable alternative solution and has comprehensive coverage, protecting against deposit shortfalls or delays during the moving process, and compensating the tenant within one month if the landlord does not return the deposit. In Korea, three institutions offer guarantee services. As depicted in Table 3, 20% of the nationwide Chonsei transactions in 2022 (equivalent to 268 thousand guarantee subscriptions out of 1359 thousand transactions) were covered using these guarantees. Enrollment in these services has been steadily increasing, leading to a rise in observable default cases. The Korea Housing and Urban Guarantee Corporation (HUG), which launched the CDRG in 2013, holds 90% of the Chonsei refund guarantee market, and made a subrogation payment of KRW 0.9 trillion for 5.4 thousand households (see Table 3).

Table 2. The ratio of Chonsei deposit to house value (annual average).

2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
58.4	60.6	62.6	64.6	66.5	66.9	67.8	65.8	65.2	64.4	63.8

Source: KOSIS (Korean Statistical Information Service 2022).

Table 3. Chonsei transaction volume and guarantee subscription (thousand households).

	Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Nation	Chonsei contracts	820	865	822	799	962	1090	1172	1303	1328	1359
	Guarantee subscription	11	19	18	40	62	114	180	199	248	268
HUG	Guarantee subscription	0.5	6	4	24	44	89	156	179	232	238
	Guarantee claims	-	-	-	-	-	0.4	1.6	2.4	2.8	5.4

Note: The three guarantee institutions involved are the HUG, the Korea Housing and Finance Corporation (HF), and Seoul Guarantee Insurance (SGI). Guarantee claims refer to requesting the guarantee institution to fulfill the obligation, which indicates non-return events (some have been resolved). The number of unlisted claims in the table is 1 in 2015, 23 in 2016, and 15 in 2017, respectively. Source The HUG.

According to the guarantee institution's terms and conditions, non-return events are defined as instances where the Chonsei deposit is not returned within one month after the expiration of the lease period, or when a forced auction occurs during the lease period. The non-return of Chonsei deposits occurs through two main pathways.

The first pathway is an underwater risk, which arises as a common form when the value of the house declines below the Chonsei deposit. Min (2023) estimated the underwater risk at the maturity of Chonsei contracts by calculating the housing price decline rate required to reach the underwater state, where the house price falls below the deposit and the probability that this decline level is realized. The author derived the probability distribution of the proportion of houses that will be in an underwater state at maturity through the Monte Carlo simulation method.

The second pathway is a rollover risk. In Korea, landlords are allowed to use the Chonsei deposit without depositing it in an escrow account (Ambrose and Kim 2003; Park and Pyun 2020; Jin 2023). At the end of the lease period, the landlord is supposed to return the deposit to the existing tenant after receiving a new deposit from a new tenant. In this process, if the market Chonsei prices decline, the landlord must make up for the gap. Such situations do not typically occur when Chonsei prices are stable or rising. However, in the case of a significant decline in Chonsei prices, the likelihood of this type of deposit non-return increases sharply (Cho 2006; Ronald and Jin 2015).

2.4. Theoretical Studies for Assessing Non-Return Risk

There has been no direct theoretical study specifically measuring the non-return risk of lease deposits. However, as examined in Section 2.1, we need to pay attention to two features, namely the intrinsic nature of Chonsei to potentially default and its structural and mechanical resemblance to a corporate bond without coupons, as argued by Bae (2012).

When interpreting the non-return of the deposit as a default, the theoretical basis for default prediction can be seen through the lens of the structural model for default risk. Such models assume that if the value of the underlying asset falls below the level of its debts, or a certain threshold, the value of equity will be zero and the firm will go bankrupt. Notable models (e.g., Merton 1974; Black and Cox 1976; Longstaff and Schwartz 1995) are included under this category. Merton (1974) first applied the option pricing theory to the valuation of corporate debts. In Merton's model, holding a risky bond equates to simultaneously buying a bond and selling a put option on the bond's face value. Therefore, the value of the risky bond, B_t, at maturity, T, is given by the following equation:

$$B_t = Ke^{-r(T-t)} - P_t \tag{1}$$

where P_t represents the value of a European put option at time t for a risky discount bond that pays a face value of K at maturity T. The value of the put option can be calculated using the Black–Scholes model (Black and Scholes 1973) as:

$$\begin{aligned} P_t &= -V_t N(-d_1) + Ke^{-r(T-t)}\, N(-d_2) \\ &= \left[-V_t \frac{N(-d_1)}{N(-d_2)} + Ke^{-r(T-t)}\right] N(-d_2) \end{aligned} \tag{2}$$

where V_t is the value of the firm's assets at time t, K is the value of the firm's debt, r is risk-free interest rate, $T-t$ is time-to-maturity at time t, and $N(d)$ is the cumulative normal distribution function following $\varphi(0,1)$. $N(-d_2)$ represents the probability that the value of the asset is below the strike price at expiration, meaning that the option will be exercised at time T. The volatility of the asset value was denoted as σ in the following formulas:

$$d_1 = \frac{\ln(V_t/K) + \left(r + 0.5\sigma^2\right)(T-t)}{\sigma\sqrt{T-t}}$$

$$d_2 = \frac{\ln(V_t/K) + \left(r - 0.5\sigma^2\right)(T-t)}{\sigma\sqrt{T-t}}$$

This can be interpreted as the probability of the put option being exercised, or equivalently, the default probability. Substituting the value of the put option from Equation (2) into the bond value Equation (1), we obtained the following equation:

$$B_t = Ke^{-r(T-t)}\, N(d_2) + V_t N(-d_1) \tag{3}$$

Based on the above, the general functional form of the Merton model (1974) can be represented as:

$$B = f\left(\frac{K}{V},\ \sigma,\ r, T\right) \tag{4}$$

In Merton's (1974) model, the value of the risky bond is determined using the leverage ratio ($\frac{K}{V}$), the volatility of the asset value (σ), the risk-free interest rate (r), and maturity (T).

If we apply the Merton's (1974) model to Chonsei, we could imagine a firm holding a single house as its only asset. At the same time, the Chonsei deposit can be seen as debt, which does not earn interest and must be repaid upon maturity. If the house price falls below the Chonsei deposit at maturity, the firm will have a higher likelihood of going bankrupt. Therefore, in Equations (1) and (2), V_t can be replaced by the current house price, K, with the Chonsei deposit, and $T-t$ with the remaining period of the Chonsei contract.

In the context of a Chonsei contract, the landlord has the option to choose the default and not return the deposit if the house price falls below the deposit. This can be seen as the landlord exercising a put option, which grants the right to sell the house at the exercise price, represented by the Chonsei deposit. Specifically, since the exercise of options in the case of Chonsei contracts occurs when the lease term expires in most cases, it can be considered similar to the European options (Ambrose and Kim 2003).

Ambrose and Kim (2003) demonstrated that the Chonsei price can be calculated using an option pricing model, and that the default risk can be evaluated based on the value of the put option. Bae (2012) compared the Chonsei contract to a par bond issued by landlords, and argued that the option pricing model commonly used for assessing bond prices can be applied to evaluate Chonsei prices. Kim and Bae (2015) empirically demonstrated the usefulness of historical volatility, measured as the standard deviation of past returns, in incorporating housing price volatility within option pricing models.

Moon (2018), drawing attention to the fact that a Chonsei contract shares characteristics with a mortgage, conducted an analysis using Brueckner's (2000) mortgage–market equilibrium model to examine the impact of the landlord's default cost and house price expectations on the size of the Chonsei deposit. This author considered Chonsei as an interest-free loan provided by the tenant to the landlord and used credit scores as a proxy for the landlord's default cost. Their study found that as the landlord's default cost increases, the size of the Chonsei deposit decreases.

It is important to note that these studies did not directly measure the risk of non-return of Chonsei deposits. Instead, they focused on determining Chonsei prices and evaluating factors related to default risk based on theoretical models and proxies. This study directly analyzed the impact of the variables presented in Merton's (1974) model on deposit non-return utilizing actual individual default data.

3. Hypotheses Development

3.1. Hypothesis for Validating Underwater Risk Using Bond Pricing Model Variables

Merton's (1974) bond pricing model comprises four components: debt-to-house value, house price volatility, risk-free interest rate, and time to maturity. Drawing upon fundamental principles governing the relationship between house price and Chonsei price, it can be postulated that a decline in house price increases the likelihood of non-return of deposit by landlords holding Chonsei price constant until maturity. As demonstrated in Bae's (2012) study, the probability that the put option will be exercised increases if the house price falls below the sum of the deposit and senior debt. Therefore, we proposed the following hypothesis:

H1a. *The risk of non-return of Chonsei deposits is positively associated with the debt-to-house value.*

As house price volatility increases, the house price may either rise or fall. However, option holders benefit from an asymmetric risk–reward structure, wherein potential losses are constrained, while potential gains are amplified. Consequently, in line with this dynamic, the price of options (call and put) rises in response to escalating volatility (Hull 2011, 8th ed., pp. 215–16). Within the context of Chonsei contracts, an escalation in house price volatility corresponds to an increase in the value of put options held by landlords, signifying an elevation in non-return risk. Therefore, we proposed the following hypothesis:

H1b. *The risk of non-return of Chonsei deposits is positively associated with house price volatility.*

According to Hull (2011, 8th ed., p. 217), the influence of the risk-free interest rate on the option value is not straightforward, as its effect on the value of put options remains to be seen. The author argued that the association between rising interest rates and stock market declines could potentially lead to an increase in the value of put options. McQuinn and O'Reilly (2008) presented a theoretical model, suggesting that an increase in interest rates reduces the availability of loans, consequently diminishing housing demand and leading to a decline in housing prices. Therefore, we proposed the following hypothesis:

H1c. *The risk of non-return of Chonsei deposits is positively associated with a risk-free interest rate.*

Regarding the time to maturity, the relationship with put options appears uncertain, particularly in the context of European options, as suggested by Hull (2011, 8th ed., p. 215). Additionally, within Chonsei contracts, non-return events tend to materialize when the maturity date is reached in most cases. From a practical perspective, Chonsei contracts, being private agreements, restrict tenants from gaining insight into the landlord's financial situation. Considering the observed occurrence of non-return events around the contract's maturity in real-world Chonsei contracts, it becomes crucial to acknowledge this practical aspect. Consequently, it can be inferred that time to maturity and the non-return of Chonsei deposits exhibit a negative relationship. Therefore, we proposed the following hypothesis:

H1d. *The risk of non-return of Chonsei deposits is negatively associated with time to maturity.*

3.2. Hypothesis for Validating Contract-Specific Variables

In addition to exploring the primary risks, we examined contract-specific characteristics that were identified by the HUG. Initially, we categorized the HUG's guarantee data into two distinct groups: the normal group (797,920 cases), wherein the deposits were returned by the landlords, and the default group (6978 cases), where the deposits were not returned, thus necessitating the HUG's fulfillment of its guarantee obligation. Subsequently, we conducted a discriminant analysis by comparing the means of two variables from the HUG's guarantee data to ascertain whether statistically significant differences existed between the two groups. The two variables under consideration were the guarantee amount (GAMT) and the number of landlord-owned houses (NUM). Upon analysis, we discovered that NUM exhibited statistically significant differences between the two groups (see Table 4).

Table 4. The differences of means between the normal and default groups (thousand won).

Variable	Normal Group	Default Group	t-Value	Selection
GAMT	205,092	205,118	−0.03	-
NUM	24.1	47.7	−23.42	Select

Source: The HUG.

Furthermore, we examined the non-return rates for different types of housing. The default rates for row houses and multi-family houses exceed the average rate of 0.87%. Therefore, we added the type of house (whether it is a row house or multi-family house) as a dummy variable (see Table 5). Hence, we proposed the following hypotheses:

H2a. *The risk of non-return of Chonsei deposits is positively associated with the number of landlord-owned houses.*

H2b. *The risk of non-return of Chonsei deposits is positively associated with the type of house (whether it is a row house or multi-family house).*

Table 5. Default rates for the type of house (%).

Multi-unit	Detached	Apartment	Office-Tel	Row House	Multi-Family
0.39	0.47	0.55	0.80	1.27	2.44

Source: The HUG.

3.3. Hypothesis for Validating Macroeconomic Variables

The risk of the non-return of Chonsei deposits exhibits variation through the business cycle. Ronald and Jin (2015) posited that between 1986 and the immediate aftermath of the 2009 global financial crisis, there were four significant Chonsei shocks due to periodic shortages and surpluses of Chonsei. These Chonsei shocks led to abrupt fluctuations in Chonsei prices, contributing to housing market instability. Through a financial business cycle study utilizing the dynamic stochastic general equilibrium model (DSGM), Iacoviello (2015) contended that homeowners may opt for the default when house prices fall below a specific threshold. During negative financial shocks, banks may accelerate household defaults through deleveraging. Additionally, Adams and Füss (2010) utilized 30-year panel data from 15 countries to demonstrate the impact of macroeconomic factors, including interest rate changes, construction costs, actual consumption, real industrial production, employment, and real GDP, on housing prices. Furthermore, Hol (2007) empirically demonstrated that incorporating the business cycle alongside financial analysis enhances the predictive power of bankruptcy compared to solely relying on financial analysis. Consequently, based on these insights, we proposed the following hypothesis:

H3. *The risk of non-return of Chonsei deposits is negatively associated with the macroeconomic condition.*

3.4. Hypothesis for Validating Rollover Risk Stemming from Korean Chonsei Practices

In this section, our objective was to elucidate one of the two pathways leading to the non-return of a Chonsei deposit, specifically known as rollover risk, which is a significant aspect of the Chonsei practice in Korea, as mentioned in Section 2.3. Min (2021) confirmed that the decline in Chonsei prices is an important variable for rollover risk by deriving a probability distribution from the movement of the Chonsei Price Index and calculating rollover risk. Furthermore, according to the report from the Bank of Korea (2023), it is estimated that the exposure to rollover risk escalates as Chonsei contracts mature during periods of reduced market Chonsei prices. Consequently, we presented the following hypothesis:

H4. *The risk of the non-return of a Chonsei deposit is negatively associated with changes in market Chonsei prices.*

4. Methodology

4.1. Default Prediction Model

Due to the inherent risks associated with Chonsei, as described in Section 2.1, we adopted Ohlson's (1980) bankruptcy prediction model to anticipate Chonsei defaults. While this model has predominantly been employed to forecast corporate bankruptcy, its application to predict Chonsei defaults within the context of lease market risk represents a novel and innovative aspect of this research. Logit analysis models the logarithm of the odds that a particular event will occur using a dichotomous dependent variable. The odds represent the ratio of the probability of default to the probability of non-default. The transformation into the natural logarithm of the odds allows the dependent variable to be continuous rather than discrete. To illustrate this idea, we considered the following model:

$$ln\left(\frac{P_i}{1-P_i}\right) = \beta_0 + \beta_1 X_1 + \cdots\cdots + \beta_k X_k + \epsilon_i \tag{5}$$

where P_i = probability of the non-return of a Chonsei deposit, β_0 = intercept, β_i = coefficient of variable X_i, X_i = independent variables, and ϵ_i = error term (assumed to be identically and independently distributed).

Therefore, the probability that a default event will occur is given by the following equation:

$$P_i = \frac{1}{1 + e^{-(\alpha + \beta_1 X_1 + \cdots\cdots + \beta_k X_k + \epsilon_i)}} \tag{6}$$

where e is a base of natural log.

4.2. Data Collection and Classification

Researchers sourced our data from the HUG's information technology system, known as the enterprise next-generation system. The annual totals were verified via cross-referencing with the HUG's Year Book 2022 (HUG 2023). From the HUG's guarantee data, we can determine the landlords' senior debt, deposit amount, contract duration, the number of houses owned by landlords, the type of houses, and whether the deposits were returned. For housing and Chonsei prices, we utilized the price index provided by the Korea Real Estate Board's Real Estate Statistics System (R-ONE 2021). We calculated the volatility of house prices based on the standard deviation of monthly housing price index changes over the 24 months preceding the default prediction period. We collected 16 interest rates from the Bank of Korea Economic Statistics System (ECOS 2011–2021), the Korea Federation of Banks (KFB 2021), and the Korea Financial Investment Association (KOFIA 2021). We employed the coincident composite economic index provided by the Korean Statistical Information Service (2022) for the macroeconomic condition. We transformed them into percentage or absolute changes to prevent spurious regression and obtain stabilized time series data. We then conducted a multicollinearity test. We observed that all variables had VIF values well below the threshold of 10, indicating that multicollinearity was not a concern in our regression model. The data spans from 2011 to 2021, including housing market data and macroeconomic indicators from 2 years ago. We utilized 804,898 guarantee data points, with current balances at each year's end from 2013 to 2020 (493,164 contracts). These data included 6978 non-return cases that have occurred until the end of 2021. To align with financial regulatory and academic communities, we set the default prediction time horizon to one year. Drawing on Hyndman and Athanasopoulos's (2018) approach, we used 80% (n = 643,919) of the modeling dataset to create the predictive model, while the remaining 20% (n = 160,979) was allocated for out-of-sample testing. The out-of-sample test datasets were randomly extracted to ensure that they were uniformly distributed over the entire period without any bias towards specific periods.

4.3. Variables for Testing Hypothesis 1

We chose house price volatility (VOL) as the first variable for examination in Merton's (1974) bond pricing model. We operationalized house price volatility by following the approach used by Kim and Bae (2015), which involves utilizing historical volatility. As Chonsei contracts are set at a two-year interval, we measured the volatility of seventeen regional monthly changes in housing prices over the preceding two years. Second, we chose a debt-to-house value (DTV) as a variable. Akin to the approach of Bae (2012), we determined the numerator as the sum of senior debts and the Chonsei deposit. The denominator incorporated the 17 regional housing price changes from the guarantee issuance time to the measurement time (the end of each year). Third, we selected the Cost of Fund Index (COFIX) as a proxy for the risk-free interest rate variable. Previous studies have employed diverse risk-free interest rates. Ambrose and Kim (2003) utilized the three-month corporate bond yield, while Kim and Bae (2015) used the average of the one-year and three-year government bond yields. Jing et al. (2022) utilized the COFIX, which serves as the benchmark rate for mortgages and Chonsei loans, in their equilibrium analysis to investigate the impact of the interest rate on Chonsei deposit size and house prices. We identified that the COFIX exhibited the highest correlation coefficient (0.917) among 16 interest rates. Fourth, we introduced time to maturity (TTM) into our analysis. Our analysis revealed that the average remaining time to maturity for default cases was 0.5 months, indicating that defaults predominantly occur around the termination of Chonsei contracts. Since we have set the default prediction time horizon to one year in our model, this observation suggests that the remaining time to maturity being less than one year holds significance. Therefore, we defined TTM as a dummy variable, indicating whether the time to maturity is less than 1 year.

4.4. Variables for Testing Hypotheses 2, 3, and 4

For testing Hypothesis 2, we selected the number of landlord-owned houses (NUM) as an independent variable. Additionally, we opted for whether it is a row house or a multi-family house (TYPE) as a dummy variable. As discussed in the previous section, regarding Hypothesis 3, it is crucial to incorporate macroeconomic conditions. In line with this, we aimed to include various factors, such as consumption, production, investment, and trade, all contributing to the gross domestic product (GDP). Adams and Füss's (2010) study inspired us to use this approach. We compared the Coincident Composite Economic Index (CCEI) and the Leading Composite Economic Index (LCEI) to achieve our aim. After analyzing the correlation between each macroeconomic condition index and the non-return of Chonsei deposits, we found that the CCEI exhibited a stronger correlation. Therefore, we chose the CCEI as a variable representing the macroeconomic condition. To verify the rollover risk proposed in Hypothesis 4, we utilized the percentage change in the market's Chonsei price. Specifically, we selected the CHONI (Chonsei Price Index) as a variable (see Table 6).

Table 6. Variables and their definition.

Abbreviation	Full Name	Definition	Sources
		Bond pricing model variables (underwater risk)	
VOL	House price volatility	Volatility of monthly percentage changes in house price indices by region over the past 24 months The standard deviation of the monthly returns of the house price indices of 17 regions over 24 months	Recomputed using house price index from R-ONE

Table 6. *Cont.*

Abbreviation	Full Name	Definition	Sources
DTV	Debt-to-house value	(Senior debt + Chonsei deposit) ÷ House price at the time of guarantee approval × (1 + percentage change in the house price indices across 17 regions from the time of guarantee issuance to the end of each year)	Recomputed using the house price index from R-ONE HUG
COFIX	Risk-free interest rate	Cost of Fund Index; outstanding, absolute change compared to 24 months ago	KFB
TTM	Time to maturity	Whether the remaining guarantee period is less than one year: 1 = if the remaining guarantee period is less than one year. 0 = otherwise.	HUG
		Contract-specific characteristics	
NUM	Number of landlord-owned houses	Number of rental houses owned by a landlord at the time of measurement (the end of each year)	HUG
TYPE	Type of house	Whether it is a row house or multi-family house: 1 = if it is row house or multi-family house; 0 = otherwise	HUG
		Macroeconomic condition	
CCEI	Coincident Composite Economic Index	Detrended Coincident Composite Economic Index, year on year change	KOSIS
		Korean Chonsei practice (rollover risk)	
CHONI	Chonsei Price Index	Percentage changes of market Chonsei Price Index in 17 regions, compared to the time of signing a Chonsei contract	R-ONE

Note: R-ONE: Korea Real Estate Board Real Estate Statistics System; KFB: Korea Federation of Banks.

5. Results

5.1. Estimation Results of Alternative Prediction Models

Table 7 presents four different models, beginning with variables from Merton's (1974) bond pricing model, followed by contract-specific characteristics, macroeconomic conditions, and a variable associated with the Korean Chonsei practice.

Table 7. Estimation results of alternative predictive models.

Category	Variable	Model 1	Model 2	Model 3	Model 4
Bond pricing model (underwater risk)	Constant	−14.138 ***	−14.703 ***	−14.716 ***	−14.575 ***
	VOL	215.675 ***	423.598 ***	262.504 ***	192.582 ***
	DTV	8.001 ***	7.744 ***	7.827 ***	7.733 ***
	COFIX	50.659 ***	107.715 ***	94.755 ***	67.234 ***
	TTM	3.660 ***	3.746 ***	3.766 ***	3.779 ***
Contract-specific characteristics	NUM		0.003 ***	0.003 ***	0.003 ***
	TYPE		1.111 ***	1.120 ***	1.150 ***
Macroeconomic condition	CCEI			−0.315 ***	−0.353 ***
Korean Chonsei practice (rollover risk)	CHONI				−3.234 ***
−2 Log likelihood		50,491.740	48,277.210	48,128.360	48,104.999
Cox and Snell R^2		0.021	0.024	0.025	0.025
Nagelkerke R^2		0.221	0.257	0.259	0.259

*** $p < 0.001$.

Model 1 validates the variables of Merton's (1974) bond pricing model. VOL, DTV, and COFIX exhibit statistically significant positive relationships with the non-return of deposits, while TTM demonstrates a significant negative association with non-return risk (in this study, the correlation with non-return is defined based on whether TTM is less than a year and is indicated as a plus). Specifically, as in Merton's (1974) bond pricing model, an increase in the volatility of the underlying asset, represented by house price volatility (VOL), leads to an increase in the value of put options held by landlords, indicating a higher probability of the non-return of deposits. This observation suggests that even when the Chonsei price remains fixed, a decline in house prices (DTV) leads to an increased risk of non-return. The risk-free interest rate (COFIX) level was also found to be significantly and positively linked to the non-return risk. As indicated in Hypothesis 1, a rise in interest rates is considered a factor contributing to underwater risk, as it reduces the availability of loans or decreases trading volume, ultimately leading to a decrease in housing value. Additionally, the time to maturity of Chonsei contracts (TTM) positively correlated with non-return risk. As mentioned earlier, Chonsei contracts typically involve the exercise of claims for Chonsei deposit refunds mostly at the end of the contract period, leading to the observed occurrence of non-return around the contract's maturity. Therefore, Model 1 provides evidence supporting the validity of hypotheses 1a, 1b, 1c, and 1d. This means that the components constituting Merton's (1974) bond pricing model were found to also operate in Chonsei contracts.

Model 2 examines the contract-specific variables. The additional variables, the number of landlord-owned houses (NUM), and whether it is a row house or multi-family house (TYPE), displayed statistically significant positive relationships with the non-return of deposits. Consequently, confirming Hypotheses 2a and 2b, we ascertained that contract-specific variables influence the non-return of deposits.

Model 3 analyzes the macroeconomic variables. The additional variable, macroeconomic condition (CCEI), demonstrated a statistically significant positive relationship with the non-return of deposits. As the macroeconomic variables encompass comprehensive indicators related to consumption, production, investment, trade, and employment, a deteriorating overall economic situation can also impact the non-return of deposits. Accordingly, we substantiated the validity of Hypothesis 3.

Model 4 investigates rollover risk resulting from Korean Chonsei practice. The additional variable, market Chonsei prices (CHONI), exhibited a statistically significant negative relationship with the non-return of deposits. This suggests that when market Chonsei prices decline in a specific region, the risk of landlords being unable to return the difference in the deposit escalates. As we expand from Model 1 to Model 4, the −2 log likelihood ratio decreases, while the Cox–Snell R^2 and Nagelkerke R^2 values increase. These trends indicate that incrementally incorporating variables improves the model's goodness-of-fit and explanatory power.

5.2. Evaluation of Predictive Performance

In our integrated Model 4, the in-sample test demonstrated an accuracy rate of 79.4%. In particular, we were most interested in the rate at which actual non-returns were predicted as non-returns, which was found to be 86.5%. This rate in identifying actual defaults indicates that the objectives of our study have been met. However, certain aspects of this model might appear less robust when viewed in isolation. For instance, 20.7% of cases were where actual returns were mistakenly classified as non-returns. The pattern appeared similarly in the out-of-sample test. This suggests that our model might somewhat overestimate the likelihood of defaults (see Tables 8 and 9).

Table 8. In-sample accuracy results (%).

Real-Prediction	Model 1	Model 2	Model 3	Model 4
Return-Return	76.0	78.8	79.3	79.3
Return-Non-Return	24.0	21.2	20.7	20.7
Non-Return-Return	12.4	13.4	13.5	13.5
Non-Return-Non-Return	87.6	86.6	86.5	86.5
Prediction accuracy	76.1	78.9	79.3	79.4

Table 9. Out-of-sample accuracy results (%).

Real-Prediction	Model 1	Model 2	Model 3	Model 4
Return-Return	75.7	78.7	79.5	79.5
Return-Non-Return	24.3	21.3	20.5	20.5
Non-Return-Return	11.8	13.2	15.0	15.0
Non-Return-Non-Return	88.2	86.8	85.0	85.0
Prediction accuracy	75.8	78.8	79.5	79.6

6. Discussion and Conclusions

In this study, we identified factors that influence the non-return risk of Chonsei deposits and constructed a non-return prediction model. The findings unveil that higher house price volatility, elevated debt-to-house value, and increased risk-free interest rates show positive associations with non-return risk. In contrast, several factors, such as longer lease maturity periods, favorable macroeconomic conditions, and rising market Chonsei price trends, demonstrated negative correlations, indicating a reduced non-return risk.

This study distinguishes itself from prior research in two key aspects. While previous theoretical studies (Ambrose and Kim 2003; Bae 2012; Kim and Bae 2015; Moon 2018) indirectly considered non-return risk when analyzing determinants of Chonsei deposit size without utilizing actual non-return data, this study first directly analyzed the non-return risk by employing real non-return cases. Additionally, unlike prior empirical studies (Min 2021, 2023; Kim 2022) that estimated market-wide non-return risk using aggregate data, this study stands out by directly predicting non-return risk for individual Chonsei contracts.

Academically, this study offers significant contributions across three main dimensions. First, it empirically analyzes the impact of variables derived from Merton's (1974) bond pricing model, which bears a theoretical resemblance to the Chonsei mechanism. This study found that the components of Merton's (1974) model also operate in lease contracts. Second, it extends the application of bankruptcy prediction models, typically used to assess corporate financial distress, to landlords in lease agreements within the housing market. Lastly, the proposed model in this study addresses both underwater risk and rollover risk, which are recognized as the two primary pathways to the non-return risk of Chonsei deposits in South Korea (Min 2021, 2023). This provides a comprehensive understanding of the non-return risk associated with individual Chonsei contracts.

Practically, our default prediction model leverages available information, making it highly useful for tenants. Although the model proposed by Moon (2018), using the landlord's creditworthiness, is theoretically consistent with the default risk, its practical feasibility is limited due to the unavailability of such information. In this regard, the predictive model in this study can be considered a practical model for rental housing consumers while showing significant robustness. Additionally, this model's regional segmentation of housing and Chonsei price changes facilitates the measurement of non-return risk across different regions, house types, and debt-to-house value levels. This segmentation also enables simulation and stress testing of underwater and rollover risks based on house and Chonsei price fluctuations.

This study's implications offer valuable insights for policymakers and industry stakeholders. Understanding key determinants of non-return risk in Chonsei contracts can guide specific policy actions to minimize tenant losses. By collaborating with public guarantee institutions, policymakers can strengthen tenant protection measures and establish relevant regulations, ensuring that landlords fulfill their contractual obligations. Overall, this study's insights contribute to understanding Chonsei deposit non-return risk, offering practical guidance for tenant protection and market stability.

The limitations of this study arise from several factors. First, the only accessible data for non-return Chonsei contracts came from guarantee institutions, leaving out non-guaranteed contracts not enrolled in these institutions, and limiting our ability to explore potential risk differences between the two groups. Secondly, in light of a low default probability, the substantial disparity in sample size between the return and non-return groups presents challenges in interpreting accuracy. This signals a need for enhanced sample selection methods. While our study was focused on identifying non-return cases and shedding light on their determinants to assist policy formulation, future research must delve deeper with more precise predictive validation.

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References

Adams, Zeno, and Ronald Füss. 2010. Macroeconomic determinants of international housing markets. *Journal of Housing Economics* 19: 38–50. [CrossRef]

Ambrose, Brent W., and Sunwoong Kim. 2003. Modeling the Korean Chonsei lease contract. *Real Estate Economics* 31: 53–74. [CrossRef]

Bae, Kwang Il. 2012. Chonsei pricing with option pricing method. *Journal of the Korea Real Estate Analysts Association* 18: 5–21. Available online: https://kiss.kstudy.com/Detail/Ar?key=3109509 (accessed on 10 May 2022).

Bank of Korea Economic Statistics System (ECOS). 2011–2021. *Interest Rates*. Available online: https://ecos.bok.or.kr/ (accessed on 25 May 2022).

Bank of Korea. 2023. Underwater Risk and Rollover Risk and Implication. Available online: http://www.bok.or.kr/portal/bbs/P0002359/list.do?menuNo=200066 (accessed on 17 July 2023).

Black, Fischer, and John C. Cox. 1976. Valuing corporate securities: Some effects of bond indenture provisions. *The Journal of Finance* 31: 351–67. [CrossRef]

Black, Fischer, and Myron Scholes. 1973. The pricing of options and corporate liabilities. *Journal of Political Economy* 81: 637–54. [CrossRef]

Brueckner, Jan K. 2000. Mortgage default with asymmetric information. *The Journal of Real Estate Finance and Economics* 20: 251–74. [CrossRef]

Cho, Dongchul. 2006. Interest rate, inflation, and housing price: With an emphasis on Chonsei price in Korea. In *Monetary Policy with Very Low Inflation in the Pacific Rim*. Edited by Ito Takatoshi and Andrew K. Rose. Chicago: University of Chicago Press, pp. 341–70. Available online: https://www.nber.org/books-and-chapters/monetary-policy-very-low-inflation-pacific-rim/interest-rate-inflation-and-housing-price-emphasis-chonsei-price-korea (accessed on 7 February 2023).

Hol, Suzan. 2007. The influence of the business cycle on bankruptcy probability. *International Transactions in Operational Research* 14: 75–90. [CrossRef]

Hull, John. 2011. *Options Futures and Other Derivatives*, 8th ed. Hoboken: Pearson Education India.

Hwang, Min, John M. Quigley, and Son Jae-young. 2006. The dividend pricing model: New evidence from the Korean housing market. *The Journal of Real Estate Finance and Economics* 32: 205–28. [CrossRef]

Hyndman, Rob. J., and George Athanasopoulos. 2018. *Forecasting: Principles and Practice*, 2nd ed. Melbourne: Monash University.

Iacoviello, Matteo. 2015. Financial business cycles. *Review of Economic Dynamics* 18: 140–63. [CrossRef]

Jin, Min-Ji. 2023. Jeonse's Weaknesses Raise Questions about System. *Korea JoongAng Daily*. Available online: https://koreajoongangdaily.joins.com/2023/06/10/business/economy/korea-jeonse-won-heeryong/20230610060009407.html (accessed on 22 September 2023).

Jing, Baiyun, Seongjin Park, and Zhang Anthony Lee. 2022. The Credit Channel of Monetary Policy Transmission: Evidence from the Chonsei System. Available online: https://ssrn.com/abstract=4019774 (accessed on 15 August 2022).

Kim, Jinwon. 2013. Financial repression and housing investment: An analysis of the Korean Chonsei. *Journal of Housing Economics* 22: 338–58. [CrossRef]

Kim, Jin Yoo. 2022. The relationship between Jeonse-to-Price ratio and Jeonse deposit non-return risk: Focused on Jeonse guarantee accident in Seoul. *Journal of the Korea Real Estate Analysts Association* 28: 55–69. [CrossRef]

Kim, Jung Hwa, and Kwang Il Bae. 2015. A study on the forecasting power of Chonsei price about volatility of housing price. *Journal of the Korea Real Estate Analysts Association* 21: 91–102. Available online: https://kiss.kstudy.com/Detail/Ar?key=3322761 (accessed on 5 February 2023).

Kim, Kyung-Hwan, and Seung Dong You. 2021. The Global Financial Crisis and transition out of homeownership in Korea. *Journal of Housing Economics* 54: 101803. [CrossRef]

Kim, Kyung-Hwan. 2004. Housing and the Korean economy. *Journal of Housing Economics* 13: 321–41. [CrossRef]

Korea Economic Research Institute. 2023. South Korea Ranks 1st in the OECD When Including Household Debt and Jeonse Deposit. *Korea Economic Research Institute*. Available online: http://www.keri.org/web/www/news_02?p_p_id=EXT_BBS&p_p_lifecycle=0&p_p_state=nomal&p_p_mode=view&_EXT_BBS_struts_action=%2Fext%2Fbbs%2Fview_message&_EXT_BBS_messageId=356448 (accessed on 20 August 2023).

Korea Federation of Banks (KFB). 2021. *COFIX*. Available online: https://portal.kfb.or.kr/fingoods/cofix.php (accessed on 20 April 2022).

Korea Financial Investment Association (KOFIA). 2021. *Bond Information Service*. Available online: https://kofiabond.or.kr (accessed on 20 April 2022).

Korea Housing & Urban Guarantee Corporation (HUG). 2023. Business Statistical Yearbook 2022. Available online: http://www.khug.or.kr/houstar/web/p01/04/p010401.jsp (accessed on 22 September 2023).

Korean Statistical Information Service (KOSIS). 2022. Statistics Korea. *Industrial Activity Trends*. Available online: https://kosis.kr (accessed on 20 May 2023).

Korea Real Estate Board Real Estate Statistics System (R-ONE). 2021. *Real Estate Statistics*. Available online: https://www.reb.or.kr/r-one/main.do (accessed on 16 May 2022).

Longstaff, Francis A., and Eduardo S. Schwartz. 1995. A simple approach to valuing risky fixed and floating rate debt. *The Journal of Finance* 50: 789–819. [CrossRef]

McQuinn, Kieran, and Gerard O'Reilly. 2008. Assessing the role of income and interest rates in determining house prices. *Economic Modeling* 25: 377–90. [CrossRef]

Merton, Robert C. 1974. On the Pricing of Corporate Debt: The Risk Structure of Interest Rates. *Journal of Finance* 29: 449–70. [CrossRef]

Min, Byung-chul. 2021. Measuring the risk of Jeonse deposit loss using Jeonse deposit fluctuation. *Journal of the Korea Real Estate Analysts Association* 27: 63–75. [CrossRef]

Min, Byung-chul. 2023. Assessing the risk of underwater Jeonse. *Journal of Housing and Urban Finance* 8: 5–18. [CrossRef]

Moon, Byunggeor. 2018. Housing investment, default risk, and expectations: Focusing on the Chonsei market in Korea. *Regional Science and Urban Economics* 71: 80–90. [CrossRef]

Oh, Frederick Dongchul, and Heejin Yoon. 2019. The role of Chonsei as a price protector in the Korean housing market. *International Economic Journal* 33: 27–41. [CrossRef]

Ohlson, James. A. 1980. Financial ratios and the probabilistic prediction of bankruptcy. *Journal of Accounting Research* 18: 109–31. [CrossRef]

Park, Sung Sik, and Ju Hyun Pyun. 2020. Between two extreme practices of rent-only and deposit-only leases in Korea: Default risk vs. cost of capital. *Regional Science and Urban Economics* 85: 103578. [CrossRef]

Renaud, Bertrand. 1989. Compounding financial repression with rigid urban regulations: Lessons of the Korean housing market. *Review of Urban and Regional Development Studies* 1: 3–22. [CrossRef]

Ronald, Richard, and Meeyoun Jin. 2015. Rental market restructuring in South Korea: The decline of the Chonsei sector and its implications. *Housing Studies* 30: 413–32. [CrossRef]

Ryu, Ki-hyun, and Jin-Ah Kim. 2018. Jeonse, will it be extinguished? Differentiation of Korean rental housing market. *Journal of Housing and the Built Environment* 33: 409–27. [CrossRef]

Shin, Hyun Song, and Se-Jik Kim. 2013. Financing growth without banks: Korean housing repo contract. In *2013 Meeting Papers*. Seoul: Society for Economic Dynamics, vol. 328, Available online: https://econpapers.repec.org/paper/redsed013/328.htm (accessed on 22 October 2022).

Son, Jae-young. 1997. A review of the Korean housing market and related policies. *Review of Urban and Regional Development Studies* 9: 80–99. [CrossRef]

Statistics Korea. 2021. Korean Statistical Information Service (KOSIS). *Housing Census*. Available online: https://kosis.kr (accessed on 2 July 2022).

Statistics Korea. 2023. Household Financial Welfare Survey. Available online: https://kostat.go.kr/board.es?mid=a10301040300&bid=215&act=view&list_no=422053 (accessed on 20 June 2023).

Yoon, Juhyun. 2003. Structural changes in South Korea's rental housing market: The rise and fall of the Jeonse system. *The Journal of Comparative Asian Development* 2: 151–68. [CrossRef]

Yun, Sungjin. 2021. Neighborhood effects of housing program using Jeonse in Korea. *International Journal of Housing Markets and Analysis* 14: 305–16. [CrossRef]