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A Study on the Adjustment Process of the Rent to *Cheonsei* Ratio on the Change of Interest Rate in the Seoul Metropolitan Area*

Lee Young-Man** and Doh Kyeong-Su***

▌Abstract ▐

Theoretically the Rent to *Cheonsei* ratio is determined by interest rate and risk premium related to housing rental market. The Rent to *Cheonsei* ratio has decreased since the 2000s due to financial deregulation and low interest rate policies in Korea. However, sometimes the Rent to *Cheonsei* ratio decoupled with interest rates. We investigate the long-run equilibrium between the Rent to *Cheonsei* ratio and interest rates, and the short-run adjustment process of the Rent to *Cheonsei* ratio when there is a disequilibrium. Our results emphasize that there is a long-run equilibrium between the Rent to *Cheonsei* ratio and the 3-year treasury bill rate. If the 3-year treasury bill rate increased by 1% point, the Rent to *Cheonsei* ratio went up 0.89% point in the long term. And if there was a disequilibrium, the Rent to *Cheonsei* ratio corrected the error from the equilibrium by 5.9% monthly. Furthermore, our results address that the Rent to *Cheonsei* ratio has coupled almost exactly with the 3-year treasury bill rate since 2008. The results imply that it may be possible that there was a structural change in 2008. And we find that the Rent to *Cheonsei* ratio by transaction price data has a lower risk premium than the Rent to *Cheonsei* ratio by appraisal price data, and also that there is no smoothing phenomenon in the Rent to *Cheonsei* ratio by appraisal price data.

Key Words: Housing rental market; Rent to *Cheonsei* Ratio; Interest rate; Long-run equilibrium; Error correction model

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** Professor at Department of Real Estate, Hansung University (Lead author, ymlee@hansung.ac.kr)

*** Doctoral candidate at Department of Real Estate, Hansung University (doh0507@naver.com)

I. Introduction

The rent to *cheonsei* ratio, which is applied in case of changing *cheonsei* (key money) to monthly rent (or changing monthly rent to *cheonsei*), has continued to decline since the 2000s.

In terms of overall housing (housing general), the nationwide rent to *cheonsei* ratio showed around 15% in the early 2000s, and dropped up to around 7% in the middle of 2015. And as for the rent to *cheonsei* ratio in Seoul, it was around 14% in the early 2000s, and dropped to around 6% in the middle of 2015. A decline in the rent to *cheonsei* ratio means that *cheonsei* has become relatively expensive compared with monthly rent. On the other hand, it also means that monthly rent has become relatively cheap compared with *cheonsei*.

The continuous decline of the rent to *cheonsei* ratio since the 2000s is said to have resulted from financial liberalization and the low interest-rate policy in Korea after the 1997 Asian Financial Crisis. That is, as the financial liberalization allowed households to borrow from financial institutions easily, and the low interest-rate policy led to a continuous decline in the mortgage interest and the credit loan interest, the rent to *cheonsei* ratio also continued to drop.[1] Particularly, the falling rate of the rent to *cheonsei* ratio seems to be also accelerated according as the low interest-rate structure has been prolonged and financial inclusion of households has been expanded since the 2007 Global Financial Crisis.

The rent to *cheonsei* ratio, however, sometimes moves differently from market interest rate. For example, from the beginning of 2005 to the middle of 2008, the Korea Treasury Bond yield and the mortgage interest rate showed an uptrend, whereas the rent to *cheonsei* ratio still dropped or drifted sideways. This implies that while the rent to *cheonsei* ratio and the market interest rate show co-movement in the long term, there may be a gap between them in the short term.

This paper intends to examine whether the rent to *cheonsei* ratio and the market interest rate show the long-run equilibrium relationship, and to analyze how a gap between the two variables is adjusted in the short term to find the long-run equilibrium, given the long-run equilibrium relationship between the two variables.

It appears that the process for adjusting a gap between the rent to *cheonsei* ratio and the market interest and maintaining their

1) See Lee (2011).

long-run equilibrium relationship varies according to the availability of mortgage loan or *cheonsei* key-money loan from financial market. It appears that the greater the degree of public financial institutions' financial inclusion of consumers, the more rapid the speed of adjustment.[2] Financial inclusion was greater during the 2010s than the 2000s. Therefore, it is supposed that the rent to *cheonsei* ratio adjusted more rapidly in the 2010s than the 2000s.

Data on the rent to *cheonsei* ratio currently available can be found largely in the following three: One is data on the rent to *cheonsei* ratio published by Kookmin Bank (KB) from August 2001 to the beginning of 2011. This data is included in statistical data titled 'National Housing Price Trend Survey' published by KB during the period. Another is data called 'Monthly Rent Interest Rate' released by the Korea Appraisal Board (KAB) from June 2010 to December 2014. This data is included in statistical data titled 'Monthly Rent Price Trend Survey' published by KAB. These two data are based on so-called appraisal information. The other is data on the rent to *cheonsei* ratio, which are included in 'National Housing Price Trend Survey'[3] announced by KAB. This is data on the rent to *cheonsei* ratio estimated by using the transaction data of rent and *cheonsei*. This data was published from 2015, but the time series period of the rent to *cheonsei* ratio begins with January 2011 from which the transaction data of rent and *cheonsei* started to be collected.

This paper intends to investigate the long-run equilibrium relationship between the rent to *cheonsei* ratio and the market interest rate and the process of short-term adjustment to find the long-run equilibrium by time period, using these three data; and to look into whether the long-run and short-run relationships with the market interest rate show differences between the rent to *cheonsei* ratio based on transaction data and one based on appraisal data.

There are many studies on how the rent to *cheonsei* ratio is determined. The representative studies include Lee, Chung and Lee (2002), Lee, Chung and Choi (2009), Choi and Ji (2007, 2008), Lee and Chung

2) That 'the speed of adjustment' is rapid means that a gap between the rent to *cheonsei* ratio and the market interest is adjusted rapidly to maintain a long-run equilibrium relationship.

3) The 'National Housing Price Trend Survey' is the national statistics of housing price and *cheonsei* price surveyed and published every month. It had been published by KB Kookmin Bank until 2012, but has been surveyed and published by the Korea Appraisal Board since 2012 according to the decision of the National Statistics Committee.

(2010), Ryu, Ji and Lee (2013), Choi and Lee (2009), Bae (2014), and Kim and Yun (2015). Most of these studies analyzed how the rent to *cheonsei* ratio is determined in terms of a lessor's return on investment[4]. Studies that analyzed how the rent to *cheonsei* ratio is determined in terms of a lessee's position are rare. Lee, Choi and Je (2009) analyzed the differences in the rent to *cheonsei* ratio according to the lessee's characteristics.

Lim (2009), Sung (2011), and Lee (2012) theoretically analyzed how the rent to *cheonsei* ratio is determined by the simultaneous equilibrium in the lessor and the lessee.

Studies on the relationship between the rent to *cheonsei* ratio and the market interest rate are also rare. Lee et al., (2009) investigated the long-run equilibrium relationships between the rent to *cheonsei* ratio, CD rate and corporate bond yield for a period between September 2002 and December 2007. They found that the rent to *cheonsei* ratio moved counter to the market interest rate, and also that there was no statistical significance.[5] Lee (2012), however, found that the rent to *cheonsei* ratio had a long-run equilibrium relationship with the mortgage interest rate, using the rent to *cheonsei* ratio data for a period between August 2001 and March 2011 published by KB. And his analysis showed that disequilibrium is corrected over an extended period.

This study follows up Lee (2012). It, however, is different from the previous study in that it investigates conditions for long-run equilibrium and the short-run adjustment process by time period, using long-term rent to *cheonsei* ratio data, and that it also examines differences between the rent to *cheonsei* ratio based on transaction data and that based on appraisal price data.

It is believed that the results of this study will be able to provide a clue to the questions of what risk premium the rent to *cheonsei* ratio has, compared with the market interest rate, and how much time it will take to resolve disequilibrium caused by a change in the market interest rate. In addition, it is deemed that it will also be possible to confirm whether the rent to *cheonsei* ratio

4) In case of calculating the rate of return to investment in a lessor's position, the rate of return to investment and the analysis of the rent to *cheonsei* ratio may vary according to whether the *cheonsei* key money is regarded as borrowing (debt leverage) or an asset for operating profit. Discussions about how the rent to *cheonsei* ratio is determined in a lessor's position are revolving around these two conflicting assumptions.

5) In the case of Lee, Chung and Choi (2009), it seems that there were limitations in investigating the long-run relationship between the rent to *cheonsei* ratio and the market interest rate, for the period of the time series was short.

based on appraisal price data shows smoothing, compared with that based on transaction price data.[6)]

II. Theoretical Review

1. The Determination of the Rent to Cheonsei Ratio

The *cheonsei* system is one of Korea's unique rental housing systems,[7)] and is a combined system of money lending and rental housing. It is not easy to understand how the rent to *cheonsei* ratio is determined, because the lessor and the lessee can have a choice between *cheonsei* and monthly rent (or monthly rent with security deposit) as well as the *cheonsei* system is a combined system of money lending and rental housing.

Lee (2012) derived equilibrium conditions for the lessor and for the lessee in choosing between *cheonsei* and monthly rent, and showed that the *cheonsei* market and the monthly rent market achieve an equilibrium when the two equilibrium conditions are satisfied simultaneously. And he called the rent to *cheonsei* ratio at a time when the two markets (*cheonsei* market and monthly rent market) achieve an equilibrium at the same time 'the market equilibrium rent to *cheonsei* ratio,' and showed theoretically how the rent to *cheonsei* ratio finds a new equilibrium according as the market interest rate changes.

This paper intends to investigate theoretically how the rent to *cheonsei* ratio varies with the changes in the market interest rate, on the basis of Lee's (2012) logic.[8)] For this, let us first suppose that there are only *cheonsei* and monthly rent in the rental housing market, and that the lessor and the lessee choose between *cheonsei* and monthly rent.[9)] And we suppose that the lessor and the les-

6) It is known that the appraisal-based price shows small volatility, compared with the transaction price, and moves with a time lag. This phenomenon is called 'smoothing bias', and has been found in the housing price index. For this, see Lee and Lee (2008).

7) The *cheonsei* system has been known meanwhile to exist in Korea only; however, it was recently found that Bolivia in South America also has a system similar to Korea's *cheonsei* system. For this, see Kim (2012) and Kim (2014).

8) Equations and explanations in this paper are the re-established equations and explanations of Lee (2012).

9) Of course, in the rental housing market, there are a lot of monthly rent agreements with a variety of security deposit types other than *cheonsei* and monthly rent. For the simplicity of the theoretical model, however, it is assumed that there exist only *cheonsei* and monthly rent. Even in case that only *cheonsei* and monthly rent with security deposit, or only monthly rent with security deposit and monthly rent are hypothesized as the objects of selection, the results of the theoretical model remain unchanged.

see can borrow money at the rate of return on risk-free asset, and deposit money at the same interest rate.[10] In addition, it is supposed that the lessor's equity capital is the same whether the lessor rents a house on a basis of *cheonsei* or monthly rent. It is assumed that the lessee's equity capital is also the same whether the lessee leases a house on a basis of *cheonsei* or monthly rent.

It is assumed that the lessor purchases and rents a house priced at P, raising money for it by borrowing C, which is equivalent to *cheonsei* key money, and providing $(P-C)$ from the lessor's own capital. It is assumed that in case of renting this house on a *cheonsei* basis, C is raised by *cheonsei* key money, while in case of renting it on a monthly rent basis, C is borrowed from a financial institution. And it is assumed that in case of leasing a house on a *cheonsei* basis, the lessee borrows C from a financial institution, while in case of leasing it on a monthly rent basis, he does not borrow money.

In the case of the lessor, the choice between renting on a *cheonsei* basis and renting on a monthly rent basis becomes indifferent only when the return on equity is the same whether he rents a house on a basis of *cheonsei* or monthly rent[11]. The return on equity for a case of renting a house on a *cheonsei* basis (r_c) can be expressed as Eq. (1), and that for a case of renting it on a monthly rent basis (r_m) can be expressed as Eq. (2). And the lessor's equilibrium conditions are as shown in Eq. (3).

$$r_c = \frac{\Delta P}{P-C} \tag{1}$$

$$r_m = \frac{\Delta P+(1-k)R-iC}{P-C} \tag{2}$$

$$\frac{\Delta P}{P-C} = \frac{\Delta P+(1-k)R-iC}{P-C} \tag{3}$$

Where ΔP denotes the expected capital gain, and R denotes rent that can be received in case of renting a house on a monthly rent basis. k is the expected rate of loss due to vacancy or bad tenant in case of renting a

10) It is obvious that the borrowing interest rate for the lessor and for the lessee are different, and that the borrowing interest rate and the deposit interest rate are different. We make this assumption to simplify the model, but will alleviate this assumption later.

11) There is no difference in return due to the difference in leverage because it is supposed that the leverage is the same whether the house is rented on a basis of *cheonsei* or monthly rent. Most of the existing studies on how the lessor's return on investment is determined assume that the lessor purchases a house by using leverage in case of renting it on a *cheonsei* basis, while the lessor purchases a house by using the equity capital in case of renting it on a monthly rent basis. In such a case, there comes to be differences in capital structure between the choice of *cheonsei* and monthly rent.

house on a monthly rent basis. And i denotes the return on risk-free asset, and it is the same as the interest rate for loan according to assumption.

Eq. (3) can be arranged as Eq.(4).

$$\frac{R}{C}=\frac{i}{1-k}=i+\pi_o \quad (4)$$

where $\pi_o=\frac{k}{1-k}i$

In Eq. (4), R/C is the rent to *cheonsei* ratio,[12] and π_o denotes the premium for rental risk (the risk of vacancy, or the arrearage or non-payment of rent) that the lessor should take when he chooses monthly rent. Eq. (4) means that the lessor becomes indifferent between *cheonsei* and monthly rent only when the rent to *cheonsei* ratio is the same with the return on risk-free asset plus a premium for rental risk.

If $r_c < r_m$ (if $R/C > i+\pi_o$), the lessor will choose monthly rent instead of *cheonsei*. On the contrary, if $r_c > r_m$ (if $R/C < i+\pi_o$), the lessor will choose *cheonsei* instead of monthly rent.

On the other hand, the lessee's choice between *cheonsei* and monthly rent becomes indifferent only when housing cost is the same whether leasing on a *cheonsei* basis or on a monthly rent basis. The lessee's housing cost in case of leasing on a *cheonsei* basis (U_c) is equivalent to Eq. (5). And that in case of leasing on a monthly rent (U_m) is equivalent to Eq. (6). The lessee's equilibrium conditions are as shown in Eq. (7).

$$U_c = iC+H \quad (5)$$

$$U_m = R \quad (6)$$

$$iC+H=R \quad (7)$$

H is a sort of contingent cost that the lessee may incur by choosing *cheonsei*. It includes cost caused by the lessor's bankruptcy and by failing to get back *cheonsei* key money timely.

Eq. (7) can be arranged as Eq. (8) below.

$$\frac{R}{C}=i+\frac{H}{C}=i+\pi_l \quad (8)$$

where $\frac{H}{C}=\pi_l$

12) As for the formula for calculating the rent to *cheonsei* ratio, there are one applied to a case where *cheonsei* is switched to monthly rent and one applied to a case where *cheonsei* is switched to monthly rent with security deposit. In the case of the latter, given the security deposit is D, the formula for calculating the rent to *cheonsei* ratio is $R(D)/(C-D)$, where $R(D)$ refers to monthly rent in case that the security deposit is D. In this paper, $D=0$, for it is assumed that there are only *cheonsei* and monthly rent; and thus, the formula for calculating the rent to *cheonsei* ratio becomes R/C.

In Eq. (8), π_l denotes the lessee's premium for risk of choosing *cheonsei*. Eq. (8) means that the lessee becomes indifferent between *cheonsei* and monthly rent only when the rent to *cheonsei* ratio is the same with the return on risk-free asset plus a risk premium on private lending (lending the *cheonsei* key money to the lessor).

If $U_c < U_m$ (if $R/C > i+\pi_l$), the lessee will choose *cheonsei* instead of monthly rent. On the contrary, if $U_c > U_m$ (if $R/C < i+\pi_o$), the lessee will choose monthly rent instead of *cheonsei*.

If the lessor and the lessee are in equilibrium at the same time, the *cheonsei* market and the monthly rent market are also in equilibrium. That is, if Eq. (9) is valid, the *cheonsei* market and the monthly rent market achieve an equilibrium at the same time.

$$\frac{R}{C} = i+\pi_o = i+\pi_l \tag{9}$$

Eq. (9) indicates that the *cheonsei* market and the monthly rent market are in equilibrium at the same time only when the lessor's risk premium coincides with the lessee's risk premium. Is this possible? There exists an equilibrium point at which Eq. (9) is satisfied because lessors and lessees have different risk premiums according to their own demographic and economic characteristics. For example, if a lessee has a lending risk premium lower than the equilibrium risk premium ($\pi_o^* = \pi_l^*$), he/she will choose *cheonsei*. On the contrary, if a lessee has a lending risk premium higher than the equilibrium risk premium, he/she will choose monthly rent. Similarly, if a lessor has a renting risk premium lower than the equilibrium risk premium, he/she will choose monthly rent. On the contrary, if a lessor has a renting risk premium higher than the equilibrium risk premium, he/she will choose *cheonsei*.

For the simplification of the theoretical model, we assumed above that both lessor and lessee can borrow money at the rate of return on risk-free asset. However, borrowing interest rates for the lessor and the lessee may be different. Generally, the lessor's loan interest rate is low because a house is used as a guarantee, whereas the lessee's loan interest is high because of having to borrow money on credit. This, however, also varies according to the lessor's and the lessee's demographic and economic characteristics. If even a lessor is heavily in debt, the financing cost will be high. If a lessee has good credit, the financing cost will be low. When the credit spread on the lessor's financing is denoted by s_o and the credit spread on the lessee's financing is denoted by s_l, Eq. (9) is modified as follows:

$$\frac{R}{C} = i+(s_o+\pi_o) = i+(s_l+\pi_l) \tag{10}$$

To think about the credit spread alone, among lessors, a lessor who have difficulty in financing will require a rent to *cheonsei* ratio higher than the equilibrium rent to *cheonsei* ratio in the market because he/she should pay a high premium. In this case, this lessor will choose *cheonsei* because of $(R/C)^* < i+(s_o+\pi_o)$. As for a lessor who can finance money easily, he/she will choose monthly rent on the contrary for $(R/C)^* > i+(s_o+\pi_o)$ due to a low credit spread.

In addition, among lessees, a lessee who can finance money easily (in particular, one who has his own money or can get *cheonsei* key money from parents) will require a rent to *cheonsei* ratio lower than the equilibrium rent to *cheonsei* ratio in the market. Thus, this lessee will choose *cheonsei* for $(R/C)^* > i+(s_l+\pi_l)$. As for a lessee who has difficulty in financing money will choose monthly rent on the contrary because of $(R/C)^* < i+(s_l+\pi_l)$ due to a high credit spread.

If the market interest rate drops (if i, the rate of return on risk-free asset, drops to i') under the condition of the simultaneous equilibrium of the *cheonsei* market and the monthly rent market, some of lessors who chose *cheonsei* will choose monthly rent because of $(R/C)^* = i+(s_o+\pi_o)^* > i'+(s_o+\pi_o)^*$ (a decrease in the supply of *cheonsei*, an increase in the supply of monthly rent). Also, some of lessees who chose monthly rent will choose *cheonsei* because of $(R/C)^* = i+(s_l+\pi_l)^* > i'+(s_l+\pi_l)^*$ (an increase in demand for *cheonsei*, a decrease in demand for monthly rent). As a result, the rent to *cheonsei* ratio comes to fall as the *cheonsei* price rises and the monthly rent price falls. Through this process, the *cheonsei* market and the monthly rent market come to find a new equilibrium.

2. The Adjustment Process of the Rent to Cheonsei Ratio

As shown above, a change in the market interest rate changes the rent to *cheonsei* ratio through demand and supply changes in the *cheonsei* market and the monthly rent market. These changes, however, may not occur immediately in the real world. For example, even though the market interest rate changes, the supply and demand changes in the *cheonsei* market and the monthly rent market may happen slowly due to the remaining period of a rental contract, costs of house moving, time taken to borrow money, etc. As a result, changes in the *cheonsei* price and the monthly rent price and the change of the rent to *cheonsei* ratio may occur with time lags. That is, while the rent to *cheonsei* ratio finds a new equilibrium according to changes in the market interest rate in the long term, it may be said that equilibrium error caused by the change of the market interest rate is slowly adjusted in the short term.

Let us model this process in which the rent to *cheonsei* ratio finds an equilibrium

in the short and long term.[13] As shown above, the condition for the simultaneous equilibrium of the *cheonsei* market and the monthly rent market is $R/C = i + (s + \pi)$, where the risk premium, $(s + \pi)$, is not observable. And the Korea Treasury Bond yield, which represents the market interest, is usually used as the rate of return on risk-free asset. However, the Korea Treasury Bond yield is not exactly equal to the theoretical rate of returns on risk-free asset because the yields of the bonds vary in liquidity risk according to their maturities. Accordingly, the long-run equilibrium relationship between the rent to *cheonsei* ratio and the market interest rate can be estimated with the following equation.

$$\left(\frac{R}{C}\right)_t = Y_t = \alpha + \beta\ r_t + e_t \quad t = 1,\ 2,\ \cdots,\ n \tag{11}$$

Where Y denotes the rent to *cheonsei* ratio, and r denotes the market interest rate that acts as proxy for the rate of return on risk-free asset. It may be said that $\widehat{Y_t} = \hat{\alpha} + \hat{\beta}\ r_t$ estimated by Eq. (11) is the equilibrium rent to *cheonsei* ratio that achieves the simultaneous equilibrium of the *cheonsei* market and the monthly rent market.

If the rent to *cheonsei* ratio and the market interest rate are non-stationary time series, Eq. (11) becomes the so-called cointegration function. In this case, an error correction model (ECM) in the form of difference shows the process in which the rent to *cheonsei* ratio adjusts equilibrium error in the short term. The error correction model in the form of difference is as shown in Eq. (12).

$$\Delta Y_t = \alpha + \delta \Delta r_t + \gamma(Y_{t-1} - \widehat{Y_{t-1}}) + u_t \tag{12}$$

Where $(Y_{t-1} - \widehat{Y_{t-1}})$ denotes the degree of disequilibrium of the rent to *cheonsei* ratio in the previous period. Eq. (12) means that when the market interest rate changes, the rent to *cheonsei* ratio reflects some of the change, and corrects some of disequilibrium in the previous period at the same time. The rent to *cheonsei* ratio converges to equilibrium only when the sign of γ is 'negative (-).' That is, if the rent to *cheonsei* ratio is higher than the equilibrium level, the rent to *cheonsei* ratio should drop in the following period to converge to the equilibrium. In the opposite case, the rent to *cheonsei* ratio should rise in the following period.[14]

13) The model explained here is a modified and supplemented Lee's (2012) model.

14) The process in which a variable converges to equilibrium can be expressed either by an error correction model (ECM) or a partial adjustment process model. Geltner (1991), Quan and Quigley (1991), and Lee

III. Empirical Analysis

1. Data

For the estimation of Eq. (11) and Eq. (12), this study uses three types of rent to *cheonsei* ratio data mentioned in the Introduction (Data on the rent to *cheonsei* ratio published by KB; data on monthly rent interest rate in the Monthly Rent Price Trend Survey published by KAB; and data on the rent to *cheonsei* ratio in the National Housing Price Trend Survey announced by KAB).

The three rent to *cheonsei* ratios to be used in empirical analysis vary in time periods and data sources, and show differences in regions covered and house types. And there are also differences in the sources of price data (data on *cheonsei* and monthly rent), which serve as the grounds for the calculation of the rent to *cheonsei* ratio.

As for the data on the rent to *cheonsei* ratio published by KB, its time series began from August 2001, but was not published after March 2011. This data was based on licensed real estate agents' appraisal price, and was subdivided by region into the whole nation, the Seoul metropolitan area, provinces, metropolitan cities, and Seoul. But it was not subdivided by houses type.

As for the data on monthly rent interest rate published by KAB, it was based on appraisal price like KB's data, and its time series began from August 2010. This data was published until December 2014 only. This data is limited to the Seoul metropolitan area, Seoul, and metropolitan cities, and was not subdivided by house type.

On the other hand, the data on the rent to *cheonsei* ratio announced by KAB has

Table 1 Types of data on rent to *cheonsei* ratio available for empirical analysis

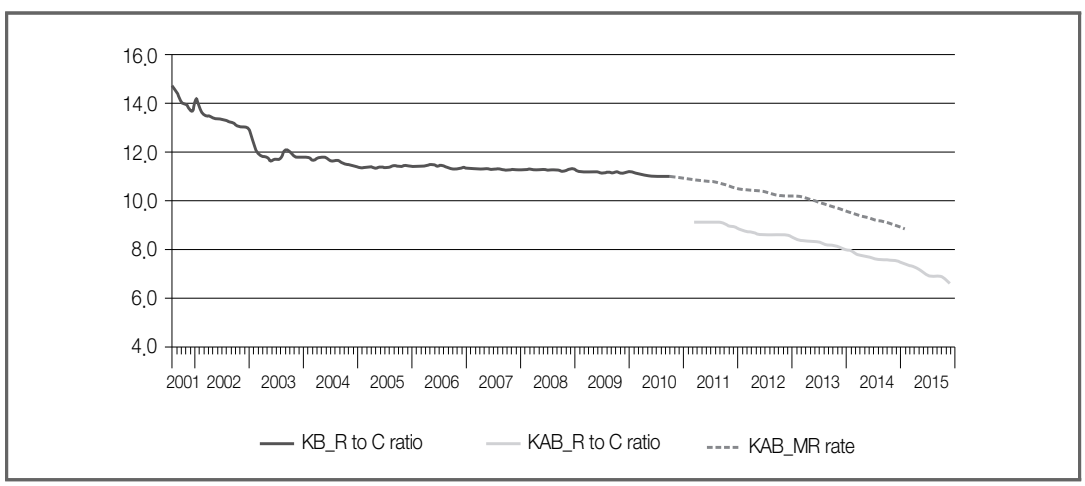
Data	Source	Period	data sources	Region/house type
KB's rent to *cheonsei* ratio	National Housing Price Trend Survey	Aug. 2001-Mar. 2011	Appraisal price data	- Region: the whole nation, Seoul metropolitan area, provinces, metropolitan cities, Seoul - Housing type: all houses
KAB's monthly rent interest rate	Monthly Rent Price Trend Survey	Jun. 2010-Dec. 2014	Appraisal price data	- Region: Seoul metropolitan area, Seoul, metropolitan cities (from May 2012) - Housing type: all houses
KAB's rent to *cheonsei* ratio	National Housing Price Trend Survey	Jan. 2011-Present	Transaction data	- Region: the whole nation, Seoul metropolitan area, 8 dos, metropolitan cities, Seoul - Housing type: all houses, apartment, detached house, row house

and Lee (2009) modeled the process for real estate price to find equilibrium, using partial adjustment process models, and Lee (2012) modeled the process for the partial adjustment of rent to *cheonsei* ratio, using the same model.

been estimated on the basis of transaction data, and differs in characteristics from the above two data on the rent to *cheonsei* ratio. This data has been published since January 2011, and includes the whole nation, the Seoul metropolitan area, eight *Do*s (provinces), and metropolitan cities by region. It also subdivides house types into all houses, apartment, detached house, and row house.

The investigation of the long-run relationship between the rent to *cheonsei* ratio and the market interest rate requires a long period time-series, if possible. In this regard, the KB data on rent to *cheonsei* ratio has no problem in investigating the long-run relationship with the market interest ratio because it has a time series as long as 10 years. It, however, has the disadvantage that it can't show the recent relationship. On the other hand, the KAB data on monthly rent interest rate or the rent to *cheonsei* ratio can show recent relationship, but has difficulty in showing the long-run relationship sufficiently for they have short time periods.

Given the above, this paper intends to generate a long-term time series data of the rent to *cheonsei* ratio by combining the KB data and the KAB data, and to investigate the long-run relationship between the rent to *cheonsei* ratio and the market interest rate. The KAB's rent to *cheonsei* ratio shows the average difference of about 2%p in the KAB's monthly rent interest rate and the KB's rent to *cheonsei* ratio. On the other hand, it seems that there is almost no difference between the KB's rent to *cheonsei* ratio



Note: KB_R to C ratio denotes the KB's rent to *cheonsei* ratio, KAB_R to C ratio denotes the KAB's rent to *cheonsei* ratio, and KAB_MR rate denotes the KAB's monthly rent interest rate, respectively.

Fig. 1. Trends of rent to *cheonsei* ratios in the Seoul metropolitan area (based on all house)

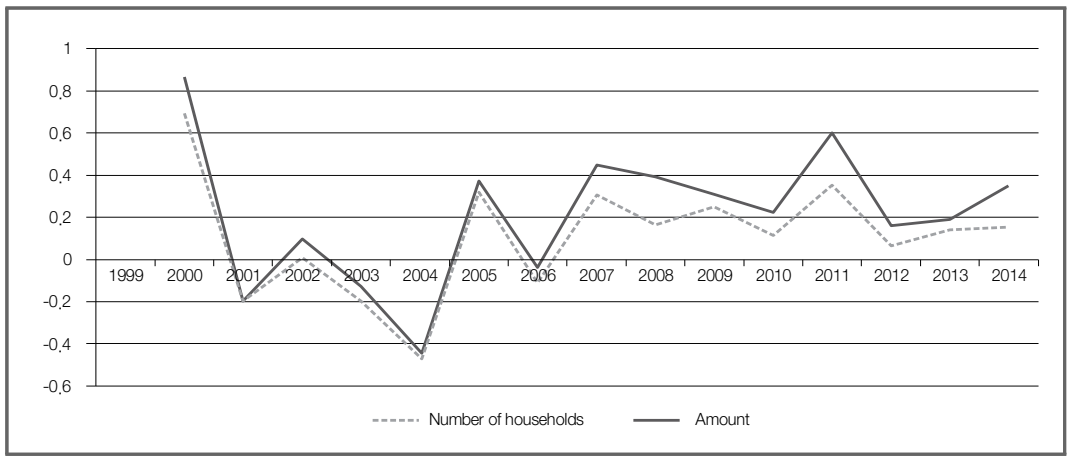


Fig. 2. The rate of an increase in the guarantee of *cheonsei* key money loan by the Housing Finance Credit Guarantee Fund

data and the KAB's monthly rent interest rate data, which are based on appraisal price.[15)]

Thus, we decided to combine the KB's rent to *cheonsei* ratio and the KAB's monthly rent interest rate into one time series,[16)] to estimate the long-run equilibrium relationship between this time series and the market interest rate, and to analyze the process of short-term adjustment. 'But the common regions of the two time series are limited to the Seoul metropolitan area and Seoul. So we decided to make analysis using the data of rent to *cheonsei* ratio on the basis of all houses in the Seoul metropolitan area because 'all houses' is the only house type available from the data.[17)]

For the market interest rate, which represents the return on risk-free asset, data on Korea Treasury Bond yields was used, provided that the three-year bond yield was used given that the term of a *cheonsei* agreement is about three years on average.

15) The KB's rent to *cheonsei* ratio data and the KAB's monthly rent interest rate are overlapped for eight months from August 2010 to March 2011. There is almost no difference in the rent to *cheonsei* ratio between the data of the two institutions.

16) In the case of the period in which the two time series(KB's rent to *cheonsei* ratio and KAB's monthly rent interest rate) overlap, the average of the two rent to *cheonsei* ratios was used as the rent to *cheonsei* ratio for the relevant period.

17) Altough regions common to the two time series are the Seoul metropolitan area and Seoul, only the rent to *cheonsei* ratio of the Seoul metropolitan area was analyzed because the Seoul metropolitan area includes Seoul. Metropolitan cities are also regions common to the two time series, but were not considered, for the time series of the rent to *cheonsei* ratio in the data on the monthly rent interest rate begins from May 2012.

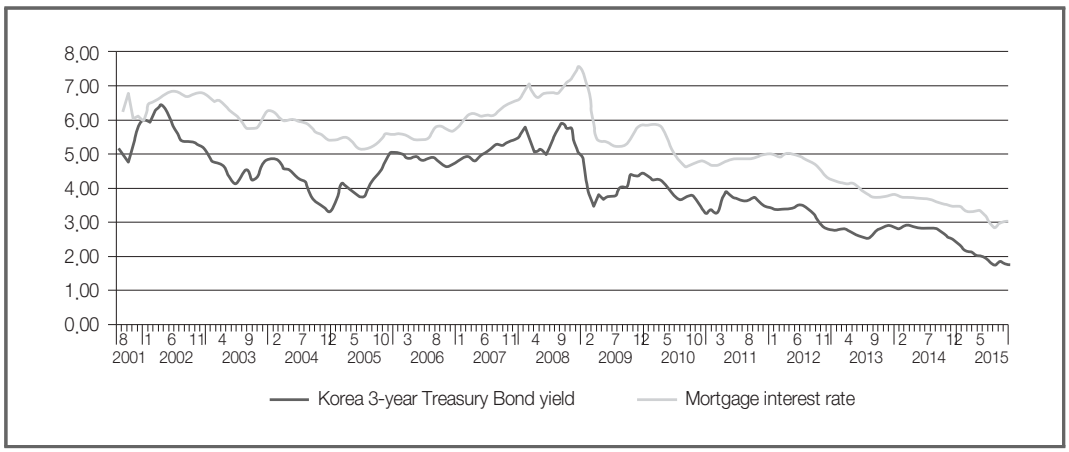


Fig. 3. Trends of the Korea 3-year Treasury Bond yield and the mortgage interest rate

If the degree of financial inclusion changes, the adjustment process of rent to *cheonsei* ratio may change. As for the volume of *cheonsei* key money loan guarantee by the Housing Finance Credit Guarantee Fund, the rate of an increase in the guarantee of *cheonsei* key money loan was very slow until 2006. Then, the rate of an increase in the guarantee becomes very fast after 2007. Given that the *cheonsei* key money loan is a kind of credit loan, the increase in *cheonsei* key money loan by the credit guarantee by the government may be interpreted as the expansion of financial inclusion of households.

On the other hand, as for the trends of the Korea 3-year Treasury Bond yield and the mortgage interest rate, although they show a downward trend in the long term, they showed a downward trend and an upward trend alternately before the mid to late 2008. Then, they have showed a continuous downward trend since 2009. There may be differences in the long-run equilibrium and the short-term adjustment process of the rent to *cheonsei* ratio between when the market interest rate repeats fluctuations and when it continues to fall.

Consequently, we will investigate whether there are differences in the long-run equilibrium and the short-term adjustment process of the rent to *cheonsei* ratio by dividing the analysis period into before and after 2008. And with the KAB's data on the rent to *cheonsei* ratio and the monthly rent interest rate, we will investigate whether there are differences in the long-run equilibrium relationship or the process of short-term adjustment between the rent to *cheonsei* ratio based on appraisal price and that based on transaction price.

2. Results of Empirical Analysis

1) Long-run equilibrium relationship

Before investigating the long-run equilibrium relationship between the rent to *cheonsei* ratio and the Korea 3-year Treasury Bond yield, we tested whether there are any unit roots in the two time series, using ADF test, DF-GLS test, and KPSS test (Kwiatkowsk-Phillips-Schmidt-Shin test). The results of the tests showed that there are the unit roots both in the rent to *cheonsei* ratio and the Korea 3-year Treasury Bond yield.[18)]

As the two variables have the unit roots, we tested whether the two variables have a long-run equilibrium relationship by using the cointegration test. As a result of testing a cointegration relationship between the two variables, using the Johansen's cointegration test,[19)] the null hypothesis of 'There is no cointegration.' was rejected. Therefore, it was judged that there is a cointegration relationship between the rent to *cheonsei* ratio and the Korea 3-year Treasury Bond yield.

As it was found that the rent to *cheonsei* ratio and the Korea 3-year Treasury Bond yield have the unit root, respectively, and that there is the cointegration relationship

Table 2 Results of the unit root test on the rent to *cheonsei* ratio and the Korea 3-year Treasury Bond yield

	Rent to *Cheonsei* Ratio		Korea 3-year Treasury Bond yield	
	Constant term	Constant term + Time trend	Constant term	Constant term + Time trend
ADF test statistic	-2.3859	-3.1518*	-1.0989	-2.9138
DF-GLS test statistic	2.6307	-0.7978	-0.4703	-2.7321*
KPSS test statistic	1.3269***	0.1707**	1.1968***	0.2098**

Note: In ADF test and DF-GLS test, * means that the null hypothesis of 'There is a unit root.' is rejected at the significance level of 10%.
In KPSS test, *** and ** mean that the null hypothesis of 'There is no unit root.' is rejected at the significance level of 1% and 5%, respectively.

18) When considering the time trend in the ADF test or the DF-GLS test, it seems that there is no unit root in the rent to *cheonsei* ratio or the Korea 3-year Treasury Bond yield at the significance level of 10%. This, however, means that they become stationary time series if the time trend is excluded; and the time series before removing the time trend are non-stationary time series. It can be shown more clearly that the two time series are non-stationary time series, with the KPSS test that tests the null hypothesis of 'There is no unit root.'

19) In case of performing the cointegration test with two time series only, a cointegration relationship can be identified by estimating a regression model consisting of the two time series, and then performing the unit root test of its residual term. In the case of this method, however, the results of the unit root test may be different when the dependent variable and the independent variable are exchanged. Due to this problem the Johansen's test method, a multivariate cointegration test method, is mostly used, even though there are two variables.

Table 3 Results of the Johansen cointegration test on the rent to *cheonsei* ratio and the Korea 3-year Treasury Bond yield

Null hypothesis on cointegration	Trace statistic in case that the cointegration function has neither constant term nor deterministic trend	Trace statistic in case that the integration function has a constant term, but has no deterministic trend
No cointegration	15.8408***	24.2842***

Note: *** means that the null hypothesis is rejected at the significance level of 1%.

between the two variables, Eq. (11), which shows the long-run equilibrium relationship between the two variables, was estimated. As a result of estimating Eq. (11), using the time series data ranging from August 2001 to December 2014, it was found that the rent to *cheonsei* ratio fluctuated in the long term, reflecting about 89% of the variation of the Korea 3-year Treasury Bond yield. The size of the constant term, which shows the risk premium size of *cheonsei* indirectly, was about 7.6% point.

And after dividing the time series data into before and after 2008,[20] we estimated Eq. (11). Differences in estimates between the two periods were revealed clearly. As a result of investigating the long-run equilibrium relationship between the rent to *cheonsei* ratio and the Korea 3-year Treasury Bond yield after setting the period from August 2001 to December 2008 as one period, it was found that the rent to *cheonsei* ratio fluctuated, with reflecting only about 55% of the variation in the Korea 3-year Treasury Bond yield. And the size of the constant term, which shows risk premium, was about 9.3% points. However, in case of setting the period from January 2009 to December 2014 as one period, it was found that the rent to *cheonsei* ratio during this period fluctuated about 1.1 times more than the variation of the Korea 3-year Treasury Bond yield, and that the size of the constant term, which shows the risk premium, was about 6.8% points.

As a result of the Wald test on the null hypothesis that the estimation coefficient of the Korea 3-year Treasury Bond yield is 1, the estimation coefficient of the Korea 3-year Treasury Bond yield with the time series from January 2009 to December 2014 failed to reject the null hypothesis. However, the estimation coefficient of the Korea 3-year Treasury Bond yield estimated with

20) The time series data could be also divided before and after 2007 and 2009. But changes in the estimation coefficients appeared when the data were divided into before and after 2008. Thus, in this paper, estimation was made after dividing the period into two, with 2008 as the reference.

the time series from August 2001 to December 2008 rejected the null hypothesis that its value is 1.[21] On the other hand, the standard error of regressor estimated with data from January 2009 to December 2014 was lower than 1/2 of that estimated with the data from January 2001 to December 2008.

These results of estimation can be understood clearly when examining the trends of variation in the rent to *cheonsei* ratio and the Korea 3-year Treasury Bond yield after 2001. From 2001 to the end of 2008, the Korea 3-year Treasury Bond yield showed a downward trend with small fluctuations. On the other hand, the rent to *cheonsei* ratio showed a continuous downward trend during the same period. After 2009, however, both of the Korea 3-year Treasury Bond yield and the rent to *cheonsei* ratio showed a continuous downward trend without great fluctuation.

Looking to these movements of the two variables, from 2001 to the end of 2008, it seems to be inevitable that the rent to *cheonsei* ratio responded insensitively to the changes of the Korea 3-year Treasury Bond yield, and that the standard error of regressor was also great. On the other hand, after 2009, the rent to *cheonsei* ratio followed the changes of the Korea 3-year Treasury Bond yield exactly. And consequently, it is found that the standard error of regressor was very small.

The results mentioned above means that the estimation coefficient value can vary with time. Actually, the risk premium of the rent to *cheonsei* ratio may vary with time, and thus the estimation coefficient of the constant term, which shows the risk premium as proxy for it, may vary over time.

Given that the estimation coefficient value may vary with time, this paper estimated Eq. (11) with the state space model, which is used to identify unobserved components. The model was estimated with Kalman fil-

Table 4 Results of estimating the long-run equilibrium relationship equation for the rent to *cheonsei* ratio and the Korea 3-year Treasury Bond yield

	Aug. 2001 - Dec. 2014	Aug. 2001 - Dec. 2008	Jan. 2009 - Dec. 2014
Constant term	7.5603***	9.2901***	6.7660***
Korea 3-year Treasury Bond yield	0.8866***	0.5452***	1.1026***
Standard error of regressor	0.676	0.811	0.353

Note: *** means that the estimation coefficient is significant at the significance level of 1%.

21) The results of the Wald test on the null hypothesis that the estimation coefficient of the Korea 3-year Treasury Bond yield is 1 are not presented here because of limitations of space.

tering, under the assumption of the random walk of the coefficient of the constant term in Eq. (11). Specifically, the state space model of Eq. (11) is as shown in Eq. (13).

$$Y_t = \alpha_t + \beta_t \; r_t + e_t \qquad (13)$$
$$\alpha_t = \alpha_{t-1} + \epsilon_t$$
$$\beta_t = \beta_{t-1}$$

The results of the estimation of Eq. (13) are as shown in Table 5. And the trends of estimation coefficients for the constant term and the Korea 3-year Treasury Bond yield over time are as shown in Fig. 4. As seen in the figure, the estimation coefficient of the constant term shows the trend of continuously rising after 2003 and falling after 2008. And on the contrary, the estimation coefficient of the Korea 3-year Treasury Bond yield shows the trend of continuously falling after 2003 and rising after 2008.

On the other hand, in order to find out what differences the rent to *cheonsei* ratio based on transaction price data and that based on appraisal price data show in the long-run relationship with the Korea 3-year Treasury Bond yield, we estimated Eq. (11) with the KAB's rent to *cheonsei* ratio data (transaction price data) and KAB's monthly rent interest rate data (appraisal price data).

Table 5 Results of estimating the state space model on the rent to *cheonsei* ratio

	Final State	Root MSE	z-Statistic	Prob.
Constant term	7.641	3.34E-09	2.29E+09	0.000
Korea 3-year Treasury Bond yield	0.860	7.78E-10	1.10E+09	0.000

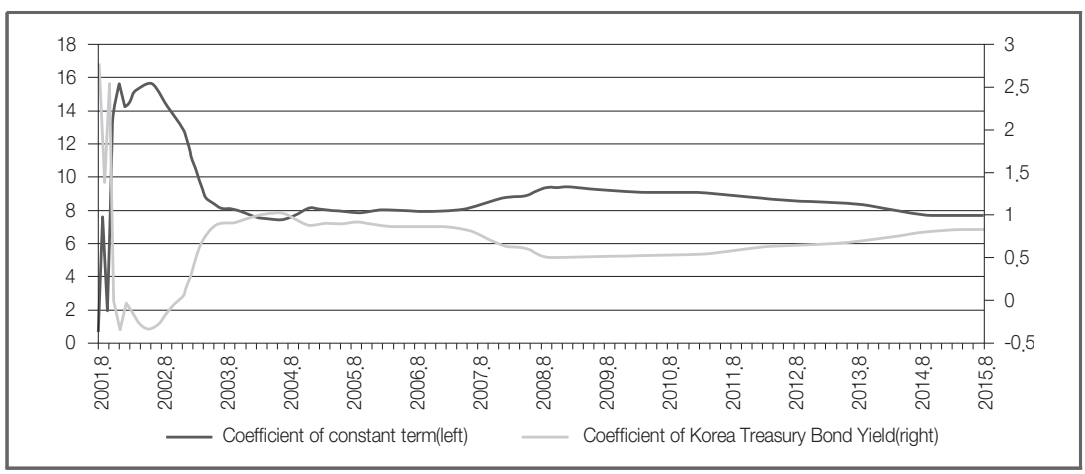


Fig. 4. The time-varying estimation coefficients of the constant term and the Korea 3-year Treasury Bond yield over time

Table 6 Results of estimating the long-run equilibrium relationship equation of the rent to *cheonsei* ratio based on real transaction data and on appraisal price data

	KAB's rent to *cheonsei* ratio (Jan. 2011 - Dec. 2014)	KAB's monthly rent interest rate (Jan. 2011 - Dec. 2014)
Constant term	5.2079***	6.5828***
Korea 3-year Treasury Bond yield	1.0559***	1.1408***
Standard error of regressor	0.287	0.324

Note: *** means that the estimation coefficient is significant at the significance level of 1%.

The common period of the two data is from January 2011 to December 2014, which is not sufficient to estimate the long-run equilibrium relationship. However, we expected that only the nature of transaction price data and appraisal price data could be identified from the estimation results of the two data.

The results of estimating the long-run equilibrium relationship with the Korea 3-year Treasury Bond yield by using KAB's monthly rent interest rate data based on appraisal price data showed no great difference from results of the above estimation using the data on the period from January 2009 to December 2014. However, the results of estimating the long-run equilibrium relationship with the Korea 3-year Treasury Bond yield by using KAB's rent to *cheonsei* ratio data based on transaction price data were found to be somewhat different. There was no great difference in the estimation coefficient of the Korea 3-year Treasury Bond yield, while the size of the constant term, which shows the size of risk premium, was lower by about 1.4% points from 6.6% points to 5.2% points.

In general, the appraisal price is known to have lower volatility than transaction price, and to follow the changes of transaction price. Owing to these characteristics of appraisal price, it was expected that the rent to *cheonsei* ratio based on appraisal price data reflected the changes of the Korea 3-year Treasury Bond yield less than the rent to *cheonsei* ratio based on transaction price data. Actually, however, there was no difference. The two were different only in the risk premium; the risk premium of the rent to *cheonsei* ratio based on appraisal price data was found to be somewhat higher.

2) The short-term Adjustment Process

Given that the rent to *cheonsei* ratio has a long-run equilibrium relationship with the Korea 3-year Treasury Bond yield, if the rent to *cheonsei* ratio breaks away from the long-run equilibrium relationship, it should be corrected to converge to the equilibrium relationship. We estimated Eq. (12) to find out whether the rent to *cheonsei* ratio ac-

tually converges to the equilibrium relationship by adjusting disequilibrium.

The adjustment process of the rent to *cheonsei* ratio was estimated, using the time series data extending from August 2001 to December 2014. As a result of the estimation, it was found that the rent to *cheonsei* ratio converges to the long-run equilibrium by reducing the estimation error of the previous period about 5.9% every month.

The results of estimation using time series data on the period between August 2001 and December 2008 were also similar. It was found that the rent to *cheonsei* ratio converged to the long-run equilibrium by correcting the error of the previous period about 7.9% every month.

However, the results of estimation using time series data on the period from January 2009 to December 2014 were quite different. It was found that the rent to *cheonsei* ratio did not correct the error of the previous period. This may be either because the rent to *cheonsei* ratio was on the downward trend after 2009 or because there was no error to correct as the rent to *cheonsei* ratio moved very closely with the Korea 3-year Treasury Bond yield after around 2009.[22)]

On the other hand, the adjustment equation of Eq. (12) was estimated similarly, us-

Table 7 Results of estimating the adjustment equation of the rent to *cheonsei* ratio

	Aug. 2001 - Dec. 2014	Aug. 2001 - Dec. 2008	Jan. 2009 - Dec. 2014
Constant term	-0.0341***	-0.0378***	-0.0326***
Korea 3-year Treasury Bond yield difference	0.1051***	0.1181***	0.0188***
EC (-1)	-0.0587***	-0.0792***	0.0119***
Standard error of regressor	0.108***	0.139***	0.033***

Note: ***, **, and * mean that the estimation coefficient is significant at the significance level of 1%, 5%, and 10%, respectively.

Table 8 Results of estimating the adjustment equation of the rent to *cheonsei* ratio based on real transaction data and on appraisal price data

	KAB's rent to *cheonsei* ratio (Jan. 2011 - Dec. 2014)	KAB's monthly rent interest rate (Jan. 2011 - Dec. 2014)
Constant term	-0.0347***	-0.0424***
Korea 3-year Treasury Bond yield difference	0.0451***	0.0214***
EC (-1)	-0.0068***	0.0116***
Standard error of regressor	0.054***	0.026***

Note: *** means that the estimation coefficient is significant at the significance level of 1%.

22) As shown in Table 4, this can be conjectured from the fact that the standard error of regressor in the long-run equilibrium relationship equation with the time series data for the period from January 2009 to December 2014 was found to be very small.

ing KAB's rent to *cheonsei* ratio data based on transaction price data and KAB's monthly rent interest rate based on appraisal price data on the period from January 2011 to December 2014.

The results of the estimation in Table 8 showed no great difference from the estimation results of the adjustment equation estimated by the time series data for the period from January 2009 to December 2014 in Table 7. That is, it was found that the error of the previous period has no great effect on the current rent to *cheonsei* ratio.

IV. Conclusion

It is known that a decline in the market interest rate is behind the continuous fall in the rent to *cheonsei* ratio since the 2000s. This paper estimated the long-run equilibrium relationship and the short-term adjustment process between the rent to *cheonsei* ratio and the Korea 3-year Treasury Bond yield. For this, a time series data of the rent to *cheonsei* ratio was generated by combining the KB's rent to *cheonsei* ratio data (August 2001 - March 2011) and KAB's monthly rent interest rate data (August 2010 - December 2014), which were prepared on the basis of appraisal price data. What is common to the rent to *cheonsei* ratio data of the two institutions is data on all houses in the Seoul metropolitan area, and thus the target region and house type of analysis were restricted to the Seoul metropolitan area and all houses.

The results of analysis revealed that the rent to *cheonsei* ratio has a long-run equilibrium relationship with the Korea 3-year Treasury Bond yield. It was found that in the long term, if the Korea 3-year Treasury Bond yield fluctuates 1% point, the rent to *cheonsei* ratio fluctuates 0.89% point. And we found that the risk premium implied in the rent to *cheonsei* ratio is about 7.56% points. And it was found that if the rent to *cheonsei* ratio breaks away from the long-run equilibrium relationship with the Korea 3-year Treasury Bond yield, it converges to the long-run equilibrium by adjusting about 5.9% of disequilibrium every month.

The market interest rate continued to drop in the 2000s. However, it was from 2008 that such a downtrend became more conspicuous. And the *cheonsei* key money loan was also greatly expanded around that time. Therefore, this paper attempted to analyze the relationship between the rent to *cheonsei* ratio and the Korea 3-year Treasury Bond yield by dividing the data into before and after 2008. As a result of the analysis, it was found that before 2008, the rent to *cheonsei* ratio responded insensitively to the variation of the

Korea 3-year Treasury Bond yield, and that the risk premium was rather high 9.29% points. And it was found that if the rent to *cheonsei* ratio broke away from the equilibrium in the short term, it made adjustment to converge to the equilibrium.

After 2008, however, it was found that the rent to *cheonsei* ratio moved almost in parallel with the Korea 3-year Treasury Bond yield, and that the risk premium was 6.77% points, and considerably low, compared with the period before 2008. And the rent to *cheonsei* ratio showed no great breakaway from the long-run equilibrium, and showed a consistent downtrend. Thus it was found that there was no correction of breakaway from the long-run equilibrium.

In this regard, it may be said that around 2008, there were structural changes in the long-run equilibrium relationship between the rent to *cheonsei* ratio and the Korea 3-year Treasury Bond yield. However, it is too early to judge that such changes were really structural changes or a temporary phenomenon, because the period of time series after 2008 was too short. Also it is yet difficult to judge whether there were structural changes, because there has been no change in the market interest rate from the downtrend to an uptrend since 2008.

That the rent to *cheonsei* ratio has recently moved together with the market interest rate means that the *cheonsei* market and the monthly rent market respond rapidly to the change of the market interest rate. It is not yet known whether they would show such response when the market interest rate rises in the future. In case that the market interest rate rises, if the rent to *cheonsei* ratio reflects it as it is, the *cheonsei* price would show a downturn at once.

The decline in the rent to *cheonsei* ratio combined with the drop in the market interest rate implies that even the government's intervention in the rental market will have limited effects. That is, despite the intervention in the market to suppress a rise in *cheonsei* price, the upward pressure on price still exists until the rent to *cheonsei* ratio finds equilibrium.

On the other hand, the same analysis was carried out to find out what differences there are between the rent to *cheonsei* ratio based on transaction price data and that based on appraisal price data, using KAB's rent to *cheonsei* ratio data (the rent to *cheonsei* ratio data based on transaction price data) and KAB's monthly rent interest rate data (the rent to *cheonsei* ratio data based on appraisal price data) for a period between January 2011 and December 2014. As a result of the analysis, it was found that the two data had the difference in risk premium only, but had no difference in the long-run and short-run

relationships with the Korea 3-year Treasury Bond yield. The rent to *cheonsei* ratio based on transaction price data showed the risk premium of 5.21% points, which is lower than 6.58% points for the rent to *cheonsei* ratio based on appraisal price data. This means that the rent to *cheonsei* ratio based on appraisal price data has no difference from that based on transaction price data, except that the former evaluates the risk premium rather excessively.

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