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IPO Underpricing and Real Estate Investment Trusts: Evidence from Japan

Authors
Johan Pettersson*
Daniel Hagn**

Abstract

This study investigates the pricing of 75 initial public offerings (IPOs) of Japanese real estate investment trusts (J-REITs) during the period 2001-2018. We find that the issues are systematically underpriced with significantly positive initial-day returns. Consistent with underpricing explanations that rely on asymmetric information and valuation uncertainty, we show that the degree of underpricing is negatively related to leverage and varies with the type of property. In addition, our findings suggest that the J-REITs outperform several benchmarks over the 18 months following their IPOs. Contrary to the predictions of signaling theories of underpricing, we show that the initial-day returns are negatively related to the aftermarket performance.

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*22985@student.hhs.se; **41113@student.hhs.se

Table of Contents

1 Introduction

Significant positive first-day returns following initial public offerings (IPOs) of equity securities is a well-documented phenomenon that has puzzled financial economists for several decades due to the apparent violation of market efficiency. This anomaly is termed underpricing and a large body of literature shows that the positive initial returns are both systematic and substantial. For example, Ibbotson et al. (1988) report that that the average initial IPO return of U.S. companies amounts to more than 16% on the first day of trading. While no consensus view exists on the exact reasons behind the anomalous pricing of IPOs, the most prominent explanations are based on information asymmetry models, in which investors are heterogeneously informed about the value of the issue. For instance, Rock (1986) argues that the winner´s curse theory and greater uncertainty about the true value of new securities issues implies deeper required discounts to attract inferiorly informed investors to participate in the IPO. As an alternative theory, Welch (1989) asserts that positive initial returns serve as a signal, which conveys to the market that the issued securities are of high quality.

Although the underpricing result seems to persist over time and across markets for industrial firm IPOs, the evidence from previous research on real estate investment trust (REIT) IPOs is less consistent. In particular, Wang et al. (1992) examine the initial returns of U.S. REIT IPOs between 1971 and 1988 and find that these issues are systematically overpriced. The authors argue that this finding is inconsistent with current explanations of underpricing due to the relatively high uncertainty associated with the underlying values of REITs and point out that their results cast some doubt on the adequacy of existing underpricing models. In a follow-up study, Ling and Ryngaert (1997) identify a period of increased valuation uncertainty in post-1990 REIT IPOs in the U.S. and show that the anomalous overpricing pattern is reversed between 1991 and 1994 as the offerings display significantly positive average initial-day returns. Given the contradicting and rather inconclusive evidence that these findings bring forth, the area calls for further empirical investigation of other markets.

Up until now, the overwhelming majority of the research on REIT IPOs has focused on the U.S. due to the mature stage of its market relative to other countries. Global REIT markets have grown substantially in the last decade, both in terms of market capitalization and the number of countries that offer REIT as an investment vehicle. Since its adoption

of the REIT structure in 2000, Japan has experienced a surge in IPO activity and is now the second largest REIT market in the world, only surpassed by the U.S.[1] Yet, the amount of studies covering Japanese REIT (J-REIT) IPOs remains strikingly scarce.

In this paper, we extend the existing empirical literature by examining the most comprehensive sample of J-REIT IPOs ever considered. Our study shows that 75 REIT IPOs issued in Japan between 2001 and 2018 are, on average, significantly underpriced by 3.49%. Further analysis indicates that the initial returns of the IPOs are negatively related to leverage. In addition, we find that the degree of underpricing varies across property types and that commonly issued property types are associated with less underpricing. These findings are all consistent with underpricing explanations based on information asymmetry and valuation uncertainty, such as the winner's curse theory.

To the best of our knowledge, we are the first to explore the aftermarket performance of Japanese REITs over a period of 18 months following the IPO. We find that our sample of J-REITs outperforms our benchmark measures over the defined aftermarket period. Interestingly, our results lend no support of signaling theories of underpricing as we demonstrate that the initial-day returns are negatively associated with the subsequent aftermarket performance. Taken together, our results provide important insights into the validity of underpricing explanations in the context of REITs.

The remainder of this paper is structured as follows. Section 2 reviews the previous literature on the research area and describes the unique contribution of our study. Section 3 discusses the institutional context of the Japanese REIT market. Section 4 describes the data collection and sample design. Section 5 outlines the methodology used to evaluate the pricing and performance of the REIT IPOs. Section 6 analyzes the empirical findings and section 7 discusses the robustness and limitations of our study. Section 8 concludes the paper.

[1] Association for Real Estate Securitization (ARES).

2 Previous Literature

This section reviews the previous research on the pricing of IPOs and identifies how our study contributes to the literature. First, we present the theoretical frameworks for explaining the IPO anomalies and discuss them in the light of prior empirical findings. Then, we describe the empirical evidence in the specific case of REIT IPOs.

2.1 IPO Anomalies and Theoretical Frameworks

The persistent and systematic underpricing of IPOs is an apparent violation of market efficiency that puzzle financial economists. Several scholars attempt to explain the large initial-day returns by using information asymmetry models where investors are heterogeneously informed about the underlying value of the new issues. Among the first, Rock (1986) proposes one form of adverse selection explanation in which better informed investors commit to buying shares that are underpriced, but withdraw from market when issues are overpriced. Due to the rationing of shares when demand exceeds supply, less informed investors receive a large fraction of overpriced issues but a small fraction of the underpriced issues. This allocation bias is generally referred to as the 'winner's curse' and implies that the offering firm must price the shares at a discount to entice less informed investors to participate in the IPO. Without the compensation through underpricing, the inferiorly informed investors would avoid the new issues and put the success of the IPO at risk. An important implication of this theory is that more uncertainty about the true underlying value of the new issue leads to greater susceptibility to the winner's curse, which in turn magnifies the underpricing.

Another popular explanation for the large positive initial returns for new issues is that rational agents actively engage in underpricing to signal the high quality of the issue to the market. Welch (1989) argues that high-quality firms may voluntarily price the IPO at a discount in order to obtain higher prices in subsequent seasoned offerings. In addition, Grinblatt and Hwang (1989) develop a two-parameter signaling model that incorporates asymmetric information and explain the positive initial returns as an equilibrium outcome, also showing that the true value of the firm is positively related to the level of underpricing. The practice of discounting the offer price serves as a credible signal because only high-quality firms can recoup the initial loss once their subsequent performance is realized (Allen and Faulhaber, 1989). Low-quality firms, on the other hand, refrain from signaling as they are aware of their expected future performance and

inability to afford the underpricing. In accordance with economic models where the underpricing is an equilibrium outcome, one would expect that the initial returns following the IPOs are positively related to the subsequent performance since only high-quality firms find it worthwhile to signal through underpricing. Given that lower-quality firms do not discount their initial offer price, the underpricing firms should then, by virtue of the signal, display a stronger performance in the aftermarket.

Tinic (1988) provides an alternative theory by developing a model where the underpricing acts as an insurance against legal liabilities and costs associated with litigation. In this context, the underpricing is deemed to reduce the risk of being of being sued. Through a comparison of the underpricing before and after the Securities Act of 1933, which increased the legal exposure of IPOs, Tinic lends some support of the litigation risk hypothesis. However, the empirical evidence is far from conclusive and skeptics point out that the more pronounced underpricing following the increased risk of litigation can potentially be explained by other factors. Contrary to what is expected from the hypothesis, Drake and Vetsuypens (1993) show that firms facing lawsuits are on average more underpriced than non-sued firms.

While equity securities typically experience large positive returns immediately after the IPO, several studies indicate that they tend to perform relatively poorly in the subsequent aftermarket period. For example, Ritter (1991) considers a large sample of IPOs in the U.S. between 1975 and 1984 and finds that these issues significantly underperform a set of matching firms over the following three years after their IPO. More recently, Brav et al. (2000) as well as Ritter and Welch (2002) evaluate the IPO performance of over the subsequent five and three years, respectively, and show that the IPOs substantially underperform the market. The theories behind this seemingly anomalous empirical documentation are less clear than in the case of initial returns. Some argue that behavioural manifestations can serve as a plausible explanation. In a renowned paper, Miller (1977) presents the divergence of opinion hypothesis in which the standard assumption about homogeneous expectations among investors is relaxed. The author states that, in the presence of uncertainty, the price is not necessarily set by the typical investor, but rather by a minority of overly optimistic investors who think highly of the prospects of the new issue. Given that the divergence of opinion is greatest at the time of the initial offering and that the degree of uncertainty is reduced over time, the appraisal

of the most optimistic investors will likely decline in the aftermarket period. This line of reasoning would explain why IPOs underperform in the long run.

Other behavioural explanations for the poor long-run performance of IPOs revolve around the concept of so called *fads*. Ritter (1991) points out that, in certain periods, investors tend to be irrationally overoptimistic in their forecasts of firms' earnings potential. If issuing firms decide to go public in such periods, the negative aftermarket performance would be symptomatic of disappointing cash flows and failure to meet expectations after the IPO. In line with this theory, Aggarwal and Rivoli (1990) provide evidence for the existence of fads in the early period of aftermarket trading by showing that investors are overoptimistic in their valuation assessments. Moreover, the IPO volume is highly cyclical and markets typically exhibit large swings in the number of issues over time. Ritter (1991) argues that if periods of high IPO activity are followed by poor aftermarket performance, this would serve as an indication that issuing firms can distinguish overoptimistic periods from others and consequently time the issues by capturing windows of opportunity. Interestingly, the author's empirical findings are consistent with such a proposition.

2.2 Empirical Manifestations in REIT IPOs

While there exists a myriad of empirical documentations on the pricing and performance of industrial firm IPOs, the amount of research covering REITs is not nearly so abundant. In fact, previous studies often exclude REITs and other specialty areas such as closed-end mutual funds from their samples (Ibbotson et al., 1988). More interestingly, the literature on REIT IPOs also offers much less consistency compared to the studies of industrial firms.

Being among the first in the area, Wang et al. (1992) study a sample of 87 REIT IPOs in the U.S. between 1971 and 1988 and show that these issues are significantly overpriced by 2.82%. The authors argue that, in contrast to similar findings, no existing theory of underpricing can explain the negative initial returns. Both Weiss (1990) and Peavy (1991) report that the first-day returns of closed-end mutual fund IPOs average zero. In these cases, the absence of underpricing is consistent with information asymmetry models where investors are not homogeneously informed, given that the uncertainty about the value of closed-end funds is very limited. However, in the case of REITs, the overpricing is much more surprising as the valuation uncertainty is much higher. Wang

et al. (1992) claim that because REIT portfolios consist of infrequently traded assets that generate little price information, the corresponding uncertainty regarding the value at the IPO is considerable.

In a later paper, Ling and Ryngaert (1997) examine 85 U.S. REITs issued in the period between 1991 and 1994 and conclude that the corresponding initial returns are significantly positive by a magnitude of 3.60%. The authors attribute the underpricing result post-1990 to a regime shift in which the valuation uncertainty and institutional involvement in REIT IPOs fundamentally increased. Consistent with the winner's curse explanation by Rock (1986), REITs issued after 1990 would then, on the basis of such changes, be more prone to underpricing. More recently, Bairagi and Dimovski (2011) consider a large set of 123 IPOs covering the period 1996-2010 and reinforce the evidence for underpricing of U.S. REITs by documenting an average positive initial return of 3.18%. The empirical evidence of the subsequent aftermarket performance following REIT IPOs is perhaps even less conclusive. While Wang et al. (1992) observe a subsequent underperformance in the first 190 trading days after the IPO, Ling and Ryngaert (1997) report that their sample moderately outperforms a benchmark over the subsequent 100 trading days.

Despite the predominant focus on U.S. REIT IPOs, several studies extend the analysis to the international scene. By investigating the Australian REIT equivalent, listed property trusts (hereafter LPTs), Dimovski and Brooks (2006) identify an average underpricing of 1.2% (not statistically significant) for a sample of 37 IPOs between 1994 and 1999. For the subsequent years between 2002 and 2008, 45 LPT IPOs experience significantly positive initial returns of 3.37% (Dimovski, 2010). As one of the few studies focusing on Japan, Kutsuna et al (2008) consider a sample of 40 IPOs and demonstrate that J-REITs show no sign of systematic underpricing for the period between 2001 and 2006. Furthermore, Wong et al. (2013) also consider other Asian REIT markets, including Singapore, Hong Kong and Malaysia, and find little evidence for underpricing (sample period: 2001 to 2008).

Even though the empirical manifestations in international REIT markets are explored to a certain extent, country-specific studies are often restricted by small sample sizes due to the relatively immature state of their markets. Given the absence of fully consistent results in the REIT IPO literature, the area calls for further empirical investigation using new data from recently matured markets. By analyzing one of the

most comprehensive samples of REIT IPOs ever considered, this paper sheds light on how the pricing and subsequent performance of IPOs manifest themselves in the Japanese REIT market.

3 REITs and Institutional Settings

This section provides an overview of the features of real estate investments trusts and discusses the institutional context that shapes the environment in which they operate. First, we briefly describe the key characteristics of REITs and review some of the relevant regulation in Japan. Second, we illustrate how the real estate market and institutional setting influence the valuation uncertainty of REIT IPOs. Building on the implications of this context along with the previous literature on the area, we finally present our hypotheses.

3.1 Institutional Perspectives and Valuation Uncertainty

REITs are very similar to closed-end funds but instead invest in real estate assets such as properties and mortgages. They serve as unique investment vehicles which allow individuals to make liquid investments in real estate while avoiding the double taxation associated with corporate structures. The exemption from corporate taxation is granted under the condition that the investment trusts comply with certain operating requirements such as dividend policy, ownership, borrowing and asset selection.

Japanese REITs were introduced in November 2000 with the amendment to the Investment Trusts and Investment Corporations Act. The Act stipulates that the REITs must be managed by an external asset manager and are also required to outsource asset custody and general administrative functions. Compared to the U.S., the J-REIT structure represents a more passive investment vehicle that generally does not engage in property development. As in the case of corporations, investors in REITs have the residual claim on the trust's assets and thus bear the residual risk. Other important characteristics of the REIT structure in the context of IPOs include certain listing requirements. For example, the J-REIT must be a closed-ended fund and at least 95% of the total assets must be invested or expected to be invested in real estate assets, assets related to real estate assets or cash and cash equivalents.[2]

The structure of J-REITs resembles the institutional environment in the U.S. prior to 1990 when REITs were considered passive investment vehicles (Ross and Klein, 1994). Similar to the current Japanese market, REITs in the U.S. were previously managed by external advisors (McMahan, 1994). As pointed out by Ling and Ryngaert

[2] For more detailed information on the characteristics of REITs, see Jampel and Kawamura (2018).

(1997), an institutional regime shift in the U.S. around the period of 1990 fundamentally made REITs more active in their management and consequently more difficult to value. Still, there are good reasons to believe that REITs were subject to considerable valuation uncertainty even before the regime shift. Wang et al. (1992) argue that, even under passive structures, there is substantial uncertainty about the values of REIT IPOs due to the composition of their portfolios which consists of infrequently traded assets that generate little price information through real estate and capital markets. This line of reasoning extends to the current institutional setting of Japan which share similar features with the pre-1990 regime in the U.S. Previous studies also emphasize that the operating cash flows of REITs are generally difficult to predict (Howe and Shilling, 1988). In some cases, it is not even specified at the time of the offering which assets the REIT will acquire with the capital raised from the IPO. Therefore, investors are not always able to make an assessment of the value of the prospective investments. As such, it is highly reasonable to assume that J-REIT IPOs are associated with a high degree of valuation uncertainty.

Japan differs from other established REIT markets such as Australia and the U.S. in another important aspect that may influence the pricing of IPOs. Kutsuna et al. (2008) note that the Japanese underwriter market for REIT IPOs is dominated by relatively few underwriters. Drawing from previous evidence which suggests that more prestigious underwriters with substantial reputational capital on average underprice less [for example, Carter and Manaster (1990)], one might expect that the higher underwriter concentration in Japan is associated with lower initial returns.

Theoretical adverse selection explanations of underpricing such as the winner's curse require not only that there exists uncertainty about the true value of the issue, but also that the investors are heterogeneously informed. It follows that more information asymmetry among investors should increase the magnitude of underpricing. Accordingly, Ling and Ryngaert (1997) argue that higher degrees of institutional involvement are associated with greater information asymmetry as the pool of potentially favored institutional investors is larger, and thus make REIT IPOs more susceptible to the winner's curse. In Japan, REITs attract considerable institutional interest with the number of institutional investors being very large.[3] Chan et al. (2013) report that the percentage of institutional holdings of REIT shares in Japan is substantial and among the highest

[3] Association for Real Estate Securitization (ARES).

from a global perspective, also surpassing the U.S. Therefore, it is plausible to maintain that the prevalence of information asymmetry in J-REIT IPOs is high.

3.2 Hypotheses

The degree of underpricing varies across markets and over time. In the case of REIT IPOs, the empirical findings from previous studies primarily focusing on the U.S. are not fully consistent. Our study sets out to provide additional evidence from investigating the Japanese REIT market. Bearing in mind its more passive investment structure and higher concentration of underwriters, one may conjecture that J-REIT IPOs are somewhat less underpriced compared to the REIT IPOs in the post-1990 regime in the U.S. Nevertheless, considering the overall institutional context and valuation uncertainty in the J-REIT IPO market, we still expect the IPOs to demonstrate positive initial-day returns and formulate the following hypothesis:

> **H1**: The relatively high institutional involvement and valuation uncertainty associated with J-REIT IPOs make them susceptible to the winner's curse and thus subject to underpricing.

While much of the literature for industrial firm IPOs suggests that new issues tend to underperform in the longer run, the evidence for REITs is less convincing with mixed empirical results. This paper seeks to add to the existing empirical research on REITs by exploring the aftermarket performance of IPOs in the Japanese market. Under the assumption that asset prices should reflect all available information, we state the following hypothesis:

> **H2**: Given that markets are efficient, the J-REIT IPOs should not be overpriced or underpriced in the long-run.

4 Data

This section provides a description of the data used to evaluate the pricing of the REIT IPOs. First, we discuss the data collection procedure and provide details on the sample design. Next, we provide a brief overview of our sample by presenting descriptive statistics.

4.1 Data Sources and Sample Design

The sample consists of 75 J-REIT IPOs issued between January 2001 and April 2018 that are identified using data obtained from the official website of the Japan Exchange Group.[4] This source provides information on all the listings and de-listings of J-REITs since the adoption of REIT legislation in 2000. For each of the identified REIT IPOs, we collect data on the initial offer price, first closing price, issue size, lead underwriters, underwriting fee and other in-depth issue related information from Bloomberg. We also extract data on the first available net debt position after the initial offering that is provided by Bloomberg, along with the corresponding market value of equity for the same date. Property type classifications are gathered from Kutsuna (2008) and Bloomberg. Our sample does not include Takara Leben Real Estate Investment Corporation and ITOCHU Advance Logistics Investment Corporation which were issued on the 27th of July and 7th of September 2018 respectively. The reason for their exclusion is missing information.

We collect data on the share prices as well as dividends and stock splits to obtain the post-IPO return series for all REITs. This information stretches from the time of the respective IPO up until September 2018 and is obtained from Bloomberg. Using the same data source, we also extract data for two stock market indices, namely the Nikkei 225 and Tokyo Stock Price Index (TOPIX), as well as for the yields of the one-year Japanese government bonds between 2001 and 2018. The Nikkei 225 is a price-weighted index and measures the performance of the Japanese stock market including dividends. The Tokyo Stock Price Index (TOPIX) is a value-weighted index that tracks the performance of domestic companies in Japan.

[4] *https://www.jpx.co.jp/english/equities/products/reits/index.html*.

Moreover, we obtain daily and monthly factor series for the Japanese Fama and French (1993) three factors from the website of Kenneth French[5]. More specifically, this data includes the market excess return (MKT), the small minus big factor (SMB) and the high minus low factor (HML).

4.2 Descriptive Statistics

Table 1 presents selected summary statistics on the issue size, as measured by the total amount of capital raised (excluding overallotment options), of the IPOs. The sample is partitioned by period and property type. The average issue size of the full sample corresponds to 43.3 billion Yen, with the issues ranging from a minimum of 3.6 billion Yen to a maximum of 166.3 billion Yen. While the average issue size during the pre-financial crisis period (2001-2007) is very close to the average issue size of the post-financial crisis period (2008-2018), the median issue size is larger in the former period, which can be attributed to several large offerings.

Table 1 also reveals that the average issue size varies with the type of REITs issued. The most commonly issued property types in our sample are REITs investing in residential, office and diversified real estate portfolios. Diversified REITs account for slightly more than a third of the total issue size over the sample period. The average issue size of the residential, hotel and other[6] categories are considerably lower compared to the other property types.

[5] *http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html#International*.
[6] Other includes REITs investing in healthcare facilities and other ´specialty areas´ within real estate.

Table 1

Summary statistics on the issue size (in billion Yen) for a sample of 75 J-REIT IPOs between 2001 and 2018.

	Number of observations	Average issue size (bn Yen)	Standard deviation	Median issue size (bn Yen)	Minimum issue size (bn Yen)	Maximum issue size (bn Yen)	Total issue size (bn Yen)
Full sample	75	43.3	30.8	36.3	3.6	166.3	3247.5
REIT IPOs partitioned by period							
Pre-financial crisis[a]	41	42.4	24.7	36.5	3.6	115.2	1738.3
Post-financial crisis[a]	34	44.4	37.2	31.9	5.9	166.3	1509.2
REIT IPOs partitioned by property type							
Residential	17	25.9	13.2	25.4	4.3	51.4	440.8
Offices	14	54.5	23.4	51.6	15.3	91.8	763.6
Retail	4	58.4	28.6	57.3	24.4	94.5	233.5
Logistics	7	21.6	16.2	16.2	3.6	45.2	151.5
Hotels	7	66.7	36.2	51.5	22.3	105.7	466.8
Other[b]	4	22.9	23.9	13.8	5.9	58.2	91.7
Diversified[c]	22	50.0	37.2	37.3	8.9	166.3	1099.6

This table presents summary statistics on the issue size (total amount of capital raised, excluding overallotment options) in billion Yen for the full sample and partitioned by period and property type between January 2001 and April 2018. [a]Pre-financial crisis refers to the period between January 2001 and the 31st of 2007, and post-financial crisis refers to the period between the 1st of January 2008 to April 2018. [b]Other includes for example healthcare facilities and 'specialty areas' of real estate. [c]Diversified REITs specialize in more than one area of real estate investing.

5 Methodology

In this section, we provide a detailed explanation of the methodology used to evaluate the pricing of IPOs. To begin with, we describe the measures used to assess the initial pricing and discuss the economic intuition behind several variables that are aimed at explaining the initial returns. Moreover, we define the aftermarket period and present our methodological approach for measuring the subsequent performance of the IPOs. Finally, we outline the procedure for explaining the aftermarket performance.

5.1 Initial Returns

To evaluate the degree of underpricing in our sample of REIT IPOs, we measure the initial performance by calculating the return on their first trading day. A positive initial-day return indicates that the issue is priced below its market value meaning that it is underpriced. Conversely, if the issue drops in value on the first trading day and experience a negative return, the IPO is deemed overpriced.

For each REIT *i*, we define the raw initial-day return as follows:

$$IR_i = \frac{P_i^f - P_i^I}{P_i^I}$$

where P_i^f denotes the closing price at the end of the first day of trading and P_i^I the initial offer price.

The IR_i measures the raw initial-day return without accounting for the contemporaneous market movement. To address this issue, we follow the methodology of Ling and Ryngaert (1997) and calculate a second measure where we adjust for the market movement on the first day of trading. The adjusted initial-day return is calculated as follows:

$$AIR_i = IR_i - R_m$$

where R_m denotes the contemporaneous market movement measured by the Nikkei 225 return.

5.2 Explaining the Initial Returns

To explain the cross-sectional variation in initial-day returns, we perform an ordinary least squares (OLS) regression analysis with the adjusted initial-day return as our dependent variable. Our methodology for identifying explanatory variables builds on the theoretical frameworks offered in the literature along with previous empirical findings on the area. In line with models that rely on uncertainty about the IPO to explain the underpricing, we include several variables that are aimed at capturing such effects.

Larger issues are by many deemed more certain as to they tend to generate considerable investor interest, which in turn would imply lower levels of underpricing. Previous research lends some support for this negative relationship [for example, Ibbotson et al. (1988)]. The issue size enters our regression model as the natural logarithm of the total amount of capital raised (excluding overallotment options).

In addition, we also include a measure of leverage in the regression. Ling and Ryngaert (1997) argue that REITs with more growth opportunities are subject to greater valuation uncertainty and thus greater underpricing. Furthermore, Smith and Watts (1992) suggest that more growth opportunities are associated with a lower reliance on debt financing. The degree of leverage is therefore expected to be negatively related to the underpricing. We calculate a financing ratio by dividing the net debt with the sum of net debt and market value of equity. The natural logarithm of one plus this ratio is included as one of the explanatory variables in the regression. We use the net debt instead of debt because it better reflects the financial position in terms of growth opportunities.

The underwriting fee is often the largest expense in many REIT IPOs. Chen and Lu (2006) point out that underwriting fees may very well be related to the certainty of new issues. Consequently, it is reasonable to conjecture that the size of the underwriting fee is associated with the degree of underpricing. As such, we include the percentage gross spread on the total issue size in our regression model.

Previous studies suggest that the prestige of the underwriter displays a negative relationship with the degree of underpricing since high profile underwriters on average engage in less risky IPOs (Carter and Manaster, 1990; Michaely and Shaw, 1995). The uncertainty about the issues underwritten by high-reputation investment banks is therefore expected to be lower. To proxy for the prestige of the underwriter, we create a simple scoring system similar to Kutsuna et al. (2008). Specifically, we construct a

dummy variable which takes on the value one if the lead underwriter corresponds to any of the big underwriting firms of REIT IPOs in Japan, namely Nomura, Diawa or Nikko, and zero otherwise. The corresponding ordinary least squares regression model is the following:

$$AIR = \beta_0 + \beta_1 \ln(Issue\ Size) + \beta_2 \ln(1 + \%\ net\ debt\ financing) + \beta_3 Underwriting\ fee + \beta_4\ Big\ Underwriter + \varepsilon$$

5.3 Aftermarket Performance

Our methodology for analyzing the aftermarket performance builds on the approach of Ritter (1991) and Wang et al. (1992). To examine the long-run performance of the J-REIT IPOs, we calculate cumulative average adjusted returns (CAAR), assuming monthly rebalancing. We use two benchmarks in this calculation. The first one is the Nikkei 225 index, which is a price-weighted index. The second benchmark corresponds to the value-weighted Tokyo Stock Price Index (TOPIX).

The aftermarket period is defined as the 18 months following the IPO, where months correspond to successive 21-trading-day periods (the average number of trading days per month) relative to the time of the IPO. As aforementioned, the initial return period is defined as the first trading day, meaning that the first aftermarket month corresponds to event days 2-22 and the second month to event days 23-43, and so forth.

We calculate the benchmark-adjusted return for REIT *i* in the event period *t* as the difference between the actual return and the return on the benchmark as follows:

$$ar_{i,t} = R_{i,t} - R_{m,t}$$

where $R_{i,t}$ is the return of the REIT on month *t* and $R_{m,t}$ *is* the return of the benchmark on month *t.*

Next, we calculate the average benchmark-adjusted return (AAR) for our sample of *n* REITs for event month *t* as the equally-weighted arithmetic average of the benchmark-adjusted returns:

$$AAR_t = \frac{1}{n}\sum_{i=1}^{n} ar_{i,t}$$

Finally, the cumulative average benchmark-adjusted return (CAAR) from the event period *k* to event period *s* is obtained through a summation of the average benchmark-adjusted returns:

$$CAAR_{k,s} = \sum_{t=k}^{s} AAR_t$$

Following the methodology of Ritter (1991), we calculate the corresponding t-statistic of the average benchmark-adjusted returns (AAR) as follows:

$$t - statistic_t = AAR_t \frac{\sqrt{n_t}}{sd_t}$$

where n_t is the number of observations in each period *t* and sd_t is the cross-sectional standard deviation in month *t* for the *AAR* in period *t*.

For the $CAAR_t$, the t-statistic is calculated in a similar way:

$$t - statistic_t = CAAR_t \frac{\sqrt{n_t}}{csd_t}$$

where the cumulative standard deviation csd_t is defined as:

$$csd_t = \sqrt{[t \cdot var + 2(t-1)cov]}$$

where *var* denotes the average cross-sectional variance over 18 months and *cov* is the first order autocovariance of the AAR_t series.

5.3.1 Fama and French three factor model

While the calculation of benchmark-adjusted returns follows the approach of Wang et al. (1992) by benchmarking the performance against the stock market, it does not does not consider the REITs' exposure to other common risk factors. To complement our analysis of the aftermarket performance, we calculate an alternative benchmark measure that accounts for additional sources of risk by estimating the expected returns of the REITs using the Fama and French (1993) three factor model.

For each REIT *i*, we regress the daily return in excess of the daily risk-free rate on the Fama and French three factors for Japan:

$$R_{i,t} - r_{f,t} = \alpha + \beta_m^i (R_{m,t} - r_{f,t}) + \beta_{SMB}^i SMB_t + \beta_{HML}^i HML_t + \varepsilon_{i,t}$$

where *t* corresponds to day *t*, $(R_{m,t} - r_{f,t})$ is the excess daily return on the market portfolio, SMB_t is the return on small firms minus the return on large firms, HML_t is the return on high book-market stocks minus the return on low book-to-market stocks, and $r_{f,t}$ corresponds to the daily Japanese risk-free rate.[7] For each time-series regression, the estimation period corresponds to the time of the respective REIT IPO up until September 2018.

The alternative benchmark-adjusted return for REIT *i* is obtained by deducting the expected values of the estimated model in month *t* from the actual returns in month *t*:

$$aar_{i,t} = R_{i,t} - \left(r_{f,t} + \beta_m^i (R_{m,t} - r_{f,t}) + \beta_{HML}^i HML_t + \beta_{SMB}^i SMB_t\right)$$

The alternative benchmark-adjusted returns (*aar*) are then used to calculate cumulative average-adjusted returns in the same manner as for the benchmark-adjusted returns (*ar*).

[7] For more details on the portfolio construction, see Fama and French (1993).

5.4 Explaining the Aftermarket Performance

To further explain the aftermarket performance, we regress the cumulative benchmark-adjusted returns (CAR) of the individual REITs for selected time horizons on a set of independent variables.

The cumulative benchmark-adjusted return (CAR) for REIT *i* is defined as:

$$CAR_{1,s}^{i} = \sum_{t=1}^{s} ar_{i,t}$$

where *s* represents the event period.

To investigate whether the initial-day return has any effect on the subsequent aftermarket performance, we include this as one of the explanatory variables in our regression model. The corresponding ordinary least squares (OLS) regression specification is the following:

$$CAR_{1,s} = \beta 0 \; + \; \beta 1 \, \mathrm{AIR}_i + \beta 2 \ln(IssueSize) + \beta 3 \, UnderwritingFee + \beta 4 BigUnderwriter$$

6 Results

This section presents and analyzes our empirical findings. We begin with discussing the initial-day returns and then describe the cross-sectional and time-series patterns that are displayed in the results. Next, we turn to the investigation of the variation in initial-day returns using multivariate regression analysis. Then, we describe our empirical results of the aftermarket performance for several benchmarks. Lastly, we attempt to explain the determinants of the aftermarket performance.

6.1 Initial Returns

Table 2 presents the average raw initial returns for our sample of 75 J-REIT IPOs, partitioned by year and sub-periods between 2001 and 2018. The average raw initial-day return for our full sample is positive by 3.49% and statistically significant at the 5% level. This supports our hypothesis that the J-REIT IPOs should be subject to underpricing. Interestingly, the sample reveals that high levels of underpricing in the period between 2013 and 2015 drive most of the overall positive initial-day returns.

A well-established finding in the literature is that both the IPO activity and the magnitude of underpricing fluctuate over time [see for example Ibbotson and Jaffe (1975) and Ibbotson et al. (1988)]. This observation is consistent with the pattern reported in Table 2. The number of IPOs displays strong cyclicality, with one third (25) of all J-REIT IPOs occurring in 2005 and 2006, followed by a period of very low IPO activity during the years after the financial crisis of 2007. After 2011, the number of REIT IPOs increases and remains relatively stable until 2017. Accordingly, the yearly total issue size for the J-REIT IPOs varies across the respective time periods with 27.3 billion Yen in 2010 and 645.6 billion Yen in 2006. There is also substantial variation in the degree of underpricing. The early years of our sample show almost no sign of underpricing while the IPO intensive period between 2013 and 2015 is underpriced by an average of 12.56%.

The significant underpricing finding and overall pattern presented in Table 2 remain robust after controlling for the contemporaneous market movement. The average adjusted initial-day return for the full sample corresponds to 3.61% (see Table A.1 in Appendix).

Table 2

Annual distribution of the number of offerings, average raw initial returns and total issue size for the sample of 75 J-REIT IPOs between 2001 and 2018.

Year	Number of observations	Average initial return (%)	t-statistic	Number of IR > 0	Number of IR = 0	Number of IR < 0	Total issue size (bn Yen)
REIT IPOs partitioned by year							
2001	2	1.18	0.45	1	0	1	135.8
2002	4	-1.92	-1.48	1	1	2	140.5
2003	4	-0.16	-0.18	2	0	2	188.5
2004	4	3.31	2.35	3	1	0	163.6
2005	13	0.86	0.34	7	0	6	398.0
2006	12	0.00	0.00	6	0	6	645.6
2007	2	20.27	0.95	1	0	1	66.3
2008	0	NA	NA	0	0	0	NA
2009	0	NA	NA	0	0	0	NA
2010	1	-1.04	NA	0	0	1	27.3
2011	0	NA	NA	0	0	0	NA
2012	4	-0.65	-0.29	2	0	2	265.2
2013	6	8.54	1.81	4	0	2	430.0
2014	6	17.76	2.60**	6	0	0	226.1
2015	6	11.38	1.38	4	0	2	133.6
2016	7	-4.52	-1.44	2	0	5	288.1
2017	2	4.56	1.66	2	0	0	94.5
2018	2	1.38	1.00	1	1	0	44.4
Total	75	3.49	2.50**	42	3	30	3247.5
REIT IPOs partitioned by period							
2001 - 2003	10	-0.60	-0.74	4	1	5	464.8
2004 - 2006	29	0.84	0.53	16	1	12	1207.2
2007 - 2009	2	20.27	0.95	1	0	1	66.3
2010 - 2012	5	-0.73	-0.42	2	0	3	292.5
2013 - 2015	18	12.56	3.32***	14	0	4	789.7
2016 - 2018	11	-1.79	-0.78	5	1	5	427.0
Total	75	3.49	2.50**	42	3	30	3247.5

This table presents the annual distribution of the number of initial public offerings, average raw initial-day returns, total issue size (in billion Yen), and number of positive, negative and zero adjusted initial-day returns between January 2001 and April 2018, partitioned by year and period. T-statistics are presented for a two-tailed test. *, ** and *** denote significance levels of 10%, 5% and 1%, respectively.

Table 3 provides summary statistics on the initial returns partitioned by various characteristics of the REIT IPOs. An investigation of the cross-sectional patterns sheds light on several interesting features. Contrary to our expectation that large issues generate considerable investor interest and face more scrutiny by market participants, in turn leading to greater certainty and less underpricing, we find no signs of such a relationship. Large-sized issues (above 60 billion Yen) appear to be associated with higher levels of underpricing compared to smaller offerings. Given the relatively small sample size, however, the significance of this observation is not clear and requires additional analysis.

Furthermore, highly levered REITs are considerably less underpriced than those with lower levels of net debt financing. Issues with a percentage of net debt financing above 40% show almost no sign of underpricing while REITs with a lower net debt financing (below 40%) on average experience positive initial-day returns of 6.68%. This indicates a strong negative relationship between the degree of underpricing and amount of leverage, which is consistent with the expectation that REITs with less leverage face greater growth opportunities and thus higher valuation uncertainty. Ling and Ryngaert (1997) document a similar but less pronounced pattern for the financing of U.S. REITs.

By segmenting the J-REIT IPOs according to their respective property type, Table 3 also shows that the magnitude of the initial returns varies across the different sectors of the real estate industry. REITs investing in logistics facilities and certain specialty areas such as healthcare facilities (labeled ‘other’ in Table 3) are more underpriced than the other property types, but make up only a small part of our sample. Apart from the diversified issues, REITs that invest in residential properties and offices constitute the largest part of our sample with 17 and 14 number of IPOs, respectively. These property types are also associated with the lowest initial-day returns. In fact, residential REITs are slightly overpriced with an average initial return of -0.85%. The differences in underpricing between the property types could partly explain why the underpricing is much lower prior to the financial crisis; almost all IPOs in this period are either residential, office or diversified REITs.

Whether the lower initial returns of residential and office REITs are attributable to the inherent riskiness of their property or more investor familiarity with such issues is not clear. On the one hand, it can be argued that a large number of IPOs of a certain type of property raises the knowledge and overall familiarity with similar issues, in turn lowering the corresponding uncertainty of those IPOs. However, it may also simply reflect the risk

characteristics associated with the nature of the property. The pattern presented in Table 3 is consistent with both interpretations and calls for further analysis using multivariate techniques.

Table 3

Summary statistics on the raw initial-day returns for a sample of 75 REIT IPOs between 2001 and 2018, partitioned by period, issue size, leverage and property type.

	Number of observations	Average initial return (%)	Standard deviation (%)	Median initial return (%)	Minimum initial return (%)	Maximum initial return (%)	t-statistic
Full sample	75	3.49	12.10	0.63	-12.97	48.40	2.50**
REIT IPOs partitioned by period							
Pre-financial crisis[a]	41	1.44	9.69	0.19	-11.07	41.59	0.95
Post-financial crisis[a]	34	5.96	14.24	3.32	-12.97	48.40	2.44**
REIT IPOs partitioned by issue size							
Large issues[b]	16	6.81	9.12	4.83	-6.20	24.00	2.99***
Medium issues[b]	34	2.54	10.43	0.63	-12.97	41.59	1.42
Small issues[b]	25	2.66	15.50	-1.70	-11.41	48.40	0.86
REIT IPOs partitioned by percentage of net debt financing							
High leverage[c]	37	0.22	12.42	-1.70	-12.97	47.82	0.11
Low leverage[c]	38	6.68	11.02	3.68	-10.20	48.40	3.73***
REIT IPOs partitioned by property type							
Residential	17	-0.85	12.22	-3.13	-11.41	41.59	-0.29
Offices	14	1.00	7.16	2.38	-11.07	17.33	0.53
Retail	4	6.58	8.32	7.55	-4.47	15.70	1.58
Logistics	7	10.25	9.24	7.31	0.00	24.00	2.94**
Hotels	7	2.65	9.86	1.82	-10.11	15.49	0.71
Other[d]	4	22.17	30.22	24.48	-8.68	48.40	1.47
Diversified[e]	22	2.58	8.58	0.53	-12.97	20.83	1.41

This table presents summary statistics on the raw initial-day return for a sample of 75 J-REITs from January 2001 to April 2018, partitioned by period, issue size, leverage and property type. [a]Pre-financial crisis refers to the period between January 2001 and the 31st of 2007, and post-financial crisis refers to the period between the 1st of January 2008 to April 2018. [b]Large issues correspond to an issue size > 60 billion Yen, medium issues correspond to an issue size ≤ 60 and > 25 billion Yen and small issues correspond to an issue size ≤ 25 billion Yen. [c]Leverage refers to the ratio of net debt to net debt plus the market value of equity (ND/(ND+E)). High leverage refers to J-REIT IPOs with a ratio of > 40% and low leverage refers J-REIT IPOs with a ratio of ≤ 40%. [d]Other includes for example healthcare facilities and 'specialty areas' of real estate. [e]Diversified REITs specialize in more than one area of real estate investing. T-statistics are presented for a two-tailed test. *, ** and *** denote significance levels of 10%, 5% and 1%, respectively.

Table 3 presents the raw initial-day returns and do not provide any information on the adjusted initial-day returns. Table A.2 in Appendix reports the same summary statistics for the adjusted initial-day returns. Both measures produce very similar results and the cross-sectional patterns do not differ substantially.

6.2 Explaining the Initial Returns

Multivariate analysis is employed to further explain the pricing of J-REITs. This allows us to disentangle the effects of individual variables on the cross-sectional variation in adjusted initial-day returns. To mitigate the effect of outliers, three REITs with an adjusted initial-day return of more than three standard deviations from the mean are excluded from the regression sample. Table 4 reports the regression estimates for various model specifications.

Model I regresses the adjusted initial-day return on the leverage, issue size, underwriting fee and big underwriter dummy. The natural logarithm of one plus the percentage of net debt financing constitutes the leverage variable. While the other variables seem to carry no significant explanatory value, the leverage shows a negative relationship which is significant at the 1% level. This is consistent with the hypothesis that highly levered REITs on average have fewer growth opportunities, in turn making them relatively more certain in terms of valuation and thus less susceptible to underpricing. The negative relationship remains statistically significant in all regression specifications. Moreover, the expected negative relationship between initial returns and the size of the underwriter appears to be non-existent. In addition, both the issue size and underwriting fee perform poorly in explaining the initial returns. For this reason, these variables are excluded in the remaining model specifications.

Ling and Ryngaert (1997) argue that a larger number of IPOs of a specific property type may increase investors' information availability and knowledge of such issues. Given a higher familiarity with commonly issued property types, the corresponding valuation uncertainty of these IPOs should be lower. As our sample covers all J-REIT IPOs since the adoption of REIT structure in Japan, it provides a particularly relevant setting for investigating potential familiarity effects on the initial returns. To explore whether the hypothesized lower valuation uncertainty due to investor familiarity is associated with less underpricing, we create dummy variables for the most commonly issued property types in our sample; residential and office REITs.

Table 4

Cross-sectional regression estimates from regressing the adjusted initial-day return on selected independent variables for 72 J-REIT IPOs between 2001 and 2018.

	Model I	**Model II**	**Model III**	**Model IV**
Intercept	0.153	0.147	0.141	0.115
	(1.55)	(4.80)***	(4.60)***	(3.52)***
ln(1 + leverage[a])	-0.380	-0.389	-0.322	-0.280
	(-3.81)***	(-4.38)***	(-3.51)***	(-3.03)***
ln(Issue size)	0.002			
	(0.13)			
Big underwriter[b]	0.018			
	(0.91)			
Underwriting fee[c]	-0.008			
	(-0.53)			
Residential[d]			-0.052	-0.052
			(-2.24)**	(-2.30)**
Offices[e]			-0.020	-0.019
			(-0.87)	(-0.85)
Early IPO[f]				0.038
				(1.99)*
Adjusted R2 (%)	18.45	20.42	23.77	26.96
F-statistic	5.02	19.22	8.38	7.55
Number of observations[g]	72	72	72	72

This table presents the ordinary least squares regression with the adjusted initial-day return as the dependent variable. The adjusted initial-day return is the raw initial-day return minus the contemporaneous return on the Nikkei 225 Index. [a]Leverage refers to the ratio of net debt to net debt plus the market value of equity (ND/(ND+E)). [b]Big underwriter (yes = 1, no = 0). [c]Measured as the percentage gross spread per share. [d]Binary variable if the J-REIT is classified as Residential (yes = 1, no = 0). [e]Binary variable if the J-REIT is classified as Offices (yes = 1, no = 0). [f]Binary variable if the J-REIT IPO is one of the first four IPOs within its respective property type (yes = 1, no = 0). [g]Three outliers with an adjusted initial-day return of more than three standard deviations from the mean are excluded from the regression sample. T-statistics in parentheses. *, ** and *** denote significance levels of 10%, 5% and 1%, respectively.

As expected, Model III shows that both variables are negatively related to the adjusted initial-day returns, which provides an indication that there might be less valuation uncertainty associated with commonly issued property types. However, only the residential property type variable is statistically significant at conventional levels.

An alternative interpretation of these results is that the different property types simply vary in risk profile. For example, residential REIT IPOs might be less underpriced solely because they naturally carry more valuation certainty compared to other property types. To address this issue, we include an additional binary variable which classifies our sample according to how early the IPO occurred relative to other observations of the same property type. If the REIT is one of the first four IPOs in its respective property category, it is assigned the value one and zero otherwise. Given that early offerings are more difficult to value, such issues should be more underpriced compared to later IPOs. Model IV presents the regression outcome after including the early IPO variable and shows both a statistically[8] and economically significant relationship between the initial returns and early issues. The positive relationship means that early issues are more underpriced. This provides some evidence that investors become more familiar with pricing new issues as the number of IPOs of that property type increases (i.e. valuation uncertainty drops), regardless of the type of property. Although the inherent riskiness of each property type is likely to serve as a partial explanation of the underpricing, our results still provide support for the investor familiarity hypothesis. It should be emphasized, however, that both interpretations are fully consistent with underpricing theories that rely on heterogeneously informed investors and valuation uncertainty, such as the winner's curse explanation.

[8] T-statistic of 1.99 and corresponding p-value of 5.05%.

6.3 Aftermarket Performance

Table 5 shows the monthly average benchmark-adjusted returns (AAR) and cumulative average benchmark-adjusted returns (CAAR) over the 18 months following the IPO date for our sample of 75 REITs using the Nikkei 225 as a benchmark. The AAR varies between 1.60% and -1.41%. Moreover, only five of the 18 months show a negative AAR, resulting in a CAAR of 5.24% in month 18. Although the CAARs are positive from month five and steadily increase until month 18, they are not statistically significant at conventional levels. In line with our hypothesis that the IPOs should not be mispriced in the longer run, Table 5 provides no convincing evidence for underperformance or outperformance in the defined aftermarket period.

Table 5

Average benchmark-adjusted returns and cumulative average benchmark-adjusted returns for the 18 following the IPOs for 75 J-REIT IPOs between 2001 and 2018, using the Nikkei 225 as the benchmark.

Month of seasoning	Number of observations	AAR (%)[a]	t-statistic	CAAR (%)[a]	t-statistic[b]
1	75	1.17	1.25	1.17	1.31
2	75	-0.40	-0.46	0.77	0.63
3	75	-1.24	-1.55	-0.47	-0.32
4	75	0.40	0.39	-0.07	-0.04
5	75	0.40	0.43	0.33	0.17
6	75	1.32	1.64	1.64	0.80
7	75	0.46	0.65	2.10	0.94
8	73	1.24	1.40	3.34	1.39
9	73	0.21	0.20	3.55	1.39
10	73	0.18	0.12	3.74	1.39
11	73	0.88	0.83	4.62	1.64
12	73	-1.41	-1.81*	3.21	1.09
13	72	0.08	0.12	3.29	1.07
14	72	1.60	2.42**	4.89	1.53
15	72	-0.43	-0.54	4.46	1.35
16	72	-0.69	-0.96	3.76	1.10
17	72	0.67	0.74	4.43	1.26
18	72	0.81	1.20	5.24	1.45

This table presents the average Nikkei 225-adjusted returns (AAR) and cumulative average Nikkei 225-adjusted returns (CAAR) along with the corresponding t-statistics for the 18 months after going public. [a]Excluding the initial-day return; [b]Details on the calculation of the t-statistics are provided in Section 5. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

While the Nikkei 225 benchmark does not consider the exposure of the REITs to common risk factors, our alternative benchmark measure addresses this matter by accounting for additional sources of risk. Table 6 presents the monthly AARs and CAARs using the benchmark returns provided by the Fama-French three factor (FF-3F) model. Contrary to our hypothesis, the results indicate that the REITs strongly outperform the benchmark returns throughout the 18 months following the IPO, with virtually all CAARs being positive and statistically significant. Only three of the 18 months display a negative AAR. The CAAR peaks at 19.17% in the last month of the aftermarket period. The difference in aftermarket returns between the Nikkei 225 and FF-3F benchmarks is attributable to the wider set of risks that the latter benchmark accounts for.

Table 6

Average benchmark-adjusted returns and cumulative average benchmark-adjusted returns for the 18 following the IPOs for 75 J-REIT IPOs between 2001 and 2018, using the Fama and French (FF-3F) three factor returns as the benchmark.

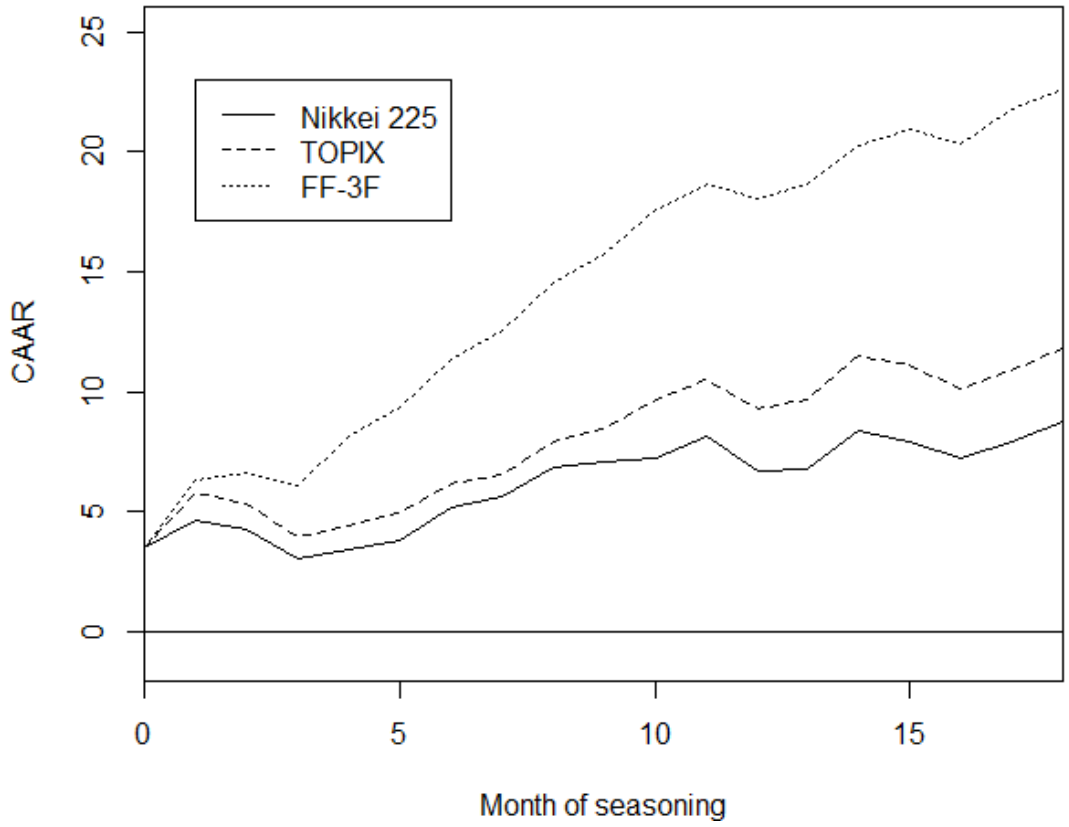
Month of seasoning	Number of observations	AAR (%)[a]	t-statistic	CAAR (%)[a]	t-statistic[b]
1	75	2.86	3.28***	2.86	3.66***
2	75	0.31	0.37	3.16	2.87***
3	75	-0.59	-0.96	2.57	1.90*
4	75	2.07	2.29**	4.64	2.97***
5	75	1.27	1.68*	5.91	3.39***
6	75	1.91	2.42**	7.82	4.10***
7	75	1.23	1.60	9.05	4.39***
8	73	1.98	2.42**	11.03	4.94***
9	73	1.27	1.34	12.30	5.19***
10	73	1.80	2.54**	14.10	5.65***
11	73	1.05	0.97	15.15	5.78***
12	73	-0.59	-0.88	14.56	5.32***
13	72	0.65	1.11	15.20	5.30***
14	72	1.58	2.34**	16.78	5.64***
15	72	0.67	0.79	17.45	5.67***
16	72	-0.56	-0.72	16.89	5.31***
17	72	1.40	1.60	18.29	5.58***
18	72	0.88	1.35	19.17	5.68***

This table presents the average FF-3F-adjusted returns (AAR) and cumulative average FF-3F -adjusted returns (CAAR) along with the corresponding t-statistics for the 18 months after going public. [a]Excluding the initial-day return; [b]Details on the calculation of the t-statistics are provided in Section 5. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

Figure 1 plots the CAARs over the subsequent 18 months relative to the initial offering date for both the Nikkei 225 and FF-3F benchmarks, also including the value-weighted TOPIX-adjusted returns. The figure also shows the average initial-day return (3.49%), represented by the origin from which the return series start. Similar to the findings of Ritter (1991), the plot demonstrates that the long-run performance and magnitude of the cumulative returns vary considerably depending on the benchmark employed. Even though the CAARs are positive for all benchmarks, only the FF-3F and TOPIX offer statistically reliable estimates.[9]

Figure 1

Cumulative average benchmark-adjusted returns for an equally-weighted portfolio of 75 J-REIT IPOs between 2001 and 2018.



This figure presents the cumulative average benchmark-adjusted returns (CAAR) for the 18 months after going public between 2001 and 2018. Three CAAR series are plotted: 1) using the Nikkei 225 returns as the benchmark and 2) using the value-weighted Tokyo Stock Price Index (TOPIX) returns as the benchmark, and 3) using the Fama and French three factor (FF-3F) returns as the benchmark. Month 0 corresponds to the full sample average raw initial-day return of 3.49%. The y-axis displays the cumulative average benchmark-adjusted returns in percentages.

[9] See Table A.3 in Appendix for the CAARs and corresponding t-statistics for the value-weighted TOPIX-adjusted returns.

Although previous studies use indices measuring the stock market performance to evaluate REIT IPOs in the longer run (Wang et al., 1992; Chan et al., 2013), there may exist industry effects that such benchmarks fail to capture. Therefore, one could argue that the FF-3F model should serve as a more appropriate benchmark by providing returns that better reflect the expected returns of the REITs. However, we also emphasize that any quantitative measurement of the long-run performance should be viewed with caution. As Dimson and Marsch (1986) point out, the relative aftermarket performance of IPOs is sensitive to the benchmark used, especially for longer horizons. Taken together, our results still provide support for outperformance of the IPOs in the longer run, with persistently positive CAARs for both the TOPIX and FF-3F benchmarks. Consequently, we reject our hypothesis of no mispricing of REIT IPOs in the longer run.

6.4 Explaining the Aftermarket Performance

Table 7 summarizes our OLS estimates from regressing the cumulative benchmark-adjusted return (CAR) for various time horizons on selected independent variables, with the FF-3F returns as the benchmark. To examine whether the initial return of the IPO has any effect on its subsequent performance, we include the adjusted initial-day return as one of the explanatory variables in the regression analysis. Model I to III show the univariate regression output from regressing the cumulative benchmark-adjusted return on the adjusted initial-day return. In the models IV through VI, we add the issue size, underwriting fee and big underwriter dummy. The net debt financing variable is excluded from the specifications due to multicollinearity issues.

The regression results demonstrate that the issue size is positively related to the CAR in the 5, 10 and 18 months following the IPO. The effect is more pronounced for the 10-month horizon, with a coefficient that is statistically significant at the 1% level. These findings are consistent with Ritter (1991) and Keloharju (1993) who show that larger offerings are related to stronger aftermarket performance. A potential explanation for this relationship could be that larger IPOs are more widely analyzed by market participants, in turn leading to more fully priced issues compared to smaller IPOs.

In line with signaling explanations of underpricing such as the model proposed by Allen and Faulhaber (1989), one would expect that only high-quality firms find it worthwhile to signal through underpricing since they, in contrast to lower-quality firms, are able to recoup the initial loss from underpricing in the subsequent aftermarket period.

Given that the underpricing of IPOs serves as an equilibrium signal of firm quality, it is reasonable to assume that the initial returns should be positively related to the subsequent aftermarket performance. Surprisingly, our results suggest the opposite. As illustrated in Model III, the degree of underpricing appears to be negatively associated with the aftermarket performance over the 18 months following the IPO. The coefficient remains negative and statistically significant at the 5% level after the inclusion of additional variables in Model VI. This result contradicts the prediction of underpricing explanations where the positive initial return serves as a signal of the quality of the firm.

One possible interpretation of the negative relationship between the initial-day returns and aftermarket performance is that it reflects a behavioral manifestation where the market overreacts. Given that investor optimism causes the price to temporarily drift away from its intrinsic value, the lower aftermarket returns could be a sign of a reversal (De Bondt and Thaler, 1985, 1987). This is consistent with our findings. Carter and Dark (1990) document a similar pattern for firm commitment offerings by showing that higher initial returns are associated with lower aftermarket returns for the 18-month period following the IPO.

Table 7

Cross-sectional regression estimates from regressing the cumulative benchmark-adjusted return on selected independent variables for 72 J-REIT IPOs between 2001 and 2018, using the Fama and French (FF-3F) three factor returns as the benchmark.

	Model I	**Model II**	**Model III**	**Model IV**	**Model V**	**Model VI**
	(1-5)[a]	**(1-10)[a]**	**(1-18)[a]**	**(1-5)[a]**	**(1-10)[a]**	**(1-18)[a]**
Intercept	0.055	0.160	0.220	-0.340	-0.253	-0.118
	(2.57)**	(5.60)***	(7.04)***	(-2.02)**	(-1.16)	(-0.48)
AIR[b]	0.148	-0.409	-0.656	0.161	-0.336	-0.634
	(0.87)	(-1.82)*	(-2.66)***	(0.95)	(-1.54)	(-2.55)**
ln(Issue size)				0.066	0.112	0.087
				(2.44)**	(3.17)***	(2.16)**
Big underwriter[c]				0.000	-0.060	-0.001
				(0.00)	(-1.05)	(-0.01)
Underwriting fee[d]				0.045	0.016	0.009
				(1.40)	(0.39)	(0.20)
Adjusted R2 (%)	-0.34	3.16	7.86	4.82	12.45	10.45
F-statistic	0.76	3.31	7.06	1.90	3.53	3.07
Number of observations[e]	72	72	72	72	72	72

This table presents the ordinary least squares regression with the cumulative FF-3F-adjusted return (CAR) as the dependent variable. [a]Denotes the time horizon (event period) in months. For example, (1-5) represents the cumulative benchmark-adjusted return over the first five months after going public. [b]The adjusted initial-day return. [c]Big underwriter (yes = 1, no = 0). [d]Measured as the percentage gross spread per share. [f]Three observations are excluded from the analysis since they do not trade for at least 18 months. T-statistics in parentheses. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

Our results remain robust after changing the benchmark used in the calculation of the CAR. Table 8 reports the regression estimates from regressing the CAR on the same explanatory variables as above, but instead using the Nikkei 225 returns as the benchmark. The estimates are largely consistent with the corresponding output for the FF-3F benchmark in Table 7. The CAR demonstrates a positive and statistically significant relationship with the issue size for the 10 and 18-month horizons as well as a negative relationship with the initial returns. Although the magnitude of the effects is slightly different after changing the benchmark, the qualitative conclusions remain the same.

Table 8

Cross-sectional regression estimates from regressing the cumulative benchmark-adjusted return on selected independent variables for 72 J-REIT IPOs between 2001 and 2018, using the Nikkei 225 Index as the benchmark.

	Model I	**Model II**	**Model III**	**Model IV**	**Model V**	**Model VI**
	(1-5)[a]	**(1-10)[a]**	**(1-18)[a]**	**(1-5)[a]**	**(1-10)[a]**	**(1-18)[a]**
Intercept	0.002	0.058	0.078	-0.296	-0.267	-0.311
	(0.09)	(1.76)*	(2.45)**	(-1.38)	(-1.04)	(-1.27)
AIR[b]	0.073	-0.447	-0.537	0.071	-0.355	-0.482
	(0.35)	(-1.73)*	(-2.15)**	(0.33)	(-1.37)	(-1.96)*
ln(Issue size)				0.049	0.100	0.111
				(1.41)	(2.39)**	(2.80)***
Big underwriter[c]				0.016	-0.089	-0.035
				(0.28)	(-1.31)	(-0.54)
Underwriting fee[d]				0.032	0.008	0.005
				(0.78)	(0.17)	(0.12)
Adjusted R2 (%)	-1.25	2.71	4.85	-1.97	7.55	11.59
F-statistic	0.12	2.98	4.62	0.66	2.45	3.33
Number of observations[e]	72	72	72	72	72	72

This table presents the ordinary least squares regression with the cumulative Nikkei 225-adjusted return (CAR) as the dependent variable. [a]Denotes the time horizon (event period) in months. For example, (1-5) represents the cumulative benchmark-adjusted return over the first five months after going public. [b]The adjusted initial-day return. [c]Big underwriter (yes = 1, no = 0). [d]Measured as the percentage gross spread per share. [f]Three observations are excluded from the analysis since they do not trade for at least 18 months. T-statistics in parentheses. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

7 Robustness and Limitations

In the following section, we address the robustness of the findings and discuss some of the limitations of our study. First, we test whether the time when we measure the leverage has any effect on the initial returns. Next, we turn to a discussion on the appropriate benchmark for evaluating the long-run performance of IPOs.

7.1 Initial Returns and Leverage

As outlined in section 3 which describes our sample design, the data used for calculating the net debt financing ratio is based on the first available net debt position of each REIT after their respective IPO. When analyzing the initial returns, however, we are interested in the ex-ante uncertainty about the IPO, meaning that there may exist an evaluation bias for the net debt financing variable. While there are good reasons to believe that our measure serves as a good proxy for the uncertainty, we further address this issue by controlling for the interaction effect between the *leverage* and the *time* between the IPO and first available net debt data.

An interaction variable is created by multiplying the logarithm of one plus the percentage of net debt financing with the time (in days) between the IPO and the first available net debt realization. The interaction effect is measured by regressing the adjusted initial return on the interaction variable along with the logarithm of one plus the percentage of net debt financing (leverage).

Table 9 presents the corresponding regression estimates after the inclusion of the interaction variable (Model II) and another specification in which only the net debt financing is included as an independent variable (Model I). The percentage of net debt financing is economically and statistically significant in both specifications. Model II demonstrates that there is no interaction between the variables with a non-significant coefficient for the interaction term. This means that the effect of the leverage on the initial returns does not depend on the time when we measure it. The absence of such interaction reinforces our belief that the net debt financing variable is a reasonable measure for the uncertainty about the issue.

Table 9

Cross-sectional regression estimates from regressing the adjusted initial-day return on the leverage and interaction variable for 72 J-REIT IPOs between 2001 and 2018.

	Model I	**Model II**
Intercept	0.147 (4.80)***	0.146 (4.72)***
ln(1 + leverage)[a]	-0.389 (-4.38)***	-0.351 (-3.31)***
ln(1 + leverage)[a] * Time[b]		-0.000 (-0.65)
Adjusted R2 (%)	20.42	19.76
F-statistic	19.22	9.74
Number of observations[c]	72	72

This table presents the ordinary least squares regression with the adjusted initial-day return as the dependent variable. The adjusted initial-day return is the raw initial-day return minus the contemporaneous return on the Nikkei 225 Index. [a]Leverage refers to the ratio of net debt to net debt plus the market value of equity (ND/(ND+E)). [b]Time refers to the time (in days) between the initial public offering and our first available net debt realization. The interaction variable is created by multiplying the logarithm of one plus the leverage with the time variable (Time). [c]Three outliers with an adjusted initial-day return of more than three standard deviations from the mean are excluded from the regression sample. T-statistics in parentheses. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

7.2 Addressing the Right Benchmark

As illustrated by our empirical findings and previous research (Dimson and Marsch, 1986), the aftermarket performance is very sensitive to the selected benchmark. We follow the approach of Wang et al. (1992) and Chan et al. (2013) and use the returns of local stock market indices as the benchmark for the REIT returns. In addition, we complement the analysis with another benchmark, namely the returns estimated by the Fama and French three factor (FF-3F) model. Although we believe these benchmarks are reasonably appropriate in evaluating the IPO aftermarket performance, they are not free from limitations.

Barber and Lyon (1997) point out that using reference portfolios as a benchmark to calculate cumulative adjusted returns is associated with an inherent listing and skewness bias. They argue that adopting a control firm approach, in which a set of comparable firms matched by size, industry and other characteristics serves as the benchmark, can eliminate the issues associated with reference portfolios. Although this methodology is appealing in theory, it is unfortunately not feasible in our case. First, our sample already includes all listed and de-listed REITs in Japan that have ever existed. For this reason, it is not possible to create a portfolio of matching J-REITs which are not part of the sample itself. Second, creating a matching firm portfolio of non-Japanese REITs would bring in other sources of potential biases by adding country-specific effects.

Another approach would be to benchmark the performance of our sample against a REIT index, which is the method used by Ling and Ryngaert (1997). One may argue that a REIT index better control for industry effects and thus serves as a more appropriate benchmark. However, given that our sample consists of all REIT IPOs in Japan since the first listing in 2001, it is not possible to obtain a J-REIT index that is not comprised of the observations in our sample. While more methodological options are available for the U.S. where REITs exist since 1960, our study is somewhat restricted by the lower number of IPOs having occurred in Japan.

Lastly, we would like to point out a limitation of the FF-3F benchmark. Since there exists no data on the REIT returns prior to the IPOs, the estimation period for the FF-3F estimates refers to the time of the respective IPO up until September 2018. Ideally, the estimation should be carried out before the event itself. For this reason, we emphasize that this measure aims to complement our analysis rather than serving as the primary benchmark.

8 Conclusion

This paper sets out to investigate the pricing of initial public offerings of real estate investment trusts. As the previous research on the area offers no clearly consistent empirical evidence, we attempt to extend the existing literature by providing additional insights from Japan. By examining the most comprehensive sample of J-REIT IPOs ever considered, we find evidence of systematic underpricing with significantly positive initial-day returns. Our results also demonstrate that the initial-day returns are negatively related to leverage and vary with the type of property. In addition, we find that less commonly issued property types are priced with deeper discounts at the IPO. These findings are all in line with underpricing explanations that are based on valuation uncertainty and heterogeneously informed investors. As such, our study clears some of the doubts raised by Wang et al. (1992) on the completeness of existing underpricing models in explaining the pricing of REIT IPOs.

Furthermore, our findings suggest that the sample of J-REITs outperform several benchmarks over the 18 months following the IPO. Consistent with previous research on industrial firm IPOs, we also find that larger issues are associated with stronger performance in the aftermarket. Additionally, we show that the initial-day returns are negatively related to the aftermarket performance. This result contradicts underpricing explanations in which the underpricing serves as a signal of a higher-quality issues. We interpret this tendency as a potential overreaction by the market, where prices may temporarily deviate from its fundamental values. Collectively, our empirical findings shed light on the validity of underpricing theories in the context of REITs and provide insights that may also extend to other new-issues markets.

While our study does not measure the degree of institutional involvement in the IPOs, it is likely that a larger number of institutional investors is associated with greater information asymmetry and thus higher levels of underpricing. Complementing our study by exploring the institutional involvement and its effects on the underpricing of J-REITs represents an interesting and valuable task for future research. Moreover, the possibility of behavioral explanations for the negative relationship between the initial returns and subsequent aftermarket performance warrants further investigation.

9 References

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10 Appendix

Table A.1

Annual distribution of the number of offerings, average adjusted initial returns and total issue size for the sample of 75 J-REIT IPOs between 2001 and 2018.

Year	Number of observations	Average initial return (%)	t-statistic	Number of IR > 0	Number of IR = 0	Number of IR < 0	Total issue size (bn Yen)
REIT IPOs partitioned by year							
2001	2	4.24	1.61	2	0	0	135.8
2002	4	-0.51	-0.46	2	0	2	140.5
2003	4	-0.02	-0.05	2	0	2	188.5
2004	4	3.82	3.07*	4	0	0	163.6
2005	13	1.01	0.42	7	0	6	398.0
2006	12	-0.08	-0.03	6	0	6	645.6
2007	2	19.46	0.91	1	0	1	66.3
2008	0	NA	NA	0	0	0	NA
2009	0	NA	NA	0	0	0	NA
2010	1	-1.53	NA	0	0	1	27.3
2011	0	NA	NA	0	0	0	NA
2012	4	-0.25	-0.10	2	0	2	265.2
2013	6	7.64	1.65	4	0	2	430.0
2014	6	17.54	2.64**	6	0	0	226.1
2015	6	11.52	1.38	4	0	2	133.6
2016	7	-4.41	-1.28	2	0	5	288.1
2017	2	4.88	1.80	2	0	0	94.5
2018	2	0.57	0.78	1	0	1	44.4
Total	75	3.61	2.60**	45	0	30	3247.5
REIT IPOs partitioned by period							
2001 - 2003	10	0.64	0.76	6	0	4	464.8
2004 - 2006	29	0.95	0.59	17	0	12	1207.2
2007 - 2009	2	19.46	0.91	1	0	1	66.3
2010 - 2012	5	-0.51	-0.25	2	0	3	292.5
2013 - 2015	18	12.23	3.25***	14	0	4	789.7
2016 - 2018	11	-1.81	-0.74	5	0	6	427.0
Total	75	3.61	2.60**	45	0	30	3247.5

This table presents the annual distribution of the number of initial public offerings, average adjusted initial-day returns, total issue size (in billion Yen), and number of positive, negative and zero adjusted initial-day returns between January 2001 and April 2018, partitioned by year and period. T-statistics are presented for a two-tailed test. *, ** and *** denote significance levels of 10%, 5% and 1%, respectively.

Table A.2

Summary statistics on the adjusted initial-day returns for a sample of 75 REIT IPOs between 2001 and 2018, partitioned by period, issue size, leverage and property type.

	Number of observations	Average initial return (%)	Standard deviation (%)	Median initial return (%)	Minimum initial return (%)	Maximum initial return (%)	t-statistic
Full sample	75	3.61	12.01	1.61	-12.65	48.17	2.60**
REIT IPOs partitioned by period							
Pre-financial crisis[a]	41	1.78	9.62	0.91	-12.02	40.84	1.18
Post-financial crisis[a]	34	5.82	14.21	4.14	-12.65	48.17	2.39**
REIT IPOs partitioned by issue size							
Large issues[b]	16	6.80	8.79	6.44	-5.99	23.50	3.09***
Medium issues[b]	34	2.73	10.28	1.72	-12.65	40.84	1.55
Small issues[b]	25	2.76	15.57	-0.16	-12.02	48.17	0.89
REIT IPOs partitioned by percentage of net debt financing							
High leverage[c]	37	0.19	12.35	-1.89	-12.65	48.17	0.10
Low leverage[c]	38	6.93	10.82	4.87	-11.08	47.96	3.95***
REIT IPOs partitioned by property type							
Residential	17	-1.06	12.20	-3.27	-12.02	40.84	-0.36
Offices	14	1.44	6.81	1.91	-9.63	16.10	0.79
Retail	4	7.44	7.32	7.79	-1.85	16.03	2.03
Logistics	7	10.77	8.91	7.60	-0.16	23.50	3.20**
Hotels	7	3.21	10.40	3.18	-11.08	16.75	0.82
Other[d]	4	22.16	30.16	24.52	-8.56	48.17	1.47
Diversified[e]	22	2.37	8.20	0.75	-12.65	19.68	1.36

This table presents summary statistics on the adjusted initial-day return for a sample of 75 J-REITs from January 2001 to April 2018, partitioned by period, issue size, leverage and property type. [a]Pre-financial crisis refers to the period between January 2001 and the 31st of 2007, and post-financial crisis refers to the period between the 1st of January 2008 to April 2018. [b]Large issues correspond to an issue size > 60 billion Yen, medium issues correspond to an issue size ≤ 60 and > 25 billion Yen and small issues correspond to an issue size ≤ 25 billion Yen. [c]Leverage refers to the ratio of net debt to net debt plus the market value of equity (ND/(ND+E)). High leverage refers to J-REIT IPOs with a ratio of > 40% and low leverage refers J-REIT IPOs with a ratio of ≤ 40%. [d]Other includes for example healthcare facilities and 'specialty areas' of real estate. [e]Diversified REITs specialize in more than one area of real estate investing. T-statistics are presented for a two-tailed test. *, ** and *** denote significance levels of 10%, 5% and 1%, respectively.

Table A.3

Average benchmark-adjusted returns and cumulative average benchmark-adjusted returns for the 18 following the IPOs for 75 J-REIT IPOs between 2001 and 2018, using the value-weighted TOPIX Index as the benchmark.

Month of seasoning	Number of observations	AAR (%)[a]	t-statistic	CAAR (%)[a]	t-statistic[b]
1	75	2.30	1.49	2.30	2.66***
2	75	-0.50	-0.58	1.80	1.51
3	75	-1.34	-1.70*	0.46	0.32
4	75	0.50	0.49	0.95	0.57
5	75	0.51	0.56	1.46	0.79
6	75	1.23	1.59	2.69	1.33
7	75	0.36	0.51	3.05	1.40
8	73	1.37	1.59	4.42	1.87*
9	73	0.53	0.52	4.95	1.97*
10	73	1.20	1.65	6.15	2.33**
11	73	0.90	0.88	7.05	2.54**
12	73	-1.22	-1.63	5.82	2.01**
13	72	0.38	0.56	6.20	2.05**
14	72	1.83	2.79***	8.03	2.55**
15	72	-0.36	-0.47	7.66	2.35**
16	72	-1.02	-1.46	6.64	1.98*
17	72	0.78	0.87	7.42	2.14**
18	72	0.92	1.48	8.34	2.34**

This table presents the average TOPIX-adjusted returns (AAR) and cumulative average TOPIX-adjusted returns (CAAR) along with the corresponding t-statistics for the 18 months after going public. [a]Excluding the initial-day return; [b]Details on the calculation of the t-statistics are provided in Section 5. *, ** and *** denote significance at 10%, 5% and 1%, respectively.