ICMBF

4th International Conference on Advanced Research in
MANAGEMENT, BUSINESS & FINANCE

Berlin, Germany
11-13 March, 2022

J-Reit Investment Utilizing Mobile Spatial Statistics

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Abstract

In this paper, we propose an idea of investing strategy on J-REIT (Japan REIT) by utilizing Mobile Spatial Statistics (MSS). More specifically, we counted the number of mobile phone users, who permitted us to analyze, mesh by mesh (MSS) and utilized these statistics to estimate operating rate of specific real estate which are included in the target REIT portfolio. Firstly, we checked its correctness by comparing with actual monthly occupancy rate officially disclosed on IR (answer data). And after our confirming its accuracy, we utilized daily operating rates for daily investing judgement to improve its efficiency. We supposed that we take long position when the standardized occupancy rate (SOR) is high (SOR is greater than upper threshold) and we take short position when the SOR is low (SOR is smaller than lower threshold). Otherwise, we supposed to take sideline strategy (neutral position). Our numerical experiments indicated that our strategy's performance resulted better than 24% annual return and its sharp ratio was better than 14 for almost two years' verification. These numbers are enough excellent to be included in the list of top performance J-REIT fund reported/aggregated by Morningstar [1]. We obtained above results by utilizing clearly classified training and verification data. We standardized daily data only with training / historical data (N-days historical data for each trading day) also decided/set daily trading threshold only with historical data (M-days historical SOR). We introduce detail settings and further experimental results in our presentation.

Keywords: Big Data analytics, Alternative Data, Machine Learning, AI in Finance

1. Introduction

The Due to extremely low interest rate environment caused by worldwide QE, many investors are seeking better return and focusing on alternative financial products especially J-REIT. Actually, its market is expanding rapidly and became second largest financial market in Japan [2]. There are many risk factors embedded in REIT. They are market liquidity, damage from natural disaster, and so on. [3] One of the most direct/influential risk factors is invested/backed assets' timely revenue level. These numbers are included / disclosed in their IR reports. The problem is that they are not disclosed timely manner, but it takes six months at least. Investors need to take their positions without any proper information. When they are disclosed, it is already too late to utilize. In our presentation, we propose to leverage MSS for capturing timely operating level of assets and to utilize them for trading. As explained later, trading process is that we exclude seasonality and systematic effects from data, standardize, set judgement thresholds with training data, and test its performance with verification data. Before our stating model explanation, we briefly mention two important points. They are accounting perspective theoretical correlation and rare event count stabilizing system. Let us explain from the correlation. We clarify the intrinsic difference in relationship of revenue and profit between corporation and J-REIT. REIT stands for Real Estate Investment Trust. J-REIT asset manager invests to real estates (like hotels, office buildings, logistics base, and so on). J-REIT receives rent income from investing real estates. And it pays dividend to investors after its subtracting operating / management costs. The business model is quite similar with common real estate leasing company. But the different point is that companies pay dividends out of profit after paying corporate tax and subtracting retained earnings. Corporate tax rate in Japan is around 23%. While J-REIT is exempt to pay corporate tax on the condition of paying out more than 90% profit as dividends. Then this regulation lets J-REIT to be profitable and attractive to investors. Simultaneously, the relationship between revenue of J-REIT and dividend becomes strong because we can regard J-REIT profit (almost dividends) as being equal almost to its profit: revenue minus cost.

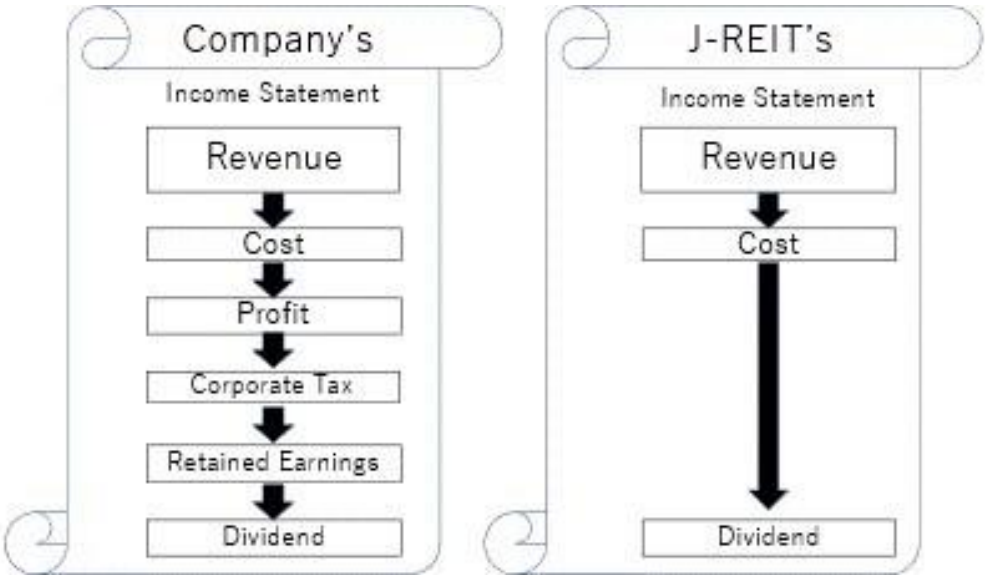

Fig.1: P/L statements of corporation and J-REIT. Corporation's P/L is shown on the left and J-REIT's P/L is on the right. Corporation needs to pay corporate tax and keep retained earnings before it pays dividend. While J-REIT pays dividend more than 90% of profit.

The important characteristics of this is that J-REIT has strong correlation between its revenue and dividend. Namely, we can have good dividend prediction by well estimating revenue. As introduced its mechanism below, good estimation of dividend brings good estimation of its stock (security) price. When we fix the payout ratio as 90%, the correlation between revenue and dividend under fixed cost can be calculated as below[1]:

$Div := 0.9 \times (Rev - Cost),\ V[Div] = 0.9^2 \sigma_{Rev}^2$

$Cov(Rev, Div) = E[(Rev - E[Rev])(Div - E[Div])] = 0.9 \sigma_{Rev}^2$

$\rho(Rev, Div) = 0.9 \sigma_{Rev}^2 / (\sigma_{Rev} \times 0.9 \sigma_{Rev}) = 1$ where cost is

constant: $Cost = E[Cost]$

Then, correlation between its revenue and dividend is calculated as one. When cost moves in relation with revenue, the correlation between revenue and dividend is calculated as below:

[1] Rev: Revenue, Div: Dividend

Cost:=x Rev, $V[Div]=0.9^2 (1-x)^2 \sigma_{Rev}^2$

$Cov(Rev, Div) = 0.9 (1-x) E[(Rev-E[Rev]) (Rev-E[Rev])] = 0.9(1-x)\sigma_{Rev}^2$ ρ(Rev,

Div)$=0.9(1-x)\sigma_{Rev}^2 / (\sigma_{Rev}\times 0.9(1-x)\sigma_{Rev})=1$

Then, correlation between its revenue and dividend is calculated as one. This strong correlation indicates that we can have good prediction on J-REIT's dividend by having good prediction on its revenue. We created prediction model in consideration of these important characteristics. More specifically, they are firstly J-REIT is exempted to pay corporate tax by paying more than 90% profits and secondly J-REIT has strong correlation between its revenue and dividend. Next, we explain the rare event counting system. In this paper we utilize the number of signals observed within the target area and utilize them for accurate revenue prediction. For example, when we estimate revenue of J-REIT which owns hotels, we count the number of signals within the target hotel. But the problem is that the area is not so large and not enough/stable number of signals are observed. Then we expand the area to include neighbor and similar purpose place to be observed as below figure. As you can see in below figure 2, there are three shapes (rectangles, triangles, and circles) and shapes indicate purpose of the space. When we target to observe the center rectangle and the target is not so large, we observe other rectangles area and add them with some weight.

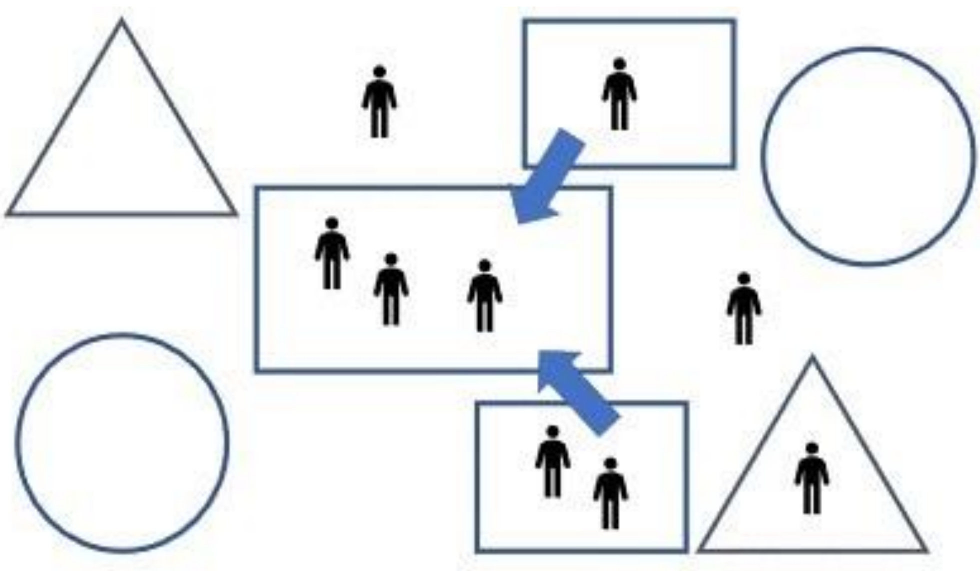

Fig. 2: Observation image: Shapes of area indicate their purpose and person epigrams are their location where smartphone signals observed. Three signals (small number) are observed. This is not effective for stable and accurate revenue prediction. In this kind of case, we consider neighbor (around target area) and same purpose area (rectangles).

2. Model

2.1 MSS (mobile spatial stats) & Stock price

Let us emphasize the points again. One of the most important characteristics of J-REIT is its corporate tax exemption on condition that it pays dividends of more than 90% profits. Additionally, J-REIT funds are recommended/requested to be stable. When J-REITs are examined to be listed on the market and of course afterwards, they are advised to invest on real estates which enable them to have stable and continuity operation. [3] These points imply stable or almost constant operating cost also there is strong correlation/relationship between revenue (A) and profits (a), le operating rate of invested assets (B) and profits (a), namely operating rate (B) and dividend (b), finally operating rate (B) and stock price[2](c)[2]. We don't need to predict retained earnings ratio and/or dividend payout ratio like usual firms. Because J-REITs are exempted to pay corporate tax under condition of paying out almost their profit to investors.

There are many types of J-REIT in Japan. Firstly, it can be divided into two categories: single and multiple. Single category includes only one type: office, hotel, residence, warehouse, commercial facility, logistics facility, and so on. Multiple categories include more than two kinds of single types. We supposed that MSS would be effective especially for hotel type

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Let P, d, r [2] Be stock price, dividend, and discount rate. As well is expressed as $P = d/r$

Known, sum of discounted dividend because the population (the number of hotel guests) could be nearly equal to the hotel occupancy rate (the number of occupied hotel rooms) with high potential. If we chose shopping mall type, we need to estimate purchasing amount in the target shopping mall after our estimating

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[2] "A" can be replaced by "B" in the same way, "a" by "b" and "c". When A has relationship (∼) with a, B∼a, B∼b, and B has relationship with c.

Population. That is why, we test hotel type first. Tests for other types and category is our future work.

2.2 Mesh by Mesh population

Let $A, T, u(i,k,t),$ and $\#A(T^k)$ be target observing area, counting time span, location of user #i at time t of date k, and the number of populations in the area of A during T^k. We increment the number of population when user's location is included in the observing area based on the following equation.

$$\#A(T^k) := \sum_{i=1}^{n} \mathbf{1}_{\left\{\int_{s\in T^k} \mathbf{1}_{\{A\cap u(i,k,s)\neq\emptyset\}} \mathbf{ds}>0\right\}} \quad (1)$$

where function $\mathbf{1}_{\{x\}}$ outputs 1 if x is true, otherwise outputs zero. When we count the number of people during multiple time span, we use following formula.

$$\#A(T_j^k) := \sum_{i=1}^{n} \prod_{j=1}^{m} \mathbf{1}_{\left\{\int_{s\in T_j^k} \mathbf{1}_{\{A\cap u(i,k,s)\neq\emptyset\}} \mathbf{ds}>0\right\}} \quad (2)$$

where time spans: T_j^k are disjoint with each other. ($T_a^k \cap T_b^k = \emptyset, a \neq b$). After our estimating population mesh by mesh or target area, we put slight adjustments to exclude noise like trend[3]. Also, we take the expansion estimate[4]. Simply speaking, we utilized following formula for precise estimation.

$$\#\tilde{A}(T^k) := \#A(T_j^k) + \sum_{i=1}^{n} \omega_i \times \#A_i(T_j^k) \quad (3)$$

where ω_i is weight calculated based on the similarity with target. The more area A_i be similar to the target, the higher weight will be given. All weights are positive and the sum of all weights is equal to 1 ($\sum \omega_i = 1$). A_i are disjoint ($A_i \cap A_j = \emptyset, i \neq j$). This expansion is necessary to make up for the lack of observable users and prepare reliable dataset.

[3] Our population is not covering entire mobile phone users. We can observe only our carrier users. Furthermore, we can observe only who permitted us to analyze and installed specific applications on their mobiles. Then, we have to put minor modification for excluding possible noises before starting analysis.

[4] This expansion estimation method is submitted to be registered to patent office in Japan. [5] Details are explained in our presentation.

3 Numerical experiments

3.1 Fluctuations of Stock & operating rate

As mentioned, we chose hotel type REIT for numerical experiments. There are 4 hotel type REITs in Japan out of 63 listed REITs. We picked up one product (Mori trust hotel REIT #3478 [6]) which is investing to 4 large size hotels. 3 hotels are closely around Tokyo station and 1 hotel is located near Osaka station.

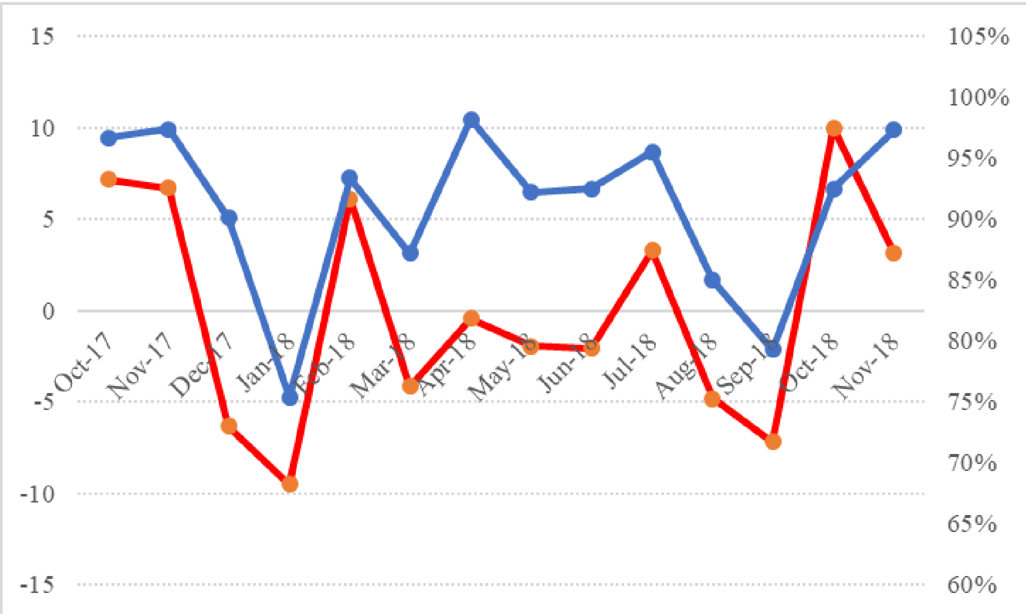

Fig.3. Blue line indicates historical operation rate of hotel in Osaka (right vertical axis). Red line indicates historical population we observed (left vertical axis).

Fig.3 shows two lines fluctuate conjointly then strong relationship is observed. Actually, the correlation is around 75.5%. Wide drop happened in September 2018 was caused by the natural disaster (Typhoon 21st). In the next step, we check trading efficiency when we utilize daily operation rate.

3.2 Trading test

Here, we test efficiency of our strategy for trading. We calculate daily operating rate and utilize them for trading strategy. Simply, we prepare two thresholds: upper threshold and lower threshold for judgement. They are set to optimize daily sharp ratio to be the best for each trading data.

$$\{Upper\ (t),\ lower\ (t)\} = argmax\ \{sharpratio\ (Data\ (t))\} \quad (4)$$

We take long position when we observe high operation rate: operation rate is higher than upper threshold, while we take short position when we observe low operation rate: operation rate is lower than lower threshold. Otherwise, we take sideline strategy (cash position). We buy the stock at opening price and sell at closing price for long position. We sell the stock at opening price and buy back at closing price for short position. Namely, we take positions only when the market opens. To realize fair test, when we decide trading strategy, we use only past information. Let $Data(t)$ and $Trade(t, upper(t), lower(t))$ be available information accumulated by time t and trading result at time t We repeat these strategies from October 2017 to April 2019. See figure 4 for training and trading procedure and 5 for our trading test.

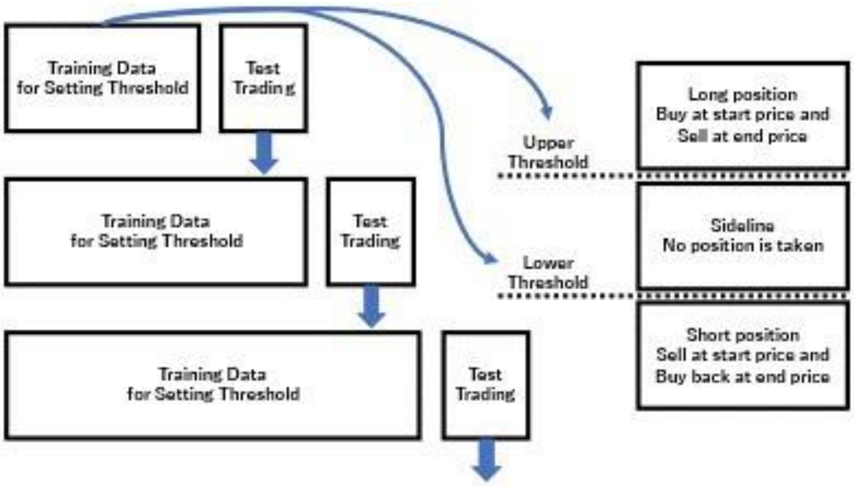

Fig. 4. This figure indicates how we treat data for setting upper and lower threshold for trading. Financial time series data increase day by day. We utilized data just before trading day and completely separated training data and test (validation) data. Upper and Lower threshold are given as to maximize sharp ratio (return risk ratio) for each training data.

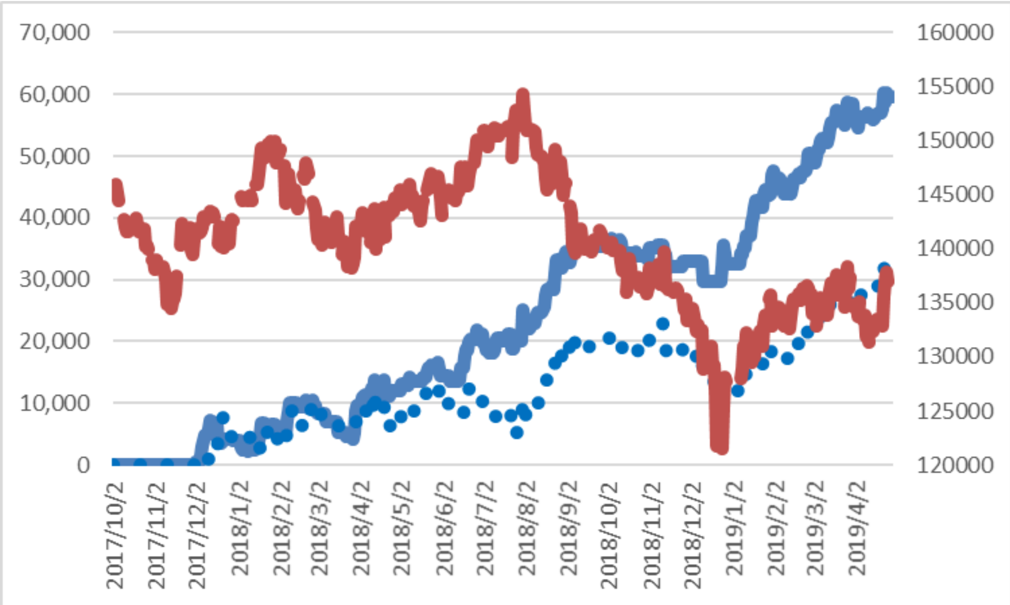

Fig.5. Blue line indicates historical cumulative profits (right vertical axis). Solid line is for 20 days' standardization and dotted line is for 10 days. Red line indicates historical closing price of #3478 REIT (left vertical axis). Details are explained in our presentation.

From above, excellent performance was observed. Out strategy's annual return was 24.74% and sharp ratio was 14.9. According to [1], the best sharp ratio was 3.21 and its annual return was 6.58%, the second-best sharp ratio was 3.18 and its annual return was 6.55%, and the third best sharp ratio was 2.84 and its annual return was 5.08% during same time window. Also, current pandemic sharply hit hotel type J-REITs and their price are dropping due to their poor operation rate. Our strategy enables us to effectively and timely trade.

4 Conclusion

In this paper, we proposed new trading strategy which enables us to invest J-REITs effectively by utilizing Mobile Spatial Statistics as above explanation. In our future work, after our improving current study more, we challenge to analyze other types of J-REIT. Now we are focusing especially on the shopping mall type. As mentioned above, this type requires researchers to consider purchasing power of each customer for accurate shipping mall's revenue prediction. We plan to characterize it by their living place, age, visiting area, working area and so on. Additionally, we plan to utilize automobiles' location data. This enables us to consider car types. They are for example luxury car, family car, sports car and so on. We use them to characterize area first and next we utilize characterizing smartphone users.

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