Risk of retail REITs during the Covid-19 pandemic

BSc thesis Spatial Planning & Design

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Abstract

This research investigates the risk of retail Real Estate Investment Trusts (REITs) during the 2020 Covid-19 pandemic. It computes daily beta values for fifteen retail REITs, all from different countries, and relates these to strictness of Covid-19 policy of the same fifteen countries. Covid-19 policy strictness is proxied by daily Stringency Index values, computed by researchers at the University of Oxford. A descriptive analysis of daily retail REIT beta values and simple linear regression models is performed. The results indicate that investment risk of retail REITs rises during the Covid-19 pandemic and that investment risk of retail REITs is positively related to strictness of Covid-19 measures. The findings of this study can have implications for investors of retail REITs.

1. Introduction

The Covid-19 pandemic has a profound effect on almost all aspects of 'normal life' as it was before. The financial markets have been affected considerably as well. Stock market indices fell dramatically early March 2020 (Mazur et al. 2020). The real estate investment markets have been affected as well, even though this industry is considered as stable and low risk (Zhou, 2012) & (Alias & Tho, 2011). As governments imposed lockdown restrictions, commercial real estate experienced a lack in usage of space, resulting in tenants being unable to pay rent to companies that own the real estate (Akinsomi, 2020). There is clear link between performance of tenants and stock market performance of these public real estate investment companies (Chen et al. 2018). The adverse effects on real estate markets form a large societal problem, as the real estate investment industry is enormous in both economic value and popularity (Philippas et al. 2013), also among individual investors. Although the societal problem is large, we have little knowledge on the behaviour of real estate markets in the current pandemic situation.[1]

Therefore, this research investigates Real Estate Investment Trusts (REITs) during the year 2020, which is dominated by the Covid-19 pandemic. REITs are companies that invest in real estate by pooling investments from individuals (Philippas et al. 2013). REIT shares can be traded as stocks on stock markets (Zhou, 2012). REITs are considered as attractive investments, involving low risk and stable returns (Akinsomi, 2020; Alias & Tho, 2011; Zhou, 2012). However, under-utilised real estate due to Covid-19, such as empty hotels, offices or shopping malls, adversely affected the performance of REITs on stock markets. As such, the nature of low risk and stable returns of REITs, can be affected by Covid-19. Therefore, this study asks:

How does the risk of retail REITs behave in relation to Covid-19 pandemic circumstances?

This research will use quantitative data to describe how the risk of retail REIT stocks behaves during, and relates to, Covid-19. Retail REITs own and manage retail real estate, such as shopping malls, and lease retail space back to tenants (Benjamin & Chinloy, 2004; Yung & Nafar, 2017). As Covid-19 measures resulted in a considerable setback of physical shopping,

[1] Real estate markets appear to benefit from stable economic conditions. Ewing & Payne (2005) find that returns of real estate stocks fall in response to macroeconomic shocks such as monetary policy shocks, unanticipated changes in economic growth and inflation news. Mazur et al. (2020) report stocks in the real estate sector fell dramatically in March 2020. Akinsomi (2020) specifies that hospitality, retail and office sectors experienced the largest negative returns of US real estate stocks during March and April 2020.

shop owners were less able to pay rent to retail REITs (Akinsomi, 2020). The US retail REIT sector experienced negative returns of -48.74% in March 2020 (Akinsomi, 2020). As particularly the retail sector was affected during Covid-19, an investigation on systematic risk of retail REITs, in the light of the low risk nature of REITs, might provide useful insights.

Retail REIT risk will be represented by the measure beta. Beta is a measure of the systematic risk, or volatility, of a stock compared to the market as a whole (Kenton 2020). Beta is represented by a coefficient that estimates the volatility of a stock's returns as response to swings in the entire market (Kenton 2020). Daily beta of fifteen retail REITs will be related to strictness of Covid-19 policy. This strictness will be represented by the Stringency Index; a daily index that measures the strictness of a governments' response to Covid-19, computed by researchers of the University of Oxford.

2. Theoretical framework

2.1 Retail REITs

The structure of Real Estate Investment Trusts (REITs) as legal entities was introduced in the United States in 1960 to enable smaller investors to earn dividends from large scale provide smaller investors access to large-scale income-producing real estate (Chen 2020). A REIT owns properties and collects rents paid by tenants, then distributes that income as dividends to investors, who possess shares in the REIT (Chen 2020). Legislation obliges REITs to distribute a large part of its cash flow (usually 70%-100%) as dividends to shareholders (Akinsomi, 2020; Boudry, 2011; Chen 2020). Investors in REITs avoid disadvantages such as illiquidity, and managing and financing real estate, while benefitting from a stable income stream and the liquidity of REIT stocks (Chen 2020).

The underlying mechanisms of REIT performance and risk are determined by the REIT, its tenants and investors. Retail REITs, in addition to a base rent, frequently also collect rent as a percentage of tenants' sales (overage rent) (Myer & Webb, 1993). This increases risk-sharing between tenant and retail REIT (Staley, 2012), as decreasing sales of the tenant results in less rent collected by the REIT. Considering that rent paid by tenants forms the cash flow to REITs and eventually as dividends to investors, investors generally pay attention to (potential) financial performance of tenants (Chen et al. 2018). Tenant performance therefore can determine whether investors wish to purchase or sell REIT shares. This determines market

prices of REITs and REIT returns; stock price is determined by supply and demand (Harper 2019), and stock returns are determined by stock prices (Hayes 2020). Subsequently, the investment risk of REITs is based on REIT returns (Kenton 2020), which show a positive relationship with tenant performance (Chen et al. 2018).

2.2 Risk

As the focus of this study is the risk of retail REITs during Covid-19, we now turn to a measure of understanding investment risk: beta. The beta coefficient estimates the change in a stock's return as response to a change in market as a whole (Kenton 2020). The 'whole market' is represented by a chosen stock market index, such as the S&P500 in the US, or the AEX in the Netherlands. A stock that has a beta of 1.0 indicates that the stock's volatility follows that of the market as a whole. A stock that has a beta of 0.2 indicates that, in theory, the stock's returns rises 2% when the market rises 10%, and falls 2% when the market falls 10% (Lioudis 2019). This stock can therefore be considered to have low so-called 'systematic' risk, compared to the overall market. The opposite is applicable for a stock that has a beta (clearly) higher than 1.0.

The beta of a stock can be calculated by the covariance of the stock's returns with the market returns, divided by the variance of the market returns (Fama & French, 2003). Historical price data for the stock and chosen market index are required for this calculation (Jassy 2020. As there is no universal time period and data interval for the calculation of beta, a daily, weekly or monthly interval, for a selected time period, can be used (Jassy 2020). Regardless of which intervals and time periods are appropriate to use, the most important factor is being consistent in the methodology applied when making inferences about various stocks based on beta coefficients (Jassy 2020; Lioudis 2019).

2.3 Risk and Covid-19 Policy

In the light of determinants of REIT performance and risk, mentioned in section 2.1 above, severeness Covid-19 policy can influence retail REIT risk through certain mechanisms. As the fear of Coronavirus and the uncertainty in the stock market rose (Lyósca & Molnár, 2020), governments started to impose measures due to Covid-19, such as social distancing and movement restrictions (lockdowns) (Akinsomi, 2020). The existence of these factors, along

with bad pandemic news (Davis et al. 2020) and easily accessible information regarding tenants of retail REITs (Chen et al. 2018), resulted in large negative returns for retail REIT stocks (Akinsomi, 2020). Investors likely displayed "flight to quality" (Akinsomi, 2020), by shifting out of high-risk investments to reduce portfolio beta and risk exposure, similar to the 2008 financial crisis (Chen 2020; Devos et al. 2012).

"Flight to quality" behaviour of investors, due to uncertainty regarding tenants of retail REITs during a pandemic, was based on forthcoming developments in the physical retail sector. Covid-19 measures particularly affected the retail sector; shopping malls received less visitors and shops experienced reduced sales (Akinsomi, 2020). Tenants of REITs were less- or unable to pay rent (Akinsomi, 2020). Apart from collecting less base rent, as some retail REITs issued rent concessions (Akinsomi, 2020), retail REITs were also likely to collect less overage rent (see section 2.1), as these rents are tied to (reduced) sales (Myer & Webb, 1993). Global REITs experienced difficulty to meet legal obligations of distributing dividends to investors (Akinsomi, 2020).

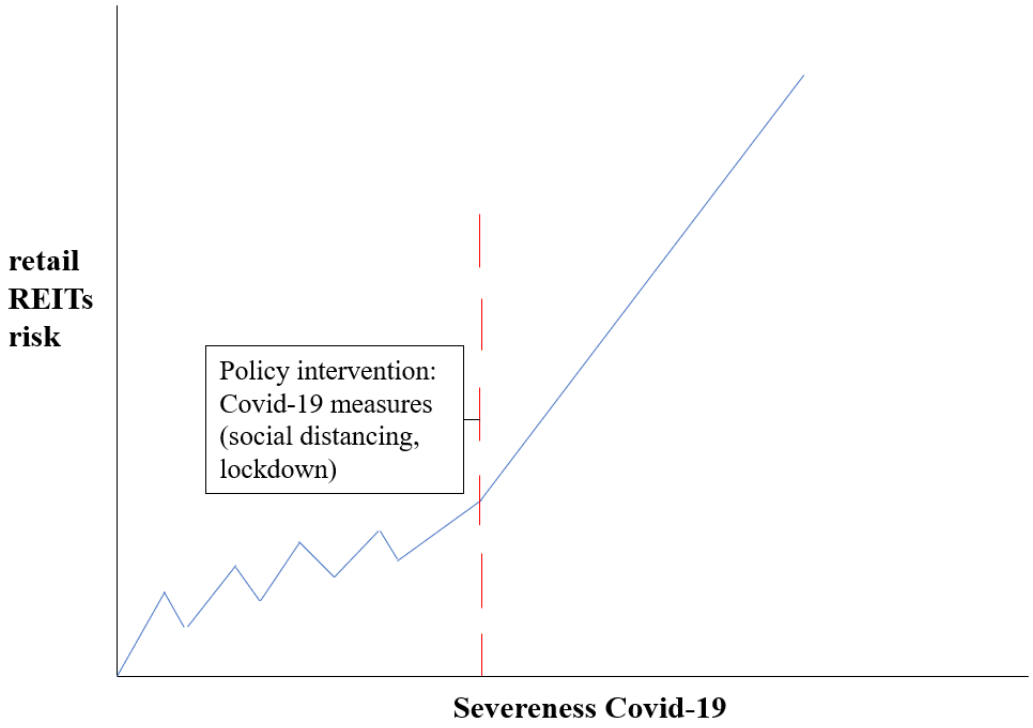
The prospect of cut dividends, as a result of the mechanisms mentioned above, is one investors typically wish to avoid. Investors therefore sell their retail REIT stocks. The result is a greater supply than demand of retail REIT stocks, resulting in decreasing retail REIT prices and returns (Harper 2019; Hayes 2020) (see section 2.1). When retail REIT returns behave more volatile than the overall market, this influences their beta (see section 2.2); which is the measure of risk used in this research.

2.4 Conceptual model

Figure 1 below represents a simple visualization of the conceptual model of this study.

As Covid-19 policy in a country becomes more severe, risk of retail REITs could rise, based on the mechanisms explained above in sections 2.1-2.3. At the point in time when a government of a certain country imposes severe Covid-19 measures (e.g. lockdown), risk of retail REITs (based in that country), could rise sharply, as explained in section 2.3 above.

Figure 1 – Conceptual model.



3. Methodology

3.1 Quantifying REIT risks

This study uses the measure beta to quantify risk of retail REITs. Even though risk of stocks is difficult to quantify, beta is one of the most widely used indicators to do so (McClure 2020).

Daves et al. (2000) in a study on appropriate time interval and time period when calculating beta, conclude that one should always use price data with a daily interval for the highest precision of beta, as daily returns keep the standard error of beta at a minimum. Daves et al. (2000) also state that a three-year period is most suited when calculating beta, as it captures a maximum of standard error reduction, while not being biased (and therefore less useful) as a result of using longer time periods.

Therefore, this study calculates beta using data with a daily interval for a time period of three years. To analyse the gradual development of retail REIT beta just before and during the pandemic, and to be able to relate beta to daily Covid-19 policy severeness (section 3.3), this

study calculates daily beta for each day of the 1-11-2019 until 20-11-2020 period. In order to meet the criterium of a three-year period, each daily beta value is calculated using three years of daily data before that specific day. The beta value calculated for e.g. the date 13-1-2020, is thus based on daily data of the 13-1-2017 until 13-1-2020 period.

To calculate beta, we first need to calculate the returns of the stock and the market index, using obtained 'adjusted close' prices of the stock and the market index (Lioudis 2019). The 'adjusted close' price reflects a stock's price at the end of a trading day, after adjusting for any corporate actions, such as distributed dividends (Dadakas et al. 2016; Ganti 2020). A return represents the percentage change of the adjusted close price (Adj close) from the prior day to the current day (Nickolas 2020). A stock's or market's return on a given day is therefore calculated by (Nickolas 2020):

$$(1) \quad Return = \frac{current\ Adj\ close - yesterday's\ Adj\ close}{yesterday's\ Adj\ close}$$

This calculation is repeated for all days in the dataset. With the stock and market index returns for a three-year period, we can calculate beta using the following formula:

$$(2) \quad Beta = \frac{Cov(Rs, Rm)}{Var(Rm)}$$

where the numerator is the covariance of the stock's returns (Rs) with the market's returns (Rm), which measures how the stock's returns move relative to the market index returns (Nickolas 2020). The denominator represents the variance of the market's returns (Rm), which measures how the market index returns move relative to its mean (Nickolas 2020).

This calculation is repeated for all days of the 1-11-2019 until 20-11-2020 period. The criterium of using three years of daily stock and market index returns is met for every repetition of the calculation[2]. The retail REIT and market index data used in the calculations will be discussed in the following paragraph.

[2] There is a side note worth mentioning regarding the daily REIT and market data used. Stock markets are generally closed in the nights, the weekend and on national holidays. A year's REIT and market data therefore does not include 365 days, but generally around 250 days, depending on the country. Of the fifteen REITs included, the maximum gap of missing days between the REIT with the least and the REIT with the most number of days is fourteen. Using three years of data for the beta calculation, I would consider this gap has very little influence.

3.2 REIT and market data

The data used in the calculation of beta are historical data of fifteen retail REITs and fifteen stock market indices (see table 1 below). All REIT and market index data were obtained from Yahoo! Finance. All fifteen retail REITs are based in different countries and the fifteen market indices reflect the stock markets of those fifteen countries (Trading Economics 2020).

Table 1 – retail REITs, countries and market indices. Column 1 shows all included retail REITs and their symbol names on the stock market in parentheses. Column 2 shows the countries in which these REITs are based. Column 3 shows the stock market indices of these countries. Column 4 shows the custom names which will be used for the REITs in this research to increase clarity.

1 Retail REIT	2 Country	3 Market index	4 Custom name
Carindale Property Trust (CDP.AX)	Australia	S&P/ASX 200	AUS-REIT
Wereldhave Belgium NV (WEHB.BR)	Belgium	Bel 20	BEL-REIT
RioCan Real Estate Investment Trust (REI-UN.TO)	Canada	S&P/TSX Composite index	CAN-REIT
Klépierre SA (LI.PA)	France	CAC 40	FRA-REIT
Deutsche Konsum REIT-AG (DKG.DE)	Germany	DAX	GER-REIT
Immobiliare Grande Distribuzione SIIQ S.p.A (IGD.MI)	Italy	FTSE MIB Index	ITA-REIT
Japan Retail Fund Investment Corporation (8953.T)	Japan	Nikkei 225	JAP-REIT
CMMT (5180.KL)	Malaysia	FTSE Bursa Malaysia KLCI	MAL-REIT
Fibra Shop (FSHOP13.MX)	Mexico	IPC MEXICO	MEX-REIT
Wereldhave NV (WHA.AS)	Netherlands	AEX-Index	NLD-REIT
Argosy Property Limited (ARG.NZ)	New Zealand	S&P/NZX 50 Index Gross	NZ-REIT
CapitaLand Integrated Commercial Trust (C38U.SI)	Singapore	STI Index	SING-REIT
Lar España Real Estate SOCIMI, S.A. (LRE.MC)	Spain	IBEX 35	ESP-REIT
Capital & Regional (CAL.L)	United Kingdom	FTSE 100	UK-REIT
Realty Income Corporation (O)	United States	S&P 500	US-REIT

The selection of these fifteen retail REITs is based on several considerations. First, the (physical) retail sector was adversely affected particularly, as Covid-19 measures limited foot traffic in shopping malls (Akinsomi, 2020; Debata et al. 2020). Retail (real estate) economics relate strongly to local markets (Liu & Liu, 2013), whereas office real estate (also 'hit hard' during Covid-19) may be more connected to international business. Therefore, as this study aims to relate 'local' (country-level) Covid-19 severeness to real estate risks, risk for retail REITs might be particularly informative. Second, retail REITs are based in many countries, retail REITs based in different countries are therefore selected to satisfy this study's comparative scope. Third, in order for a REIT to be included, it has to be clearly focused on retail real estate. Additionally, reliable data for the retail REIT and the stock market index of the country in which the retail REIT is based, had to be obtainable. The set of fifteen retail REITs includes REITs from almost all major international REIT markets, from various parts of the globe (Zhou & Anderson, 2012).

A market index (table 1) represents the entire stock market of a country (Young 2020). It provides a benchmark, comprised of a certain set of stocks, to represent a stock market's changes over time (Young 2020). The selected stock market indices (table 1) are generally accepted as indicators of the overall stock market in the selected countries (Trading Economics 2020).

3.3 Measure of Covid-19 policy

As this study aims to relate retail REIT risk, which is quantified my the measure beta, to Covid-19 policy strictness in a country, we now turn to a measure that quantifies the Covid-19 policy strictness in a country. This research uses the 'Stringency Index' to indicate the severeness of the Covid-19 policy in a country on a given moment. The Stringency Index is part of the Oxford Coronavirus Government Response Tracker; a project by researchers of the University of Oxford that uses data to present a series of indices which track governments policy responses to Covid-19 (Hale et al. 2020; Our World in Data 2021).

The Stringency Index (SI) indicates how severe the government's response to Covid-19 is in a given country on a given day (Our World in Data 2021). It is based on data regarding the set of active Covid-19 measures in a country on a given day (Our World in Data 2021). The SI in a country on a given day is the mean of the following nine metrics (Our World in Data 2021):

1. School closures
2. Workplace closures
3. Cancellation of public events
4. Restrictions on public gatherings
5. Closures of public transport
6. Stay-at-home requirements
7. Public information campaigns
8. Restrictions on internal movements
9. International travel controls

Each of the nine metrics can take a value between 0 and 100 (Hale et al. 2020). The country-specific SI is therefore also a value between 0 and 100; the higher the value, the stricter the active government response on the given day (Hale et al. 2020; Our world in Data 2021). SI values are available for (almost) all countries in the world, and for all dates starting 1-1-2020. As a set of Covid-19 measures in a country is usually active for a certain time period, the SI for a country usually remains the same value for the period that the set of measures is active.

This research selected the Stringency Index (SI) to quantify the active Covid-19 policy in a country based on the following considerations. The SI incorporates nine Covid-19 restrictions, which altogether appear to be an appropriate representation of Covid-19 policy that could be relevant in an effect on retail REIT investment risk. The SI, to quantify Covid-19 policy, has already been used in various studies that examine the effect of Covid-19 policy on stock (market) returns and volatility (Ashraf, 2020; Baig et al. 2020; Liu et al. 2020; Zaremba et al. 2020). Furthermore, to satisfy the study's aim of relating daily beta of retail REITs to Covid-19 policy, the daily interval of the SI is particularly useful. As such, daily Stringency Index values can be related to daily retail REIT beta values, to assess if there is a relationship between Covid-19 policy and retail REIT investment risk (in the form of beta).

Stringency Index data for all fifteen countries have been obtained from the Our World in Data website (Our World in Data 2021). Our World in Data specifies on its website that the sources of their data are specialized institutes, research articles, international institutions or statistical agencies.

3.4 Method of analysis

To assess how the risk of retail REITs behaves in relation to Covid-19 circumstances, the analysis will consist of two sections.

The first section will analyse a series of line graphs in which the daily beta values of the fifteen REITs are visualised. This section aims to provide a general description of the developments of REIT beta before and during the Covid-19 pandemic.

The second section aims to assess if there is a relationship between retail REIT beta and SI of the countries in which the retail REITs are based. The section will contain scatter plots of daily REIT beta and daily SI values, matched by date. This section will also present the results of simple linear regression models, in which the daily beta and SI data were used.

I estimate a simple linear regression model for each country, to illustrate partial correlation. The model specification can be written as:

$$(3) \qquad Y_i = \alpha + \beta X_i + \varepsilon_i$$

where Y is the beta value on *i*th day; α is the constant (the beta value 2-1-2020); β is the regression coefficient; X is the Stringency Index value on the observed day; and ε is the difference between the actual beta value and the expected beta value (by the regression model) on the *i*th day.

An important notion regarding the Stringency Index values, used in the second section of the analysis, has to be mentioned. As mentioned in section 3.3, the SI can take a value between 0 and 100. However, all SI values in this research were divided by 10 (depicted by the * in figures 2A-2E). This action was performed to benefit from more clarity in the interpretation of the linear regression models. The interpretation of the regression coefficients in section 4.2 regards the REIT beta values, which consist of values with several decimal points. As a change in Covid-19 policy usually involves a set of multiple Covid-19 measures, original SI values usually change with multiple points at once. The implications for this regression model are as follows. A one-unit change in SI therefore depicts an in reality more common, 10-unit, change on the original SI scale. In order to formulate more easily comprehensible changes of beta as response to changes in SI, this action was performed. The consequences of this action are taken into account in the interpretation of the linear regression results.

4. Results

4.1 Retail REITs beta

As a baseline, we will first examine the developments of retail REIT betas before and during Covid-19. Figures 1A-1C below present line graphs of the daily beta values for all fifteen retail REITs[3].

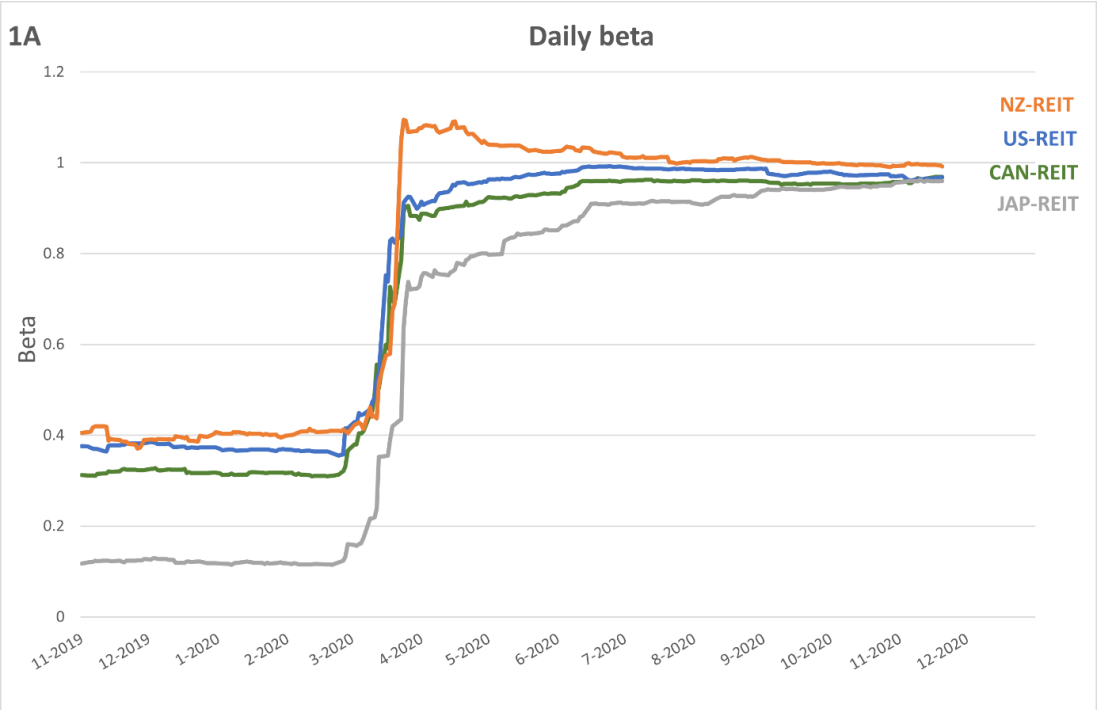


Figure 1A. Line graphs of the calculated daily beta values for four REITs that show the steepest rise in beta.

The line graphs in figure 1A represent retail REITs whose beta rises steeply around the mid-March stock market crash (Mazur et al. 2020), after which beta becomes more stable at the level of the peak.

[3] Be aware of the differences in scale along the vertical axes.

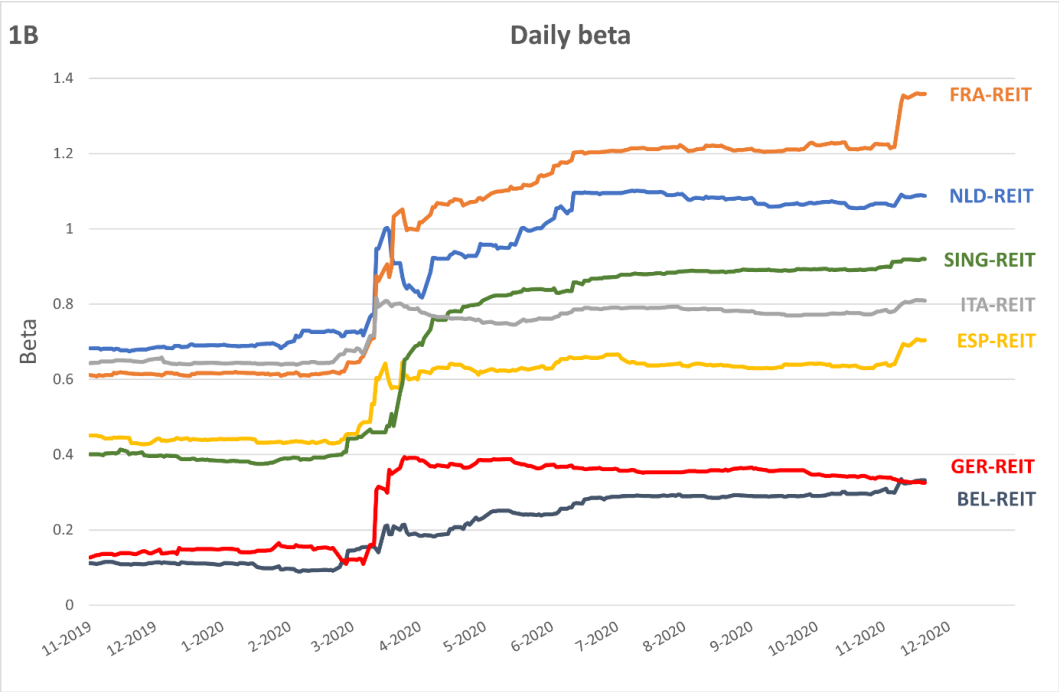


Figure 1B. Line graphs of the calculated daily beta values for seven retail REITs that show a moderately steep rise in beta.

The line graphs in figure 1B represent retail REITs whose beta, *generally*, shows a moderately steep rise around the mid-March stock market crash (Mazur et al. 2020), after which beta for some REITs falls slightly. After this fall, beta of these REITs is relatively stable or shows a small rise, and remain at or above the level of their peak.

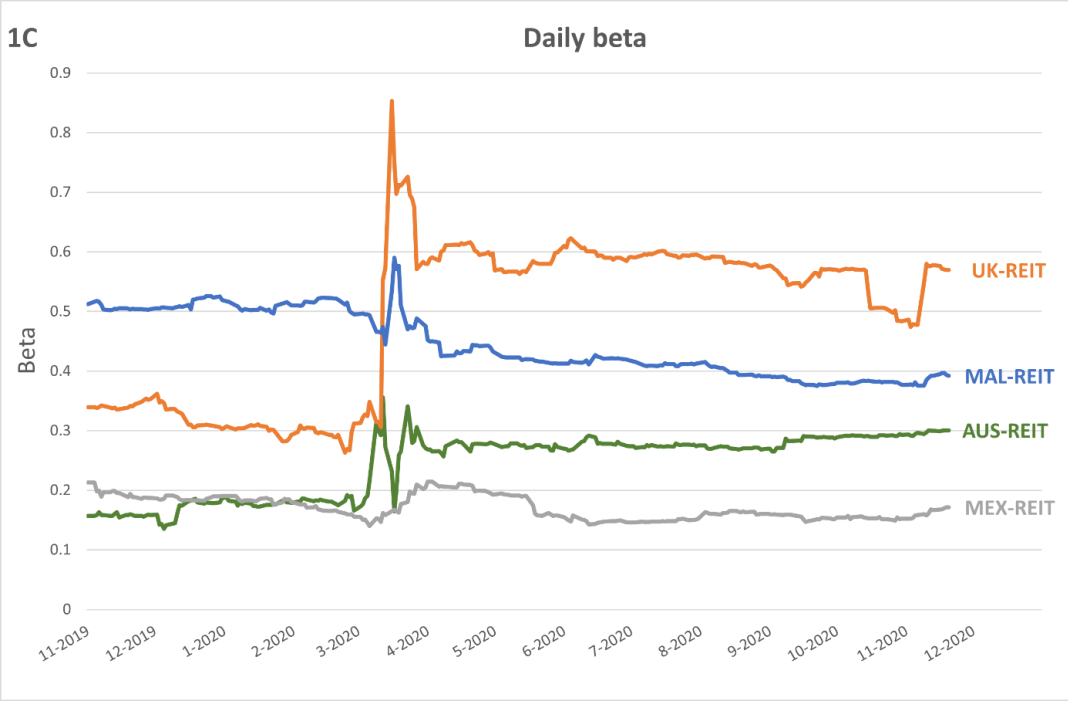


Figure 1C. Line graphs of the calculated daily beta values for four retail REITs

The line graphs in figure 1C represent retail REITs whose beta, *generally*, show a (steep) rise around the mid-March stock market crash (Mazur et al. 2020), after which beta falls and remains below the level of their peaks.

A general observation is that beta of (almost) all fifteen retail REITs rises clearly around mid-March. Despite apparent resemblances, the patterns show differences as well. This suggests that in different countries, different responses of beta values on the Covid-19 induced market shock were present.

To position these results in the light of retail REIT betas found by other institutions, figure 3 below will be discussed. This figure by the Case (2018) of the National Association of Real Estate Investment Trusts shows the average beta (in percentage instead of a coefficient) per REIT sector in the US.

Apr 2008	Apr 2009	Apr 2010	Apr 2011	Apr 2012	Apr 2013	Apr 2014	Apr 2015	Apr 2016	Apr 2017	Apr 2018
Self Storage 73%	Self Storage 50%	Self Storage 57%	Health Care 51%	Health Care 63%	Infra-structure 28%	Infra-structure 38%	Infra-structure 47%	Health Care 36%	Data Center 47%	Health Care 40%
Diversi-fied 91%	Residen-tial 76%	Health Care 81%	Self Storage 57%	Self Storage 65%	Health Care 61%	Residen-tial 48%	Health Care 49%	Infra-structure 44%	Infra-structure 48%	Retail 46%
Residen-tial 93%	Health Care 87%	Residen-tial 110%	Residen-tial 87%	Residen-tial 77%	Residen-tial 67%	Health Care 55%	Residen-tial 57%	Residen-tial 46%	Self Storage 55%	Data Center 49%
Health Care 93%	Diversi-fied 112%	Office 142%	Office 91%	Timber-land 89%	Self Storage 71%	Diversi-fied 61%	Diversi-fied 60%	Self Storage 49%	Health Care 57%	Self Storage 52%
Office 97%	Office 125%	Diversi-fied 165%	Diversi-fied 103%	Diversi-fied 92%	Diversi-fied 83%	Self Storage 71%	Self Storage 63%	Retail 52%	Residen-tial 61%	Residen-tial 54%
Retail 100%	Retail 128%	Retail 183%	Retail 108%	Office 98%	Timber-land 91%	Retail 76%	Retail 65%	Diversi-fied 64%	Retail 67%	Infra-structure 60%
Indus-trial 104%	Lodging 141%	Indus-trial 214%	Indus-trial 112%	Retail 99%	Office 93%	Office 78%	Office 76%	Office 72%	Diversi-fied 97%	Diversi-fied 67%
Lodging 116%	Indus-trial 245%	Lodging 233%	Lodging 163%	Indus-trial 142%	Retail 94%	Timber-land 87%	Indus-trial 87%	Indus-trial 77%	Office 101%	Indus-trial 83%
				Lodging 155%	Indus-trial 122%	Indus-trial 107%	Timber-land 100%	Lodging 104%	Indus-trial 107%	Office 84%
					Lodging 147%	Lodging 128%	Lodging 130%	Timber-land 116%	Timber-land 115%	Timber-land 103%
									Lodging 135%	Lodging 130%

Figure 2. Average beta per US based REIT sector. (Case 2018).

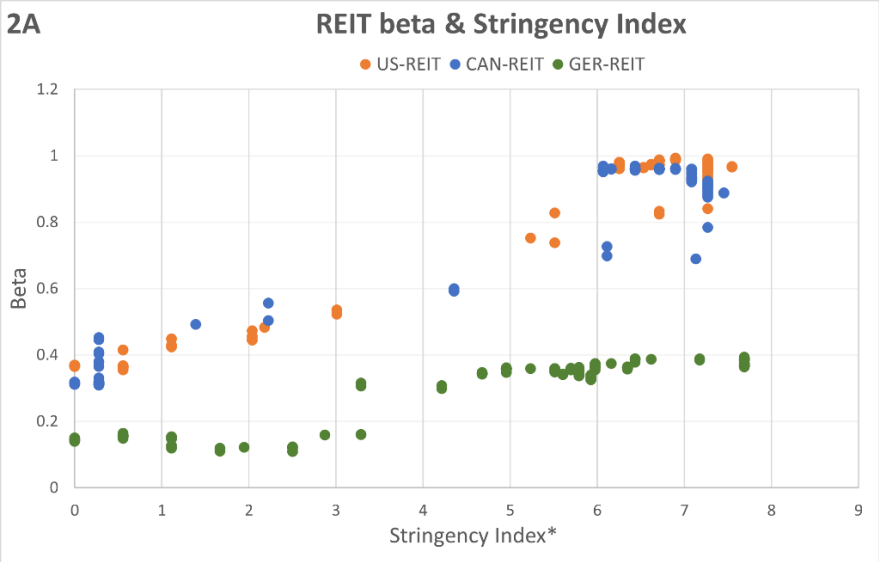
Even though these REIT betas are averages of monthly beta estimates, the calculation along the various sectors is consistent (section 2.2). Betas for the retail REIT sector appear to show an interesting pattern. The figure shows relatively high beta for retail REITs during the first

years. This could relate to the financial crisis of 2008. After these years, the beta for retail REITs falls relative to other REIT sectors. This could indicate that the beta of retail REITs is related to macroeconomic conditions, where retail REIT beta is relatively high during macroeconomic downturn and vice versa.

4.2 Retail REIT beta in relation to the Stringency Index

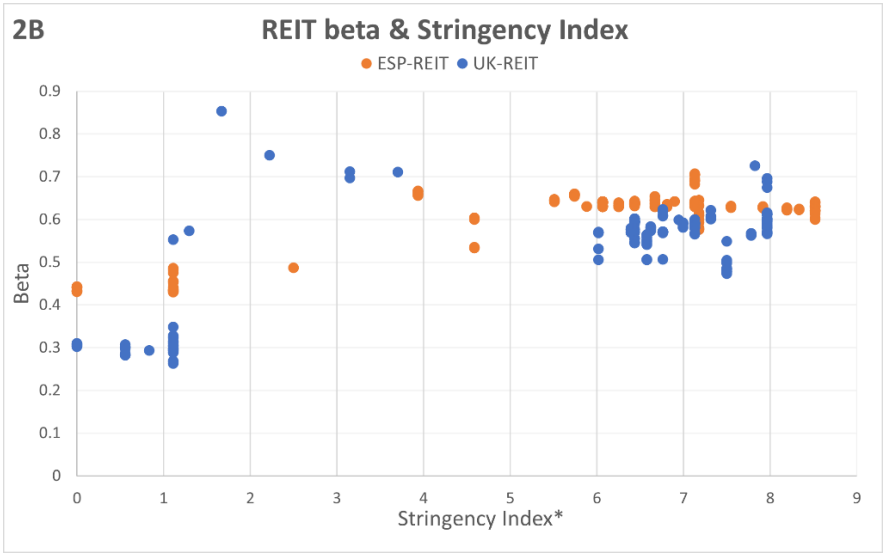
To address the relationship between retail REIT beta and Stringency Index, we will now analyse several scatter plots and the results of simple linear regression models.

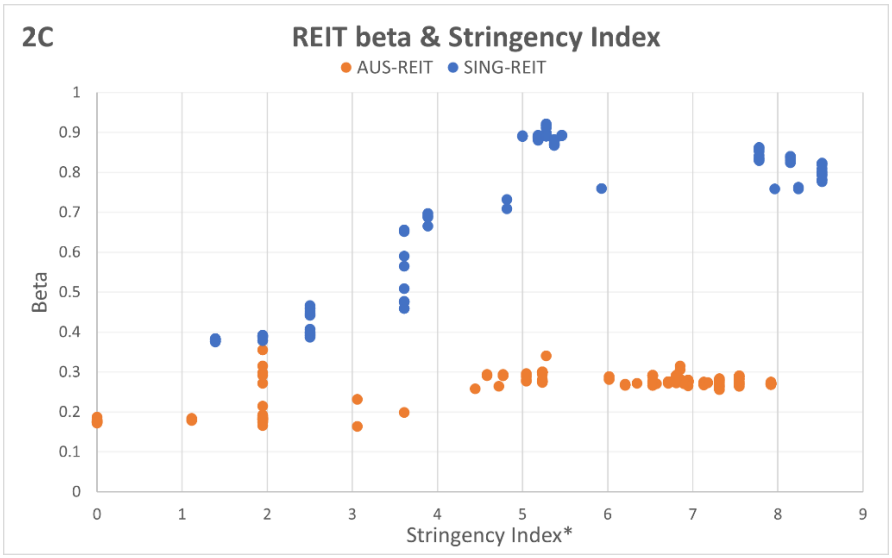
In the scatter plots of figures 2A-2F below, the daily beta values of the retail REITs are plotted on the y-axis against the SI values on the corresponding days, from the countries in which the respective retail REITs are based, on the x-axis[45].

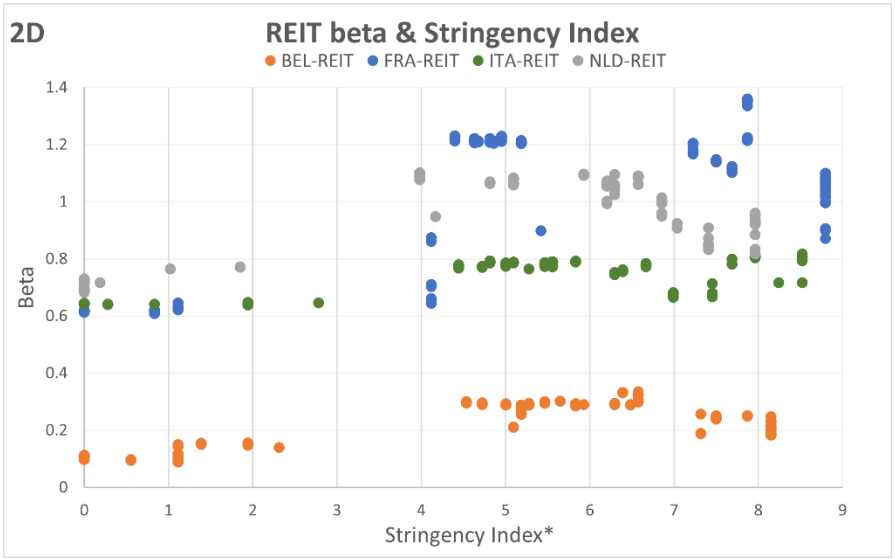


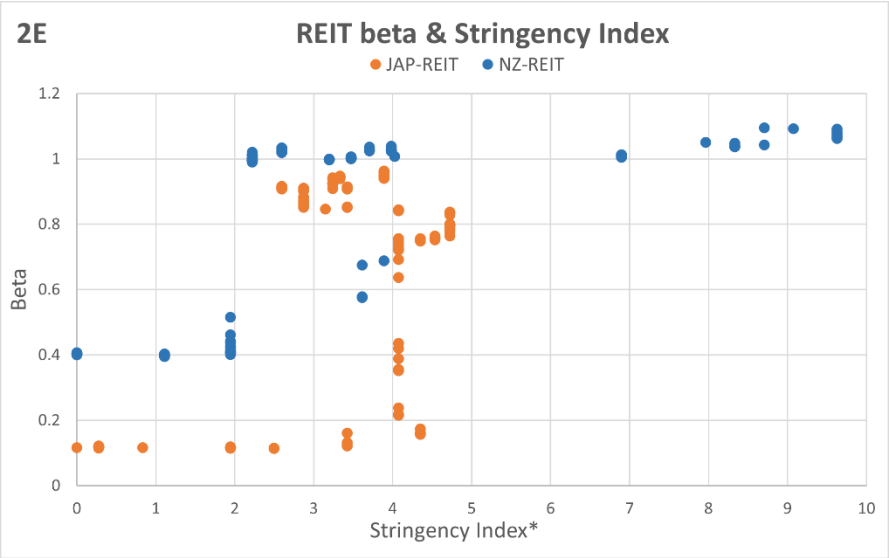
[4] The colours in figures 2A-2F have no relation to the colours in figures 1A-1D. The REITs are in the figures are ordered based on their R-squared values of the regression models, see table 2 below. Be aware of slightly varying scales between the figures. An example on how to examine these figures: the blue dot where CAN-REIT has a beta of 0.6 and a SI of approximately 4.3, represents a day on which the Canadian retail REIT has a beta of 0.6 and the SI in Canada is 4.3.

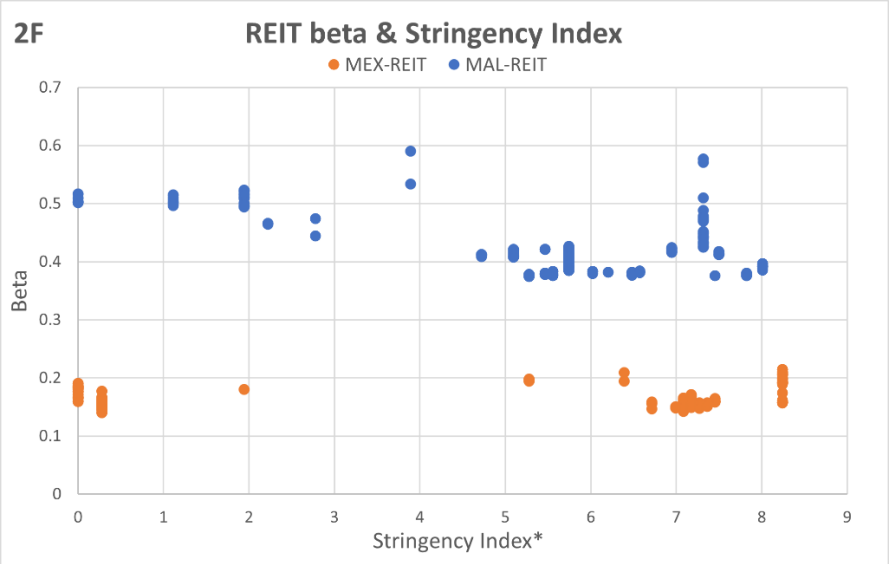
[5] As explained in section 3.4, the SI values are divided by 10. Furthermore, the time period covered by these scatter plots and the linear regression models below, comprises 2-1-2020 until 20-11-2020; as 2-1-2020 is the first date for which SI values are computed and for which the stock markets were open.


2B
REIT beta & Stringency Index
ESP-REIT
UK-REIT
Beta
Stringency Index*


2C
REIT beta & Stringency Index
AUS-REIT
SING-REIT
Beta
Stringency Index*


2D
REIT beta & Stringency Index
BEL-REIT
FRA-REIT
ITA-REIT
NLD-REIT
Beta
Stringency Index*





Figures 2A-2F. Scatter plots of retail REIT beta against the Stringency Index values.

A general observation is that the majority of the retail REITs, show a positive relation between their daily beta values and SI values of the countries in which these REITs are based.

The data used in the scatter plots above, are the same data as used in the simple linear regression models, whose results will now be discussed.

Table 2 below presents the results of the simple linear regression models as explained in section 3.4. Each row represents the results for an individual model in which the independent variable is country SI and the dependent variable is retail REIT beta.

Table 2 – Regression model results.

1 - Country	2 - Coefficient β	3 - R^2
Australia	0.0137	0.63
Belgium	0.0196	0.43
Canada	0.0911	0.94
France	0.0591	0.44
Germany	0.0367	0.87
Italy	0.0149	0.46
Japan	0.148	0.29
Malaysia	-0.0149	0.45
Mexico	insignificant	
Netherlands	0.0375	0.46
New Zealand	0.0498	0.29
Singapore	0.0719	0.55
Spain	0.0270	0.76
United Kingdom	0.0383	0.71
United States	0.0903	0.96

As explained in section 3.4, the SI values were divided by 10 to benefit from more clarity in the interpretation of the results of table 2. The results will be discussed using this 0-10 SI scale.

The second column depicts the regression coefficients, which indicates the change in the dependent variable, retail REIT beta, as response to a one-unit change in the independent variable; SI. The regression coefficients represent that the beta of a clear majority of the retail REITs show a positive association with the SI of their corresponding countries. E.g. a one-unit change of the SI (0-10 scale) would result in a 0.0903 change in beta of the US-REIT. This might seem a small change in beta. However, the beta of the US-REIT, before Covid-19, was very stable at the level of 0.36 (see section 4.1, figure 1A). Considering that this US-REIT beta would change to 0.45, as a response to a change in SI by 10 percentage points[6], would render these results more relevant.

[6] A change of one unit on the 'adjusted' 1-10 SI scale, corresponds to a 10-unit SI change on the 'original' 1-100 scale.

5. Discussion and Conclusion

5.1 Discussion

What is important to mention again, is that the beta of a REIT indicates the REITs systematic risk (or volatility), *compared* to the *whole market*, and that beta for the REITs was calculated based on three-year daily data. It would therefore be false to think, when seeing rising beta values around mid-March in figures 1A-D of this research, that "these increases are obvious, as due to the Covid-19 panic, all stocks fall in price". As beta already takes the movement of the entire market, in the form of a market index, into account, these increases in beta of the REITs around mid-March, mean the risk[7] of the REITs increased compared to the overall market. It can therefore be said that the fifteen retail REITs included, especially those that showed a sharp rise in beta, gained risk, or became more volatile, during the Covid-19 pandemic. This importantly shows that, while retail real estate in 'normal' times is a relatively safe investment asset, during the Covid-19 pandemic investors tend to shy away from this asset type.

As section 4.1 showed beta of retail REITs rises during the pandemic, the results of section, considered jointly, show that for the majority of the retail REITs, beta is positively related to the Stringency Index. The REITs depicted in figures 2A-2D, show, in table 2, noteworthy responses of beta to a change by 10 percentage points in the SI; a proxy for severeness of Covid-19 measures. A review of the SI data for the fifteen countries shows the SI, if it changes, tends to change with at least one dozen, or several dozen, percentage points. The presumable explanation for this is that new Covid-19 policy usually introduces a set of stricter (or less strict) Covid-19 measures, resulting in a clear change in SI. This adds to the notion that risk of retail REITs, proxied by beta, responds clearly to a change in strictness of Covid-19 policy, proxied by the SI.

Considering that investing in REITs generally involves low risk and stable returns (Alias & Tho, 2011; Zhou, 2012), the results of this study might be reason to put a notion to this viewpoint. In line with the pattern of retail REIT betas suggested by figure 2 (Case 2018) in section 4.1, the results of this study suggest that risk of retail REITs is related to macroeconomic conditions, as retail REITs tend to have higher beta values around the years of the financial crisis (2008) and during the Covid-19 pandemic. The mechanisms described

[7] Considering that this study uses beta as a measure of risk compared to the overall market. I.e. beta is not the same as risk, but a measure of risk, or a measure of volatility.

in section 2.3 could explain this. As during tough macroeconomic conditions, shop owners; the tenants of retail REITs, tend to experience reduced sales (REFERENCE), less rent (overage and/or base rent, see section 2.1 and 2.3) will be collected by retail REITs (Akinsomi, 2020; Myler & Webb, 1994). This prospect of reduced cash flow can create the prospect of cut dividends (Akinsomi, 2020), which investors usually tend to avoid. Investors might therefore showcase "flight to quality" behaviour, by selling retail REITs to reduce risk exposure and portfolio beta (Chen 2020; Devos et al. 2012). Greater supply than demand of retail REIT stocks on the market results in decreasing retail REIT prices and returns (Harper 2019; Hayes 2020) (section 2.3), which can cause rising retail REIT beta (section 2.2); the measure of risk used in this study.

5.1.2 Implications for investors and future research

Retail REITs becoming riskier during Covid-19, or the suggestion that risk of retail REITs is prone to macroeconomic conditions, may have some implications for investors. As investors might invest in REITs for their nature of low risk and stable returns (Alias & Tho, 2011; Zhou, 2012), also to secure a stable income stream during economic downturn, retail REITs might be a type of asset to reconsider investing in when aiming for a low-risk investment strategy. Furthermore, when investing in retail REITs, investors might benefit from diversifying their assets over various countries, "*do not put all your eggs in one basket"*, as we have seen that retail REIT beta reacts differently in different stock markets.

However, this study has focused on risk of individual stocks. Investors operate with investment portfolios, which consist of a wide range of assets (Tardi 2020). Future research could therefore investigate risk of portfolios of diversified, in the sense of various countries, or less-diversified portfolios, in the sense of having retail REIT assets from one country.

5.2 Conclusion

This research has provided a unique new overview of the risk of real estate markets under a pandemic. Risk of fifteen retail REITs, all from different countries, were investigated in their relation to Covid-19 in the corresponding countries. Beta was used as measure of risk and the Stringency Index, computed by researchers at the University of Oxford, was used as a proxy for severeness of Covid-19 measures imposed by governments. Daily beta values were

calculated on retail REIT and market index data. Descriptive analysis of daily retail REIT beta values showed a moderate to steep rise of beta around mid-March when strict Covid-19 measures were implemented around the world. After this rise, the development of daily beta varied between the retail REITs. The relation between daily retail REIT beta values and daily Stringency Index values of the corresponding countries showed beta values correspond remarkably closely to Stringency Index values. Regression coefficients of simple linear regression models represented noteworthy rises of retail REIT beta as response to realistic changes in Covid-19 policy strictness (proxied by the Stringency Index). The results indicate that risk of retail REITs rises during Covid-19, and is positively related to strictness of Covid-19 measures imposed by governments. The findings, along with existing findings on retail REIT beta, suggest that risk of retail REITs rises during macroeconomic downturn. Retail REITs may therefore be considered riskier assets relative to the low-risk nature of other REITs. The findings of this study may inform (potential) retail REIT investors who aim for a low-risk investment strategy.

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