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EFFECT OF GOVERNMENT POLICY ON THE RISK OF REAL ESTATE INVESTMENT – THE CASE OF TAIWAN'S LUXURY TAX

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Abstract

In order to solve the problem of very high housing prices in Taiwan, the government implemented the Luxury Tax (Specifically Selected Goods and Services Tax) in June 2011 to prevent speculation in real estate and to guarantee the right of habitation. However, few research studies have explored the effect of this policy on the risk of real estate investment, as most studies focus on analyzing the short-term real estate market impact without any long-term observation, and so the effect of the policy cannot be measured effectively. Therefore, this paper used the EGARCH model to analyze the effect of Taiwan's policy of the Luxury Tax on real estate investment, so as to discuss the change of risk (volatility) in real estate through a dynamic model. The empirical results found that the real estate is different from general commodities and does not have the volatility asymmetry phenomenon. Thus, the phenomenon of higher housing prices continuously has existed in Taiwan during the initial period of implementing this tax. Moreover, according to the analysis result of the Luxury Tax in the later period, Taiwan's real estate market exhibits the tendency of slight volatility asymmetry - namely, the increased amplitude of housing prices tends to slow down gradually. This result shows that the Luxury Tax cannot hold down the continuous rise in housing prices, but it can reduce the increased amplitude of housing prices under long-term implementation of the policy. As a result, some policy announcement effects still exist. Due to the limitation in data acquisition, this research used Taiwan's construction index as the alternative data for a real estate price index.

It is suggested that follow-up research carry out a cross-check analysis of different databases.

Keywords: Real Estate Investment, Luxury Tax (The Specifically Selected Goods and Services Tax), Asymmetric Volatility

Introduction

Taiwan's real estate market has a close relationship with the international economic environment as well as Taiwan's domestic policies. For instance, the oil crises in 1973 and 1980 caused "cost-push inflation" and "hedging effect" in Taiwan, which then led to a sharp rise of housing prices. Being affected by the 2008 financial crisis, various countries (including Taiwan) in the world have taken up monetary easing policies to boost their economies. Due to the low-interest environment and a lack of other more attractive economic policies or incentives, Taiwan experiences a large amount of capital investment into real estate, causing a continuous rise in housing prices (Lin, 2014). "Excessively higher housing prices" has become the most important public grievance in Taiwan.[1] In order to prevent housing prices in metropolitan areas from rising unsuitably and to solve public grievances, the Taiwan government declared to set up the Luxury Tax in February 2011, passed the draft in the first review in April, and implemented it in June that same year (Hsieh, 2011). This fairly rare legislative efficiency has shown the urgency for implementing such a policy.

The so-called Luxury Tax is lawfully termed the "Specifically Selected Goods and Services Tax" (hereafter referred to as Luxury Tax), and in nature, it is similar to the Stamp Duty in Singapore or Hong Kong and the Speculation Tax in Germany. In the tax law, a heavy tax (transaction tax) is mainly levied on sales of real estate held for a short term, so as to prevent speculation and to guarantee the right of habitation. According to statistics of real estate transactions by the Ministry of Interior, the transaction volume did show a tendency toward declining during the period of implementing the Luxury Tax. However, relevant research has rarely discussed the effect of this policy on the risk to real estate investment, as most focus on analyzing the real estate market impact and lack any long-term observation. Thus, the effect of the policy cannot be measured effectively. This paper shall analyze this issue from the perspective of investment risk.

Real estate investment is one type asset investment, and in the literature related to asset price and risk and return it is usually used to explain risk. However, risk has become the main factor used to explain the return ever since the relation between risk and return was presented by Fama (1971). As risk is a variable that cannot be directly quantified by the market, it is abso-

[1] Please refer to the investigation result of network opinion in 2019, Research, Development and Evaluation Commission, Executive Yuan (Taiwan).

lutely necessary to look for a suitable proxy variable for risk.

The traditional finance literature mostly supports the viewpoint that volatility can be used as the proxy variable of risk. The capital asset pricing model (CAPM) proposed by Sharpe (1964), Lintner (1965), and Mossin (1966) together confirm that systemic risk has become an important factor to explain the return on assets. Thus, the Arbitrage Pricing Theory (APT) proposed by Ross (1976), the three-factor model (market, scale, and book-to-market value) proposed by Fama and French (1992, 1993), and the 4 factors (market, scale, book-to- market value, and momentum effect) of Carhart (1997) are used to predict return. The volatility of these factors is because these factors are the main explanatory variables, and so volatility research has always been the main field to look into the price of financial instruments. Volatility also extends from a static estimation to a dynamic model to conduct a prediction with the development of a measuring tool. Therefore, this research adopted the dynamic model to discuss the change of real estate risk (volatility) in Taiwan.

Much attention has been paid to volatility asymmetry in academic circles. For instance, Chelley and Steeley (1996), Laopodis (1997), Hung (1997), and Yang (2000) found that the phenomenon of volatility asymmetry exists. The so-called volatility asymmetry refers to the price volatility caused by new information. When new information is positive, future price volatility will be smaller. On the contrary, when new information is negative, future price volatility will be larger. The phenomenon of volatility asymmetry appeared the earliest in stock market research, where Black (1976) first tested for a negative relationship between the current return of the stock market and future volatility. Christie (1982), Schwert (1990), and Koutomos and Saidi (1995) also found the same result. Based on the above-mentioned inference, when new information causes the stock price to decline, the company's financial leverage ratio will rise; namely, the risk of holding stocks will increase (the volatility of the future rate of return will be greater); on the contrary, when new information causes the stock price to rise, the company's financial leverage ratio will decline; namely, the volatility of the future rate of return will be smaller and this phenomenon is called the leverage effect. However, Lo and MacKinlay (1988) believed that this phenomenon originates from non-synchronous trading. According to the research of Sentana and Wadhwani (1992), the phenomenon of volatility asymmetry is caused by traders' herding behavior. Wei et al. (2012) found that government policy also has a very significant effect on the change in risk in an asset investment. Thus, a consistent conclusion has not been reached about whether the phenomenon of volatility asymmetry of stock return is caused by the leverage effect.

Cai and Chen (2008) discussed the volatility asymmetry of real estate and only took Taipei City as the observation subject due to data limitation. Their result found that volatility in the real estate market has a reverse leverage effect. In other words, when the negative information related to return on housing price occurs in the previous period, the return volatility in the current period will be smaller, showing asymmetry between declining housing prices and the increasing volatility and proving that housing prices in Taipei show resilience. Nevertheless, such research ignored an analysis of the rate of return from new information and lacked an overall analysis of Taiwan for it only took Taipei City as the research scope. As a result, whether the policy will cause volatility in real estate still needs to be further researched.

Both the price and trading volume in the stock market are high- frequency financial time-series data. Brooks (2002) believed that a linear model is unable to deal with leptokurtosis, volatility clustering, and other phenomena related to financial time-series, and so it is necessary to consider using a non-linear model. The two kinds of non-linear models used most frequently in finance include the ARCH (Autoregressive Conditional Hetroskedasticity) model and the switching model, among which the application of the former is the most common. The ARCH model was proposed by Eegle (1982) and expanded by Bollerslev (1986) to the GARCH model (Generalized ARCH), which can describe the volatility clustering phenomenon of return. The research related to volatility mainly discusses volatility asymmetry and the long-term and short-term effects of volatility. The GARCH model cannot distinguish between the different effects of positive and negative information on the degree of volatility (namely, the phenomenon of volatility asymmetry), and so Nelson (1991) developed the exponential GARCH model (EGARCH) to distinguish them, while Campbell and Hentschel (1992) applied the quadratic GARCH model (QGARCH) to fit the phenomenon of volatility asymmetry. However, Engle and Ng (1993) compared the 2 models and found that the EGARCH model shows a better fit, while Hafner (1998) also used the empirical materials to verify that the EGARCH model has the advantage of fitting the volatility of high-frequency data.

In terms of volatility asymmetry, this research has adopted EGARCH to conduct the related investigation. The main framework of this paper runs as follows. First, it introduces the research motivation and explores the relevant literature to confirm the research purpose and direction. Section 2 describes the data source and method of this paper and mainly includes data source, basic statistical analysis, and operation of volatility asymmetry in EGARCH. Section 3 is the empirical research analysis, empirical analysis, and verification, which are mainly based on the research method in Section 2. Section 4 puts forward a comprehensive conclusion and suggestion according to the empirical analysis results in Section 3 and provides a future feasible research direction for follow-up research.

Explanation of Research Materials

As previously mentioned, the purpose of the Luxury Tax is to control higher housing prices in Taiwan after it was implemented on June 1, 2011. In addition, Taiwan took the measure of actual real estate price registration on August 1, 2012, hoping that such price transactions become open and transparent; at the same time, a real estate transaction income tax can be levied according to actual price. This paper focuses on the effect of the Luxury Tax on the risk in real estate investment, and so in order to avoid interference from other relevant policies, this research divided the observation period into 2 stages: Stage 1 is the earlier period of implementing the Luxury Tax policy, with the period set as January 1, 2009 to March 31, 2011 to measure the risk status before the formulation of the policy and to analyze investors' overreaction; Stage 2 is from October 1, 2012 to December 31, 2014 to analyze the risk change of real estate investment after the implementation of the Luxury Tax.

The research materials were divided into 3 categories. Category 1 is the real estate index. As there is no real estate index in Taiwan, this research used the construction index to replace the real estate index. Category 2 is Taiwan's economic status index. This research took TWII as the indicator and additionally established a new index that excludes the construction index in Taiwan's stock market. This new index was also calculated by TWII's calculation model and took December 1, 2008 as the base period of 4500 points, namely:

$$I_i \equiv \frac{\text{Total market capitalization excluding construction stock in the current period}}{\text{Total market capitalization excluding construction stock in the base period}} * 4500 \quad (1)$$

The trend of the 3 kinds of indices is shown in the following diagram, and the data were taken from TEJ database. For the convenience of presenting the trend of various kinds of indices, the 3 indices were placed in one diagram. The construction index is multiplied by 40, and the result is shown in the following diagram. It can be found from Figure 1 that Taiwan's housing prices start in a high-growth era after Taiwan's construction index goes through a slight decline due to the effect of the 2008 financial tsunami; in particular, housing prices increased continuously since the second quarter of 2009. In 2011, after the Taiwan government declared the plan to implement the Luxury Tax, the stock market index began to decline. After the Taiwan government planned to implement actual price registration at the end of 2011, the index began to go up. The diagram shows that the index of real estate is greatly affected by government policy. As shown in Figure 2, the construction index began to rise significantly compared with TWII ever since the second quarter of 2009, and the amplitude in the rise of the construction index is far greater than the TWII during the research period.

The calculation method for rate of return in this research is the natural exponential of the closing index on the t^{th} day divided by the daily closing index on the $(t-1)^{th}$ day multiplied by 100. The rate of change of the trading volume is the natural exponential of total trading volume on the t^{th} day divided by the total trading volume on the $(t-1)^{th}$ day multiplied by 100. We define its calculation formula as:

$$r_{i,t} = \left[\ln\left(\frac{I_{i,t}}{I_{i,t-1}} \right) \right] \times 100 \quad (2)$$

First of all, the basic statistics (including sample size, average, standard deviation, coefficient of skew, and kurtosis coefficient in each period), Jarque-Bera statistics, and ADF and PP unit root test statistics of the reward series of the 3 indices are observed in the earlier and later periods of the financial crisis. The above-mentioned data are summarized in Table 1.

Figure 1. Diagram for the trend of the construction index

Empirical Results

Operation of GARCH model

This research adopted the GARCH model and indicated that ARCH/GARCH needs to have leptokurtosis distribution and conditional variance heterogeneity according to Bollerslev (1986). According to Table 1, the sample size in this research shows leptokurtosis distribution. Thus, this research still needs to consider conditional variance heterogeneity.

In order to understand whether the materials of this research have the ARCH effect, this research used Ljung-Box's Q statistics for observation. Ljung-Box's Q statistics are shown in Table 2. The test of $LB(2)^2 \sim LB(12)^2$ is mostly significant under the level of 1%, indicating that the residual square of each sequence may have autocorrelation, and so the phenomenon of Conditional Hetrocedesticity (CH) exists. The mean equation of the GARCH model can process the autocorrelation phenomenon of sequence, and its variance equation allows that the variance depends on the past variance and disturbance term. Therefore, the existence of the conditional variance heterogeneity can be accepted. Hence, the GARCH model is a suitable choice. It means that the sequences of this research all present conditional variance heterogeneity. Thus, the samples in this research are

Table 1. Basic Statistics

Index	Period	Obs.	μ	σ	S	K	JB		ADF		PP	
TWII	Earlier period	559	0.1140	1.2900	-0.3410	5.8512	200	(0.00)	-21.4143	(0.00)	-21.3408	(0.00)
	Later period	559	0.0336	0.7228	-0.2088	4.1935	37	(0.00)	-22.5881	(0.00)	-22.5658	(0.00)
Construction index	Earlier period	559	0.1599	2.2047	-0.1112	3.9048	20	(0.00)	-20.9210	(0.00)	-20.8526	(0.00)
	Later period	559	0.0048	0.8366	-0.2163	5.6418	167	(0.00)	-21.4482	(0.00)	-21.5375	(0.00)
TWII excluding construction index	Earlier period	559	0.1211	1.4086	0.1647	9.3791	950	(0.00)	-20.8410	(0.00)	-20.9500	(0.00)
	Later period	559	0.0425	0.7296	-0.1506	4.0229	26	(0.00)	-22.7460	(0.00)	-22.7300	(0.00)

Table 2. Ljung-Box's Q statistics

		$LB(1)^2$	$LB(2)^2$	$LB(3)^2$	$LB(4)^2$	$LB(5)^2$
TWII	Earlier period	9.9106 (0.00) ***	10.1370 (0.01) ***	13.4360 (0.00) ***	14.2370 (0.01) ***	14.4200 (0.01) **
	Later period	29.7610 (0.07) *	30.6370 (0.08) *	31.0240 (0.10) *	34.8290 (0.05) *	36.8860 (0.05) **
Construction index	Earlier period	20.5040 (0.00) ***	38.4000 (0.00) ***	61.1290 (0.00) ***	92.7410 (0.00) ***	111.2700 (0.00) ***
	Later period	0.0901 (0.76)	6.2113 (0.05) **	7.3558 (0.06) *	7.4765 (0.09) *	7.9156 (0.09) *
TWII excluding construction index	Earlier period	31.5180 (0.00) ***	31.6090 (0.00) ***	31.7980 (0.00) ***	32.1500 (0.00) ***	32.2970 (0.00) ***
	Later period	33.0080 (0.03) **	34.2290 (0.03) **	35.5240 (0.03) **	40.2180 (0.02) **	42.1730 (0.01) **

suitable to conduct the GARCH model analysis.

In order to set the GARCH model applicable to research related to return volatility of various stock indices, one must determine the most suitable lag phase in the aforesaid general formula of the model; namely; it is required to determine the optimal lag phase of the mean equation and variance equation. In terms of the lag phases of the variance equation, Brooks (2002) believed that the GARCH (1,1) model usually can capture the volatility clustering effect in the data; namely, only the conditional variance and residual square in one lag phase are gained. For the purpose of parameter parsimonity, we first set the GARCH(1,1) model to achieve the empirical research. After the estimation of the coefficient, the standardized residual and the square of the standardized residual are used to test whether the autocorrelation effect does not exist in order to confirm the applicability of the GARCH (1,1) model.

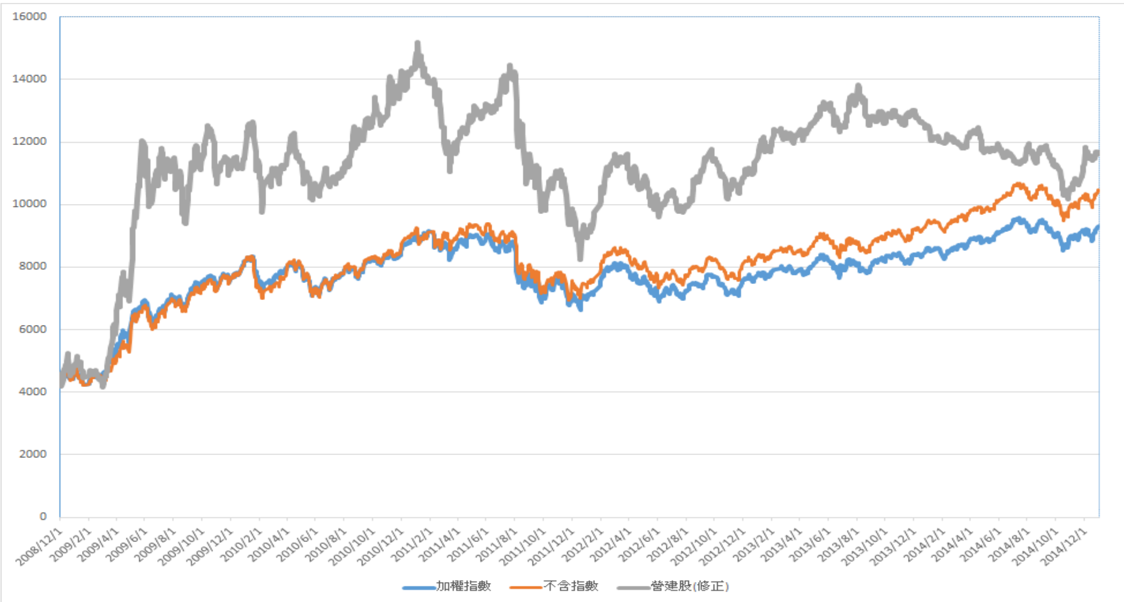

Figure 2. Integrated Diagram For The 3 Indices

In regards to the most suitable lag phase of the mean equation, the model where the general research uses the minimum AIC (Akaike's information criterion) value is the most suitable. The AIC values of various indices in each period are shown in Table 3. This research can create the optimal mean equation of various indices. With the earlier period of TWII as the example, its optimal mean equation is:

$$r_t = \alpha_0 + \alpha_1 r_{t-1} + \alpha_2 r_{t-2} + \alpha_3 r_{t-3} + \alpha_4 r_{t-4} + \varepsilon_t$$

Both the earlier period of TWII excluding the construction index and the earlier period of the construction index adopt a lag Phase 4. The later period of TWII and the later period of TWII excluding the construction index

Table 3. AIC value

Scale	Period	AIC value					
		AR(1)	AR(2)	AR(3)	AR(4)	AR(5)	AR(6)
TWII	Earlier period	3.3394	3.3373	3.3406	**3.3102**	3.3156	3.3188
	Later period	**2.1928**	2.1964	2.1992	2.2042	2.2076	2.2089
Construction index	Earlier period	4.4105	4.4082	4.4021	**4.3799**	4.3817	4.3742
	Later period	2.4778	2.4828	**2.4769**	2.4814	2.4861	2.4869
TWII excluding construction	Earlier period	3.5114	3.5122	3.5160	**3.4905**	3.4959	3.4998
	Later period	**2.2124**	2.2165	2.2195	2.2243	2.2283	2.2297

Note: the bold number is the minimum value

adopt a lag Phase 1. Lastly, the later period of the construction index adopts a lag Phase 3 as the optimal mean equation.This research discusses the effect of the Luxury Tax on the risk of real estate investment, as risk has always been replaced by standard deviation (volatility) in statistics. In terms of the discussion on volatility, this paper adopts EGARCH to discuss the volatility asymmetry and suggests that the model setting should be based on the principle of simplification according to Bollerslev, Chou, and Kroner(1992). This research adopts the EGARCH(1,1) model developed by Nelson(1991) for analysis and describes the model as:

$$R_t \big| I_{t-1} \sim f\left(\mu_t, \sigma_t^{\,2}\right) \quad (4)$$

$$R_t = \beta_0 + \sum_{i=1}^{p} \beta_i R_{t-1} + \varepsilon_t \quad (5)$$

$$\ln(h_t) = \alpha_0 + \alpha_1\left(\left|z_{t-1}\right| - E\left[\left|z_{t-1}\right|\right] + \delta \cdot z_{t-1}\right) + \phi \ln(h_{t-1}) \quad (6)$$

In the model above, Eq. (4) indicates that based on the ensemble of communication (I_{t-1}) in the (t-1)th phase, the rate of return (R_t) of the t^{th} phase is subject to the allocation that both the expected value and variance vary with time. Equation (5) describes the autocorrelation behavior of the rate of return - namely, the mean equation.

The variance equation in Eq. (6) is the key equation of the EGARCH model, which means that the variance also has the autocorrelation of exponential form and that the residual affects future variance, among which $z_t \equiv \varepsilon_t / h_t$ is the standardized value of the residual after going through conditional variance. The degree of the effect from the standardized residual in the previous period on the variance in the current period can be seen from the coefficient α_1 of the $(|z_{t-1}| - E[|z_{t-1}|] + \delta \cdot z_{t-1})$ term in Eq. (3). If α_1 is positive, then new information will increase future volatility, but the increased amplitude of the volatility caused by the positive information or negative information is different. The z_{t-1} of positive information is positive and the z_{t-1} of negative information is negative, and so when coefficient δ is negative, the increased amplitude of future volatility caused by the negative information will be greater than that caused by the positive information. If coefficient δ is positive, then the increased amplitude of future volatility caused by the positive information will be greater than that caused by the negative information. In other words, this is the situation of volatility asymmetry.

Analysis Results and Discussion

This research focuses on the effect of the Luxury Tax in Taiwan on the risk of real estate investment. We use EGARCH to discuss the change of risk before and after the tax; i.e. the change of return volatility before and after it. Therefore, in terms of the volatility change, this research employs a comparison of the absolute value of coefficient δ.

We first divide the period of the 3 indices into 3 sub-periods: earlier period of the Luxury Tax and the earlier and later periods of the tax. We do so in order to understand whether various indices exhibit the phenomenon of volatility asymmetry during the sample period. In terms of such phenomenon, we mainly adopt the above-mentioned EGARCH model and present the analysis result in Table 4. By observing whether the δ value has an obvious discrepancy between the 2 sub-periods, this research can examine and compare the degree of volatility asymmetry between the 2 sub-periods of the Luxury Tax.

As previously mentioned, the so-called phenomenon of volatility asymmetry refers to the increased amplitude of volatility being different due to positive information or negative information. When coefficient δ is negative, the increased amplitude of future volatility caused by the negative information will be greater than that caused by the positive information. When coefficient δ is positive, the increased amplitude of future volatility caused by the positive information will be greater than that caused by the negative information.

This research assumes that the general error distribution has the null hypothesis. We present the estimation result of the AR(4)-EGARCH(1,1) model in the earlier period of TWII as:

Table 4. Estimation of the EGARCH model

Country	Period	AR(p)	α_0	α_1	δ	ψ	$\frac{1+\lvert\delta\rvert}{1-\lvert\delta\rvert}$
TWII	PER-	4	-0.1109	0.1503	-0.0614	0.9832	1.1309
			(0.0011) ***	(0.0016) ***	(0.0326) **	(0.0000) ***	
	POST-	1	-0.1031	0.1378	-0.0591	0.9837	1.1257
			(0.0011) ***	(0.0016) ***	(0.0423) **	(0.0000) ***	
Construction index	PER-	4	-0.0935	0.1758	0.0003	0.9712	1.0006
			(0.0107) **	(0.0015) ***	(0.9919)	(0.0000) ***	
	POST-	3	-0.0629	0.0768	-0.0102	0.9858	1.0205
			(0.0436) **	(0.0343) **	(0.6498)	(0.0000) ***	
TWII excluding construction	PER-	4	0.3863	0.3933	-0.2365	-0.2486	1.6195
			(0.0187) **	(0.0000) ***	(0.0076) ***	(0.1840)	
	POST-	1	-0.0158	-0.0162	-0.1345	0.9604	1.3107
			(0.5036)	(0.5342)	(0.0000) ***	(0.0000) ***	

$$R_t = 0.1316 + 0.0925R_{t-1} - 0.0820R_{t-2} + 0.0027R_{t-3} - 0.0118R_{t-4} + \varepsilon_t$$
$$\ln\left(\sigma_t^{\ 2}\right) = -0.1109 + 0.1503\left(\lvert z_{t-1}\rvert - E\left[\lvert z_{t-1}\rvert\right] - 0.0614 z_{t-1}\right) + 0.9832\ln\left(\sigma_{t-1}^{\ 2}\right)$$
$$\ln\left(\sigma_t^{\ 2}\right) = \alpha_0 + \alpha_1\left(\lvert z_{t-1}\rvert - E\left[\lvert z_{t-1}\rvert\right] + \delta z_{t-1}\right) + \phi\ln\left(\sigma_{t-1}^{\ 2}\right)$$

From Table 4 we see that TWII and the weighted index (excluding the construction index) still have volatility asymmetry. The index -0.0614 (0.0326) and the index -0.0591 (0.0423) respectively in the earlier and later period of TWII, and the index -0.2365 (0.0076) and index -0.1345 (0.0000) respectively in the earlier and later period of weighted index excluding construction index are all significant, but the construction index shows no significant difference (the index in the earlier and later period is respectively 0.0003 (0.9919) and -0.0102 (0.6498)). However, when the two indices are compared, they will be significantly unequal, and the asymmetry in the later period has a significant change (earlier period $\frac{1+\lvert\delta\rvert}{1-\lvert\delta\rvert}$ 1.0006, later period $\frac{1+\lvert\delta\rvert}{1-\lvert\delta\rvert}$ 1.0205), which seemingly indicates that the implementation of the Luxury Tax prompted some investors in Taiwan's real estate to exit from their investment. Thus, the relative risk of higher housing prices becomes smaller.

Conclusion

Taiwan's housing prices have been consistently rising since 2008, which has affected the normal development of the local real estate market.

The Taiwan government implemented its Luxury Tax in an effort to control housing prices. There are many studies that have explored the effect of policy implementation on the real estate market or asset prices, but most of them analyze an earlier period of the policy or use the event study method to discuss the effect on construction firms' stock prices. Thus, any long-term effect from policy implementation is unclear, especially when evaluating risk of real estate investment. Therefore, we divided the research period into 2 stages to analyze the effects of the tax during the earlier and later periods.

Empirical research has found that different from general commodities, real estate does not exhibit the phenomenon of volatility asymmetry. Even in the initial period of implementing the Luxury Tax, Taiwan's housing prices still moved higher. This result is in line with some concepts of the reverse leverage effect proposed by other empirical studies - namely, real estate does show resilience (Tsai and Chen, 2008), or the single Luxury Tax policy cannot fully control housing prices.

We also note after observing the analysis results of the later period of the Luxury Tax that Taiwan's real estate market presents the tendency of slight volatility asymmetry; in other words, the increased amplitude of higher housing prices gradually slows down. This research shows in the long term that, although the Luxury Tax cannot prevent housing prices from rising continuously, a long-term implementation of such policy can lower the increased amplitude. Therefore, policy announcement effects still exist.

This paper used the EGARCH model to analyze the effects of Taiwan's policy of the Luxury Tax on real estate investment in order to effectively test the phenomenon of volatility asymmetry in real estate. Due to the limitation in data acquisition, this research utilized Taiwan's construction index as the alternative data for the real estate price index. It is suggested that follow-up research can reference this paper and carry out a cross-section comparison and analysis of different databases after Taiwan's long-term real estate price database becomes more complete.

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