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Does the Learning Effect of Housing Policies Affect Anomalies in the Apartment Market? Evidence from Korea

Juwan Kim *
Korea University Business School, Anam-dong, Seongbuk-gu, Seoul 136 -701, Korea. Phone: +82-10-7520-7744, Fax: +82-55-266-7990, E-mail: memoo21@korea.ac.kr.

Cheolyoung Kim
College of Business & Economics, Changwon National University, 9 Sarim-dong, Changwon, Gyeongnam, 641-773, Korea, Phone: +82-10-3836-7990, Fax: +82-55-266-7990, E-mail: cykim@changwon.ac.kr.

This paper examines whether the learning effect of housing policies could empirically affect anomalies in the apartment market in Korea. We find that a learning effect exists in apartment market anomalies, but depending on area, estimation period and size, investors behave differently to anomalies in an apartment market that is affected by housing policies. Furthermore, we confirm that in order to explain anomalies in detail with housing policies, we need to consider economic factors. Of these economic factors, surprisingly, oil price plays the most important role in explaining the anomalies.

Keywords

Apartment asset; Anomaly; Housing policies; Economic factors

* Correspondence author (All errors remain ours)

1. Introduction

In Korea, while housing policies have been only recently announced, the fluctuations of housing business conditions have been cyclical. Consequently, socioeconomic polarization of housing has been intense for a long time and this has caused complications across social stratums. The essential aim of housing policies is to improve housing environments by stabilizing the apartment market, but many investors believe that such policies are inconsistent with the real estate business. Thus, housing conflicts still remain in the market.

Therefore, some researchers have investigated whether housing plans devised by the government have any effect on the prices of real estate. Of these, many researchers have inquired about the effect of the introduction and abolition of carefully calculated housing plans after consideration of other market factors. For instance, Oh (2005) focuses on explaining the effects of changes in housing and apartment prices on real estate policies. He proposes that the 5.22 policy[1] (negative effect) in 1998 and 10.29 policy[2] (positive effect) in 2003 have significant effects on the changes in housing and apartment prices.

Likewise, Chung (2005) has shown that the rapid changes in real estate prices have a strong effect on real estate policies, and the housing market also responds strongly to real estate plans devised by the government rather than to the land market. In 2004, the Korean government had not managed to resolve the issues around real estate prices, but on August 31, 2005, a formal policy was officially announced. Furthermore, Cho and Chung (2007) have insisted that in order to decrease housing prices, the government should not devise housing plans that include strong restraints on demand and excessive supply. Also, they have argued that the government should not stabilize the real estate market by setting the tone for only housing policies. What is more, Chung (2007) has provided evidence in which the real estate market in southern Seoul and nationwide react negatively to the policy, but the Daejeon market has nevertheless, followed the policy. Also, he has suggested that both housing and rental markets significantly respond to real estate policies and follow the aim of the policies in the period from 1988 to 2002. However, during 2002 through to 2006, the real estate market reacted against real estate policies. Moreover, Seo (2008) has found that the apartment market in southern Seoul and large-size apartment market do not consistently meet the

[1] To boost the housing market in Korea, the '5.22 policy' was announced in 1998. The essential particulars of this policy are the liberalization of housing sale prices, exemption of housing sales tax and the abolition of housing contracts.

[2] In order to control speculation and extreme demands in housing, the '10.29 policy' came into effect in 2003. After the '10.29 policy' was released, the price of real estate stabilized for one year. This policy had provided many positive changes related to taxation, and provided financial aid to household economies.

goals of the policies, regardless whether the goals were attainable or not. However, northern Seoul and the national capital region, local and small-size markets had a significantly positive reaction to the policies.

Curiously, despite the findings of many researchers, **'the learning effect of housing policies'** has not been examined to date in Korea. In this paper, for the first time, we suggest the idea of **'the learning effect of housing policies'** which means that all investors learn about future events concurrently, that is, there is likely to be a common understanding prior to public announcements (Errunza and Miller (1998)). The learning effect for future housing policies is a procedure in which practical investors accept information at different time periods in advance. This means that there can be hints about future housing policies through the news, so future housing policies can be better anticipated by market participants.

Moreover, little research has been conducted on the market adjusted method in the investigation of individual markets. Many researchers fail to examine local market anomalies in terms of housing policies in a specific market, because they do not take note of which abnormal returns on individual markets should be employed to obtain anomalies purely in the individual markets. The elements in the total housing market should be eliminated by using a market adjusted model to obtain factors that purely belong to individual markets. This can be considered purely as individual market anomalies. In order to identify whether there only exist individual market anomalies, an event study is tested in this paper.

Furthermore, following the findings of Chen, Roll, and Ross (1986), it could be likely that the prices on assets are sensitively coupled with a variety of systematic economic news. Investors view these macroeconomic conditions as a sort of investment risk. The synchronization between assets and economic state variables means that there exists an exogenous influence on economic factors. In general, the price on assets is considered to react to external shocks, although they have feedback effects. It is likely normal that all economic state variables are eventually endogenous. Therefore, this paper models the prices on assets by using macroeconomic variables. It is apparent that systematic factors influence the changes in the discount factor of assets, so that the discount rate changes with the interest rates, term structure and risk premium in pricing assets. The rate of inflation would also affect the interest rates and systematically influence the changes in asset prices.

At this point, as far as we know, this paper is the first to investigate whether the learning effect of housing policies has an effect on anomalies in the individual apartment market, adding lagged dummy variables from housing policies and economic state factors. The main goal of this paper is that we intend to empirically confirm that there is a learning effect in the apartment

market and we will find the determinants of anomalies on the individual apartment market created by housing policies.

In our article, first, an event study is used to measure whether housing policies are associated with abnormal returns in the individual apartment market, so that we can ensure that there are market anomalies caused by housing policies. Secondly, by classifying the effects of housing policies into two parts (revitalization and stabilization), we will estimate abnormal returns in the individual apartment market. Abnormal returns in the individual apartment market are regressed on lagged dummy variables of housing policies by categorizing areas (the national capital region and localities), size (large, medium, small) and estimation period (1986-1999 and 2000-2009). This allows us to measure the existence, core and trends of different effects of housing policies on the individual apartment market. Finally, by containing macroeconomic state proxies as right-hand-side variables, abnormal returns on each market are regressed on the basis of the second step.

The main results of this paper are that, underlying an event study, we can confirm that there exists the possibility of anomalies in the apartment market which results from housing policies. It appears likely that there is a learning effect in the apartment market which is associated with anomalies across area, sample period, and size, but this is not continuous and the traits and characteristics of the learning effect are different depending on area, period, and size of apartment assets. The most noticeable consequences are that investors in the national capital respond negatively to the aims of housing policies. This is in contrast with investors in the local areas. It seems likely that investors in the national capital market reflect upon private information and are more sophisticated than those in the local areas.

Moreover, anomalies which underlie the size of apartments are positively associated with the purpose of housing policies to revitalize the apartment market for the sample period from 1986 to 1999. It is unlikely that anomalies which underlie the size of apartments react in contrast to the intentions of the housing policies to stabilize the apartment market, which implies that it is likely that investors in the apartment market interpret the aims of the housing policies differently and they have non-public information in regards to the size of apartment assets.

We ensure that not only the dummies of the housing policies, but also economic state factors should be considered when investigating the effects of housing policies. It seems likely that oil price(OP) is a very important factor that explains the anomalies in apartment markets without any connection to area and size.

As a counterpoint to general belief, smaller returns in market portfolios have a significant effect on anomalies in localities. Interest rates that determine the decline in rate of assets is only significant in Busan for 1987-1999.

It seems plausible that investors in Busan from 2000 to 2009 required more return as compensation for default risk tracking of long term business cycles in order to hedge against unexpected increases in default risk premia. Also, default risk tracking of long-term business cycles causes downward anomalies in the apartment market in southern Seoul. Moreover, term structure tracking of short-term business cycles from 2000 through 2009 is positively significant for anomalies in the Daegu market, which means as long term interest rates increase, the returns on the Daegu apartment market also increases.

Aside from that, inflation from 2000 to 2009 was negatively related with abnormal returns in the Daegu market, which implies that apartment assets in the Daegu market do not serve to hedge the effects of inflation. As well, inflation triggered hedging apartment assets in Incheon for 2000-2009. Note that exchange rates are significant to anomalies in any apartment market; this suggests that anomalies in apartment markets are not linked with world-wide risk.

The paper proceeds as follows. We introduce the data and explain sources and the nature of the data in Section II. We then show the methods with regards to abnormal returns on the local apartment market which adopt dummy variables in housing policies, and the macro variables in Section III. Section IV suggests and interprets the results from regressions. Section V summarizes our findings and suggests some directions for future research.

2. Data Description

2.1 Indexes of Apartment and Economic Factors

Our sample includes the monthly indexes of apartment asset data from the Kookmin Bank for the period of 1986-2009. In general, real estate assets are accompanied with high transaction costs in Korea, therefore, the reason that we have especially chosen the indexes of apartment assets as proxies is that apartment assets have the highest liquidity compared to other types of real estate assets. Therefore, the cost of liquidity, such as bid-ask spread and transaction costs could be small. In terms of territory and size factors that are important to price apartment assets, we have obtained apartment indexes of the national capital region (northern Seoul, southern Seoul[3], Incheon, and

[3] Historically, even though southern Seoul and northern Seoul constitute Seoul, the features of southern Seoul vary from that of northern Seoul. Without taking this into consideration, it does not make sense that statistical tests should compare the means of

Gyeonggido) and those of districts (Busan, Daegu, Daejeon, Gwangju,and Ulsan) from the Kookmin Bank data set. [4]

The index data is constructed monthly based on actual transaction selling prices obtained from the Korean commercial housing market which comprise 144 major cities in Korea on a national scale. The 144 cities are located in the metropolitan area and region. The national index reflects valued-weighted returns in consideration of characteristics that depend on the region and transactions, and includes new construction and existing apartments.

In our study, the estimation period is broken into two sub-periods, which is 1986-1999 and 2000-2009. That is because the traits of the Korean economy have dramatically changed before and after the Asian financial crisis. On account of the Asian financial crisis, the Korean economy has changed by and large, for example, in interest rates, default risk, the price of an apartment and many other things, and so without deliberation, the results would differ from reality. For that reason, we have divided the sample period into two time frames.

Moreover, monthly economic factors that help to explain market anomalies were identified in the data set as suggested by the Bank of Korea. Economic factors introduced by this study are the monthly rates of: (i) the Korea Composite Stock Price Index (KOSPI), (ii) one-year monetary stabilization bonds (MSB), (iii) term structures (TERM), (iv) default risk premiums (DEFAULT), (v) oil prices (OP), (vi) exchange rates (EXCHANGE), and (vii) inflation (INFLATION).

It should be added KOSPI, which is defined by the returns on stock market portfolios is regressed to examine linkages between non equity assets and stock market portfolios. In spite of smoothing and averaging the properties in a macroeconomic time series, these variables are not expected to capture any available information. It is well known that stock price responds promptly to public information.

According to Fama (1981), Fama and Schwer (1977), and Chen, Roll, and Ross (1986), the yield on three-month T-bill serves as a proxy for future economic activity. Nevertheless, in the interest of decreasing correlations among state variables, we apply MSBs to serve as interest rates in Korea (Kim (2009)), when running the regression.

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the regression dummies of Seoul with those in other areas. Many Korean researchers have investigated the Seoul housing market by dividing northern Seoul from southern Seoul.

[4] Kookmin bank's homepage address is http://kbstar.com.

Also, with respect to the findings of Fama and French (1989), DEFAULT, defined by the difference between the yield of BAA and AAA rated bonds, tracks long term business cycles and TERM, defined by the differences between the yield of a 10-year T-bond and three-month T-bill, refers to short-term business cycles.

DEFAULT captures the effects of returns on unexpected changes in risk premia and on average, should be zero in a risk neutral world. It is generally introduced that DEFAULT is considered as a measure of the degree of risk aversion. We recognize that DEFAULT would reflect unexpected movement in the level of risk aversion and in pricing real estate.

To calculate TERM, three-month T-bill (10-year T-bond) is replaced with 92-day certificate of deposit (5-year government bond) in Korea to guarantee the liquidity of bonds. TERM is the calculation of unexpected returns on long bonds.

It is frequently mentioned that OP has to be included in systematic variables that are influential to Korean economic conditions. To examine this and substitutes for economic factors, we obtain the monthly time series of the oil price (OP) in the logarithmic form offered by the Bank of Korea (Chen, Roll, and Ross (1986)).

EXCHANGE is a representative variable of the Korean economy in consideration of exports and imports. In the same manner as the findings from Chen, Roll, and Ross (1986), in this article, INFLATION is taken from the data set offered by the Bank of Korea. We expect that INFLATION has a positive effect on the elements of increase in the prices of the apartment market for the purpose of hedging risk.

2.2 Cumulative Abnormal Returns (CAR) of Individual Markets

Figure 1 plots the cumulative abnormal returns (CARs) in northern and southern Seoul, Incheon and Gyeonggido. This figure shows the cumulative effects of abnormal returns in the local apartment market. In comparison to other apartment markets in the national capital region, the cumulative effect of abnormal returns on apartment assets in southern Seoul is almost the largest for the sample period. After 1999, the CAR in southern Seoul becomes positive and dramatically increases until 2006. It appears likely that the cumulative effect of abnormal returns on apartments in southern Seoul has turned out to be larger than the total apartment market since the Asian financial crisis, owing to strong policies of stabilization in 2006, especially CARs in southern Seoul which greatly declined in comparison to other markets. In contrast to apartment assets in southern Seoul, the CAR in apartment assets in northern Seoul decreased until July 2006, and then grew sharply, but is still negative. Even though northern Seoul and southern Seoul

comprise the city of Seoul, their progress is obviously different from each other after the Asian financial crisis. Instead of the total market, territories that own relatively long-term positive CARs are southern Seoul and Gyeonggido.[5]

Figure 1 Cumulative Abnormal Return (CAR) in the National Capital Region.

This figure illustrates the results of CARs in the national capital region. We cumulate the differences between raw returns in the individual markets and returns in the total market, and then we can ensure the cumulative effect of individual local markets. $CAR_{i,t} = \sum_{t=1}^{t} R_{i,t} - R_{m,t}$, where, $CAR_{i,t}$ = CAR for the local housing market i, month t; $R_{i,t}$ = raw return for local housing market i, month t; $R_{m,t}$ = return for month t for the total housing market m. The sample period begins in 1986 and ends in 2009.

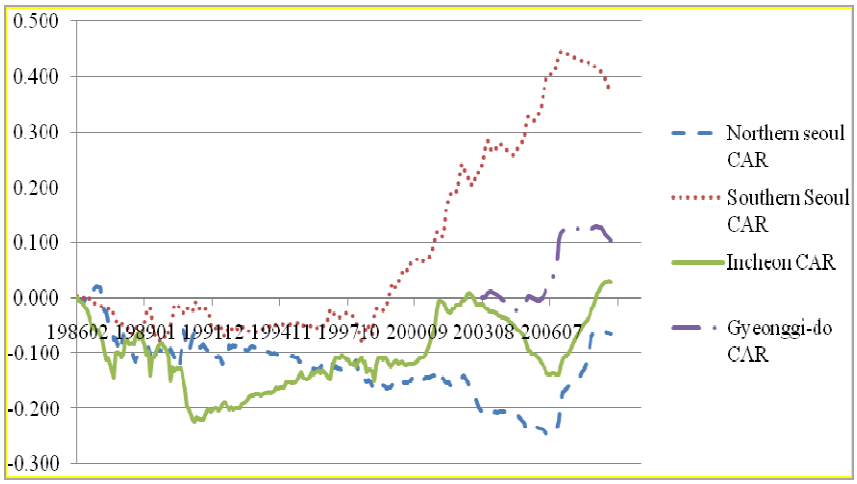


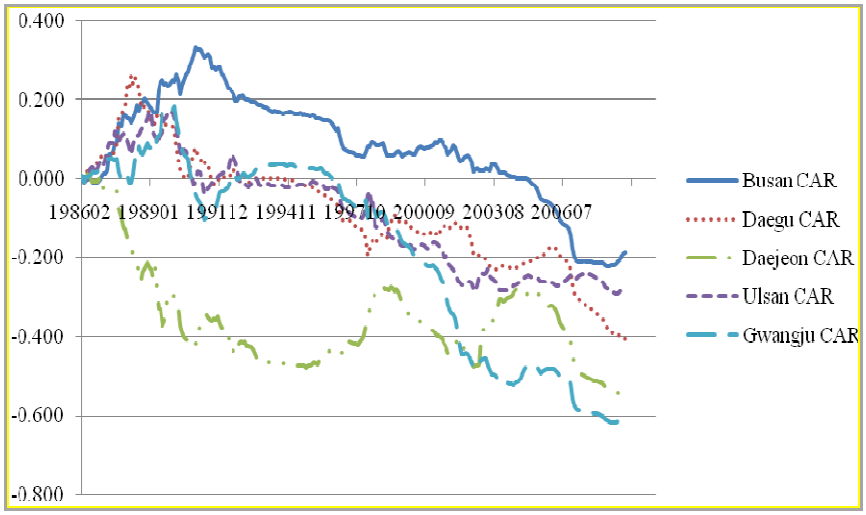
Figure 2 graphs the CAR in localities (Busan, Daegu, Daejeon, and Ulsan) from 1986 through to 2009. In contrast with the national capital region, except for the CAR in Daejeon, the rest were positive until the early 1990s, then turned largely downwards. The CAR in Busan has exceptional increases until December 1990, but has also persistently decreased for the following approximate 18 years. For the entire period, the CAR in Busan has the greatest CAR in the localities, that is, the magnitude of CAR in Busan compared to the localities is the largest. The CAR in Busan was positive until 2004, and then afterwards, became negative and rapidly shrunk. The degree of decline for Daejeon is the greatest among the large cities until 2003, but new events, such as construction of a capital city in Daejeon caused the CAR in the

[5] Due to the lack of observation,the time series of Gyeonggido starts from July 2003.

Daejeon apartment market to rise sharply, but this was short lived. As a secondary effect of the economic panic from the financial tsunami crisis, the CAR in Gwangju dropped sharply until 2009, which meant that the Gwangju market had the worst cumulative effect of anomalies in comparison to other markets beginning 2003. Before and after the financial panic, Gwangu businesses looked down on other individual markets. Due to this, returns in Gwangu became increasingly poor.

Figure 2 The Cumulative Abnormal Return (CAR) in Localities.

This figure graphs the results of CARs in localities (Busan, Daegu, Daejeon, Ulsan, and Gwangju). We cumulate the differences between raw returns in individual markets and returns in the total market, and by doing so; we can ensure the cumulative effect of individual local markets. $CAR_{i,t} = \sum_{t=1}^{t} R_{i,t} - R_{m,t}$, where, $CAR_{i,t}$ = cumulative abnormal return for local housing market *i*, month *t*; $R_{i,t}$ = raw return for local housing market *i*, month *t*; $R_{m,t}$ = return for month *t* for the total housing market *m*. The sample period starts in 1986 and ends in 2009.



2.3 The Characteristics of the Data Statistics

Table 1 shows a summary of the statistics on returns in the national capital region and localities, and economic factors. Owing to a lack of observation for Gyeonggido, abnormal returns in Gyeonggido will be regressed from 2003 in this work. The volatility of OP is the largest among the economic state variables.

Table 1 Summary of the Statistics

This table provides a summary of the statistics on returns in the national capital region and localities, and economic factors. Owing to a lack of observations for Gyeonggido, abnormal returns in Gyeonggido will be regressed from 2003 in this work. The sample period is from February 1986 to February 2009.

Panel A The National Capital Region							
	Northern Seoul	Southern Seoul	Incheon	Gyeonggido			
Mean	-0.0002	0.0014	0.0001	0.0015			
Median	-0.0001	0.0000	0.0001	-0.0001			
Maximum	0.0356	0.0365	0.0437	0.0409			
Minimum	-0.0274	-0.0228	-0.0423	-0.0076			
Std. Dev.	0.0076	0.0081	0.0089	0.0067			
Observations	277	277	277	68			
Panel B Localities							
	Busan	Daegu	Daejeon	Gwangju	Ulsan		
Mean	-0.0007	-0.0015	-0.0019	-0.0021	-0.0010		
Median	-0.0009	-0.0010	-0.0015	-0.0011	-0.0008		
Maximum	0.0552	0.0707	0.0717	0.0557	0.0335		
Minimum	-0.0370	-0.0406	-0.0545	-0.0459	-0.0666		
Std. Dev.	0.0098	0.0113	0.0129	0.0114	0.0115		
Observations	277	277	277	277	277		
Panel C Economic Factors							
	Kospi	MSB	Term[6]	Default	OP	Exchange	Inflation
Mean	0.0075	0.099871	0.0060	0.0360	0.1831	0.0035	0.0308
Median	0.0144	0.116800	0.0056	0.0372	0.1320	0.0007	0.0300
Maximum	0.2245	0.187700	0.0233	0.0533	1.4070	0.3707	0.0740
Minimum	-0.2631	0.025200	-0.0087	0.0214	-0.6280	-0.1662	-0.0030
Std. Dev.	0.0776	0.046827	0.0063	0.0072	0.3651	0.0432	0.0151
Observations	101	266	101	101	157	157	157

Table 2 reports the results of the unit root test for several variables that capture the variables which embrace non-stationary elements to provoke pseudo regression among proxies. It is well known that autocorrelation and seasonality embodied in state variables could lead to biased estimates of the loadings on variables. These could bias downward the significance of variables. In Table 2, it seems likely that almost all of the variables are said to be stationary except for MSB, DEFAULT, and INFLATION since others are simply rejected at the 5% significance level which rest on the analysis with an augmented Dickey-Fuller (ADF) test and Phillips-Perron (PP) test under a null hypothesis. Since MSB, DEFAULT and INFLATION (the first-differenced) are significantly rejected at the 1% level under a null hypothesis,

[6] Due to the many financial crises in Korea, it is considered that the mean of the term shows a smaller number than the default.

they should be considered as differenced in the first level to become stationary economic factors. Therefore, the first-differenced MSB, DEFAULT, and INFLATION will be exploited to explain abnormal returns in the apartment market in our analysis.

Table 2 Unit Root Test

This table displays whether the time series is stationary or not. An augmented Dickey-Fuller (ADF) test and Philips Perron (PP) test is conducted for a unit root test under a null hypothesis. Economic factors are KOSPI, MSB, TERM, DEFAULT, OP, EXCHANGE, and INFLATION. The sample period is from February 1986 to February 2009.

Panel A	***National Capital Region***						
	Southern Seoul	Northern Seoul	Incheon	Gyeonggido			
ADF	**-10.24**	**-11.86**	**-8.63**	**-3.52**			
PP	**-9.89**	**-11.76**	**-15.09**	**-3.45**			
Panel B	***Localities***						
	Busan	Daegu	Daejeon	Gwangju	Ulsan		
ADF	**-12.25**	**-8.20**	**-8.05**	**-11.56**	**-12.35**		
PP	**-12.77**	**-12.39**	**-11.74**	**-12.55**	**-11.99**		
Panel C	***Economic Factors***						
	Kospi	MSB	Term	Default	Wti	Exchange	Inflation
ADF	**-15.23**	-0.88	**-3.27**	-1.60	**-3.85**	**-11.21**	-2.39
PP	**-15.23**	-0.66	**-2.66**	-1.79	**-3.46**	**-11.14**	-2.36
		-11.25		**-4.11**			**-7.80**
		-11.03		**-3.99**			**-11.89**

Table 3 displays the correlation matrix for economic state variables. MSB, DEFAULT and INFLATION, which includes elements of non-stationary time series, are differenced to obtain the stationary time series. The strongest correlation is between MSB and DEFAULT. This is expected because to calculate DEFAULT, the yield of BAA rated bonds associated with MSB and the yield of AAA rated bonds related with MSB are exploited. Actually, the resulting multicollinearity shows a tendency to lessen the impacts of these proxies, but the impacts are not sufficient to qualitatively change the primary results in our findings.

Term structure (TERM) and OP are correlated with each other, and TERM and INFLATION are strongly correlated. These correlated relations are a result of the reasons why OP and INFLATION are connected to interest rates. Many of the other correlations cannot be negligible, but it is hard to say that almost all variables are perfectly correlated with each other and no variables can be replaced with any other one.

Table 3 Correlation Matrix of Economic Factors

This table proposes a correlation matrix of economic factors to explain abnormal returns in the apartment market. Economic factors are KOSPI, MSB, TERM, DEFAULT, OP, EXCHANGE, and INFLATION. The sample period is from February 1986 to February 2009.

	KOSPI	MSB	TERM	DEFAULT	OP	EXCHANGE
KOSPI						
MSB	0.049					
TERM	0.155	0.261				
DEFAULT	-0.062	-0.440	-0.138			
OP	-0.223	0.291	-0.360	-0.259		
EXCHANGE	0.048	-0.017	0.006	0.107	-0.128	
INFLATION	0.052	-0.096	-0.324	0.064	0.157	-0.053

3. Methodology

In this section, prior to full-scale estimation and to ensure that there exist anomalies aroused by the housing policies which are statistically significant, an event study is conducted. In the sequential, abnormal returns in the individual apartment market are regressed (white heteroskedasticity-consistent standard errors and covariance) on housing policy dummies in the case of finding relations between abnormal returns and housing policies. In contrast to previous papers, we have separated housing policies into two sub-sets, that is, revitalization and stabilization. Accordingly, in order to explain the parts with abnormal returns that are unrelated to housing policies in the individual market, economic state factors are exploited as independent variables.

In real estate work, many researchers in practice have employed raw returns in the individual market without regard for abnormal returns when investigating the traits of the individual market. Actually, it is well known that the apartment market has obvious uniqueness and peculiarities of its own in comparison to other types of assets. Therefore, in this paper, the reason why we will apply a market adjusted model is to extract differences between raw returns in the distributive individual market and returns in the total market. Then, we can identify the anomalies of the individual market from the total market on the basis of this procedure. The definition of AR is as follows:

$$AR_{i,t} = R_{i,t} - R_{m,t} \tag{1}$$

where $AR_{i,t}$ = abnormal return for individual apartment market i, month t;
$R_{i,t}$ = raw return for individual apartment market i, month t;
$R_{m,t}$ = return for month t on the total apartment market m.

A definition of CAR is as follows;

$$CAR_{i,t} = \sum_{t=1}^{t} R_{i,t} - R_{m,t} \tag{2}$$

where $CAR_{i,t}$ =cumulative abnormal return for local housing market i, month t;

$R_{i,t}$ = raw return for local housing market *i*, month *t*;
$R_{m,t}$ = return for month *t* on the total housing market *m*.

To examine whether the learning effect of housing policies is influential on anomalies in an apartment market, abnormal returns were estimated by regressing on housing policy dummies.[7] In general, many investors have recognized that it is enough to maintain the learning effect of housing policies for five months in the market. For this reason, we assume that the learning effect of housing policies could exist for five months, so we set up the time interval as five months.[8] This is highly probable because the explanatory power of regression is empirically stronger on the assumption of the persistence of the learning effect for five months. It is viable to classify the impacts of housing policies into two groups, which include the revitalization and stabilization of the housing market. Traditionally, Korean government policy makers have come up with such policies in order to control economic conditions because unlike other countries, the housing market ranks first in the investment of asset markets rather than other financial asset markets. Therefore, owing to these policies, the total asset markets in Korea undergo various influences. Additionally, given that among investors there is no belief that returns in the apartment market could be linked to the housing political announcements when they happen, a lagged estimation window is needed to be included as a dummy, which allows for the fact that prior housing policies are considered as news, hints and clues about political announcements to happen likely later, to test the learning effect. The related equation is as follows:

$$AR_{i,t} = \alpha + \sum_{t=0}^{t=-4} \beta_{1,t} Dummy_{1,t} + \sum_{t=0}^{t=-4} \beta_{2,t} Dummy_{2,t} + \varepsilon_t \qquad (3)$$

where $AR_{i,t}$ = abnormal return for individual housing market *i*, month *t*;
$Dummy_{1,t}$ = if the housing policy to revitalize housing market is announced at time *t*, then $Dummy_{1,t}$ = 1, otherwise $Dummy_{1,t}$ = 0;
$Dummy_{2,t}$ = if the housing policy to stabilize the housing market is announced at time *t*, then $Dummy_{2,t}$ = 1, otherwise $Dummy_{2,t}$ = 0;
α = constant term;
β = the loadings on the dummies and state variables; and
ε = idiosyncratic error term.

In contrast to previous papers, in this thesis, we follow the housing policies suggested by Lee et al. (2008). They have provided the principal housing policies which were announced by the Korean government from 1970 through

[7] In accordance to Henry (2000), we have set up dummy variables.
[8] Even though we have set up different estimation windows, the results are still not changeable.

to 2009. By virtue of the report written by Lee et al. (2008),[9] we will categorize the housing policies into two subsets, which are revitalization and stabilization.[10] The Korean government has traditionally announced housing policies in attempts to revitalize the housing market when the housing market was in the state of panic and to stabilize the housing market during an overly pumped economic boom. The following equation estimates the determinants of abnormal returns by adding economic factors. Economic factors are mentioned in section II.

$$AR_{i,t} = \alpha + \sum_{t=0}^{t=-4} \beta_{1,t} Dummy_{1,t} + \sum_{t=0}^{t=-4} \beta_{2,t} Dummy_{2,t} + \sum_{i=0}^{i=7} \beta_i X_{i,t-1} + \varepsilon_t \quad (4)$$

where $AR_{i,t}$ = abnormal return for individual housing market i, month t;

$Dummy_{1,t}$=if the housing policy to revitalize the housing market is announced at time t, then $Dummy_{1,t}=1$, otherwise $Dummy_{1,t}=0$;

$Dummy_{2,t}$=if the housing policy to stabilize the housing market is announced at time t, then $Dummy_{2,t}=1$, otherwise $Dummy_{2,t}=0$;

$X_{i,t-1}$ = economic factors;

α = constant term;

β = the loadings on the dummy and state variables; and

ε = idiosyncratic error term.

In previous literature, there have been various accounts which investigate the effects of real estate policies that use the vector autoregressive model(VAR). For example, many have been written by Jung (2005), Jung(2007), Jo and Jung (2007), and Seo (2008). From the entire process in our study, we are able to identify a VAR and find unexpected results by relying on the response function and variance decomposition function. However, it is more meaningful and concrete to employ a single equation that can be examined immediately. The general failure of accurately filtering out biases in independent variables is related to serial correlation and heteroskedasticity. Given that monthly rates of return are mostly not serially uncorrelated in this work, these proxies can be exploited as factors without any specific corrections. Given the fact that there may exist serial correlations which are embodied in the factors, the differencing allows us to obtain the time series without the elements of serial correlation, then we regress (white heteroskedasticity-consistent standard errors and covariance) abnormal returns in the individual apartment market on dummies and economic factors. These processes can moderate the errors caused by the model misspecification for examining the learning effect of housing policies.

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[9] This report is written by Lee, Kim, Park, Pyeon, and Chun in 2008. Their report which is published in the Korean Research institute for Human Settlements (KRIHS) is titled “Development of System Dynamics Model for Housing Policy Impact Analysis”.

[10] As evident in the appendix, we have tried to thoroughly reflect the housing announcements by the government that are important to the Korean housing market and based on the reports; we have carefully categorized the announcements to eliminate extraneous influences.

All lagged economic factors introduced in this thesis might have a significant predictive content for abnormal returns in the apartment market. Then, these will be exploited to explain the anomalies in the apartment market. This approach might provide an antithetical investigation, which is to find the effects of exogenous economic factors on anomalies in the apartment market. In this article, the time subscripts of economic factors such as t-1 apply to the end of each month conditional on the applied information available at the end of month t-1, which is the standard period.

4. Empirical Results

4.1 The Event Study

We found interesting results from testing the event study and regressing (white heteroskedasticity-consistent standard errors and covariance) abnormal returns in individual apartment markets which exploit dummy variables of the housing policies and state variables in this section according to apartment market, sample period, and size.

Table 4 suggests the results of an event study of apartment market dwellings on housing policies broken into subsamples, such as national capital region and localities. We examine whether there are abnormal returns in the execution month ($t = 0$) or lagged months ($t = 0 \sim t = -4$), respectively, where announcing the housing policy is statistically significantly different from zero. The results of the event study offers evidence that abnormal returns in the apartment market in Incheon, Busan, and Ulsan on the implementation month ($t = 0$) are rejected, at a 10% percent significance level, significantly on the null of which an abnormal return is not different from zero. Also, it is found that abnormal returns in the apartment market in southern Seoul, Incheon, Busan, Daejeon, Gwangju, and Ulsan for lagged months ($t = 0 \sim t = -4$) are significantly different from zero. It seems likely that these suggest the possibility that there are significant apartment market anomalies which have brought about a learning effect from the housing policies. From this analysis, we will propose the outcomes of regression which adopt lagged dummy variables to find the learning effect.

4.2 The Learning Effect of Housing Policies

Table 5 reports the results in which the learning effect has an influence on anomalies in the individual apartment market in the national capital region. The main result from Table 5 is that there exists different learning effects from the housing policies to anomalies by means of territory and estimation period, but this learning effect does not continuously persist. Furthermore, the striking result is that, in contrary to the aim of the housing policies, the estimated sign is in contrast to the expected sign of the dummies for the most part at the 5%

significance level,[11] which means that investors reversely respond to the housing policies in the national capital.[12] This can be interpreted that investors have private information or understand the policies differently.

Table 4 An Event Study of the Housing Market

This table shows the results of an event study on the basis of the housing policies. Panels A and B display the consequences of the national capital region (localities) for an estimation window where $t = 0$, and $t = 0 \sim t = -4$. The sample period starts in 1986 and ends in 2009. Bolded characters represent significantly different from zero at the 10% significance level.

Panel A National Capital Region				
	Northern Seoul	**Southern Seoul**	**Incheon**	**Gyeonggido**
t=0	-0.070511	0.9648674	**1.8398598**	-0.112816
t=0,-1,-2,-3,-4	-0.897067	**2.648666**	**1.647286**	0.7637312
Panel B Localities				
	Busan	**Daegu**	**Daejeon**	**Gwangju**	**Ulsan**
t=0	**-2.099237**	-0.818693	-0.590878	-1.37124	**-1.851262**
t=0,-1,-2,-3,-4	**-1.811292**	-1.431438	**-1.65527**	**-3.378029**	**-2.847309**

In contrast to the period from 2000 to 2009, the explanatory power of the learning effect in the sample period from 1986-1999 is stronger with the exception of northern Seoul. All of this creates the sense that, recently, the effectiveness of the learning effect in the housing policies has become weaker. Therefore, we can argue that there is a somewhat likelihood that abnormal returns in an apartment market could be explained by other factors simultaneously and jointly.

Table 6 shows the results of whether the learning effect could affect anomalies in apartment assets in localities which exploit housing policy dummies for four lagged months. The principal results of Table 6 are that, similar to the national capital region, it appears likely there are learning effects, but these are not persistent in the entire sample period. The astonishing findings are that in contrast to the national capital areas, local areas follow the intentions of the housing policies mostly in the entire sample period at a 5% significance level expect for Gwangju.[13] Namely, it would be very likely that the estimated sign of dummy variables in Table 6 are consistent with the anticipated sign of dummy variables determined in section II. However, in the case of Gwangju,

[11] At a 10% significance level, the results do not particularly change. The result of northern Seoul is somewhat weaker for 1986-1999.

[12] In section II, dummies1 and 2 are based on the housing policies that revitalize and stabilize the apartment market, respectively, so the anticipated sign of dummies 1 and 2 will be positive and negative, respectively.

[13] The results do not change much at a 10 % significance level.

whenever housing policies are mentioned, abnormal returns significantly become negative, so that anomalies in the Gwangju market is demonstrated to be negatively related to the housing policies more than the total market.

Table 5 The Learning Effect of Housing Policies in the National Capital Region

This table provides the results in which abnormal returns in the national capital region are regressed (white heteroskedasticity-consistent standard errors and covariance) on lagged dummy variables of the housing policies. The sample period in panels A and B begins with 1986 and 2000, respectively, and ends in 1999 and 2009, respectively. Bolded characters imply rejection due to a significance level under 5%.

Panel A 1986 – 1999								
	Northern Seoul		**Southern Seoul**		**Incheon**			
Variable	***Coef.***	***t-Stat.***	***Coef.***	***t-Stat.***	***Coef.***	***t-Stat.***		
Constant	-0.001	-1.536	-0.001	-1.825	-0.001	-0.715		
DUMMY1	0.001	0.521	-0.005	-1.365	0.005	1.220		
DUMMY1(-1)	-0.001	-0.265	0.006	1.517	-0.002	-0.471		
DUMMY1(-2)	-0.003	-1.312	0.003	1.111	0.003	1.047		
DUMMY1(-3)	0.000	0.060	**0.014**	**2.520**	**-0.014**	**-3.078**		
DUMMY1(-4)	0.004	1.950	-0.003	-0.704	0.007	1.386		
DUMMY2	-0.001	-0.330	**0.008**	**2.871**	-0.004	-1.114		
DUMMY2(-1)	-0.001	-0.523	0.001	0.324	**0.007**	**2.246**		
DUMMY2(-2)	-0.001	-0.490	0.003	1.188	**-0.010**	**-1.960**		
DUMMY2(-3)	0.001	0.266	-0.003	-0.949	**0.008**	**2.578**		
DUMMY2(-4)	0.006	1.440	0.002	0.552	-0.004	-1.367		
R^2	0.043		0.184		0.169			
Panel B 2000 – 2009								
	Northern Seoul		**Southern Seoul**		**Incheon**		**Gyeonggido**	
Variable	***Coef.***	***t-Stat.***	***Coef.***	***t-Stat.***	***Coef.***	***t-Stat.***	***Coef.***	***t-Stat.***
Constant	0.003	2.960	0.003	3.321	0.001	0.888	0.001	1.467
DUMMY1	-0.001	-0.397	-0.002	-0.660	0.004	1.761	**-0.003**	**-2.490**
DUMMY1(-1)	-0.001	-0.936	0.000	-0.030	0.003	0.821	-0.001	-0.659
DUMMY1(-2)	0.000	-0.184	-0.004	-1.340	0.001	0.265	-0.001	-0.313
DUMMY1(-3)	0.000	0.064	0.000	-0.217	0.001	0.361	**-0.004**	**-2.897**
DUMMY1(-4)	-0.003	-1.544	-0.004	-1.758	0.002	0.672	-0.003	-1.852
DUMMY2	0.000	-0.149	**0.006**	**2.324**	-0.001	-0.801	0.006	1.347
DUMMY2(-1)	-0.001	-0.259	0.000	-0.070	0.000	0.138	0.004	1.687
DUMMY2(-2)	-0.001	-0.705	-0.003	-1.079	0.000	-0.093	0.001	0.538
DUMMY2(-3)	**-0.003**	**-1.970**	-0.002	-0.686	0.001	0.716	-0.002	-0.926
DUMMY2(-4)	-0.003	-1.917	0.003	0.957	-0.001	-0.540	-0.002	-1.028
R^2	0.078		0.158		0.103		0.244	

Table 6 The Learning Effect of Housing Policies in Localities

This table depicts the results of the housing policies in localities which exploit the lagged dummy variables. Abnormal returns in the metropolis in localities are regressed(white heteroskedasticity-consistent standard errors and covariance)on lagged dummy variables of the housing policies. The sample period of panels A and B begins with 1986 and 2000, respectively, and ends in 1999 and 2009, respectively. Bolded characters imply rejection due to a significance level under 5%.

Panel A Localities									
	Busan.		**Daegu.**		**Daejeon.**		**Gwangju.**		**Ulsan.**
Variable	***Coef.***	***t-Stat.***	***Coef.***	***t-Stat.***	***Coef.***	***t-Stat.***	***Coef.***	***t-Stat.***	***Coef.*** ***t-Stat.***
Constant	0.000	0.281	0.000	0.230	-0.001	-0.855	0.001	1.133	0.001 0.881
DUMMY1	0.003	0.808	**0.009**	**3.291**	0.004	1.252	0.007	1.339	-0.004 -0.384
DUMMY1(-1)	-0.005	-1.763	0.000	0.077	0.008	1.526	**-0.010**	**-2.375**	-0.014 -1.113
DUMMY1(-2)	0.001	0.590	0.005	0.917	0.005	1.262	-0.001	-0.457	-0.008 -0.946
DUMMY1(-3)	-0.005	-0.992	**-0.007**	**-2.142**	0.001	0.315	**-0.012**	**-2.743**	0.000 0.044
DUMMY1(-4)	0.002	0.805	0.006	1.623	-0.003	-0.872	0.005	1.040	0.006 0.841
DUMMY2	-0.003	-0.500	**-0.012**	**-2.837**	**-0.009**	**-1.973**	**-0.014**	**-4.116**	-0.011 -1.877
DUMMY2(-1)	0.000	-0.082	-0.006	-1.788	0.003	0.560	-0.005	-1.879	-0.005 -1.178
DUMMY2(-2)	0.001	0.217	-0.006	-1.349	-0.004	-0.636	-0.003	-0.571	-0.003 -0.762
DUMMY2(-3)	0.006	1.018	-0.002	-0.631	-0.007	-1.193	-0.001	-0.241	-0.003 -0.836
DUMMY2(-4)	0.000	-0.107	0.000	-0.023	-0.006	-1.699	**-0.008**	**-2.071**	0.001 0.105
R^2	0.027		0.113		0.085		0.152		0.105
Panel B Localities									
	Busan		**Daegu**		**Daejeon**		**Gwangju**		**Ulsan**
Variable	***Coef.***	***t-Stat.***	***Coef.***	***t-Stat.***	***Coef.***	***t-Stat.***	***Coef.***	***t-Stat.***	***Coef.*** ***t-Stat.***
Constant	-0.002	-2.907	-0.003	-3.631	-0.004	-3.590	-0.003	-2.946	-0.001 -1.210
DUMMY1	0.003	1.417	0.002	1.018	0.000	0.043	0.001	0.409	0.000 0.063
DUMMY1(-1)	-0.002	-0.619	0.002	1.428	-0.001	-0.226	-0.001	-0.241	-0.004 -0.899
DUMMY1(-2)	0.005	1.817	-0.001	-0.687	0.001	0.426	0.001	0.330	**0.006** **3.244**
DUMMY1(-3)	0.000	0.040	0.001	0.383	0.003	1.034	0.000	0.100	0.001 0.229
DUMMY1(-4)	**0.007**	**3.017**	0.002	1.549	**0.006**	**2.129**	0.002	0.623	-0.002 -0.914
DUMMY2	**-0.005**	**-2.004**	-0.003	-1.156	-0.001	-0.134	-0.005	-1.630	**-0.006** **-3.806**
DUMMY2(-1)	-0.001	-0.337	0.001	0.459	0.001	0.247	-0.002	-0.678	**-0.003** **-2.007**
DUMMY2(-2)	0.003	1.484	0.001	0.662	-0.001	-0.427	0.001	0.547	**0.004** **2.324**
DUMMY2(-3)	0.001	0.656	0.003	1.505	0.004	0.841	0.001	0.508	0.004 1.624
DUMMY2(-4)	-0.002	-1.215	-0.002	-0.930	0.007	1.634	-0.001	-0.545	0.000 -0.035
R^2.	0.220		0.101		0.097		0.076		0.241

Table 7 offers the results in which anomalies across the size of apartment assets are associated with the learning effect at a 5% significance level; under the 10% level, the results are not different. Resting on the results of Table 7, for the period of 1986-1999 in panel A, the housing policies on stabilization do not have learning effects on the size of apartment assets because almost all anomalies respond mostly in the month when the housing policies are announced. Abnormal returns react contrary to the intentions of the housing policies to stabilize the apartment market; investors in the apartment market

have different interpretations of the aim of the housing policies or have non-publicized information about the policies. It is unlikely that abnormal returns are positively associated with the purpose of the housing policies to revitalize the apartment market for the sample period from 1986 to 1999, which implies that investors follow the goals of the housing policies, but there are no learning effects for 2000-2009.

Table 7 The Learning Effect of Housing Policies Underlying on Size

This table offers the outcomes of the learning effects of housing policies on size which apply lagged dummy variables. Abnormal returns based on size are regressed (white heteroskedasticity-consistent standard errors and covariance) on lagged dummy variables of the housing policies. The sample period is broken into two sub periods, 1986-1999 (Panel A), and 2000-2009 (Panel B). Bolded characters imply rejection due to a significance level under 5%.

Panel A 1986 - 1999						
	Large		**Medium**		**Small**	
Variable	***Coefficient***	***t-Statistic***	***Coefficient***	***t-Statistic***	***Coefficient***	***t-Statistic***
Constant	0.000	0.640	0.000	-0.196	0.001	1.174
DUMMY	-0.002	-1.218	-0.002	-1.345	-0.003	-1.684
DUMMY(-1)	0.004	1.510	**0.004**	**1.931**	0.003	1.875
DUMMY(-2)	-0.002	-1.522	0.000	0.114	-0.001	-0.439
DUMMY1(-3)	**0.006**	**3.352**	**0.004**	**2.232**	**0.004**	**2.035**
DUMMY1(-4)	0.001	0.256	-0.001	-0.291	-0.003	-1.615
DUMMY2	**0.005**	**2.076**	**0.006**	**3.294**	**0.007**	**2.884**
DUMMY2(-1)	0.002	1.168	0.002	0.998	0.001	0.836
DUMMY2(-2)	0.002	0.607	0.004	1.854	0.003	1.377
DUMMY2(-3)	0.003	1.789	0.000	-0.345	-0.001	-0.926
DUMMY2(-4)	0.002	1.019	0.002	0.649	0.002	0.973
R^2	0.124		0.147		0.161	
Panel B 2000 - 2009						
	Large		**Medium**		**Small**	
Variable	***Coefficient***	***t-Statistic***	***Coefficient***	***t-Statistic***	***Coefficient***	***t-Statistic***
Constant	0.001	3.033	0.001	2.413	0.001	2.310
DUMMY	-0.001	-1.436	0.000	0.365	0.000	-0.142
DUMMY(-1)	-0.001	-0.831	0.000	0.036	0.001	0.603
DUMMY(-2)	-0.001	-0.372	0.000	-0.070	0.000	0.171
DUMMY1(-3)	-0.001	-0.900	0.000	0.351	0.000	0.006
DUMMY1(-4)	-0.002	-0.955	-0.001	-0.816	-0.001	-0.842
DUMMY2	**0.004**	**3.408**	**0.003**	**3.763**	**0.002**	**2.999**
DUMMY2(-1)	**0.003**	**2.845**	0.002	1.944	0.001	1.045
DUMMY2(-2)	0.001	0.602	0.000	0.021	0.000	-0.638
DUMMY2(-3)	-0.001	-1.259	0.000	-0.227	0.000	-0.267
DUMMY2(-4)	0.001	1.019	0.001	1.492	0.001	1.366
R^2	0.327		0.292		0.192	

4.3 The Learning Effect of Housing Policies with Economic Factors

Table 8 presents the anomalies in apartment markets that are related differently to the housing policies by adding economic state variables in the national capital region. In Panel A, the reason why only the return on stock market portfolio (KOSPI), MSB, and INFLATION are used as independent variables is that the rest of the variables were not available until 1996. On the whole, the explanatory power increases with the addition of economic state variables in comparison to Table 5. This implies that when estimating anomalies in the apartment market, it is essential to not consider dummy and economic state variables at the same time. Notwithstanding supplementing economic state variables, we confirm there are no distinct changes in the results mentioned in Table 5 when taking into account the coefficients on dummy variables in Table 8.[14]

In order to examine the influence of the stock market, KOSPI is added as the right-hand-side variable, but the explanatory power of KOSPI has nothing to do with the anomalies for all of the national capital market in the entire sample period. To test the impacts of interest rates, MSB is added as an independent variable, but no coefficients on MSB are significant in the entire sample period for the entire national capital market. Overall, INFLATION is insignificant in the entire period except for the Incheon market; this suggests that hedging by inflation is available only in the Incheon apartment market for 2000-2009. Moreover, EXCHANGE which is created by external risk is not significant in the entire national capital market. This is read in the context where anomalies in the apartment market are not related with world-wide risk.

As for TERM, the negative risk premium implies that the return on assets is reversely associated with rises in the long term rate over the short term rate. This is because TERM examines the changes in the long-term rate of interest. Investors will place a great deal of weight on assets when long term rates decline and such assets include negative risk premiums. Thus, assets are correlated with long-term bond returns. Both southern Seoul and Incheon have significant coefficients on TERM, but their signs are different from each other. Only DEFAULT has negatively significant anomalies in the southern Seoul market; this can be understood that without the function of hedge assets, the distress risk causes downward abnormal returns in the apartment market in southern Seoul.

[14] Rather, the number of significant dummy variables rise somewhat and the sign of coefficients are slightly changed.

Table 8 The Learning Effect of Housing Policies which Exploit Economic Factors in the National Capital Region

This table illustrates the consequences of the learning effect by applying lagged dummy variables of the housing policies and macroeconomic variables. Abnormal returns in the capital region are regressed (white heteroskedasticity-consistent standard errors and covariance) on lagged dummy variables of the housing policies and economic state variables. The sample period is broken into two sub periods, 1987-1999 (Panel A), and 2000-2009 (Panel B). Bolded characters imply rejection because the significance level is under 5%.

Panel A 1987 - 1999						
	Northern Seoul		**Southern Seoul**		**Incheon**	
Variable	**Coefficient**	***t*-Statistic**	**Coefficient**	***t*-Statistic**	**Coefficient**	***t*-Statistic**
Constant	-0.001	-1.733	-0.001	-1.890	0.000	0.118
DUMMY1	0.000	0.000	-0.003	-0.836	0.004	0.941
DUMMY1(-1)	-0.001	-0.331	0.006	1.328	-0.005	-1.154
DUMMY1(-2)	-0.003	-1.188	0.001	0.234	0.006	1.713
DUMMY1(-3)	-0.001	-0.498	**0.013**	**2.262**	**-0.013**	**-2.976**
DUMMY1(-4)	0.004	1.153	-0.005	-0.798	**0.014**	**2.610**
DUMMY2	-0.001	-0.353	**0.009**	**2.868**	-0.005	-1.268
DUMMY2(-1)	0.000	-0.149	0.001	0.538	0.006	1.796
DUMMY2(-2)	-0.001	-0.261	0.003	1.177	**-0.011**	**-2.140**
DUMMY2(-3)	0.001	0.282	-0.002	-0.779	**0.008**	**2.139**
DUMMY2(-4)	0.006	1.554	0.002	0.582	-0.004	-1.422
KOSPI(-1)	-0.011	-1.063	0.012	1.352	-0.010	-1.135
MSB(-1)	-0.181	-1.334	-0.121	-0.981	0.063	0.474
INFLATION(-1)	-0.114	-0.733	-0.029	-0.193	0.166	0.891
R^2	0.069		0.214		0.208	

(*Continued…*)

(***Table 8 Continued***)

Panel B 2000 - 2009								
	Northern Seoul		**Southern Seoul**		**Incheon**		**Gyeonggido**	
Variable	***Coefficient***	***t-Statistic***	***Coefficient***	***t-Statistic***	***Coefficient***	***t-Statistic***	***Coefficient***	***t-Statistic***
Constant	0.006	2.907	0.004	2.171	0.004	2.587	0.005	1.645
DUMMY1	-0.001	-0.387	0.001	0.326	0.003	0.819	-0.001	-0.324
DUMMY1(-1)	-0.002	-1.099	0.000	0.246	0.003	0.846	-0.002	-1.552
DUMMY1(-2)	-0.001	-0.344	-0.003	-1.661	0.000	0.033	-0.001	-0.663
DUMMY1(-3)	-0.002	-0.660	-0.003	-1.059	-0.002	-0.402	**-0.006**	**-2.273**
DUMMY1(-4)	-0.005	-1.867	**-0.007**	**-2.531**	0.002	0.555	-0.001	-0.774
DUMMY2	0.000	0.215	**0.006**	**2.385**	0.000	-0.035	0.007	1.521
DUMMY2(-1)	0.000	-0.075	-0.002	-0.680	0.000	0.240	0.004	1.451
DUMMY2(-2)	-0.001	-0.440	-0.004	-1.512	0.001	0.322	0.001	0.371
DUMMY2(-3)	**-0.003**	**-2.002**	-0.003	-1.282	0.001	0.474	-0.002	-0.811
DUMMY2(-4)	**-0.003**	**-2.001**	-0.001	-0.199	-0.002	-0.974	-0.002	-0.914
KOSPI(-1)	-0.008	-0.873	0.011	0.858	-0.010	-1.202	-0.006	-0.584
MSB(-1)	0.399	1.077	-0.368	-0.945	0.240	0.655	0.164	0.462
TERM(-1)	-0.274	-1.687	**0.329**	**2.111**	**-0.238**	**-1.960**	-0.243	-1.358
DEFAULT(-1)	0.277	0.668	**-1.078**	**-2.199**	-0.360	-0.700	-0.984	-1.788
OP(-1)	-0.006	-1.914	**-0.008**	**-2.468**	**-0.006**	**-2.318**	-0.008	-1.728
EXCHANGE(-1)	-0.018	-1.356	0.001	0.043	-0.008	-0.937	0.000	-0.047
INF(-1)	0.375	1.088	0.250	0.636	**0.708**	**2.269**	0.323	0.969
R^2	0.185		0.363		0.210		0.356	

Moreover, OP is frequently pointed out as an essential economic factor even though there is no evidence that OP should have the same extent of impact as for instance, interest rates. Table 8 reports that OP is significant at the 5% and 10% levels in all apartment markets. This is because OP is a predictor of the Korean economy as it was an important raw material in the Korean industry which had a strong impact on anomalies in the entire national capital market from 2000 to 2009.

Even though economic factors are included in the analysis, the main results of Table 9 are analogous to those of Table 6.[15] The coefficient on DEFAULT in the Busan apartment market for 2000-2009 is only positively significant at variance with southern Seoul (negatively significant). In the case of the results in Busan, DEFAULT tracking of long-term businesses has a positive risk premia because investors in Busan try to hedge against unexpected increases in risk premia; they require more return as compensation on DEFAULT. Anomalies in the Busan apartment market is positively related with MSB which determined the discounted rates from 1987 through to 1999. In Table 9, OP is at a 5% and 10 % positively significant level in all localities for 2000-2009. Hence, in counterpoint to the national capital region, OP gives rise to increases in abnormal returns in localities. This can be construed in such a way that investors in localities consider apartment assets as the way of hedging a price increase by OP. Furthermore, INFLATION is negatively related to abnormal returns in the Daegu market, which lends that apartment assets do not significantly hedge inflation. Moreover, TERM is positively significant to anomalies in the Daegu market, in which as long term interest rates increase, the returns in the Daegu apartment market also increase. The returns on the market portfolio and interest rates do not have significant effects on anomalies in localities for the whole period.

Table 10 provides evidence where the housing policies influence the anomalies differently in the apartment market across size of apartment. The result in Table 10 is consistent with the result in Table 7 which shows that there is a learning effect which forms the basis for size.[16] We are sure that if economic factors are added into the model, the explanatory power increases, then this can be said that not only the dummies of the housing policies, but also economic state factors should be jointly considered when investigating the effects of housing policies. Consistent with the former results, OP is a very important factor that explains anomalies in the apartment market across the size of apartment assets.

[15] Preferably, the explanatory power of Table 9 is better than Table 6.
[16] Preferably, the explanatory power of Table 10 is better than Table 7.

Table 9 The Learning Effect of Housing Policies by Adding Economic Factors in Localities

This table proposes the outcomes of the learning effect by applying lagged dummy variables of the housing policies and economic factors. Abnormal returns on localities are regressed (white heteroskedasticity-consistent standard Errors and covariance) on lagged dummy variables of the housing policies and economic state variables. The sample period is broken into two sub periods, 1987-1999 (Panel A), and 2000-2009 (Panel B). Bolded characters imply rejection due to a significance level that is under 5%.

Panel A 1987 - 1999										
	Busan		**Daegu**		**Daejeon**		**Gwangju**		**Ulsan**	
Variable	**Coefficient**	***t*-Statistic**	**Coefficient**	***t*-Statistic**	**Coefficient**	***t*-Statistic**	**Coefficient**	***t*-Statistic**	**Coefficient**	***t*-Statistic**
Constant	0.000	0.113	0.000	0.125	-0.001	-0.571	0.001	0.848	0.001	0.791
DUMMY1	0.004	0.947	**0.008**	**2.803**	0.003	0.700	0.007	1.319	-0.003	-0.221
DUMMY1(-1)	-0.004	-1.156	-0.003	-0.483	0.008	1.558	**-0.011**	**-2.433**	-0.010	-0.887
DUMMY1(-2)	0.004	1.108	0.007	1.189	0.005	1.066	-0.002	-0.554	-0.018	-1.590
DUMMY1(-3)	-0.002	-0.400	**-0.010**	**-2.390**	0.002	0.538	**-0.014**	**-2.612**	0.006	0.657
DUMMY1(-4)	0.001	0.366	0.008	1.702	-0.004	-0.713	0.005	0.769	-0.001	-0.075
DUMMY2	-0.002	-0.423	**-0.012**	**-2.826**	**-0.009**	**-2.000**	**-0.014**	**-3.986**	**-0.012**	**-2.011**
DUMMY2(-1)	-0.002	-0.526	-0.005	-1.671	0.002	0.483	-0.004	-1.384	-0.006	-1.238
DUMMY2(-2)	0.000	0.070	-0.005	-1.404	-0.004	-0.619	-0.003	-0.515	-0.001	-0.370
DUMMY2(-3)	0.007	1.121	0.000	-0.149	-0.008	-1.340	0.000	-0.028	-0.005	-1.017
DUMMY2(-4)	-0.001	-0.204	0.000	-0.037	-0.006	-1.645	-0.007	-1.894	0.002	0.358
KOSPI(-1)	0.011	1.004	-0.012	-1.176	-0.008	-0.477	-0.002	-0.177	0.018	1.513
MSB(-1)	**0.477**	**2.710**	0.133	0.756	-0.117	-0.494	-0.098	-0.423	-0.029	-0.170
INFLATION(-1)	0.001	0.004	-0.525	-1.849	0.191	0.641	-0.162	-0.452	0.469	1.758
R^2	0.088		0.158		0.100		0.151		0.178	

(***Continued…***)

(***Table 9 Continued***)

Panel B **2000 - 2009**										
	Busan		**Daegu**		**Daejeon**		**Gwangju**		**Ulsan**	
Variable	**Coefficient**	***t*-Statistic**	**Coefficient**	***t*-Statistic**	**Coefficient**	***t*-Statistic**	**Coefficient**	***t*-Statistic**	**Coefficient**	***t*-Statistic**
Constant	-0.005	-2.106	-0.007	-3.074	-0.007	-2.738	-0.007	-3.156	-0.003	-1.784
DUMMY1	0.002	0.909	0.001	0.646	-0.001	-0.331	-0.001	-0.251	0.000	-0.158
DUMMY1(-1)	-0.002	-0.890	0.002	1.138	-0.002	-0.518	-0.001	-0.398	-0.004	-0.856
DUMMY1(-2)	0.006	1.985	0.001	0.605	0.001	0.254	0.001	0.417	**0.005**	**2.786**
DUMMY1(-3)	0.000	0.134	**0.006**	**2.309**	0.005	1.253	0.004	0.964	0.000	0.116
DUMMY1(-4)	0.007	1.963	0.003	1.500	**0.009**	**2.278**	0.004	1.162	-0.001	-0.494
DUMMY2	**-0.006**	**-2.156**	-0.005	-1.609	-0.002	-0.466	-0.005	-1.753	**-0.006**	**-3.681**
DUMMY2(-1)	0.000	0.051	0.001	0.362	0.000	0.129	0.000	-0.105	-0.002	-1.377
DUMMY2(-2)	0.003	1.796	0.000	0.148	-0.001	-0.422	0.002	0.842	**0.005**	**2.433**
DUMMY2(-3)	0.002	1.363	0.003	1.438	0.004	0.943	0.003	1.050	**0.005**	**2.172**
DUMMY2(-4)	0.000	0.054	-0.001	-0.406	0.009	1.896	0.002	0.702	0.002	0.860
KOSPI(-1)	-0.006	-0.650	0.011	0.965	-0.021	-1.072	0.000	-0.007	-0.006	-0.759
MSB(-1)	-0.120	-0.398	0.274	0.793	-0.040	-0.090	-0.153	-0.296	-0.546	-1.649
TERM(-1)	0.016	0.075	**0.355**	**2.247**	0.173	0.800	-0.057	-0.257	-0.026	-0.224
DEFAULT(-1)	**1.056**	**2.563**	0.706	1.557	0.748	1.188	0.822	1.476	0.106	0.191
OP(-1)	0.005	1.662	**0.008**	**2.163**	**0.009**	**2.180**	**0.014**	**3.666**	**0.005**	**2.438**
EXCHANGE(-1)	-0.007	-0.661	0.009	0.673	0.027	1.821	-0.002	-0.127	0.006	0.644
INFLATION(-1)	-0.364	-1.023	**-0.790**	**-2.748**	-0.079	-0.158	-0.339	-0.946	-0.323	-1.013
R^2	0.332		0.254		0.197		0.281		0.344	

Table 10 The Learning Effect of Housing Policies Forms the Basis for Size by Adding Economic Factors

This table presents the results of the learning effect by drawing on size which exploits lagged dummy variables of the housing policies and economic state variables. Abnormal returns across size are regressed (white heteroskedasticity-consistent standard errors and covariance) on lagged dummy variables of the housing policies and economic fundamentals based on size. The sample period is broken into two sub periods, 1987-1999 (Panel A), and 2000-2009 (Panel B). Bolded characters imply rejection due to a significance level which is lower than 5%.

Panel A 1987 - 1999						
	Large		**Medium**		**Small**	
Variable	***Coefficient***	***t-Statistic***	***Coefficient***	***t-Statistic***	***Coefficient***	***t-Statistic***
Constant	0.001	1.378	0.000	-0.152	0.001	1.442
DUMMY	-0.001	-0.704	-0.002	-0.906	-0.002	-1.424
DUMMY(-1)	0.003	1.252	0.003	1.648	0.003	1.535
DUMMY(-2)	-0.003	-1.351	-0.001	-0.471	-0.001	-0.765
DUMMY1(-3)	**0.006**	**3.117**	0.003	1.402	0.003	1.542
DUMMY1(-4)	0.001	0.351	-0.001	-0.314	-0.003	-1.211
DUMMY2	0.005	1.920	**0.006**	**3.172**	**0.007**	**2.788**
DUMMY2(-1)	0.002	0.925	0.002	1.134	0.002	0.897
DUMMY2(-2)	0.001	0.394	0.004	1.821	0.003	1.308
DUMMY2(-3)	0.003	1.599	0.000	-0.094	-0.001	-0.848
DUMMY2(-4)	0.002	0.753	0.002	0.656	0.002	0.935
KOSPI(-1)	0.007	0.964	0.005	0.905	0.003	0.502
MSB(-1)	0.110	0.985	-0.064	-0.568	-0.041	-0.558
INFLATION(-1)	-0.073	-0.721	-0.069	-0.691	-0.029	-0.268
R^2	0.140		0.157		0.158	

(*Continued…*)

(***Table 10 Continued***)

Panel B 2000 - 2009						
	Large		**Medium**		**Small**	
Variable	***Coefficient***	***t-Statistic***	***Coefficient***	***t-Statistic***	***Coefficient***	***t-Statistic***
Constant	0.001	1.351	0.001	1.970	0.001	1.013
DUMMY	0.000	-0.184	0.001	1.104	0.000	-0.070
DUMMY(-1)	-0.001	-0.685	0.000	0.285	0.001	0.965
DUMMY(-2)	0.000	-0.236	0.000	0.135	0.001	0.862
DUMMY1(-3)	-0.001	-1.102	-0.001	-0.676	-0.001	-0.792
DUMMY1(-4)	-0.002	-1.202	-0.002	-1.258	**-0.002**	**-2.137**
DUMMY2	**0.004**	**3.359**	**0.003**	**3.891**	**0.002**	**3.056**
DUMMY2(-1)	**0.003**	**2.156**	0.001	1.316	0.000	0.635
DUMMY2(-2)	0.000	0.064	0.000	-0.678	0.000	-0.651
DUMMY2(-3)	-0.002	-1.622	-0.001	-0.959	0.000	-0.621
DUMMY2(-4)	0.000	0.294	0.000	0.251	0.000	0.624
KOSPI(-1)	0.005	1.001	0.005	1.645	0.001	0.440
MSB(-1)	-0.132	-0.697	-0.072	-0.421	-0.039	-0.269
TERM(-1)	0.126	1.488	0.092	1.288	0.084	1.352
DEFAULT(-1)	-0.391	-1.503	-0.252	-1.455	-0.085	-0.519
OP(-1)	-0.001	-0.626	**-0.003**	**-2.988**	**-0.002**	**-2.062**
EXCHANGE(-1)	0.011	1.392	0.000	-0.102	-0.002	-0.645
INFLATION(-1)	-0.155	-0.767	0.043	0.325	0.134	1.151
R^2	0.434		0.483		0.347	

To summarize, investors who take part in investing on apartment assets in the national capital behave differently depending on several factors, which is because they trade apartment assets with different strategies according to areas, period, and size.

5. Conclusion

Our article sheds light on the evidence that the learning effect of housing policies is related to anomalies in the Korean apartment market. Hence, in light of what has been said above, it is concluded that there is a learning effect that affects anomalies in the apartment market. This effect has different traits and characteristics depending on territory, estimation period, and size. Grounded in factors, the estimation period, location and size, which are important to the price of apartment assets, we investigate the existence and characteristics of the learning effect of housing policies on anomalies for apartment assets in Korea which exploit economic state variables.

It is especially relevant that anomalies in the apartment market for the national capital show opposite responses to the goal of the housing policies which differs from localities. Viewed in this light, investors in the national capital market have private information when investing in apartments; this can be interpreted that they are more sophisticated traders in contrast to those in localities. Moreover, anomalies in the apartment market which underlie size are positively linked with the learning effect of the housing policies on revitalization, but these are negatively linked to the learning effect of the housing policies on stabilization. Seen in this perspective, investors interpret the housing policies differently with regard to the size of the apartment assets.

The most noticeable result linked by adding economic factors is that OP has the statistically strongest relevance to anomalies in the apartment market for the whole period. This is because oil is a representative Korean economic factor and an important raw material. Not all economic variables included in the data set in this paper are significant to anomalies in the apartment market. As expected, the significance of economic state variables depends on area, period, and size, which seems plausible as apartment assets have their own uniqueness and characteristics in comparison to other types of assets and investors. This evidence suggests that investors in the apartment market need to consider different strategies with regards to area, period and size when trading apartment assets.

Whenever the Korean government mentions housing policies, it leaves much room for consideration of the learning effect on anomalies and economic factors in the apartment market with regards to time period, location, and size. Our article defines the boundaries which are needed to control the relationship between internal and external economic state variables. Unfortunately, there

might be the possibility of selection bias in the economic factors in this work. We hope that this paper will contribute to real the estate market.

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Appendices

Appendix 1: Important Housing Policies and their Details in the 1980s

Year	The Principal Policies	Contents of Policy
1980	9.16 policy	1. A reduction in the housing sales tax (5%-20%) 2. Large-scale low cost housing construction
	12.13 policy	1.Introduction of flexible housing sales tax rates
1981	6.26 policy	1.Easing of the housing sales tax 2.Partial removal of controlled housing prices
1982	1.14 policy	1. Extension of flexible housing sales tax adoption 2. Improvement of housing funds and finances 3. Real property acquisition tax cut (30%) 4. Extension of unsold housing supply
	12.22 policy	1. Differential pricing of sold housing 2. Prohibition of resale for 2 years
1983	2.16 policy	1. Housing sales tax based on sale price of apartment. 2. A brokerage license system 3. The bond bidding system
	4.18 policy	1. Spread of residential land development 2. Reduction in flexible housing sales tax adoption
	9.5 policy	1. Notice of the metropolitan area 2.Computerization of actual conditions of land possession
1985	5.20 policy	1. Induction of an integrated land tax system 2. Progressive taxation in real estate dealings 3. A heavy property tax for large-sized housing
1986	2.12 policy	1. Exemption of housing sales tax for households 2. Expansion of a nation-housing fund
1988	8.10 policy	1. Strengthening of tax exemption requisite 2. Reorganization of housing sales tax 3. Early execution of an integrated land tax system
1989	2.4 policy	1. Extension of housing in the metropolitan area 2. Establishment of a housing trading system 3. Construction of five new towns
	12.30 policy	1. Betterment recapture through land taxation

Appendix 2: Important Housing Policies and their Details in the 1990s

Year	The Principal Policies	Contents of Policy
1990	2.16 policy	1. Retroactivity of rent raised unfairly for 5 years
	4.13 policy	1. Registration of housing trading 2. Introduction of land trust 3. Construction of multi-family housing 4. Intensification of gift tax
	5.8 policy	1. Restraint of the acquisition of real estate by large companies
1995	9.19 policy	1. Imposing a fine for idle land 2. Forced purchase of housing
	1.20 policy	1. Construction of a national capital region 2. Permission for land trading zone 3. Taxation of land prices due to sharp rise
1997	5.22 policy	1. Deregulation of price ceiling 2. Exemption of real estate sales tax 3. Permission for re-sale of housing
1998	6.22 policy	1. Lending partial payment for a house in installment sale 2. Aid for redevelopment projects
	9.25 policy	1. Aid for partial payments 2. Liberalization of privately-built apartment housing
	12.12 policy	1. Liberalization of privately-built apartment housing 2. Reduction and exemption of real estate sales tax
	3.22 policy	1. Establishment of reconstruction funds
1999	5.31 policy	1. Lending partial payment 2. Housing fund for small sized housing
	8.20 policy	1. The construction of 100,000 rental houses 2. Upward funding limits for housing loans
	10.7 policy	1. Easing of a privately-managed subscription 2. Establishing various branches which support apartment-application deposits

Appendix 3: Important Housing Policies and their Details in 2000s

Year	The Principal Policies	Contents of Policy
2000	11.1 policy	1. Construction of new cities 2. Exemption of real estate sales tax in non-metropolitan areas 3. Reduction and exemption of housing bonds
2001	1.27 policy	1. Extension of businessman's housing rental guarantee
	3.16 policy	1. Supporting common people's bank guarantee 2. Supporting financing of businessman's housing rental
	5.23 policy	1. Discharge of new real estate sales tax 2. Reduction and exemption of a registration tax of national housing
	5.26 policy	1. Extension of housing in multi-family land
	7.26 policy	1. Supply small-sized housing
	9.14 policy	1. Increase of 30,500 rental housing nationally 2. Supply gratuitous land in the metropolitan area
2002	1.8 policy	1. Tax survey for speculators
	3.6 policy	1. Restriction of resales in overheated investment zone 2. Sales for the homeless masses
	5.20 policy	1. Support of deposit money for leasing a house 2. National construction of rental housing 3. Increase in tenant guarantees
	8.9 policy	1. Tighter rebuilding standards 2. Investigation of the source of the money for reconstructions of apartments
	9.4 policy	1. Construction of new cities in the metropolitan area
	10.11 policy	1. Complaints about speculators 2. Real estate sale taxation in speculations
2003	1.15 policy	1. Appointment of new cities in the metropolitan area 2. Construction of housing in the metropolitan area
	5.23 policy	1. Resurrection of housing resales 2. Construction of new towns in the metropolitan area
	5.28 policy	1. Construction of 500,000 rental housing nationally
	9.3 policy	1. Construction of 1,500,000 rental houses in 10 years

	9.5 policy	1. Restriction of reconstruction shares 2. Increase of small-sized reconstructions
	10.29 policy	1. Double taxation of real estate sales tax 2. The introduction of comprehensive real estate holding tax
2004	2.2 policy	1. Promoting housing investment 2. The creation of housing demands
2005	2.17 policy	1. Pressure for a feasibility study on reconstructions
	5.4 policy	1. Taxation of real estate sales tax based on real prices 2. Expansion of real estate tax 3. Extension of reconstruction shares
	8.31 policy	1. Increase of housing supply 2. Transparency of housing trading
2006	3.30 policy	1. Recapture through development profits from reconstruction
	11.15 policy	1. Construction of 1,640,000 housing units in the metropolitan area 2. Increase in housing development in new towns
2007	1.11 policy	1. Creation of a maximum sale price in speculative areas 2. Restrictions on secured loans in speculations
	1.31 policy	1. Expansion in supply for rental housing 2. Increase in financing for common people 3. Extension in lease market