Using REIT Data to Assess the Geographic Effects of Mega-events: The Case of the 2020 Tokyo Olympics

Ogawa, Ryoh

Osaka City University

1 May 2017

Using REIT Data to Assess the Geographic Effects of Mega-events: The Case of the 2020 Tokyo Olympics

Ryoh Ogawa

Graduate School of Economics, Osaka City University, Osaka, Japan

r.ogawa@econ.osaka-cu.ac.jp; 3-3-138 Sugimoto Sumiyoshi-ku, Osaka-shi, 558-8585 JAPAN

Using REIT Data to Assess the Geographic Effects of Mega-events: The Case of the 2020 Tokyo Olympics

This study proposes a new approach based on the capitalization hypothesis to evaluate the geographic effects of a mega-event of interest. The event study method with real estate investment trust (REIT) data allows for an estimation of abnormal returns accruing from serious announcements of hosting a mega-event (e.g. site decision); it also clarifies the relationship between the abnormal return level and the characteristics of a REIT property portfolio, such as location, which allows a prediction to assess the impacts on the value of profitable real estate properties by local areas. I present an empirical example – the 2020 Tokyo Olympic Games – and the results are as follows: (1) abnormal returns from the successful bid announcement for Japan REITs are significantly positive on average, (2) whereas the extent decreases as the distance from Tokyo increases, the properties used for hotels and commercial facilities are relatively susceptible to impacts even in areas far from Tokyo and (3) the prediction shows that the announcement increases the asset amount of income-producing real estate in Tokyo-to by 4.7%, corresponding to JPY 3.3 trillion or only 60% of that throughout Japan.

Keywords: mega-events; Olympic games; geographic effects; real estate investment trust; event study method

JEL codes: G14; L83; R30

1. Introduction

How much does a global mega-event such as the Olympics, the Football World Cup or the World Expo benefit the host-cities and the other domestic areas? Such prestigious projects are viewed as an honour by the host-citizens but require considerable public funds. Usually, a large amount of not only the host-city's tax revenue but also national funds are allocated to the project; that is, residents in non-host cities/regions must also bear the event's costs. Thus, the economic net benefits that a nation enjoys from hosting a mega-event are a matter of public concern.[1]

According to the capitalization hypothesis, future benefits and cost flows that accrue from a mega-event should be incorporated into the present value of assets, such as corporate stocks and real estate properties.[2] Many researchers have examined whether successful (or unsuccessful) bid announcements significantly affect stock prices (Berman,

---

[1] Regarding various effects caused by mega-events, for example, see Scherer and Strauf (2003).

[2] The impacts of mega-events on other individual economic aspects also have been investigated in the literature. (See Baade and Matheson [2016] and Maennig [2017] for surveys on the effects of major sports events, including the Olympics.) Rose and Spiegel (2011) find that hosting mega-events significantly increases national exports, and Brückner and Pappa (2015) show that the Olympics in particular have a positive impact on gross domestic product, consumption and investment. For these studies, Maennig and Richter (2012) and Langer, Maennig, and Richter (2017) highlight the estimation bias that stems from not completely considering structural economic differences between host-countries and others (or bidding countries and others). In addition, other studies investigate the effects on host-cities' income and employment levels (Jasmand and Maennig 2008; Hagn and Maennig 2008, 2009; Feddersen, Grötzinger, and Maennig 2009; Feddersen and Maennig 2012; Miyoshi and Sasaki 2016) and on tourism (Mitchell and Stewart 2015). While these previous studies use aggregate-level data, Lamla, Straub, and Girsberger (2014) use firm-level data collected through a questionnaire to examine the effects of EURO 2008 on sales and prices at restaurants and hotels.

Brooks, and Davidson 2000; Veraros, Kasimati, and Dawson 2004; Samitas, Kenourgios, and Zounis 2008; Leeds, Mirikitani, and Tang 2009; Mirman and Sharma 2010; Sullivan and Leeds 2016). These analyses of corporations' stock price fluctuations address the effects on corporate profits. Moreover, it is difficult to identify the geographical incidence of the changes in corporate profits because the shareholders reside in various areas.

In contrast, investigating the changes in real estate property prices from the announcement of mega-events can uncover more comprehensive net effects brought to specified local areas of interest. Kavetsos (2012) highlights the positive impacts of the 2012 London Olympics announcement (i.e. a successful bid in 2005) on property transaction prices in the host areas (boroughs) within London and in areas close to the main stadium.[3] However, the approach using property price data suffers from the removal of simultaneous shocks unrelated to the effects of mega-events; an approach using stock price data would easily address this problem. This is because of differences in asset liquidity. A stock is frequently traded in exchange markets enough to reflect immediately the value change attributable to the shocks; therefore, its price is available in high-frequency data (e.g. day, hour or real-time unit data). This feature reduces the risk that multiple significant shocks will occur concurrent with the announcement period. In contrast, real estate property transactions occur infrequently relative to stock transactions; thus, following the news release on a mega-event, some reasonable time should elapse to accumulate a certain number of transaction observations. Moreover, the available time

---

[3] Some associated retrospective studies investigate the regional effects of constructing and opening sports stadiums and use a hedonic price model with property price data (e.g. Tu [2005]; Ahlfeldt and Maennig [2010]).

series data on property prices (e.g. transaction prices or appraisal values) are usually of a low frequency (in general, one-year units). This suggests a high risk of multiple shocks being combined.[4]

The current study proposes an approach for assessing the geographic effects of hosting the mega-event of interest; I use real estate investment trust (REIT) data. REITs are companies that raise funds to invest in commercial and residential real estate. That is, a REIT issues a financial instrument whose price has the dual features of stock and property prices. Because REIT prices are obtained in the form of high-frequency data such as stock prices, it is possible to employ an event study method to measure abnormal returns given the announcement of the mega-event of interest.[5] The abnormal returns indicate the relatively comprehensive effects attributable to the mega-event because the REIT price, similar to a property price, represents the discounted present value of future rents from the properties that the REIT invests in and owns. Additionally, the determinants of abnormal returns can be clarified using the characteristics of properties owned by REITs. REITs create real estate portfolios following their investment policies, implying that each REIT's portfolio likely has a unique set of characteristics of real estate

---

[4] Even with the difference-in-differences method, this low liquidity problem (or low-frequency data) cannot be completely addressed because the method does not thoroughly remove other shocks unrelated to the shock of interest that is common to all sample units belonging to the treatment area. Moreover, this approach needs to set the control area or the counterfactual of the treatment area, such as which surrounding areas are mostly chosen. However, this area may also be significantly affected by mega-events.

[5] The event study method supposes that the effects of an event will reflect immediately in security prices, assuming rationality in the marketplace (MacKinlay 1997).

properties. This feature allows for an investigation of the relationship between estimated abnormal returns and a portfolio's characteristics, particularly location, by estimating a cross-sectional model.

To measure the extent of the impacts from announcement on the value of profitable real estate in regions of interest, including not only REIT properties but also others located in each area, it is necessary to conduct out-of-sample prediction by area; I plug into the estimated cross-section model the particular values of the independent variables that represent the population of profitable real estate located in each area that can be available from the related exhaustive survey of real estate conducted once every few years. [6]

I examine the effectiveness of this method by taking up the case of the 2020 Tokyo Olympics. On 8 September 2013, Tokyo won the bid to host the Olympics. The International Olympic Committee's (IOC) announcement was expected to change to some extent investors' prospects of future income from the properties owned by Japanese REITs (J-REITs).[7] Tokyo's final odds by William Hill, a major British bookmaker who takes bets on not only sports matches but also politics, was 1.67, indicating an expected

---

[6] If there is no such exhaustive survey, it is possible to construct a real estate portfolio by region from REITs' properties. However, the properties owned by REITs are part of the entire profitable real estate; the distribution of the attributes of properties owned by REITs is not necessarily consistent with that of the population.

[7] Miyakoshi, Shimada, and Li (2016) clarify that the fundamental value of the Japan REIT is determined by the real estate price rather than the stock price during May 2003 to December 2014.

winning probability of 60%.[8] The results from the event study method show that the prices of the J-REITs responded significantly to the IOC announcement. In addition, I find that the abnormal returns level depends on the geographical location of the J-REIT properties. Specifically, investors foresaw that the Olympics would mainly affect the host-city (i.e. Tokyo-to) and that the extent of the impact would gradually decrease at distances away from it. However, even in areas far from the host-city, the property values of hotels and commercial facilities were found to be relatively sensitive to the announcement of the Olympics relative to those of other intended use. Finally, according to the out-of-sample prediction, the successful bid announcement will increase the total asset amount of income-producing real estate owned by corporations in Japan will increase by 2.8%, corresponding to JPY 5.5 trillion, and by 4.7% in Tokyo-to, corresponding to JPY 3.3 trillion or only 60% of that in Japan.

This study is the first to investigate the impacts of major sports events on REIT returns. Although some studies address events strongly associated with a REIT (see Howe and Jain [2004] for regulatory change and Tang et al. [2016] for debt announcements for each REIT), others identify the effects of social and economic mega-events (see Bredin, O'Reilly, and Stevenson [2007] for monetary policy and Glascock and Lu-Andrews

---

[8] We can check these final odds as the result (6 September 2013) of "Which City Will Host The 2020 Summer Olympics?" on the website of William Hill. (http://sports.williamhill.com/bet/en-gb/results///E/2736244/thisDate/2013/9/6///Which+City+Will+Host+The+2020+Summer+Olympics%3f.html).

[2015] for extreme market-related events, such as the Lehman Brothers bankruptcy).[9] This study contributes to the latter research stream; however, it is also the first study to examine the relationship between the extent of a shock and the characteristics (e.g. location and intended use) of REIT properties, and to present a prediction approach that measures the geographic impacts of a mega-event on the asset value of income-producing real estate property, which are of significant interest for policymakers in holding a mega-event as a trigger for urban and regional development.

The remainder of this paper is organized as follows. Section 2 describes some features of the J-REIT securities market and its investment properties. Section 3 observes J-REITs' returns before and after the Tokyo 2020 Olympics announcement, goes on to describe the use of the event study method and investigates the relationship between the change in returns and J-REITs' characteristics. Section 4 describes the prediction to measure the geographic impacts attributable to the announcement on the asset value of real estate property, and Section 5 concludes.

2. Features of J-REIT Data

This section describes some features of the J-REIT securities market and its investment properties.

---

[9] The purpose of the study of Glascock and Lu-Andrews (2015) was to clarify how REITs' liquidity and size determine the extent of abnormal returns as a result of extreme market-related events.

J-REIT Securities Market

The J-REIT market has grown rapidly since 2001. When established in September 2001, there were only two J-REIT companies with a market capitalization at the end of 2001 of JPY 222 billion. However, at the end of 2016, there were 57 companies and their market capitalization at the end of that year was JPY 12,123 billion.[10] J-REITs comprise the largest REIT market in the world after the United States and Australia: as of November 2014, there were 231 REITs in the United States; in Australia, 52; and in Japan, 46. Market capitalization (in USD millions) in the United States was 82,549; in Australia, 86,169; and in Japan, 84,100.[11]

How frequently are J-REIT securities traded on the stock market? I use the turnover ratio as an indicator of security liquidity.[12] Table 1 shows the distribution of the daily average (trading-day base in 2013) turnover ratios for the 41 J-REITs that had listed at the end of August 2013 relative to that for securities in the Tokyo stock price index (TOPIX).[13] TOPIX's securities are ordinary corporates listed on the first section of the Tokyo Stock Exchange.

---

[10] This information was obtained from the Association for Real Estate Securitization (ARES) J-REIT Databook (http://j-reit.jp/statistics/).

[11] See Table 1 in Miyakoshi, Shimada, and Li (2016), wherein the data source is the *EPRA Global REIT Survey 2014* of the European Public Real Estate Association.

[12] The turnover ratio on any given day is defined as the trading volume divided by the shares outstanding on that day.

[13] These 41 J-REITs are also subsequently used to investigate the effect of the 2020 Tokyo Olympics. Their names and security codes are included in Table 3 in Section 3.

[Table 1 near here]

The mean values of the daily average turnover ratios are 0.0050 for the J-REITs and 0.0068 for the TOPIX. Although the average frequency of J-REIT transactions is less than that of ordinary corporate stocks, it is not much of a difference. Additionally, the standard deviation for the J-REITs is 0.0031, much less than that of the TOPIX (0.0124); indicating that the average frequency of J-REIT transactions is more stable than that of ordinary corporate stocks.[14]

J-REIT Investment Properties

The number of real estate properties acquired and owned by J-REIT companies has also increased; Figure 1 shows the annual number and total acquisition cost of the properties. What are the attributes of these investment properties? In general, information on the individual properties within a REIT is found in the settlement of account of the REIT investment company. In the case of Japan, the Association for Real Estate Securitization (ARES) constructs and discloses the J-REIT Property Database, which includes various types of attributes of the real estate properties, including location, market value, intended use (i.e. purpose of use) and age.[15]

[Figure 1 near here]

The left graph in Figure 2 shows the asset value of the J-REIT properties by intended use, namely, residences, hotels, offices, commercial facilities and logistics

---

[14] The coefficient of variation (i.e. the ratio of the standard deviation to the mean) is 0.6267 for 41 J-REITs, much less than the ratio of 1.8219 for TOPIX.

[15] The ARES J-REIT Property Database is available from the ARES website (https://jreit-pdb.ares.or.jp/pdb/).

facilities. The asset amount of properties used as an office is the largest (49%), followed by commercial facilities (21%), residence (18%), logistics facilities (9%) and hotels (3%). I find that this feature is not much different from that of the population of profitable real estate by comparing with the right graph in Figure 2, based on the '2013 Corporation Survey on Land and Buildings' (i.e. the survey of land and building ownership and usage by corporations) that covers a substantial proportion of income-producing real estate in Japan.[16]

[Figure 2 near here]

The left and right maps of Figure 3 show the geographical distributions (by prefecture[17]) of J-REIT investment properties and the profitable real estate population, respectively. When comparing the two, J-REIT properties are relatively concentrated in certain prefectures, especially Tokyo-to, Kanagawa-ken, Chiba-ken, Saitama-ken, Osaka-fu, and Aichi-ken, whose population and gross domestic product (GDP) are relatively higher among the prefectures.

[Figure 3 near here]

---

[16] This exhaustive survey is conducted by the Japanese government every five years and contains information on the amount of real estate properties that corporations own (as of January 1st) by location of prefecture unit and category of intended use. This survey classifies the present usage of lands into twenty-three groups and the present main usage of buildings into twelve groups. I reclassify these into five types (i.e. residences, hotels, offices, commercial facilities and logistics facilities) and exclusive ones. See Table A in the appendix for details.

[17] The prefecture is the first level of administrative jurisdiction in Japan. There are 47 prefectures, and its name is appended with 'ken', 'fu', 'to', or 'do'.

REITs construct real estate portfolios for the sake of risk diversification, complying with the investment policy of each company; therefore, the portfolio of each REIT will bear a unique set of characteristics. Table 2 reports the features of each J-REIT's portfolio properties. The mean values for proportion by intended use (asset value base) are as follows: 37.7% for offices, 27.1% for residences, 16.9% for commercial facilities, 11.6% for logistics facilities and 6.7% for hotels. Additionally, the standard deviation and minimum and maximum values indicate that proportions by purpose of use vary widely across the J-REITs.

Regarding the proportion of value by prefecture (asset value base), the mean values in the key areas are as follows: 55.2% for Tokyo-to, 9.7% for Osaka-fu, 7.0% for Kanagawa-ken, 6.0% for Chiba-ken, 3.6% for Saitama-ken and 3.6% for Aichi-ken. These values indicate that many J-REIT companies tend to invest in and own real estate in Tokyo-to. However, the standard deviation, minimum and maximum values indicate that the magnitude of the proportion of properties in Tokyo-to varies to some extent across the J-REITs.

[Table 2 near here]

3. Event Study Method with J-REIT Data

To assess the net effects of the 2020 Tokyo Olympics brought to each domestic area, I fundamentally rely on the event study method using J-REIT data. Section 3 states how J-REIT returns changed when Tokyo-to won the bid to host the 2020 Olympics. First, I calculate the abnormal returns for individual J-REIT prices on the first trading day immediately following the bid announcement. Second, I confirm whether the extent of abnormal returns is truly 'abnormal'. Finally, I examine the relationship between the abnormal returns and the characteristics of J-REIT property portfolios (intended use and location). The estimated relationship allows prediction of the geographical incidence of the impacts on real estate values in host-city and non-host-areas introduced in section 4.

Tokyo's 2020 Olympics Bid Win and J-REIT Returns

Despite failing to secure the opportunity to host the 2016 Summer Olympics, Tokyo-to continued to engage in invitation activities and appealed to the notion of geographically compact games: most of the competitions would occur within 8 km of the athletes' village. As a result, the announcement that Tokyo-to would host the 2020 Summer Olympics and Paralympics was made on 8 September 2013. It is believed that the IOC announcement changed investors' prospects regarding future income from properties inside and outside Tokyo-to and guided them towards those that the J-REITs owned. As previously mentioned, Tokyo's final odds by William Hill was 1.67, indicating an expected winning probability of about 60%. Thus, investors likely predicted that the chances of Tokyo's victory or defeat were nearly even. Consequently, the choice of the Olympic games site by the IOC probably forced investors, including J-REITs, to change their investment portfolios.

I check the movement of J-REIT prices around the day on which Tokyo-to won the bid. The award day was a Sunday (i.e. a non-trading day in Japan); thus, I assumed that J-REIT return responses to the announcement would occur on the next trading day. For this analysis, I set 9 September 2013 as the event day; on that day, all 41 J-REITs were trading on the Tokyo Stock Exchange, as seen in Table 3.

[Table 3 near here]

Figure 4(a) shows the daily change in the average returns for the 41 J-REITs around the event day (i.e. 39 pre-event trading days, the aforementioned event trading day and five post-event trading days).[18] I find that the average value on the event day is approximately 3%,[19] an apparently large change compared with the previous day. In addition, no large negative value emerged in the five post-event days. Figure 4(b) shows the cumulative values of the daily average returns described in Figure 4(a). I find that the cumulative values are negative on the pre-event days, but that the negative width sharply shrinks on the event day and becomes (and remains) positive in the post-event days. These observations suggest that the announcement of Tokyo's win likely significantly changed investors' prospects regarding J-REIT properties.

[Figures 4(a) and 4(b) near here]

Furthermore, I make comparisons with ordinary corporate stock market movements. Figures 5(a) and (b) show plots of the returns for the TOPIX and the cumulative values, respectively. The TOPIX appears to react to the IOC's announcement; however, unlike with J-REITs, the positive returns on the event day appear to be 'less abnormal' than the return movements during the pre-event days. These observations imply that the impact on J-REITs is stronger than that on ordinary Japanese corporates via the stock market.[20]

---

[18] Hoshino Resort (No. 3287), one of the 41 J-REITs, was first listed on the stock market on 12 July 2013, about 40 trading days prior to the event day. This is because I set 16 July (the next trading day) as the beginning of the pre-event days period.

[19] The simple average is strictly 2.9%, as seen in Table 3.

[20] Actually, Sullivan and Leeds (2016) clarify statistically that the Nikkei 225 stock index, comprising listed stocks with active trading and high liquidity selected from the listed stocks of the first section of the Tokyo Stock Exchange, did not respond to the IOC's

[Figures 5(a) and 5(b) near here]

Calculating Abnormal Returns and Testing the Hypotheses

I examine whether the announcement of Tokyo's successful bid affected J-REIT returns – and, if so, by how much – by following the event study method (e.g. MacKinlay [1997]). This involves estimating abnormal returns and testing hypotheses. Abnormal returns are a measure used to evaluate the impact of an event of interest and are calculated as the excess of actual returns over the normal returns in an event period. Normal returns are defined as the expected returns free from the event of interest for analysis – in this study, the decision on the 2020 Olympics site previously mentioned in detail. There are two common choices for modelling normal returns: the *constant mean return model* and the *market model*. The former assumes that the mean returns of a given security are constant through time, and the normal returns in the event period are usually calculated by averaging actual returns over the pre-event period. In contrast, the latter model assumes a stable linear relationship between market returns and each security's actual returns, and the normal returns in the event period are predicted through the linear relationship estimated in the pre-event period.

This case study uses the constant mean return model. The market model is considered to be superior to the constant mean return model with respect to removing effects attributable to common shocks to securities, rather than those attributable to the

---

announcement on the 2020 Olympics; they do so by estimating an autoregressive regression.

shock of interest in an event period.[21] However, it is advantageous in this case study to apply the constant mean return model, considering the possibility that mega-events can also significantly affect market returns (i.e. J-REIT market returns or corporate stock market returns). If the IOC's announcement also had a significant impact on the firm via the stock market, it would be difficult to correctly identify the extent of that impact on J-REIT returns by using the market model. We cannot rule out the possibility, according to the preliminary observation previously mentioned (see Figure 5).

To estimate the normal returns, I set two blocks for the pre-event period. One is 16 July 2013 to 6 September 2013 (i.e. 39 pre-event trading days), which I refer to as 'pattern A'; the other is 22 June 2012 to 6 September 2013 (i.e. 300 pre-event trading days), which I refer to as 'pattern B'.[22] Pattern A is the same as that shown in Figure 4 and is the longest span that includes all 41 J-REITs listed on the event day. In contrast, pattern B is longer than pattern A, although only 35 J-REITs are included. The difference in the number of J-REITs is because six of the 41 J-REITs were not listed on all 300 of the pre-event days.[23]

Table 4 summarizes each J-REIT's normal and abnormal returns on the event day (9 September 2013) according to the two aforementioned patterns in the constant mean return model. Both the weighted and simple averages of abnormal returns for pattern A

---

[21] The non-common (or individual) shocks to securities in an event period can be addressed by averaging abnormal returns over securities, even when we apply the constant mean return model.

[22] The trading day immediately preceding the event day was 6 September 2013.

[23] MacKinlay (1997) suggests the use of more than 120 pre-event trading days.

exceed 3%; the maximum value is 7.80%, the minimum value is 0.53% and the standard deviation is 1.43%. These results are almost identical to those of pattern B.

[Table 4 near here]

Using these estimated abnormal returns values, I conduct a t-test for the null hypothesis (i.e. hosting the 2020 Olympics has no impact on J-REIT returns); the simple average abnormal returns over J-REIT securities on event day is 0. Actually, a normal t-test may lead to over-rejection when event days for each security are in a cluster (e.g. the extreme case when the event day is the same for all securities, as in this study). This is because the covariances between the abnormal returns for securities will not be 0 (MacKinlay [1997]). Thus, I use the adjusted test statistics proposed by Kolari and Pynnönen (2010):

$$t_{KP} = t_{BMP}\sqrt{\frac{1-\bar{r}}{1+(n-1)\bar{r}}}, \quad (1)$$

where n is the number of securities and $\bar{r}$ is the average of the sample cross-correlations over the pre-event days' residuals.[24] The test statistics proposed by Boehmer, Musumeci, and Poulsen (1991), t_{BMP}, is:

$$t_{BMP} = \frac{\overline{SAR}\sqrt{n}}{s}, \quad (2)$$

where $\overline{SAR}$ is the average of the event-day scaled abnormal returns ($SARs$) and s is the (cross-sectional) standard deviation of the $SARs$, defined as the square root of the sample variance. SAR is defined as the abnormal returns divided by the standard deviation of pre-

---

[24] In the constant mean return model, the residual on a pre-event day for a security is calculated as the actual returns on the pre-event day reduced by the estimated normal returns.

event day residuals corrected by the prediction error, as described by the right-hand side of equation (5) in Kolari and Pynnönen (2010).[25]

Table 5 presents the results of testing the hypothesis. Under the null hypothesis, the adjusted t-statistic, t_{KP}, in the constant mean return model is 2.31 for pattern A and 1.74 for pattern B, thus rejecting the null hypothesis at the 5% and 10% significance levels, respectively. These results indicate that hosting the 2020 Olympics had an impact on J-REITs' returns.

[Table 5 near here]

Estimating Determinants of the Extent of Abnormal Returns

I clarify whether and how attributes such as intended use and location influence the level of abnormal returns. The following relationships are assessed: (1) between the degree of impact and distance from the host-city, (2) between the degree of impact and the intended purpose of a property and (3) intended use that is relatively susceptible to the shock of a mega-event even when the property is far from the host-city. To do so, I estimate the following cross-sectional regression model (3).

$$\widehat{AR}_{i\tau} = a + b \cdot log(WAD_i) + \sum_{k=2}^{K} c_k \cdot USAGE_{ki} + \sum_{k=2}^{K} d_k \cdot log(WAD_i) \cdot USAGE_{ki} + \varepsilon_i, (3)$$

where $\widehat{AR}_{i\tau}$ is the abnormal return for J-REIT i at time τ, previously estimated in pattern A; WAD_i is the weighted average of the distances between the host-city and the location of the properties that J-REIT i owns, that is, the distance of the J-REIT asset from the host-city; $USAGE_{ki}$ is the usage-share variable that corresponds to the share of the

[25] The denominator of this right-hand side corresponds to the square root of equation (8) in MacKinlay (1997).

amount, based on market value, of real estate for intended use k for J-REIT i; and ε_i is the disturbance term.

To build WAD_i, I use the straight-line distances between the offices of two prefectural governments (i.e. Tokyo-to and the prefecture in which the property is located). The weights are the shares of asset values based on market value. For WAD_i, the mean value is 140 km and the standard deviation is 160 km. The minimum is 0; thus, I consider $log(WAD) \equiv log(WAD + 1)$ for the regression.

For $USAGE_{ki}$, I classify J-REITs' real estate properties into five categories, as previously mentioned: residences, hotels, offices, commercial facilities and logistics. For example, if a mega-event increases the number of tourists, the share price of a J-REIT that invests in hotels is likely to respond to the announcement of hosting the Olympics. Furthermore, if a mega-event significantly improves its incomes or amenities, the share price of a J-REIT that invests in residences should also respond to the event. $USAGE_{1i}$ is used as a base variable, where one of the categories must be excluded from the regression equation. (Here, I select 'residence'.) The descriptive statistics of $USAGE_{ki}$ are the same as in Table 2.

Equation (3) also includes the interaction terms ($log(WAD_i) \cdot USAGE_{ki}$), whose coefficients ($d_k$) are important clues for clarifying the susceptibility of intended use to the shock of a mega-event.

[Table 6 near here]

Table 6 shows the results of regression model (3). Models 1 and 2 have only one type of independent variable – $log(WAD_i)$ or $USAGE_{ki}$, respectively – whereas Model 3 has both types. Additionally, Model 4 adds the interaction terms ($log(WAD_i) \cdot USAGE_{ki}$) to the independent variables of Model 3.

The estimated coefficients of $log(WAD_i)$ in Models 1, 3 and 4 are significantly negative, which means that the farther from Tokyo a property is located, the less it feels the impact from the Olympics.

In Model 2, the results of the estimated coefficients on $USAGE_{ki}$ differ from those of Model 3. Because the adjusted R-squared and Akaike Information Criteria (AIC) for Model 3 is much better than that of Model 2, we should rely on the results of Model 3.

The coefficient of hotels in Model 3 is positive and significant at the 10% significance level: a 1% increase in the share of hotels, to replace a 1% decrease in the share of residences, increases the extent of the abnormal returns (0.026%). The coefficients on offices and commercial facilities are positive and negative, respectively, but both are insignificant, even at the 10% significance level. Therefore, in terms of effect, they do not differ from residences. The coefficient on logistics facilities is negative and significant at the 10% significance level: a 1% increase in the share of logistics facilities, to replace a 1% decrease in the share of residences, lowers the extent of the abnormal returns (–0.009%).

The adjusted R-squared and the AIC of Model 4 are better than those of Model 3, which implies the importance of considering the interaction between location and intended use. The significant value of the coefficient on $log(WAD_i)$ in Model 4 (–1.498) apparently measures the negative effect when real estate is fully allocated to residences; however, the results of the coefficients on $log(WAD_i) \cdot USAGE_{ki}$ show that the magnitude of this negative relationship depends on the intended use. The coefficients on these interaction terms regarding hotels and commercial facilities are positive and significant at the 5% and 10% significance levels, respectively. These results suggest that the magnitude of the negative relationship for hotels and commercial facilities is weaker rather than that for residences.[26] These results indicate that, even in locations far from the host-city, hotels and commercial facilities are more likely to be affected by the Olympics.

4. Prediction of Geographic Impacts on Profitable Real Estate Value

The previous section showed that the average abnormal returns for 41 J-REITs attributable to the announcement of the site decision for the 2020 Olympics is significantly positive and revealed that the extent of the abnormal returns for each REIT significantly depends on the attributes (area and usage) of their real estate portfolios. Based on the results, this section predicts the geographical impacts on real estate value; I conduct an out-of-sample prediction for the announcement impacts on the value of profitable real estate, including not only REITs' properties but also the others, by local area (in this paper, prefectures).

Out-of-sample Prediction

I plug the particular values of the independent variables that represent the population from the related exhaustive survey of real estate into the cross-section model estimated in the previous section. As preparation for the out-of-sample prediction by area, I need to determine the particular values of the independent variables (WAD_i and $USAGE_{ki}$) by prefecture that represent the area's population of real estate located in each prefecture. As for WAD_i, I use again the straight-line distances between the seats of two prefectural governments: one is that of Tokyo-to, and the other is that of each prefecture. To determine the particular values of $USAGE_{ki}$ by prefecture, I use the '2013 Corporation

---

[26] Additionally, the value for offices is negative and significant at the 10% significance level.

Survey on Land and Buildings' data from Section 2. Table 7 includes the particular WAD_i and $USAGE_{ki}$ values by prefecture.

[Table 7 near here]

Prediction Results

Figure 6 shows the prediction results. I find that the increase in return for the host-city (Tokyo-to) is 4.7%, which amounts to JPY 3.3 trillion in asset value.

[Figure 6 near here]

For the other prefectures in the Kanto range, the returns range from 2.5% to 3.2%. For prefectures in Tohoku, Chubu and Kinki, the returns are within the 1–2% range. In Chugoku, Shikoku, Kyushu and Hokkaido – all relatively far from Tokyo-to – the returns are less than 1%.

Further, I confirm that the difference in usage shares also leads to disparities in impact. For example, the return of Mie-ken (belonging to Kinki) is identical to that of Aichi-ken (belonging to Chubu). Even though the former is farther from Tokyo-to than the latter, this result occurs because Mie-ken's usage shares of hotel and commercial facilities are larger than those of Aichi-ken.

According to these results by prefecture, the asset amount of income-producing land and building owned by corporations in Japan increase by 2.8% (corresponding to JPY 5.5 trillion).[27] This estimate is slightly lower than the J-REIT abnormal return

---

[27] To assess the impact of hosting itself, it is necessary to consider the degree of surprise of the successful bid. Actually, investors are thought to have already purchased real estate properties in the candidate countries and cities according to the expected victory

average value estimated in Section 3. Moreover, the effects on Tokyo turn out to be 60% of that for all of Japan, which means that 40% of the effects spill over to non-host-cities/regions.

5. Conclusion

This study proposes an alternative method for evaluating the geographic effects of hosting mega-events. Using real estate investment trust (REIT) data allows one to capture the features of both property and stock prices. Starting from this premise, I examine the impact of the 2020 Tokyo Olympics and Paralympics using the standard event study method.

The results show that the average of the abnormal returns is significantly positive (about 3%), implying that investors expect the Olympics to have an impact mainly on the host-city (i.e. Tokyo-to), and the extent of the impact gradually decreases as the distance from the host-city increases. However, even in areas far from the host-city, the property values of hotels and commercial facilities are more sensitive to the Olympics than those of properties with other intended uses. Finally, I propose an out-of-sample prediction to measure the impact of the successful bid on the value of all income-producing real estate by area. The result expects that the asset amount of income-producing land and buildings

---

probability of each. Fortunately, the decision to host mega-events such as the Olympics is subject to public gambling (e.g. major British bookmakers), in which the odds allow one to calculate the total impact. As previously mentioned, the probability of a Tokyo victory according to the final odds (1.67) by William Hill was 60%; I calculate that the impact from hosting mega-events on real estate value is 2.8%*100/60=4.6% (corresponding to JPY 9.2 trillion).

owned by corporations in Japan increases by 2.8% (corresponding to JPY 5.5 trillion) and in Tokyo by 4.7% (corresponding to JPY 3.3 trillion). Therefore, approximately 40% of the effects spill over to outside the host-city.

As the REIT market grows, the number of REITs will increase and the related real estate portfolios will become richer in variety. Accordingly, the accuracy of estimations and predictions is expected to improve. In this context, the method described herein will become increasingly helpful for researchers to clarify the comprehensive net effects of holding mega-events and for policymakers to hold a mega-event as a trigger for urban and regional development.

Acknowledgements

I am grateful for the constructive comments from Yukari Iwanami, Shin Kimura, Minoru Kitahara, Wolfgang Maennig, Kenkichi Nagao, Tetsuya Nakajima, Hideki Nakamura, Akihiko Noda, Ryosuke Okazawa, Shinpei Sano and Shuji Uranishi.

References

Ahlfeldt, G. M., and W. Maennig. 2010. "Impact of Sports Arenas on Land Values: Evidence from Berlin." *Annals of Regional Science* 44: 205–227.

Baade, R. A., and V. A. Matheson. 2016. "Going for the Gold: The Economics of the Olympics." *Journal of Economic Perspectives* 30: 201–218.

Berman, G., R. Brooks, and S. Davidson. 2000. "The Sydney Olympic Games Announcement and Australian Stock Market Reaction." *Applied Economics Letters* 7: 781–784.

Boehmer, E., J. Musumeci, and A. B. Poulsen. 1991. "Event Study Methodology under Conditions of Event Induced Variance." *Journal of Financial Economics* 30: 253–72.

Bredin, D., G. O'Reilly, and S. Stevenson. 2007. "Monetary Shocks and REIT Returns." *Journal of Real Estate Finance and Economics* 35: 315–331.

Brückner, M., and E. Pappa. 2015. "News Shocks in the Data: Olympic Games and their Macroeconomic Effects." *Journal of Money, Credit and Banking* 47: 1339–1367.

Feddersen, A., A. L. Grötzinger, and W. Maennig. 2009. "Investment in Stadia and Regional Economic Development—Evidence from FIFA World Cup 2006." *International Journal of Sport Finance* 4: 221–239.

Feddersen, A., and W. Maennig. 2012. "Sectoral Labour Market Effects of the 2006 FIFA World Cup." *Labor Economics* 19: 860–869.

Glascock, J. L., and R. Lu-Andrews. 2015. "The Price Behavior of REITs Surrounding Extreme Market-related Events." *Journal of Real Estate Finance and Economics* 51: 441–479.

Hagn, F., and W. Maennig. 2008. "Employment Effects of the Football World Cup 1974 in Germany." *Labour Economics* 15: 1062–1075.

Hagn, F., and W. Maennig. 2009. "Large Sport Events and Unemployment: The Case of the 2006 Soccer World Cup in Germany." *Applied Economics* 41: 3295–3302.

Howe, J. S., and R. Jain. 2004. "The REIT Modernization Act of 1999." *Journal of Real Estate Finance and Economics* 28: 369–388.

Jasmand, S., and W. Maennig. 2008. "Regional Income and Employment Effects of the 1972 Munich Summer Olympic Games." *Regional Studies* 42: 991–1002.

Kavetsos, G. 2012. "The Impact of the London Olympics Announcement on Property Prices." *Urban Studies* 49: 1453–1470.

Kolari, J. W., and S. Pynnönen. 2010. "Event Study Testing with Cross-sectional Correlation of Abnormal Returns." *Review of Financial Studies* 23: 3996–4025.

Lamla, M. J., M. Straub, and E. M. Girsberger. 2014. "On the Economic Impact of International Sport Events: Microevidence from Survey Data at the EURO 2008." *Applied Economics* 46: 1693–1703.

Langer, V. C. E., W. Maennig, and F. Richter. 2017. "The Olympic Games as a News Shock: Macroeconomic Implications." *Journal of Sports Economics* 19:884–906. doi: 10.1177/1527002517690788.

Leeds, M., J. M. Mirikitani, and D. Tang. 2009. "Rational Exuberance? An Event Analysis of the 2008 Olympics Announcement." *International Journal of Sport Finance* 4: 5–15.

MacKinlay, A. C. 1997. "Event Studies in Economics and Finance." *Journal of Economic Literature* 35: 13–39.

Maennig, W. 2017. "Major Sports Events: Economic Impact." Hamburg Contemporary Economic Discussions No. 58 (Working Papers from Chair for Economic Policy, University of Hamburg).

Maennig, W., and F. Richter. 2012. "Exports and Olympic Games: Is There a Signal Effect?" *Journal of Sports Economics* 13: 635–641.

Mirman, M., and R. Sharma. 2010. "Stock Market Reaction to Olympic Games Announcement." *Applied Economics Letters* 17: 463–466.

Mitchell, H., and M. F. Stewart. 2015. "What Should You Pay to Host a Party? An Economic Analysis of Hosting Sports Mega-events." *Applied Economics* 47: 1550–1561.

Miyakoshi, T., J. Shimada, and K. Li. 2016. "The Impacts of the 2008 and 2011 Crises on the Japan REIT Market." *Journal of the Japanese and International Economies* 41: 30–40.

Miyoshi, K., and M. Sasaki. 2016. "The Long-term Impacts of the 1998 Nagano Winter Olympic Games on Economic and Labor Market Outcomes." *Asian Economic Policy Review* 11: 43–65.

Rose, A. K., and M. M. Spiegel. 2011. "The Olympic Effect." *Economic Journal* 121: 652–677.

Samitas, A., D. Kenourgios, and P. Zounis. 2008. "Athens' Olympic Games 2004 Impact on Sponsors' Stock Returns." *Applied Economics Letters* 18: 1569–1580.

Scherer, R., and Strauf, S. 2003 "How to Measure the Economic Impacts of Mega-events – the Example of the World Economic Forum in Davos." 43rd Congress of the European Regional Science Association: "Peripheries, Centres, and Spatial Development in the New Europe", 27th–30th August 2003, Jyväskylä, Finland, European Regional Science Association (ERSA), Louvain-la-Neuve.

Sullivan, C., and M. A. Leeds. 2016. "Will the Games Pay? An Event Analysis of the 2020 Summer Olympics Announcement on Stock Markets in Japan, Spain, and Turkey." *Applied Economics Letters* 23: 880–883.

Tang, C. K, Mori, M., S. E. Ong, and J. T. L. Ooi. 2016. "Debt Raising and Refinancing by Japanese REITs: Information Content in a Credit Crunch." *Journal of Real Estate Finance and Economics* 53: 141–161.

Tu, C. C. 2005. "How Does a New Sports Stadium Affect Housing Values? The Case of Fedex Field." *Land Economics* 81: 379–395.

Veraros, N., E. Kasimati, and P. Dawson. 2004. "The 2004 Olympic Games Announcement and Its Effect on the Athens and Milan Stock Exchanges." *Applied Economics Letters* 11: 749–753.

Table 1. Turnover ratios of REITs and ordinary corporate stocks listed on the Tokyo Stock Exchange

	Mean	S.D.	Min.	Max.
J-REIT	0.0050	0.0031	0.0015	0.0200
TOPIX	0.0068	0.0124	0.0001	0.1921

Notes: I use the sample of 41 J-REITs and 1,898 stocks that belonged to the TOPIX, listed on the first section of the Tokyo Stock Exchange as of the end of August 2013. The descriptive statistics are calculated based on the daily average (trading-day base in 2013) of turnover ratio for securities.

Source: NEEDS Financial Quest, NIKKEI Media Marketing Inc.

Table 2. Characteristics of J-REIT portfolios (at the end of August 2013)

		Mean	S.D.	Min.	Max.
Number of properties		56.9	46.2	6.0	204.0
Asset value of properties (billlion JPY)		242.5	199.7	17.6	1048.2
Intended use (%; asset value base)	Residence	27.1	40.8	0.0	100.0
	Commercial facilities	16.9	25.5	0.0	100.0
	Office	37.7	38.6	0.0	100.0
	Logistics facilities	11.6	28.9	0.0	100.0
	Hotel	6.7	22.2	0.0	100.0
Location (%; asset value base)	Tokyo-to	55.2	30.3	0.0	100.0
	Kanagawa-ken	7.0	6.4	0.0	26.9
	Chiba-ken	6.0	10.3	0.0	47.4
	Saitama-ken	3.6	6.1	0.0	30.6
	Osaka-fu	9.7	15.1	0.0	80.5
	Aichi-ken	3.6	3.7	0.0	12.7
	The other prefectures	14.9	21.1	0.0	100.0

Notes: I use the sample of 41 J-REITs listed at the end of August 2013. The asset value is based on market value – specifically, the then-prevailing appraisal values. J-REIT data are from the ARES J-REIT Property Database (as of the end of August 2013).

Table 3. Actual returns of 41 individual J-REITs on the event day (9 September 2013)

Securities code	Name	Listing date	Close price at 6-Sep-2013 (JPY)	Actual return (%)
8951	Nippon Building	10-Sep-2001	545,500	4.31
8952	Japan Real Estate	10-Sep-2001	531,500	4.14
8953	Japan Retail	12-Mar-2002	186,600	2.09
8954	ORIX JREIT	12-May-2002	106,300	4.14
8955	Japan Prime Realty	14-Jun-2002	287,800	3.34
8956	Premier	10-Sep-2002	378,000	5.69
8957	TOKYU REIT	10-Sep-2003	101,000	2.97
8958	Global One	25-Sep-2003	274,500	3.64
8959	Nomura Real Estate Office	4-Dec-2003	424,000	0.83
8960	United Urban	22-Dec-2003	129,500	2.78
8961	MORI TRUST	13-Feb-2004	167,200	3.71
8964	Frontier	9-Aug-2004	430,000	2.67
8966	HEIWA	8-Mar-2005	64,900	3.70
8967	Japan Logistics	9-May-2005	175,800	2.50
8968	Fukuoka REIT	21-Jun-2005	145,600	1.24
8972	Kenedix Office	21-Jul-2005	384,500	2.73
8973	Sekisui House SI	28-Jul-2005	92,800	2.48
8975	Ichigo Office REIT	12-Oct-2005	57,800	2.25
8976	Daiwa Office	19-Oct-2005	366,500	4.09
8977	Hankyu REIT	26-Oct-2005	98,000	1.63
8982	Top REIT	1-Mar-2006	423,500	7.67
8984	Daiwa House Residential	22-Mar-2006	181,750	2.75
8985	Japan Hotel	14-Jun-2006	39,450	5.45
8986	Japan Rental Housing	22-Jun-2006	67,100	1.49
8987	Japan Excellent	27-Jun-2006	105,400	3.61
8963	Invincible	1-Aug-2006	13,010	2.23
3226	Nippon Accommodations	4-Aug-2006	321,500	3.11
3227	MCUBS MidCity	29-Aug-2006	219,300	1.92
3234	MORI HILLS REIT	30-Nov-2006	113,600	4.58
3240	Nomura Real Estate Residential	14-Feb-2007	471,000	4.46
3249	Industrial & Infrastructure	18-Oct-2007	432,500	2.08
3269	Advance Residence	2-Mar-2010	199,000	1.56
8979	Starts Proceed	27-Jul-2010	169,900	1.47
3278	Kenedix Residential	26-Apr-2012	194,000	2.53
3279	Activia Properties	13-Jun-2012	702,000	2.14
3263	Daiwa House REIT	28-Nov-2012	331,000	1.96
3281	GLP J-REIT	21-Dec-2012	94,000	1.60
3282	Comforia Residential	5-Feb-2013	152,000	3.29
3283	Nippon Prologis	14-Feb-2013	169,400	1.30
3285	Nomura Real Estate Master	12-Jun-2013	95,600	0.42
3287	Hoshino Resorts	12-Jul-2013	582,000	3.26
	Number of J-REITs			41
	Weighted average			3.15
	Simple average			2.92
	Standard deviation			1.43
	Min.			0.42
	Max.			7.67

Notes: The 41 J-REITs were listed on the Tokyo stock market on the event day; in this table, they are listed in order of the initial listing date. The weighted averages of actual returns are calculated using the weights of the shares of the close price on 6 September 2013, the trading day immediately preceding the event day.

Table 4. Normal and abnormal returns on the event day

J-REIT Securities code	Contant mean return model			
	Pattern A		Pattern B	
	Normal return (%)	Abnormal return (%)	Normal return (%)	Abnormal return (%)
8951	-0.20	4.51	0.14	4.17
8952	-0.13	4.27	0.15	3.99
8953	-0.26	2.35	0.16	1.93
8954	-0.23	4.37	0.16	3.98
8955	-0.04	3.37	0.09	3.25
8956	-0.16	5.84	0.12	5.57
8957	-0.36	3.33	0.10	2.87
8958	-0.11	3.75	0.04	3.60
8959	-0.13	0.96	0.01	0.82
8960	-0.00	2.78	0.16	2.62
8961	-0.15	3.85	0.09	3.62
8964	-0.19	2.87	0.10	2.57
8966	-0.20	3.89	0.14	3.56
8967	-0.11	2.61	0.09	2.41
8968	-0.22	1.45	0.11	1.13
8972	-0.11	2.85	0.15	2.58
8973	-0.13	2.61	0.11	2.36
8975	-0.17	2.42	0.17	2.08
8976	-0.07	4.17	0.22	3.87
8977	-0.05	1.69	0.11	1.52
8982	-0.13	7.80	-0.01	7.68
8984	-0.26	3.01	0.11	2.64
8985	0.10	5.35	0.22	5.23
8986	-0.14	1.63	0.21	1.28
8987	-0.18	3.79	0.10	3.50
8963	-0.06	2.29	0.25	1.98
3226	-0.18	3.29	0.09	3.02
3227	-0.08	1.99	0.02	1.89
3234	-0.27	4.84	0.21	4.37
3240	-0.17	4.63	0.06	4.40
3249	-0.31	2.40	0.20	1.88
3269	-0.25	1.81	0.10	1.45
8979	-0.01	1.48	0.15	1.32
3278	-0.27	2.80	0.04	2.49
3279	-0.19	2.33	0.16	1.97
3263	-0.15	2.12		
3281	-0.02	1.61		
3282	-0.39	3.68		
3283	-0.06	1.36		
3285	-0.11	0.53		
3287	-0.01	3.27		
Number of J-REITs	41	41	35	35
Weighted average	-0.15	3.31	0.10	3.16
Simple average	-0.15	3.07	0.12	2.96
Standard deviation	0.10	1.43	0.06	1.43
Min.	-0.39	0.53	-0.01	0.82
Max.	0.10	7.80	0.25	7.68

Notes: Abnormal returns for a J-REIT on the event day are calculated as actual returns on the event day reduced by normal returns on the event day. The normal return on the event day is calculated following the constant mean return model of the standard event study method (e.g. MacKinlay 1997). Weighted averages are calculated using the weights of the shares of the closing price on the trading day preceding the event day.

Table 5. Results of hypothesis tests

	Pattern A	Pattern B
Average of abnormal returns	3.07 **	2.96 *
	(2.31)	(1.74)

Notes: Abnormal returns for a J-REIT on the event day are calculated as actual returns on the event day reduced by normal returns on the event day. The normal return on the event day is calculated following the constant mean return model of the standard event study method (e.g. MacKinlay 1997). I set two patterns for the pre-event period to estimate the normal returns: pattern A is 16 July 2013 to 6 September 2013, and pattern B is 22 June 2012 to 6 September 2013. The values above the parentheses are averages over the 41 J-REITs that correspond to all J-REITs listed on the event day, or over the 35 J-REITs that continued to list over the period of pattern B. The values in parentheses are adjusted t-statistics proposed by Kolari and Pynnönen (2010) to control for cross-correlation between abnormal returns.

Significantly different from zero at * 90% confidence, ** 95% confidence and *** 99% confidence.

Table 6. Cross-sectional model

		Model 1	Model 2	Model 3	Model 4
log(WAD)		-1.349 **		-1.594 ***	-1.498 **
		[0.578]		[0.520]	[0.622]
$USAGE_k$	Hotel		0.011	0.026 *	-0.014
			[0.009]	[0.015]	[0.013]
	Office		0.011 *	0.007	0.021 **
			[0.006]	[0.005]	[0.009]
	Commercial		-0.011 *	-0.001	-0.022
			[0.006]	[0.008]	[0.014]
	Logistics		-0.013 **	-0.009 *	-0.018
			[0.005]	[0.005]	[0.020]
$log(WAD)*USAGE_k$	Hotel				0.027 **
					[0.011]
	Office				-0.026 *
					[0.015]
	Commercial				0.021 *
					[0.013]
	Logistics				0.011
					[0.019]
Constant		4.059 ***	2.910 ***	3.908 ***	3.848 ***
		[0.464]	[0.335]	[0.464]	[0.432]
Adj-R-squared		0.185	0.193	0.367	0.482
AIC (Akaike Information Criteria)		139.4	141.8	132.6	127.4
Sample size		41	41	41	41

Notes: The estimation method for regression model (3) is least squares. The dependent variable is the estimated abnormal returns of pattern A. Robust standard errors used to correct for heteroskedasticity are in square brackets.

Significantly different from zero at * 90% confidence, ** 95% confidence and *** 99% confidence.

Table 7. Values of independent variables for the out-of-sample prediction

Prefecture		District	WAD (100km)	Income-producing real estate					
				Asset amount (billion JPY)	USAGE (%)				
No	Name				Residence	Office	Hotel	Commerce	Logistics
1	Hokkaido	Hokkaido	8.31	5,166.9	11.5	38.2	7.8	33.3	9.2
2	Aomori-ken	Thohoku	5.77	855.0	10.5	32.4	5.4	36.1	15.6
3	Iwate-ken	Thohoku	4.64	1,044.8	9.8	31.9	6.9	40.7	10.8
4	Miyagi-ken	Thohoku	3.05	2,136.4	11.8	32.5	4.7	33.4	17.5
5	Akita-ken	Thohoku	4.49	716.3	6.7	31.8	8.8	42.0	10.6
6	Yamagata-ken	Thohoku	2.89	713.1	7.3	37.7	6.2	36.0	12.8
7	Fukushima-ken	Thohoku	2.39	1,274.8	8.2	36.3	6.5	34.7	14.3
8	Ibaraki-ken	Kanto	0.99	2,669.2	7.8	39.1	3.5	32.9	16.6
9	Tochigi-ken	Kanto	0.99	1,624.8	10.0	36.1	6.8	31.5	15.6
10	Gunma-ken	Kanto	0.96	1,500.4	6.0	33.8	2.9	38.7	18.6
11	Saitama-ken	Kanto	0.19	7,217.2	17.6	29.6	1.1	37.3	14.5
12	Chiba-ken	Kanto	0.40	8,168.6	22.3	25.6	2.9	35.1	14.1
13	Tokyo-to (Host-city)	Kanto	0.00	70,785.9	17.6	61.6	3.3	14.7	2.8
14	Kanagawa-ken	Kanto	0.27	16,344.6	18.2	32.1	2.2	33.5	14.0
15	Niigata-ken	Chubu	2.53	1,943.4	10.5	33.1	10.5	34.8	11.1
16	Toyama-ken	Chubu	2.49	1,038.3	5.7	36.8	8.5	35.9	13.1
17	Ishikawa-ken	Chubu	2.94	956.3	7.4	31.6	9.7	39.2	12.1
18	Fukui-ken	Chubu	3.16	626.5	6.7	38.8	4.6	34.6	15.2
19	Yamanashi-ken	Chubu	1.02	705.7	6.8	26.5	23.0	38.0	5.8
20	Nagano-ken	Chubu	1.73	2,141.7	5.1	41.7	10.4	36.6	6.2
21	Gifu-ken	Chubu	2.71	1,867.2	8.7	35.9	10.7	36.7	8.0
22	Shizuoka-ken	Chubu	1.43	4,431.5	8.0	33.7	7.2	37.6	13.4
23	Aichi-ken	Chubu	2.59	10,921.7	12.6	32.2	3.9	38.2	13.1
24	Mie-ken	Kinki	3.09	1,887.7	7.2	31.6	11.3	40.2	9.7
25	Shiga-ken	Kinki	3.56	1,298.3	12.1	32.1	5.8	36.4	13.6
26	Kyoto-fu	Kinki	3.65	3,195.0	19.0	36.6	4.5	34.4	5.6
27	Osaka-fu	Kinki	3.96	14,497.0	20.0	40.4	1.9	26.4	11.3
28	Hyogo-ken	Kinki	4.25	6,987.2	20.0	29.1	2.4	37.4	11.1
29	Nara-ken	Kinki	3.69	1,020.3	20.6	28.6	3.3	40.7	6.8
30	Wakayama-ken	Kinki	4.44	747.6	14.6	29.4	6.2	39.5	10.4
31	Tottori-ken	Chugoku	4.95	431.3	13.4	28.8	7.9	33.2	16.8
32	Shimane-ken	Chugoku	6.02	578.3	6.1	43.4	4.8	36.3	9.4
33	Okayama-ken	Chugoku	5.37	1,998.2	8.8	39.2	3.7	31.0	17.3
34	Hiroshima-ken	Chugoku	6.75	3,293.7	9.2	33.0	3.2	40.4	14.2
35	Yamaguchi-ken	Chugoku	7.69	1,420.8	7.4	38.6	4.2	31.2	18.6
36	Tokushima-ken	Shikoku	5.03	600.4	5.7	39.6	4.8	36.5	13.4
37	Kagawa-ken	Shikoku	5.37	843.9	9.4	37.0	3.8	33.4	16.5
38	Ehime-ken	Shikoku	6.66	1,303.5	11.6	39.7	7.7	27.4	13.6
39	Kochi-ken	Shikoku	6.12	445.4	7.9	34.1	4.0	43.6	10.4
40	Fukuoka-ken	Kyushu	8.81	5,554.4	20.7	33.2	3.2	34.7	8.1
41	Saga-ken	Kyushu	9.04	579.2	8.6	30.6	2.8	42.8	15.2
42	Nagasaki-ken	Kyushu	9.61	1,065.9	10.9	30.3	4.8	47.9	6.1
43	Kumamoto-ken	Kyushu	8.85	1,143.6	14.3	31.8	3.8	42.1	8.0
44	Oita-ken	Kyushu	7.90	985.7	10.3	28.0	7.6	40.4	13.7
45	Miyazaki-ken	Kyushu	8.72	627.8	6.8	32.8	3.2	46.5	10.6
46	Kagoshima-ken	Kyushu	9.63	1,107.0	7.3	32.5	5.1	38.2	16.8
47	Okinawa-ken	Kyushu	15.54	1,217.2	10.8	42.4	14.8	26.8	5.2
	Japan			197,679.7	15.7	43.8	4.0	27.7	8.8

NOTE: WADs are straight-line distances between the seat of Tokyo-to and that of the other prefectures. USAGEs are the shares of the amount, based on market value, of income-producing real estate used for specified usages in each of the prefectures using the '2013 Corporation Survey on Land and Buildings'.

Figure captions

Figure 1. Plots of number and total acquisition cost of J-REIT properties

Figure 2. The asset values of J-REIT properties by intended use (JPY billion)

Figure 3. Geographical distribution (by prefecture) of J-REIT investment properties and income-producing real estate owned by corporations

Figure 4. Plot of J-REIT average returns around the event day

Figure 5. Plot of TOPIX returns around the event day

Figure 6. Prediction results of abnormal returns by prefecture and throughout Japan

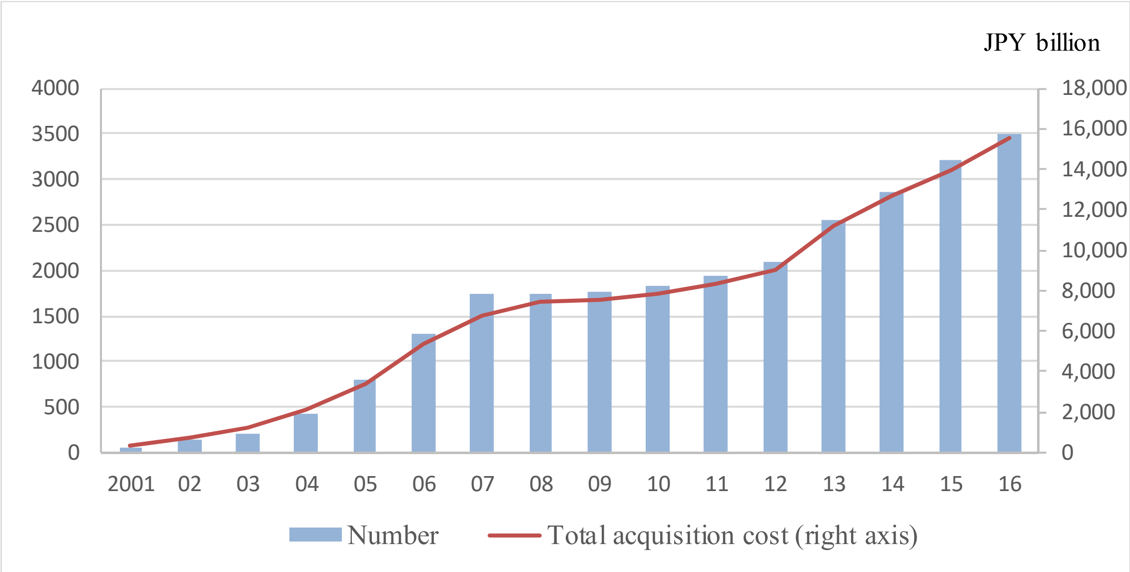


Figure 1. Plots of number and total acquisition cost of J-REIT properties

Source: ARES J-REIT Databook (http://j-reit.jp/statistics/).

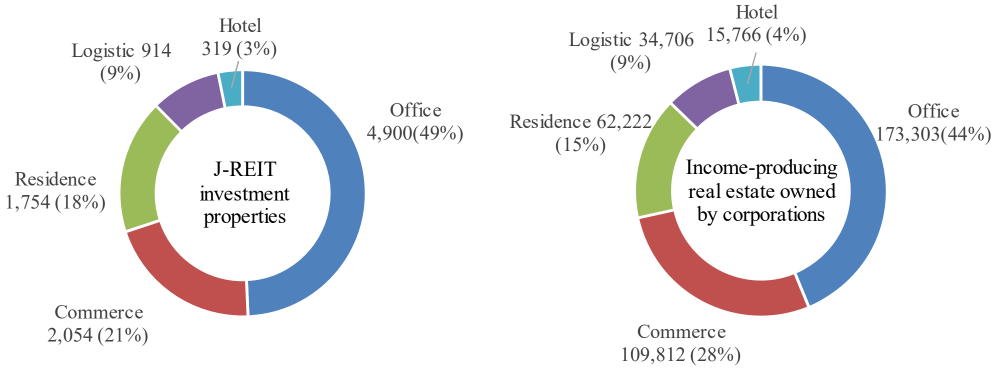


Figure 2. Asset values of J-REIT properties by intended use (JPY billion)

Notes: In the left graph, using the latest financial reports of each J-REIT at the end of August 2013 (from the ARES J-REIT Property Database [https://jreit-pdb.ares.or.jp/pdb/]), I classify the J-REIT real estate properties into five categories: residence, hotel, office, commercial facilities and logistics facilities. If a piece of real estate has more than two intended uses, I select that which is listed first, assuming that it is likely the primary one. The asset value is based on market value – specifically, appraisal values prevailing at the time. In the right graph, using '2013 Corporation Survey on Land and Buildings', I classify the real estate properties into the five categories (see the Appendix for detail).

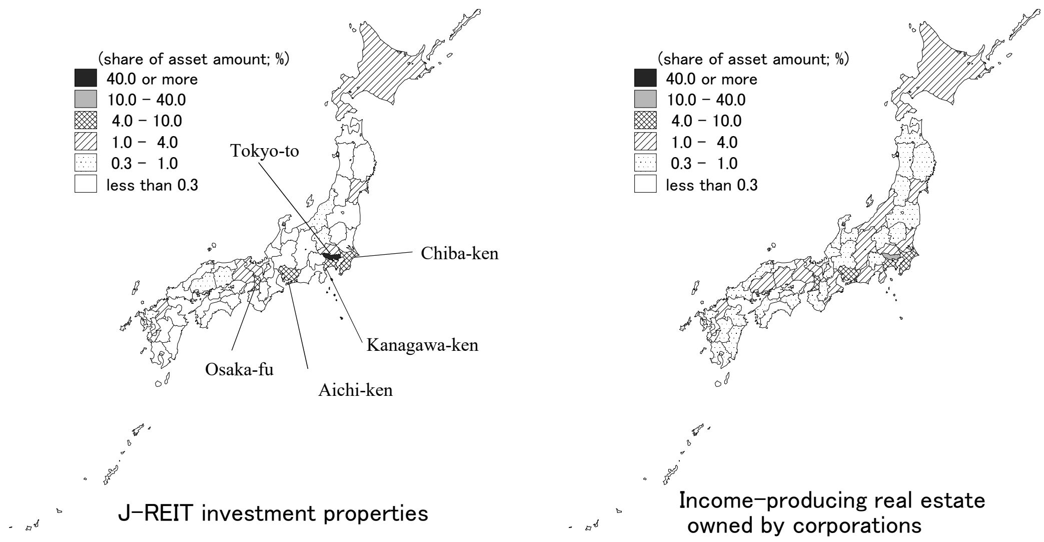
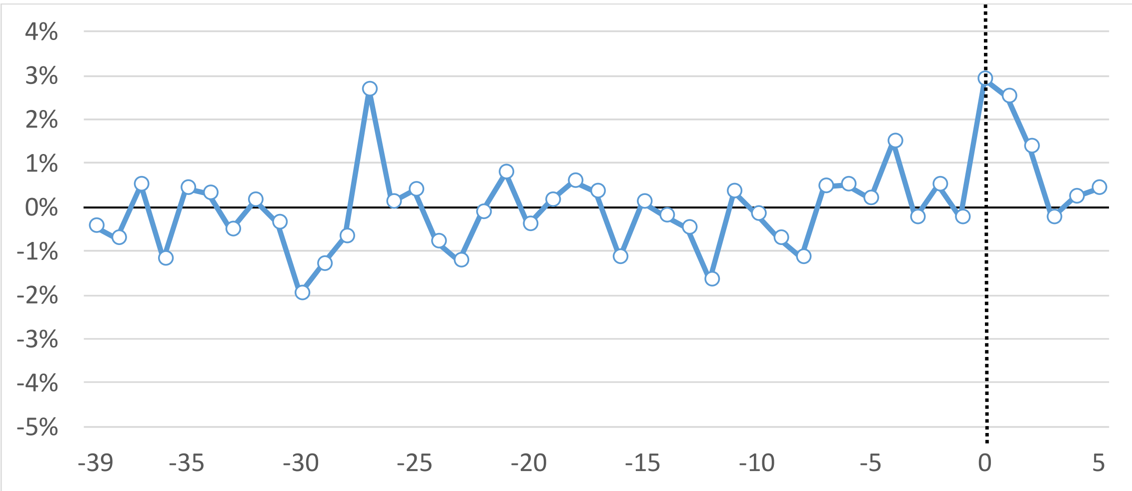


Figure 3. Geographical distribution (by prefecture) of J-REIT investment properties and income-producing real estate owned by corporations

Notes: The source and processing of the data on J-REIT investment properties and income-producing real estate owned by corporations are the same as those in Figure 2.

(a) Average returns for J-REITs



(b) Cumulative values of average returns for J-REITs

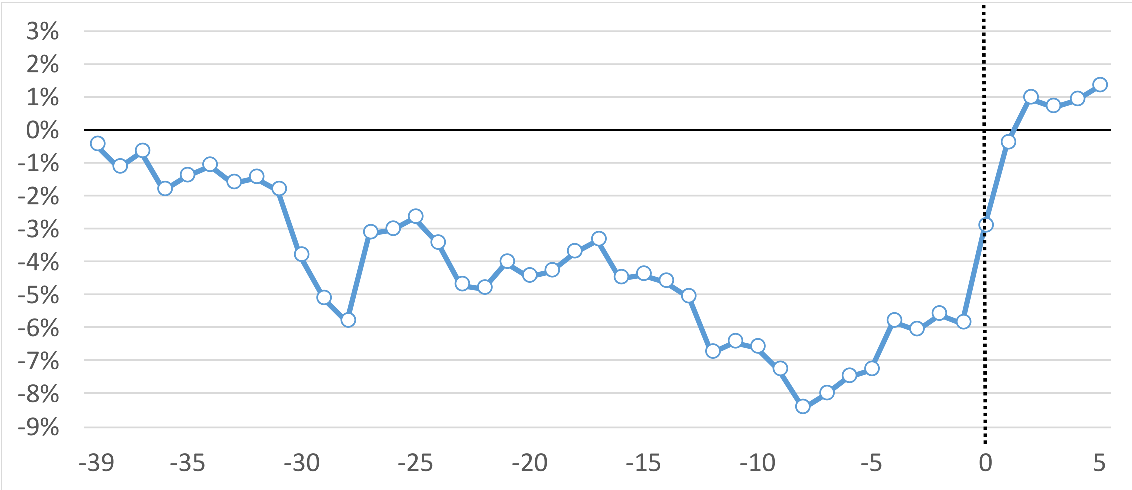
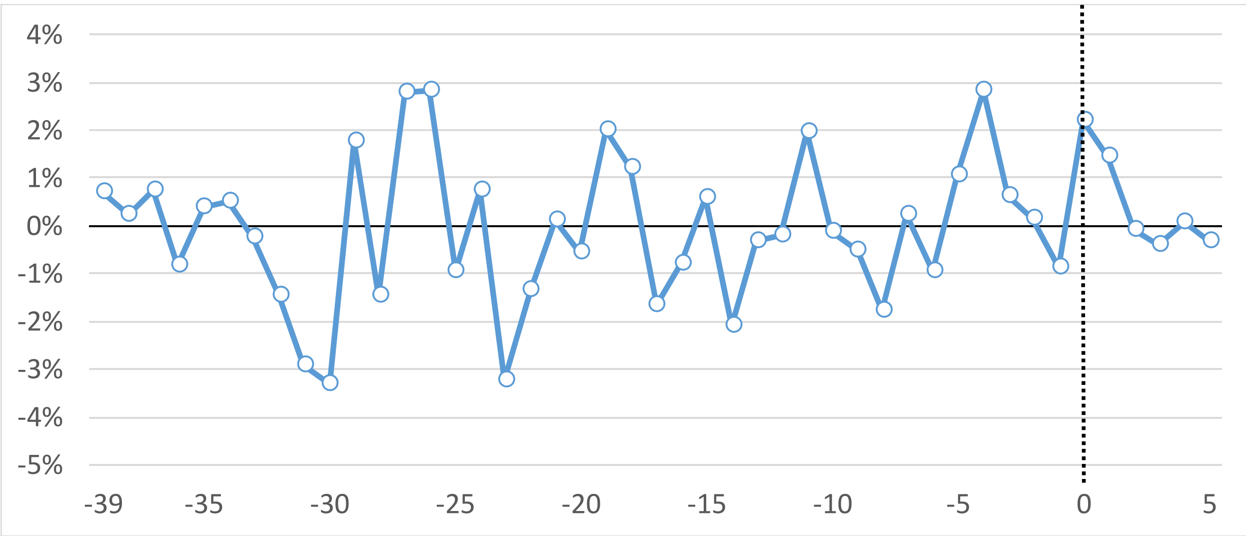


Figure 4. Plot of J-REIT average returns around the event day

Notes: The observation period consists of 39 pre-event days, the event day, and five post-event days; the event day (9 September 2013) is expressed as 0. The returns of the 41 J-REITs, each of which traded on the Tokyo Stock Exchange on the event day, are calculated on a closing-price basis. J-REIT daily prices are obtained from the *NEEDS Financial Quest* database by NIKKEI Media Marketing Inc.

(a) TOPIX returns



(b) Cumulative values of TOPIX returns

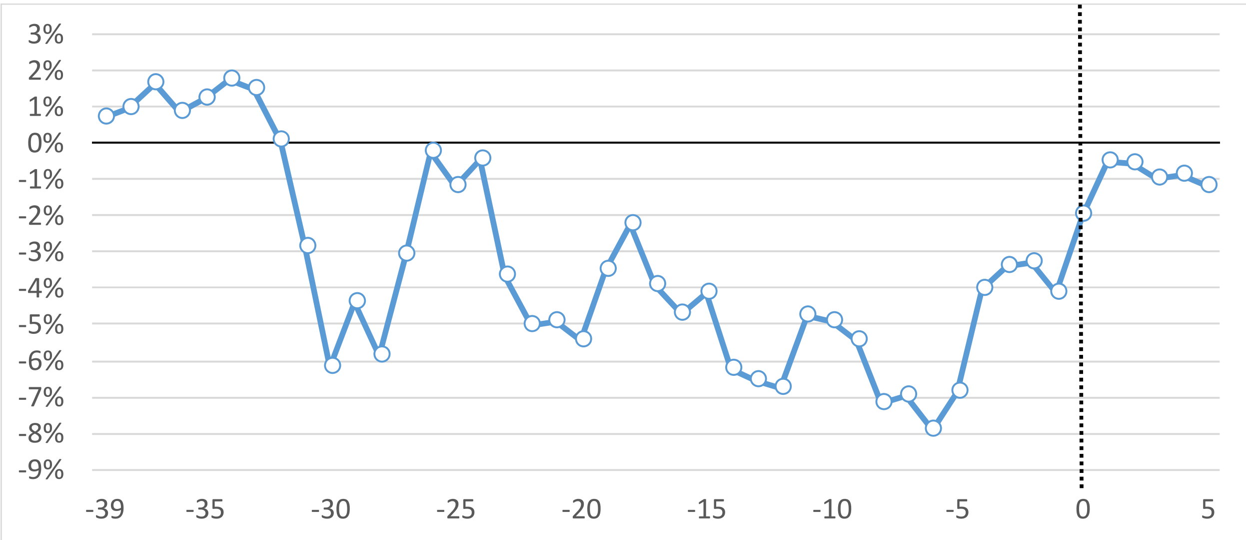


Figure 5. Plot of TOPIX returns around event day

Notes: The observation period is identical to that of Figure 2. TOPIX is obtained from the *NEEDS Financial Quest* database by NIKKEI Media Marketing Inc.

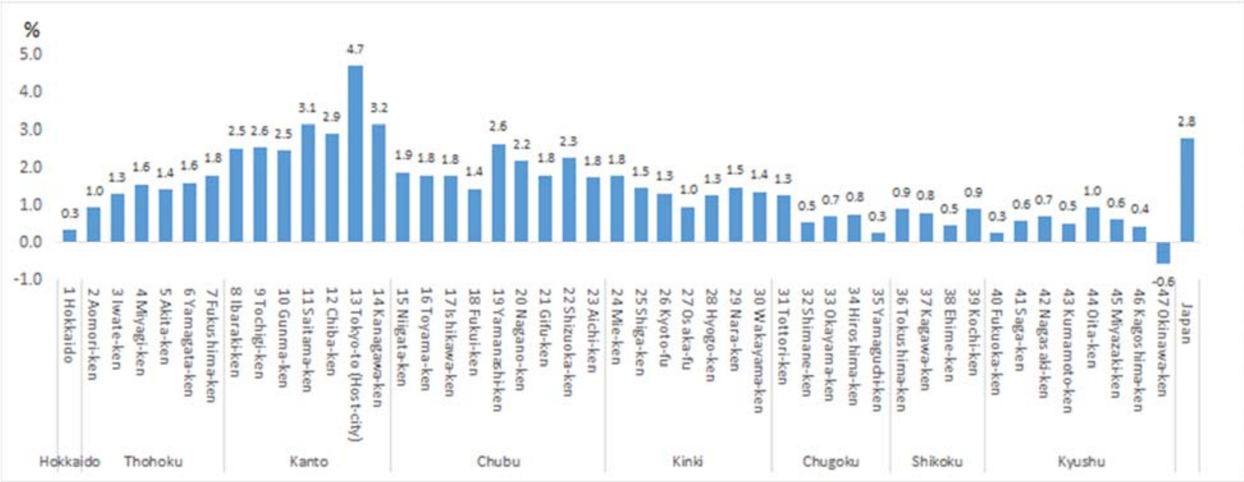


Figure 6. Prediction results of abnormal returns by prefecture and throughout Japan

Notes: To obtain the predicted values of the abnormal returns by prefecture, I plug the particular values for *WAD* and *USAGE* into Model 4 in Table 6. Additionally, to obtain the value of Japan as a whole, at first I calculate the predictions of the change in asset amount by prefecture, multiplying asset amount of income-producing real estate and the prediction of abnormal returns. I then add up predictions of the change in asset amount of each prefecture and, finally, divide it by the total asset amount.

Appendix

Table A. Main usage of land and buildings

Main usage of land and buildings	Asset Amount		Recrafication into the five types
	Billion yen	Share	
Land (Building Site etc.)			
Used for building site			
Office site	66,391	22.8%	Office
Store site	29,020	10.0%	Commercial facilities
Factory or warehouse site	47,057	16.1%	Logistics facilities *1
Housing or dormitory site owned by company	7,745	2.7%	(Exclusion)
Other facilities site for employee welfare	1,759	0.6%	(Exclusion)
Rental housing site	22,231	7.6%	Residence
Site of hotel or inn	4,324	1.5%	Hotel
Educational facilities site	26,565	9.1%	(Exclusion)
Religious facilities site	21,549	7.4%	(Exclusion)
Parking building site	436	0.1%	Commercial facilities
Other building site	15,901	5.5%	(Exclusion)
Buildings not used	1,060	0.4%	(Exclusion)
Used for other than building site			
Parking lot	11,484	3.9%	Commercial facilities
Storage yard	1,880	0.6%	(Exclusion)
Athletic ground, etc. for employee welfare	1,297	0.4%	(Exclusion)
Golf course, ski ground or camping ground	278	0.1%	Commercial facilities
Reservoir or water channel	57	0.0%	(Exclusion)
Educational area	2,258	0.8%	(Exclusion)
Religious area	10,126	3.5%	(Exclusion)
Other usage, N.E.C.	12,520	4.3%	(Exclusion)
Vacant lot	7,653	2.6%	(Exclusion)
Total	291,591	100.0%	
Building			
Office	20,490	23.0%	Office
Store	13,455	15.1%	Commercial facilities
Warehouse	4,578	5.1%	Logistics facilities
Factory	12,775	14.3%	(Exclusion)
Housing	8,992	10.1%	Residence
Facilities for employee welfare	1,020	1.1%	(Exclusion)
Hotel or inn	3,596	4.0%	Hotel
Educational facilities	8,559	9.6%	(Exclusion)
Religious facilities	2,689	3.0%	(Exclusion)
Parking building	440	0.5%	Commercial facilities
Other building	12,270	13.8%	(Exclusion)
Building not used	199	0.2%	(Exclusion)
Total	89,063	100.0%	

*1) It was proportional to the ratio of factory and warehouse based on the asset amount of the buildings.

Note: ‘2013 Corporation Survey on Land and Buildings’