# Real Estate Asset Markets: Risk and Return Differences Between Public and Private Real Estate Equities

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We analyze the return and risk properties of public and private real estate equities in the US from 1994 to 2016. We construct our own public real estate index by using quarterly return data of 229 different REITs, which we delever. From this index we render a property composition which we use to adjust the transaction based version of the NCREIF index. We compare the restated return series and do not find a significant return differential between the two assets. Even though the returns are akin, we find that private real estate embodies a higher risk profile, measured in terms of volatility. We divide the sample into two sub-periods and find that this risk differential holds very well for the period of 1994 to 2001, yet doesn't hold in the more recent 2002 - 2016 era.

# Contents

# 1 Introduction

Real estate is a relevant asset class to consider for a portfolio manager of an institutional asset management firm (Brueggeman et al., 1984). This is especially true for pension funds, as real estate is the alternative asset class that is invested in the most by pension funds (Andonov et al., 2015). There are several ways of investing in real estate equity: public and private, and liquidity and transactional costs differ substantially between public and private, with the former having the least of these costs (Pagliari et al., 2005).

Moreover, we find that the absolute amount of transactional costs involved with buying private real estate are so high that this asset class is only attainable for pension funds and other institutional investors. For that reason, our research is specifically interesting for institutional investors, as they are the only investors that are in the position to choose whether they want to invest in public or private real estate.

This research aims at identifying the return and risk characteristics between two asset classes (i.e. public and private real estate) in order to create a complete and recent picture for institutional asset managers. We will do this by restating the indices to account for leverage, property type and appraisal smoothing. Then, we will statistically test the return and risk properties between the two asset classes, using data from 1994 to 2016. During this research we will mostly follow the methodologies as performed by Pagliari et al. (2005), who executed a somewhat similar research with data from the US between 1981 and 2001. They find a meaningful yet insignificant return differential, and a low, unsubstantial and insignificant risk differential. The main goal of our research is to provide and updated analysis on this very subject, by using data up until 2016.

We have divided our main research question into two hypothesis:

**Hypothesis 1:** The returns between public and private real estate differ significantly.

**Hypothesis 2:** The volatilities between public and private real estate differ significantly.

Numerous articles about REITs and private real estate in the asset management universe have been studied for this research. Researches like Lee and Stevenson (2004) and Oikarinen et al. (2011) find that REITs and private real estate tend to behave rather similar in the long term, albeit REITs seem to behave more like stocks in the short run (see e.g. Froot (1995) and Morawski et al. (2008)).

Risk and return differentials between the two asset classes has also been studied. Riddiough et al. (2005) finds a 300 basis point outperformance of public real estate returns between 1980 and 1998, but this also comes with a higher volatility of REITs. MacKinnon and Al Zaman (2009) find no return benefit of public over private real estate but do find a higher risk differential of public real estate.

Just like Pagliari et al. (2005), we do not find a significant difference in return. The difference in results is nevertheless striking, as we do not at all observe such an absolute annual mean return difference of public over private for our time frame, even when we restate the time frames. For risk, we conversely find that the restated private real estate index is significantly more volatile than public real estate. Specifically when restating the index to the 1994 - 2001 era to compare with Pagliari et al. (2005), we find significance that holds on the 1% level that private real estate is riskier than public real estate.

The remainder of this paper is structured as follows: Chapter two provides information about investing in real estate equities. Chapter three provides institutional context by linking the investment strategy of a large U.S. pension fund to investing in public and private real estate. Chapter four gives an elaborate academic background on the subject. Chapter five shows the data we have used for our research and also provides an extensive description of the methodologies used, chapter six explains the results and chapter seven concludes this paper.

## 2 Investing in Real Estate Equities

### 2.1 What are public real estate equities?

With public real estate equities we refer to equity REITs, or Real Estate Investment Trusts. In the US, equity REITs are companies that are listed on a public stock exchange, whose core business activity is to create an economic income through ownership of property, pay out at least 90% of their taxable income in dividend and for which 75% or more of its assets are classified as equity holdings. Besides public real estate equities, one can also refer to public real estate *debt*, which are known in the US as mortgage REITs. Those financial products invest in mortgages or mortgage securities and do not generate economic rent by ownership of the actual properties. This paper specifically focuses on real estate equities, hence we will not discuss mortgage REITs.

#### 2.1.1 Managers and costs

An institution can invest in REITs by selecting them in-house, or by outsourcing the selection to an external manager. In the US, selecting REITs internal is rather unique, as only about 10% of the US pension funds invests internally (Andonov et al., 2013).

The costs, however, are rather small. In that very same research, Andonov et al. (2013) found that between 1990 and 2009, the average difference between gross and net annual returns for public real estate investments for pension funds was 29 basis points, which is really low in an asset management context.[1]

### 2.2 What are private real estate equities?

With private real estate equities we also solely mean companies whose core business activity is to create an economic income through ownership of property. However, these companies have a private limited business entity and are

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[1] However, their research is globally and not just pension funds in the US. The US pension funds generally have higher costs, not only because there external managers are more expensive in terms of basis points, but also because a larger share of their funds are managed by external managers.

therefore not publicly owned. Consistently with its public counterpart, we will not focus on private real estate debt. Examples of private real estate debt are private companies that invest in real estate mortgages or other real estate debt products. These companies are not in the business of ownership of properties and are therefore not considered in this research.

### 2.2.1 Managers and costs

There are three ways for institutions to invest in private real estate equities: internally, externally and via fund-of-funds.

Internally means that an institution set up its own fund to invest in real estate and manages this fund internally.

Externally means that the institution finds an external manager to manage the real estate assets. CalPERS', the large U.S. pension fund, has its private real estate investments managed by external managers. These external managers operate either alongside CalPERS in a joint venture structure, or as fiduciaries. An example of a joint venture in this case is CalEAST, which is a real estate company that is owned by CalPERS alongside GI Partners. It controls and operates logistical and industrial real estate. GI partners adds value in the sense of operational knowledge, whereas CalPERS uses its asset management knowledge. An example of a fiduciary for CalPERS' private real estate portfolio is Invesco. This asset manager takes care of the residential private real estate equities in the Midwest and West regions excluding Texas (CalPERS, 2017).

A fund-of-fund means that the investor buys into a fund, and this fund invests in a portfolio of underlying assets, rather than that the investor invests in these underlying assets directly. Using the example of CalPERS again, we observe multiple private real estate fund-of-funds in which CalPERS invests. An example is its holding in the LaSalle Japan Logistics Fund II LP. This is a private equity fund that focuses on real estate investments in Japan (CalPERS, 2017). A fund-of-funds can also have public real estate equities in its portfolio, but it is still considered private real estate as the fund-of-funds itself in this case will not be tradable on any public listing.

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The costs that are involved with selection, acquiring and maintaining private real estate in a pension fund portfolio are, unsurprisingly, high. We refer again to the research of Andonov et al. (2013) who find an average difference of 82 basis points between gross and net annual returns of holding private real estate equities in a pension fund portfolio.

## 2.3 Real Estate Markets and Return

Public and private real estate markets are both rather sizeable, as public real estate (i.e. REITs) had a market cap of $960 billion and private real estate $525 billion in the US by the end of 2016.[2]

The benchmark we use for private real estate equity in the US is the NCREIF Property Index (NPI). This index aims to reflect the private real estate market in the US closely. We will elaborate further on the NPI index properties and methodology in chapter five of this paper.

As benchmark for public real estate equity in the US, we use the FTSE NAREIT All Equity REITs Total Return Index.[3] The index contains all the equity REITs in the US that are identified by the National Association of Real Estate Investment Trusts (NAREIT). We have derived the data from Bloomberg (Ticker: FNERTR). In chapter five of this paper, we'll give a comprehensive description of the properties and methodology of this index.

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[2]The public real estate market in the US is covered by the NAREIT organisation, and data is derived from Bloomberg. The private real estate market in the US is represented by the NCREIF organisation, and data is derived from their website.

[3]"Total Return" means that dividends are reinvested in the index. The NPI itself is already composed on a total return basis (NCREIF, 2017).
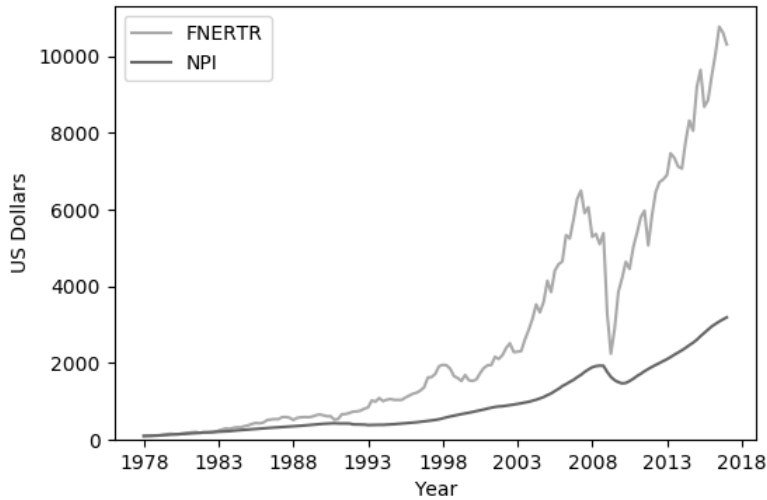
Figure 1: Returns from the NAREIT and NPI from 1977 to year-end 2016.
Indexed on year-end 1977 on $100.

Using Bloomberg data, we construct a simple return graph that combines both indices so that we get a broad idea how the indices have behaved in the past. Figure 1 shows the return index for public real estate and private real estate in the US from year-end 1977 to year-end 2016. Note that FNERTR is the Bloomberg mnemonic for the FTSE NAREIT All Equity REITs Total Return Index. We refer to chapter five of our research for an elaborate description of this index.

At first glance, public real estate seems like the better investment. However, there's a lot of nuance to be considered. For example, leverage effects are still included in the REITs index here and the property type mix between the two differ greatly. In short, this figure gives us an all but equal comparison between the two assets. This research aims to give a fair resemblance of the differences in return between the two asset classes. We do this by conducting an elaborate analysis further on in this article.

# 3 Example: the case of CalPERS

As stated earlier, pension funds often invest in real estate. Figure 1 made the large long term return differences clear between public and private real estate. We are also aware of the differences in risk, specifically through the use of leverage by REITs. In chapter four we'll show that academics seem to have all but a consensus on how pension funds should allocate their funds. With the current chapter, however, we want to give you a picture of the institutional context of investing in real estate. We do this by looking into the investment decisions and investment strategies of one of the largest pension funds in the U.S.

Generally, pension funds favor private real estate investments over REITs. Andonov et al. (2013) researched 884 pension funds globally over a time period of 20 years. They found that the pension funds had a combined $240 billion dollars invested in private real estate and $74 billion in public real estate in 2009.

We look at the specific case of CalPERS. CalPERS, or California Public Employees' Retirement System is one of the biggest pension funds in the world, with 1.8 million members and $302 billion assets under management in 2016 (CalPERS, 2016a). From their 2016 Annual Investment Report, we find that the fund had $33.4 billion invested in real estate on June 30th, 2016 (which is the end of their fiscal year). Of this $33 billion, $5.7 was invested in REITs and $27.7 billion in private real estate. Looking at these numbers, we conclude that CalPERS substantially favors private over public real estate, and we wish to investigate CalPERS' rationale of this allocation (CalPERS, 2016b).

The organization's website supplies us with its investment beliefs. We will look into these beliefs to find out about CalPERS' investment decisions regarding the allocation of real estate assets:

1. Liabilities must influence the asset structure
2. A long time investment horizon is a responsibility and an advantage
3. CalPERS investment decisions may reflect wider stakeholder views, provided they are consistent with its fiduciary duty to members and benefi-

ciaries

4. Long-term value creation requires effective management of three forms of capital: financial, physical and human

5. CalPERS must articulate its investment goals and performance measures and ensure clear accountability for their execution

6. Strategic asset allocation is the dominant determinant of portfolio risk and return

7. CalPERS will take risk only where we have a strong belief we will be rewarded for it

8. Costs matter and need to be effectively managed

9. Risk to CalPERS is multi-faceted and not fully captured through measures such as volatility or tracking error

10. Strong processes and teamwork and deep resources are needed to achieve CalPERS goals and objectives

We will look into those beliefs and see if they link to CalPERS' allocation decision for Real Estate, and specifically the allocation difference between public and private real estate.

**Investment belief 1:** *Liabilities must influence the asset structure.*
In Asset-Liability Management (ALM), apart from the standard asset management factors, there's simply said simply three factors that are a lot more important for ALM managers than for standard asset managers; inflation-hedging, cash generation and liquidity.

For inflation hedging, real estate is seen as a good investment, as real estate in its fundamental form generates a very steady and inflation-adjusted income through rent. In its choice for public or private real estate, a pension fund could prefer private real estate over public real estate in the short run, as public real estate is more correlated with the stock market in the short term than it is with its fundamental value. In the long run, however, public real estate is assumed to behave like its fundamental value, meaning that the inflation-hedging properties of private real estate are only superior in the short term.[4]

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[4]In our literature review chapter, we supply an elaborate discussion about short and long run correlations between public and private real estate and their fundamental values.

For cash generation, public and private real estate will be more or less similar if you assume equal sector allocation. Dividends are driven through rent, and public real estate has more duties regarding dividend payouts than private real estate. However, in practice private real estate companies will generally assign a lot of its cash to dividend payouts as well.[5]

For liquidity, public real estate has an obvious advantage versus private real estate, as the latter is a rather illiquid asset.[6]

Altogether we conclude that real estate is an investment that accommodates CalPERS' 1st investment belief, and that it will be somewhat indifferent between public and private real estate.

**Investment belief 2:** *A long time investment horizon is a responsibility and an advantage.*

Real estate has proven to be a great investment for the long term (see e.g. MacKinnon and Al Zaman (2009)), and in the long term, public and private real estate seem to behave very similar (see e.g. Oikarinen et al. (2011) and Van Den Goorbergh (2014)). So for investment belief 2, we conclude that a real estate investment accommodates the organization's belief although this belief wouldn't prefer public over private real estate or vice versa.

**Investment belief 3:** *CalPERS investment decisions may reflect wider stakeholder views, provided they are consistent with its fiduciary duty to members and beneficiaries.*

CalPERS' primary stakeholders are its members, its employees and the Californian taxpayers. Hence, generally speaking Californian citizens would bear the economic consequences of the fund's investment decisions. Taken this belief into account, real estate investments would generally be more appropriate than other assets, as real estate is (obviously) more location dependent than most other asset classes.

Moving on to the difference between public and private real estate, we observe that private real estate is generally more focused on a specific location.

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[5] Especially in CalPERS' case, as they often have a lot of shares and thus voting rights in the private real estate projects they invest in, so they will have at least some degree of control of the dividend payout ratio.

[6] We have discussed liquidity in the previous chapter.

Private real estate is also called 'direct' real estate meaning that you (theoretically) invest directly in its underlying value, thus when CalPERS wants to invest in a real estate project in the state of California, direct real estate would therefore be a more accommodating way. When we take a closer look into CalPERS' direct real estate investments, the local real estate investments become more evident: the annual investment report 2016 shows us a $3.63 billion private real estate investment into an institution called CalEast (this is more than half of CalPERS total investments in REITs), which is a joint venture between CalPERS and GI Partners that owns and operates industrial real estate. Although they don't solely invest in California, it is the state where their main focus is (GI Partners is also headquartered in California). This makes a strong case to suggest that CalPERS uses some of its private real estate investments to directly invest in real estate in its own state to economically benefit its stakeholders.[7]

**Investment belief 4:** *Long-term value creation requires effective management of three forms of capital: financial, physical and human.*

From a corporate governance perspective, real estate investments will generally be worse than investments in stocks or bonds, due to multiple deficits, mainly the following (Kohl et al., 2009):

- No general property valuations

- Insufficient control of possible conflicts of interest

- No efficient control of management of subsidiary companies operating in the real estate business

- Lack of explanation of corporate strategy, future lines of business and growth forecasts

Moreover, there's two agency problems that private real estate firms have which do not apply to REITs:

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[7]An important nuance on this subject is that REIT managers may get mandates from their shareholders to concentrate their investments in specific locations (Ling et al., 2016a), which in theory means that CalPERS could persuade REITs into doing California-specific investments. However, in reality it turns out that this doesn't really happen, as the CalEast institution proves that CalPERS funds local initiatives through private real estate initiatives.

- Managerial entrenchment: a classic agency problem arises when a manager has to look after the shareholders' interests, as there's often a substantial conflict of interest for the manager. A prime example is the problem that arises with free cash flow. Managers will want to invest this cash while shareholders will desire to receive a payout (see e.g. Jensen (1986)). This problem is pretty much resolved through the organizational structure of REITs - recall that U.S. law requires a mandatory 90% payout of a REIT's net payout. This disciplines the manager of a REIT, as he has a limited amount of cash to invest.[8]

-Lack of appropriate disclosure of the market value of real estate assets and the appraisal methods.

Looking at governance and management effectiveness, we see that real estate is not the most desirable asset class, and specifically on this point, problems arise with private real estate, where its difficult (if not impossible) to disclose appropriate market values at any given time.

**Investment belief 5:** *CalPERS must articulate its investment goals and performance measures and ensure clear accountability for their execution.*

This belief complies with CalPERS' internal execution and should not benefit one asset over the other.

**Investment belief 6:** *Strategic asset allocation is the dominant determinant of portfolio risk and return.*

Real estate is a great diversification method, something we will address in next chapter through the works of e.g. Lee and Stevenson (2004) and Tsai et al. (2007).

Specifically speaking of public and private real estate, Oikarinen et al. (2011) find that diversification benefits arise when combining the two asset classes, especially in the short term. This provides for a great argument that CalPERS should have both of the asset classes.

Asset allocation becomes dynamic when the assets are mean reverting. REITs are found to be more mean reverting than private real estate, because their

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[8]It is important to note that there is still some room for managerial entrenchment. Because the depreciation expenses for a property company is large, there can still be a substantial amount of cash flow to expend.

large day-to-day price changes will eventually adjust back to their fundamental value, whereas direct real estate is way more rigid so it stays a lot closer to its fundamental value in the first place. But then again public real estate has a very high correlation with stocks in the short term, meaning that the diversification benefits with REITs only really arise in the long term. All in all, for investment belief 6 real estate seems like a good investment, and we observe no obvious preference between public and private real estate.

**Investment belief 7:** *CalPERS will take risk only where we have a strong belief we will be rewarded for it.*

I'm sure fund will try to get a high return while keeping its risk low, which is the adage of any asset manager. Real estate generally has a higher return than most assets and a risk profile that is somewhat higher also. This investment belief is too ambiguous to approve or disapprove for real estate in its portfolio. In a search for a good risk/return trade-off, CalPERS will probably do research whether they should invest in public or private real estate. As our research shows, the risk and return differences are very similar between the two, and differences are mostly insignificant, meaning that we have to be indifferent concerning this point.

**Investment belief 8:** *Costs matter and need to be effectively managed.*

We look into CalPERS' annual report 2015 - 2016 and find under Investment Expense a total of $1.47 billion in portfolio management costs, or 49 basis points of the $302 billion assets under management. The report does not specify its fees for real estate costs, so we refer once again to Andonov et al. (2013) who find a 81 basis points annual average costs for managing real estate for the pension funds in their sample. Hence we conclude that the fees for investing in real estate are higher than with other assets.

Separating public and private real estate, Andonov et al. (2013) find that REITs in their sample have 29 basis points in annual costs and private real estate 82 basis points, meaning that according to this investment belief, REITs have the advantage over private real estate.

**Investment belief 9:** *Risk to CalPERS is multi-faceted and not fully cap-*

*tured through measures such as volatility or tracking error.*

Like investment belief number 7, this belief is a little too ambiguous to conclude whether we should favor real estate. For all the risks that fall outside of the classic asset management risks, we are sure CalPERS will be cautious - our assessment has nothing to do with that.

**Investment belief 10:** *Strong processes and teamwork and deep resources are needed to achieve CalPERS goals and objectives.*

This investment belief, just like Belief 5, is applicable to CalPERS' own efforts and do not make a case for or against investments in real estate nor do they add value in the discussion between public and private real estate.

| Investment Belief no. | Favors RE in Portfolio? | Prefers Public or Private RE? |
|---|---|---|
| 1 | Yes | Indifferent |
| 2 | Yes | Indifferent |
| 3 | Yes | Private Real Estate |
| 4 | No | Public Real Estate |
| 5 | N/A | N/A |
| 6 | Yes | Indifferent |
| 7 | Indifferent | Indifferent |
| 8 | No | Public Real Estate |
| 9 | Indifferent | Indifferent |
| 10 | N/A | N/A |

Table 1: The relevance of real estate - and public and private real estate specifically - in CalPERS' Investment Beliefs

Table 1 projects an overview of the relevance of investing in real estate per investment belief. We observe that out of the eight (there's ten beliefs but in two cases our assessment wasn't applicable) investment beliefs that we have investigated, real estate as an asset is favored in four of the beliefs, two times the belief would be indifferent between adding real estate and not adding real estate to the portfolio, and in two occasions we think that real estate wouldn't benefit the portfolio as they wouldn't be positively aligned with two specific beliefs. Overall this means that according to those eight beliefs, real estate is a valuable asset to have in CalPERS' portfolio. Once again looking at the CalPERS' portfolio, we observe a $33 billion allocation to real estate assets in

June 2016, out of a total of \$302 billion, or about 11 percent. Purely looking at CalPERS' investment strategy this allocation doesn't seem inappropriate.

Looking at the two particular assets - public and private real estate - we observe that five beliefs are indifferent, two favor public real estate and only one favors private real estate (i.e. fiduciary duty to stakeholders). If we assume that CalPERS assets under management are one hundred percent in alignment with its investment beliefs, and that it values every investment belief equally, than that would mean that CalPERS would have a (slightly) higher allocation towards REITs than towards private real estate. Yet, we have observed that \$27.7 billion is allocated to private real estate and *only* \$5.7 billion to REITs.

Basically, this has to mean that one of the two assumptions which we just stated is wrong (i.e. assuming that our analysis as summarized in table 1 is at least reasonably correct). Let's address them again: 1] *CalPERS assets under management are one hundred percent in alignment with its investment beliefs* and 2] *CalPERS values every investment belief equally important.*

Assumption 1 might be wrong, meaning that CalPERS has different strategies in mind than the strategies it publicly states. However, such speculation is not the aim of this research. Another explanation could be that their investment beliefs are a goal that they aim to work towards. Using this rationale, CalPERS would gradually shift assets away from private real estate and towards public real estate. After researching CalPERS' investment outlooks and reports we do not observe any signs that such a shift is happening or will be happening in the near future. Therefore, we can only conclude that assumption 1 still holds.

Ruling out any speculation of CalPERS' alternative motives than its motives it has stated publicly, the only reason for the over-allocation in private over public real estate that is left in our argumentation, is that CalPERS values some investment beliefs higher than others. Looking again at our investment beliefs analysis, this would mean that CalPERS would assign a lot of value into investment belief number 3; its fiduciary duties to its stakeholders. Through private real estate investment, CalPERS can invest more effectively in local

Californian real estate projects than it can with public real estate, and consequently support the local economy and the Californian citizens in general. This reason, then, must trump the sum of investment beliefs number 4 and 8 in importance in order to justify their $27.7 out of $33.4 billion allocation in private real estate.

This chapter aimed at connecting the theory of investing in public and private real estate to a real-life example of a U.S. pension fund, by looking at the fund's investment strategy and link this to public and private real estate characteristics. We observed that its investment beliefs seem reasonably in sync with CalPERS' allocation in real estate. Concerning the asset allocation towards public and private real estate specifically, CalPERS' investment decisions do seem a little out of sync, however. The next chapter will provide an extensive description of academic literature in the world of public and private real estate in the universe of asset management.

# 4 Literature Review

## 4.1 REITs and private real estate in the universe of asset management

The question whether REITs add value to an investment portfolio for the institutional investor started appearing gradually in academic research starting from the 1970s. Smith and Shulman (1976) compare nine REIT funds with the Standard and Poor's Composite Index from year-end 1963 to 1974 and conclude that REITs have a worse return than common stock over the sample period, as well as a worse return than closed-end investment companies, when matched to the same sample period. Although this research did add some insights into the return, risk and diversification characteristics of real estate, it was, above all, a rather premature study. All but one of the REIT funds included mortgage investments along with equity investments in Real Estate, where some of these funds even consisted of more than 40% of mortgage investments.

Brueggeman et al. (1984) held a more optimistic view towards adding real estate to an institutional investment portfolio. They found that real estate outperformed the S&P 500 as well as common bonds in terms of returns, diversification benefits and inflation hedging. However, the authors do admit that the then existent data set on real estate was still limited, as alternative assets were rather novel at the time. It was not until 1990s that relevant academic research surfaced that made comparisons between public and private real estate equities. Meyer and Webb (1993) compared private and public real estate as well as stocks and closed-end funds, and concluded that public real estate returns appear to be more strongly related to private real estate than common stocks and closed-end funds.

Froot (1995) however, argues a different narrative, as he believes that REITs have a higher correlation with the stock market than with private real estate equity. He states that REITs are traded like stocks to an excessive extent. This has the result that REITs have a very low correlation with the actual underlying value, i.e. the profit that the real estate projects generate. Morawski et al.

(2008) support this view when one takes quarterly or annual time horizons.

However, Lee and Stevenson (2004), argue that REITs could be interesting in a mixed-asset portfolio for an investor with a long time horizon. They find that the diversification benefits of REITs tend to increase as the investment horizon is extended. This indicates that REITs potentially could be attractive to investors with longer holding periods. This is in accordance with Tsai et al. (2007), who state that REITs behave more like their underlying asset (i.e. real estate) than it behaves like stocks, albeit this only becomes evident when one takes a look at the bigger picture. They argue that the longer an asset is being securitized, the more investors acknowledge that the product is actually about the underlying asset rather than a stock. In other words, when using a longer time frame, REITs seem to behave more closely to private real estate. Although their explanation isn't proven, their condition does indeed seem to hold. Morawski et al. (2008) find increasing correlations between public and private real estate when the time horizon is increased. Oikarinen et al. (2011) use a time frame from 1977 to 2008 to investigate the relationship between the NCREIF and NAREIT total return series. They find evidence of a tight long-run relationship between the two, although they do not find similarity in diversification properties between indirect and direct real estate. Over a very long time period, the diversification properties are similar in their research. The high efficiency found in the REIT market indicates that the private real estate returns can be predicted by the alteration from the long-run cointegrating relation. Although those findings are not particularly novel, they also find that public real estate returns might possibly be used to predict private real estate returns in the short term also. They also look at return differentials, and find that an observed outperformance of securitized real estate was only temporary for the early 1990s, and did not persist for the entire time frame.

Hoesli and Oikarinen (2012) use data from the US, UK and Australia and construct two different variance decompositions methods and conclude that REITs are closer related to their underlying value than to the general stock market.

Van Den Goorbergh (2014) argues that public and private real estate should be considered as one and the same asset class. He gives arguments to support this statement that are not unlike the majority of the findings in this subsection of our report, namely that the connection between the two asset classes in the short run do not seem too obvious, yet as their underlying values are similar, the connection becomes clear when looking at a longer time frame.

After examining multiple articles on the matter, we can comfortably conclude that long-run relationships exists between private en public real estate equities. This finding holds for different time periods and in multiple geographical markets.

## 4.2   Risk and return differentials

Generally, a significant positive relationship between two asset classes implies that returns in the long run between the two asset classes should be rather similar too. Now that we have concluded that private an public real estate equities behave as somewhat similar entities in the long run, we examine multiple articles that aim to compare returns and risks between the said asset classes.

Seiler et al. (1999) examine return characteristics between public and private real estate by the four major property types and find significant differences between the public and private market per property type, and observe very different results across the types. Nevertheless, they don't check for leverage, which is incremental for a proper comparison between the two markets.

Pagliari et al. (2005) compare public and private real estate performances in the US over the time period 1981 to 2001 in terms of risk and return. They conclude that public real estate equity has a higher return of 300 basis points annually with no meaningful difference in risk, after controlling for appraisal smoothing, property type and leverage. The authors do not find the considerable return difference to be statistical significant.

Moreover, Pagliari et al. (2005) observe a trend of declining differences in return, yet reason that this trend might be circumstantial, and suspect that restated REITs will, for any time frame, be higher than restated private real

estate. They observed that public returns exceeded private returns over the period of 1981 to 2001 by 300 basis points. However, when the series were adjusted for property weighting, leverage and appraisal smoothing. Because the 'early' era of REITs consisted of low data availability and a surge in REITs (that resulted in sudden and idiosyncratic increases of the underlying value through an increased market capitalization of the constituent REITs), they fear that this period of their sample will not yield the most robust results. So they divided the results into two periods. In the subperiod of 1981 to 1992, they noticed an outperformance of REITs by 479 basis points, and in the subperiod of 1993 to 2001 62 basis point. Because they believe that the results of their sub sample of the early era should be considered with a grain of salt, the authors suggested that a seemingly obvious trend towards zero return differential will not happen. We want to investigate if this suggestion holds in a newer era, which brings us to our third and last hypothesis:

**Hypothesis 3:** There's no trend towards a return differential of zero, because REITs, by their very nature, will always provide a higher return than private real estate.

Riddiough et al. (2005) employ a time frame from 1980 to 1998 and detect that investments in REITs have produced higher average returns than similar investments in private real estate, of about 300 basis points. This is after controlling for differences in leverage, property mix and management fees. Nevertheless, they also record that the measured volatility of returns on private real estate portfolios is lower than those of REIT portfolios.

MacKinnon and Al Zaman (2009) use quarterly data from 1984 to 2007 and see no benefit in buying REITs over private real estate for investors that have the scale to invest in private real estate (i.e. pension funds and other institutional investors), as the former is riskier for all the time horizons that are researched in the article.

Cotter and Roll (2015) use the S&P/Case-Shiller (SCS) database to get

data from private real estate markets. They compare these with characteristics of residential REITs and conclude that the residential REITs are considerably more volatile than the SCS series.

Ling and Naranjo (2015) investigate returns between private and public real estate equities for four major property types in the US and find that unlevered REITs outperform private real estate in the case of offices and retail, but observe the opposite for residential and industrial property types. Unlike earlier research like Pagliari et al. (2005), they make use of the NCREIF Transaction Based Index (TBI). This is the unsmoothed version of the NCREIF Property Index (NPI) which means that this data set should not be adjusted for appraisal smoothing for a correct comparison between the two indices. When the aggregate of the property types is taken, they observe an outperformance of 49 basis points of unlevered public real estate versus private real estate equities. Their sample period lasts from Q1 1994 to Q4 2012. However, the results are rather unconvincing. For one, the cumulative unlevered return of the TBI is higher than the return of the NPI for the majority of the time up until 2009. That is, if the time frame of this research would have been three years shorter, the conclusions would have been the exact opposite. Moreover, the private real estate index is taken as a benchmark for property type weights to construct both the TBI and the REIT portfolio to come up with the 49 basis points difference. When the authors use the public real estate index as benchmark for property weights (but obviously only the four major property types), they find a mere 6 basis points annually outperformance of public real estate. Even if we use the TBI benchmark for property type weights, the article does not provide any statistical significance for the 49 basis points outperformance of public real estate.

Hoesli and Oikarinen (2016) use a cointegration framework to measure returns and risks for the four major property types between private and public real estate equity in the US from 1994 to 2011 and find similar return and risk characteristics between private and public real estate equities when every property type is measured separately, but neglect to measure the returns nor

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the risks for the aggregate of the four property types.

In short, there is no consensus about the similarities in returns between public and private real estate. Academics either find no significance difference, or a difference in favor of public real estate. We will use a time frame from 1994 to 2016 to measure the returns between public and private real estate in the US. Where the data from Ling and Naranjo (2015) and Hoesli and Oikarinen (2016) finish merely after the the financial crisis of 2008, our time frame conveniently spans to well beyond the first years of recovery of financial markets and will therefore make for a more complete picture.

## 4.3 Public and Private Real Estate in a multi-asset portfolio

REITs and direct real estate may or may not have different return and risk properties, but whether they are mutually exclusive for a mixed-asset portfolio is a different question.

Geltner et al. (1995) use historical performances from 1975 to 1993 to research the role of private and public real estate in multi-asset portfolios. They conclude that both assets are very similar, but in a diversified portfolio, neither of the two functions as a perfect substitute for the other, and a pension fund should allocate a significant portion of money in both asset classes.

Mueller and Mueller (2003) investigate the effect of inclusion of public and private real estate in a mixed-asset portfolio from 1977 to 2002 and find an improvement of the efficient frontier over different time horizons. They argue that the inclusion of both benefits a diversified portfolio because the public and private real estate have very low quarterly correlations. Although the correlations increase for longer time horizons (as we also concluded earlier on in this chapter), portfolio managers report their results on a quarterly basis and therefore, the quarterly differentials matter.

MacKinnon and Al Zaman (2009) state that real estate investments become more interesting for investors that have a long investment horizon. They test several optimal portfolio allocation strategies and argue that pension funds should hold a lot more real estate in their portfolio than the amount that they

were holding during the investigative time period.

# 5 Data & Methodology

## 5.1 Private real estate data

For the private real estate market we will make use of data provided by the National Council of Real Estate Investment Fiduciaries (NCREIF). This is a not-for-profit organization that provides information about financial performances of private real estate funds in the US. The index we are specifically interested in is the NCREIF Property Index (NPI). The NPI aims to reflect the private real estate market in the US and is seen as the most established benchmark for institutionally held private real estate (Pagliari et al., 2001). The NPI started in the last quarter of 1977 and is weighted by market value. It is calculated using quarterly total returns on a compounded basis and therefore it automatically functions as a total return index. Although some of the properties constituted in the index are leveraged investments, the returns of the NPI are reported on an unlevered basis, as it measures returns at the property level and thus doesn't consider investment or capital structure arrangements (see www.ncreif.org).

## 5.2 Public real estate data

In order to anayze public real estate equities, we will construct our own index. We will gather information of constituent REITs which is facilitated by the the National Association of Real Estate Investment Trusts (NAREIT). The NAREIT is the trade association for REITs that have an interest in US property and investment markets. We then use the Bloomberg database to attain the financial data of these constituents. We aim to construct an index similar to the FTSE NAREIT All Equity REITs Index (Bloomberg mnemonic: FNER). The FNER is part of the FTSE NAREIT Composite Index, which is a headline index of the FTSE NAREIT US Real Estate Index Series. This index series provides exposure to all tax-eligible REITs in the US that are securitized on the New York Stock Exchange and the NASDAQ. In order for REITs to qualify for the FTSE NAREIT All Equity REITs index specifically, they have to adhere to certain size and liquidity thresholds as set by FTSE Russel and NAREIT,

so that it resembles a broad REITs index and can simultaneously function as a practical liquid investment product. For example, only REITs that have a market capitalization greater than $100 million and have a free float of more than 5% are included in the index. We refer to FTSE-Russel (2017) for all the qualification criteria for this index. The total returns of this index are found on the Bloomberg terminal under the mnemonic FNERTR.[9]

A more detailed look at the FTSE NAREIT US Real Estate Index Series learns us that the NAREIT consists of more property types than the NPI does. Specifically, where the NPI only consists of four property types, we find that the NAREIT consists of a total of twelve different property types. Table 2 portrays all the property types that make up the NAREIT All Equity Index, measured in market capitalization at the end of 2016.[10] Now, we could have just gathered the data from all the core property indices to construct the core REITs index. We decided not to do so because of data constraints. More specifically, data about debt (which is crucial information needed to delever the equities) from these indices is only available from 2006 onward. From the individual REITs, however, we managed to find a lot more data going back until the 1990s. Hence we decided to gather data from all the individual REITs so that we could have a relevant time frame.

Because we want to compare identical property types, we only want to add REITs that are part of one of the 'core' property types to our data set. Notice that 'Diversified' here is a combination between multiple core property types, or even all core property types. This means that a REIT that is labeled as 'Diversified' has for example malls (Retail) and apartment buildings (Residential) under it's portfolio. Theoretically it can even have assets from all four the property types under its portfolio.

Besides constructing our own REITs index, we need to adjust the NCREIF index in order to equally compare public real estate equities with its private counterpart. Specifically, we need to adjust the NCREIF for appraisal smooth-

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[9]Recall that the NPI is already a total return index by itself.

[10]From 1996 to 2014, the NAREIT also had the property type 'Mixed', which were REITs that consisted of Industrial and Office properties.

| Property type | Bloomberg Mnemonic | Core/Non-Core | Market Cap (in millions) |
|---|---|---|---|
| Retail | FNRET | Core | $203,528 |
| Residential | FNRES | Core | $132,142 |
| Office | FNOFF | Core | $99,999 |
| Health Care | FNHEA | Non-Core | $98,294 |
| Infrastructure | FN28U | Non-Core | $81,064 |
| Industrial | FNIND | Core | $61,802 |
| Diversified | FNDIV | Core | $59,472 |
| Self Storage | FNSEL | Non-Core | $58,003 |
| Data Centers | FNDC | Non-Core | $53,168 |
| Lodging/Resorts | FNLOD | Non-Core | $50,271 |
| Specialty | FNSPE | Non-Core | $34,549 |
| Timber | FNTIM | Non-Core | $27,901 |

Table 2: NAREIT Market Cap per property type as per December 31st, 2016.

ing and reweigh its property mix. We will address appraisal smoothing in the next paragraph.

## 5.3 Restate private real estate for appraisal smoothing

The concept of appraisal smoothing applies to the NCREIF index. Like Ling and Naranjo (2015), we make use of the cumulative returns of the NCREIF Transaction Based Index (NTBI) as a tracker of private real estate equity in the US. This is the unsmoothed version of the NCREIF Property Index (which we used in order to construct figure 1). This means that the NTBI does not have to be adjusted for appraisal smoothing anymore when we compare the index with the NAREIT index. Geltner (2011) facilitates a thorough explanation about the nature of the TBI. They find that the NTBI replicates the NPI closely at the aggregate all-property level.

## 5.4 Restate public real estate

### 5.4.1 Gather return data

Recall that, for constructing our own index, we aim to create a somewhat similar index as the FTSE NAREIT All Equity Index. However, we use a slightly different methodology. For example, we include REITs that do not adhere to

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the $100 million threshold that the FTSE NAREIT ALL Equity Index has, nor to the >5% free float threshold that they use, in order to attain a larger dataset. Our time frame is naturally limited by data availability also. Through the NAREIT website, we attain all the constituent companies from 1991 until 2016. In the Bloomberg database we note, however, that the data in the first few years proved to be very limited and inconsistent. From Q2 1994, we find a lot more data to be available for the constituent REITs. We filter out all the REITs that weren't specified by NAREIT as Retail, Residential, Industrial, Office. Moreover, we need to include 'Diversified' and 'Mixed'. Diversified REITs exist of a combination of the four core property types and Mixed is a combination of Industrial and Office only and we should therefore include Diversified and Mixed into our dataset. Hence, we have gathered all the available REITs we found on the NAREIT website in between Q2 1994 and year-end 2016 that belong to at least one of the core property types.

Subsequently, we collect quarterly data of the total return index (gross dividends) for every US REIT constituent (as recorded by the NAREIT organization) from Q2 1994 through Q4 2016 using the Bloomberg database, as well as the constituent's market capitalization and debt to asset ratio. For the debt to asset ratio, we use the exact Bloomberg metric "Total Debt to Total Assets". This is the leverage ratio which defines the total amount of debt of a company relative to its assets. The total debt is defined by the sum of short term and long term debt.[11] By default, it's defined as a percentage, so we simply divide it by a hundred to get to the ratio. For the cost of debt, we cannot determine the exact cost of debt per company like Pagliari et al. (2005), as Bloomberg doesn't have a metric that calculates the preferred dividends. To counter this problem we'll use a proxy index. After examining a sub sample of all the debt offerings of NAREIT constituents from 1994 until now, we find that the debt offerings have credit ratings between BB and A, measured by the Bloomberg Composite credit rating. Therefore, we approximate the cost of debt by using

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[11]Note that we use total debt (i.e. the sum of short term and long term debt) and not total liabilities. With REITs, the amount of liabilities could theoretically be higher than the total debt as liabilities includes security deposits. Therefore, the measure of total debt that we use is the book value of debt.

the yield of maturity of a bond index that corresponds with such a rating as a proxy. A bond index that operates in between investment grade (i.e. BBB and higher) and high yield (i.e. BB and lower ) is called a crossover index and can broadly be seen as a mix between double B and triple B rated corporate bonds (Arif and Brownell, 2015). We therefore believe that a crossover bond will have a rather similar yield as the loans of the REITs we are investigating. We use the yield to maturity of the Bank of America Merrill Lynch US diversified Crossover Corporate Index (denoted as XOVD) as a proxy for the cost of debt for our REITs index. However, as crossover indices are a rather novel phenomenon, we find that the inception date is only at year end 1998. To cover the period from 1994 until 1998, we blend a high yield US bond and an investment grade corporate US bond together. To be exact, we take the yield to maturity of the Bank of America Merrill Lynch US High Yield Index, and the Bank of America Merrill Lynch US Corporate Index. The former is, as the name suggests, a high yield index, and the latter is an investment grade index. The result is illustrated in figure 2. For our analysis we divide the cost of debt by four to get to the actual cost of debt per quarter.

Now that we have amassed all the needed info from the Bloomberg database, we erase all the insufficient data. We end up with a relevant dataset which we use to construct our REITs index. The amount of constituent REITs in our dataset is depicted in table 3.

Now that we have gathered all the data, we will apply certain methods so that we can construct the REITs index.

### 5.4.2   Adjust for leverage

In this paragraph, we will address the leverage of the REITs in our data set. Recall from the beginning of this chapter that NPI returns are reported on an unlevered basis. However, the NAREIT index contains leverage, or debt, that we need to 'delever' so that it becomes a better comparable to the NPI. We use $D_j$ to denounce the debt to asset ratio of firm $j$. Now, in order to delever the index, we take proposition II of Modigliani and Miller (1958):
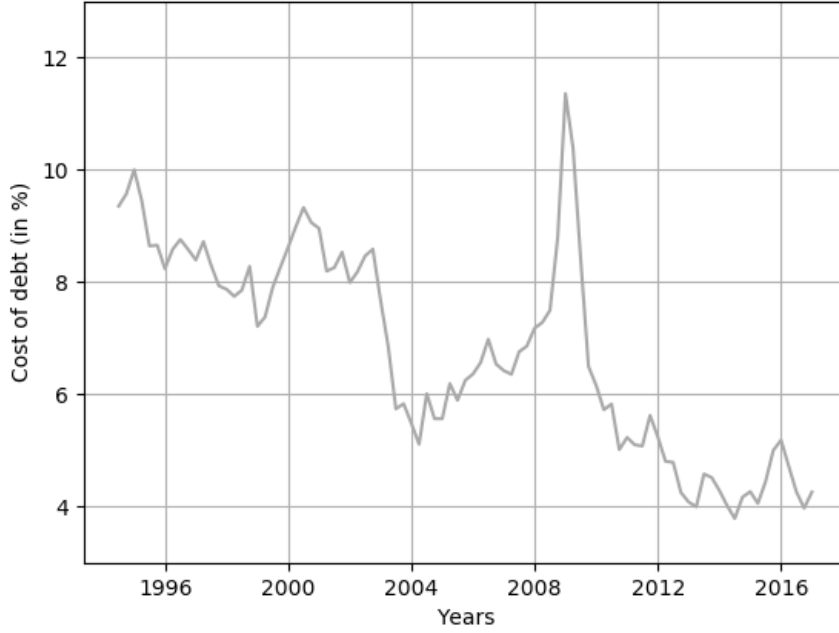
Figure 2: The yield to maturity of a sequence between a high yield and a investment grade US corporate bond index, which functions as a proxy for the approximation of the cost of debt.

$$i_j = p_j + (p_j - k_d)(D_j/1 - D_j), \qquad (1)$$

using basic algebra we get to

$$p_j = i_j(1 - D_j) + k_d D_j \qquad (2)$$

with $p_j$ being the unlevered asset return, $i_j$ the return on the (levered) equity of firm $j$, $D_j$ the debt to asset ratio of firm $j$, and $k_d$ the cost of debt. Recall that we assume the cost of debt to be equal to the quarterized yield to maturity of the Bank of America Merrill Lynch US High Yield Index.

Now, $p_j$ is the quarterly unlevered return of one REIT, independent of the market capitalization of that asset. Just like the FTSE NAREIT index, we want to create a market weighted index (FTSE/Russel, 2017). We do this by

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| | Retail | Residential | Industrial | Office | Diversified | Mixed | Total |
|---|---|---|---|---|---|---|---|
| 1994 | 22 | 18 | 10 | 8 | 17 | 0 | 75 |
| 1995 | 23 | 18 | 7 | 8 | 18 | 0 | 74 |
| 1996 | 24 | 18 | 7 | 8 | 17 | 0 | 74 |
| 1997 | 26 | 17 | 8 | 16 | 20 | 0 | 87 |
| 1998 | 31 | 11 | 9 | 17 | 21 | 0 | 89 |
| 1999 | 31 | 11 | 8 | 17 | 19 | 1 | 87 |
| 2000 | 34 | 13 | 8 | 21 | 20 | 2 | 98 |
| 2001 | 34 | 13 | 5 | 21 | 21 | 2 | 96 |
| 2002 | 31 | 14 | 5 | 21 | 21 | 2 | 94 |
| 2003 | 30 | 15 | 6 | 22 | 19 | 2 | 94 |
| 2004 | 28 | 15 | 7 | 25 | 19 | 2 | 96 |
| 2005 | 26 | 18 | 5 | 25 | 20 | 3 | 97 |
| 2006 | 23 | 18 | 4 | 21 | 16 | 3 | 85 |
| 2007 | 21 | 17 | 4 | 21 | 16 | 3 | 82 |
| 2008 | 21 | 17 | 4 | 19 | 17 | 3 | 81 |
| 2009 | 21 | 16 | 4 | 20 | 17 | 3 | 81 |
| 2010 | 23 | 16 | 5 | 22 | 21 | 3 | 90 |
| 2011 | 24 | 17 | 5 | 22 | 21 | 3 | 92 |
| 2012 | 26 | 17 | 5 | 23 | 25 | 2 | 98 |
| 2013 | 28 | 19 | 6 | 22 | 31 | 2 | 108 |
| 2014 | 28 | 19 | 6 | 26 | 37 | 2 | 118 |
| 2015 | 30 | 17 | 6 | 28 | 39 | 2 | 122 |
| 2016 | 31 | 17 | 6 | 27 | 37 | 2 | 120 |
| Unique REITs | 61 | 39 | 19 | 47 | 60 | 3 | 229 |

Table 3: Number of constituent REITs in our dataset per property type, measured at the end of each year. Also includes the amount of unique REITs that we have used over the entire time frame.

reweighing each quarterly return to it's relative weight. We accomplish this by applying equation (3):

$$p_k = p_j \left( \frac{M_j}{M_t} \right) \tag{3}$$

where $p_k$ is the quarterly return of one REIT adjusted for it's market capitalization relative to the aggregate market capitalization of all combined REITs that are accounted for in that quarter. $M_j$ here is the market capitalization of REIT $j$ in a certain quarter and $M_t$ the total market capitalization in that

quarter for our dataset. Figure 3 illustrates the advancement of $M_t$ over the course of our time frame. In this figure, one can see what the mortgage crisis of 2007/2008 did to the market capitalization of REITs. In Q1 2007 we find that our dataset has a $271 billion market cap, and ind Q1 2009 just $77 billion. Interestingly, this 72% drop in market cap didn't induce a drop of a similar magnitude in terms of return, which we will address in the next section.
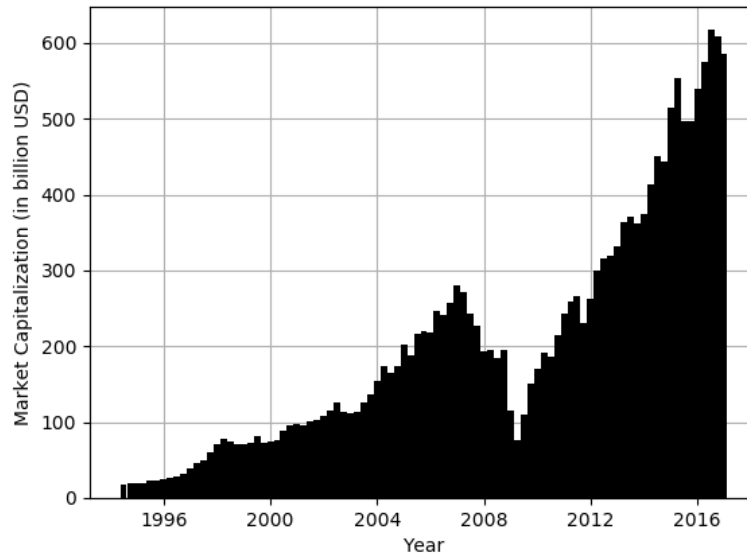


Figure 3: The development of the total market capitalization of our selected REITs.

### 5.4.3 Aggregate results

To obtain the quarterly return of our index, we simply take the sum of all the $p_k$'s of that quarter, regardless of its property type. We do this for all quarters from Q2 1994 through Q4 2016. Finally, we convert this into an index by assigning a theoretical value of $100 to the index at the beginning of Q2 1994 and use the aggregate quarterly returns to produce our market weighted total return REITs index, which we'll call PublicTR. The index returns are graphically portrayed in figure 4. In this figure, we see that the unlevered return from the REITs in our dataset would have gone from $100 in Q2 1994 to

just over \$1000 by year-end 2016. In the next chapter, we'll discuss this result and compare it to the return of its private real estate counterpart.
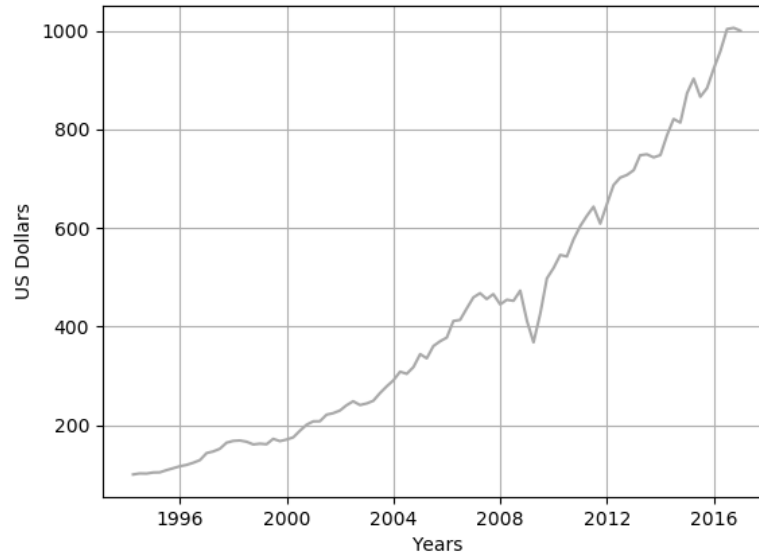


Figure 4: The constructed REITs index, from Q2 1994 to year-end 2016.

## 5.5 Render property mix

Note how we combined all the $p_k$'s together to create our REITs index. For us to calculate the property mix, recall that we still need to address two property segments: 'Diversified' and 'Mixed'. The property type 'Diversified' constitutes of multiple core property types, and does not include any non-core REITs. We used the same method as Pagliari et al. (2005) for including the diversified REITs, namely to spread the market weight of diversified REITs equally over all the core property types. We also identified the property type 'Mixed', which is a mix between Industrial and Office properties. Consequently, we weigh these REITs equally over the Industrial and Office properties. Through this method, the property mix for our public real estate index has been composed, and is graphically depicted in figure 5.

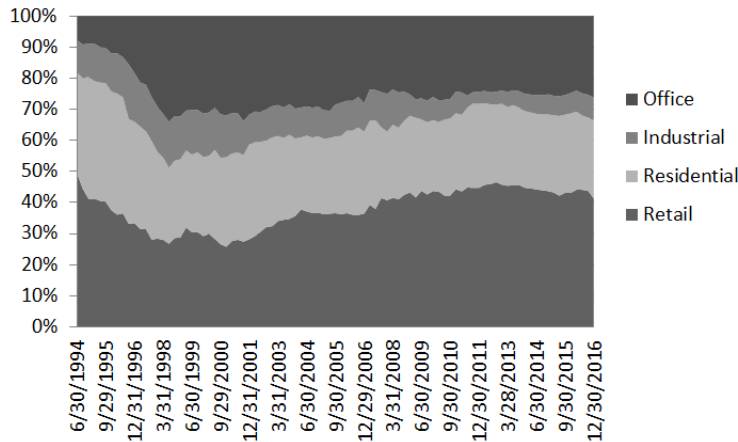We will use this property mix as a benchmark for the NCREIF. We need

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Figure 5: The property mix of our constructed REITs index over time.

to reconfigure the returns of the NCREIF transaction based index (TBI) so that it matches the property mix of the REITs index. So instead of taking the aggregate NCREIF TBI, we use the NCREIF transaction based indices of the four core property types on the Thomson Reuters Datastream database, of which table 4 presents a brief overview.

| Property type | Index name | Datastream Mnemomic |
|---|---|---|
| Retail | US NCREIF: TBI RETURNS - RETAIL | USNTBIRRR |
| Residential | US NCREIF: TBI RETURNS - APARTMENT | USNTBIRAR |
| Industrial | US NCREIF: TBI RETURNS - INDUSTRIAL | USNTBIRIR |
| Office | US NCREIF: TBI RETURNS - OFFICE | USNTBIROR |

Table 4: NCREIF transaction based indices

Even though we only select core properties, we still need to make adjustments so that the weightings of these property types of both the public and the private index are identical. In fact, the differences in return between different core property types are visible. Figure 6 illustrates that difference for appraisal smoothed private real estate equities. The figure shows the total returns per property type from the NCREIF transaction based index as well as the TBI in the aggregated form. The differences between the property types becomes especially apparent in the long term.
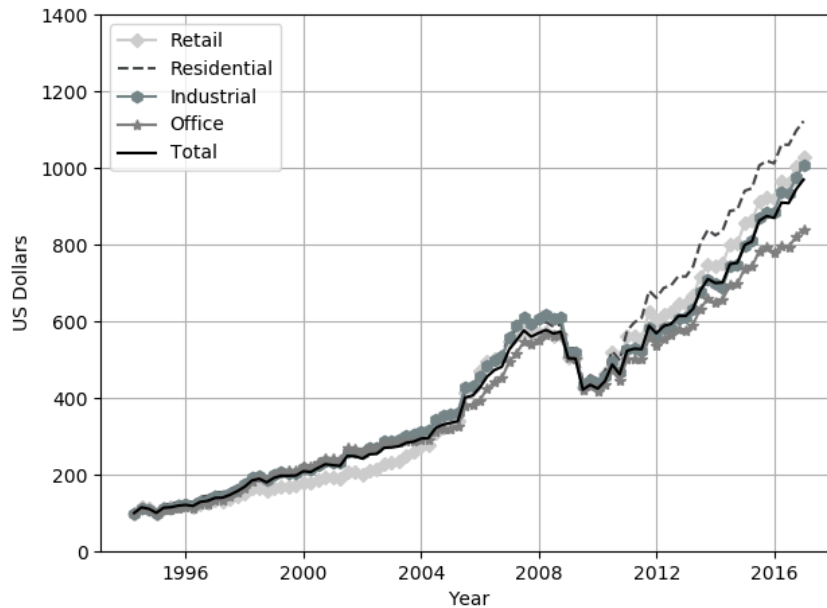
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Figure 6: Returns of the NCREIF transaction based index per property type, from 1994 to 2016. Indexed at Q1 1994 on $100.

Pagliari et al. (2001) did a similar research using a time frame from 1978 to 1997 and found similar results: the residential sector also outperformed the aggregate index in their research on TBI returns and the office sector underperformed compared to the aggregate index.[12] The reason for outperformance of the residential sector, they argue, is due to the high dividend yield and high earnings growth when compared to the other property types. Similarly, they link the underperformance of the office sector to low growth and low dividend yield. We compare these returns to the public residential real estate returns in the next chapter.

Ling and Naranjo (2015) find different results when comparing different REITs sector returns. After delevering, from the period of 1994 to 2012 they find a 9.29% mean annual return for unlevered return of the aggregate of the four

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[12]Pagliari et al. (2001) find that between 1978 and 1997 the residential NCREIF property type yields the highest returns, industrial second, retail third and office last, which is more or less the same performance as that we found from 1994 to 2016.

property types, where retail (9.90%) and (surprisingly) office (9.37%) outperform and industrial (9.02%) and residential (9.08%) perform worse.[13]

We finish our methodology by assigning a theoretical $100 to the index on Q2 1994 and use the reconfigured TBI returns from Q3 1994 onward to generate the NCREIF index. Figure 7 shows the result of this index as well as our REITs index. In the next chapter, we'll describe this figure and give a more detailed result table.
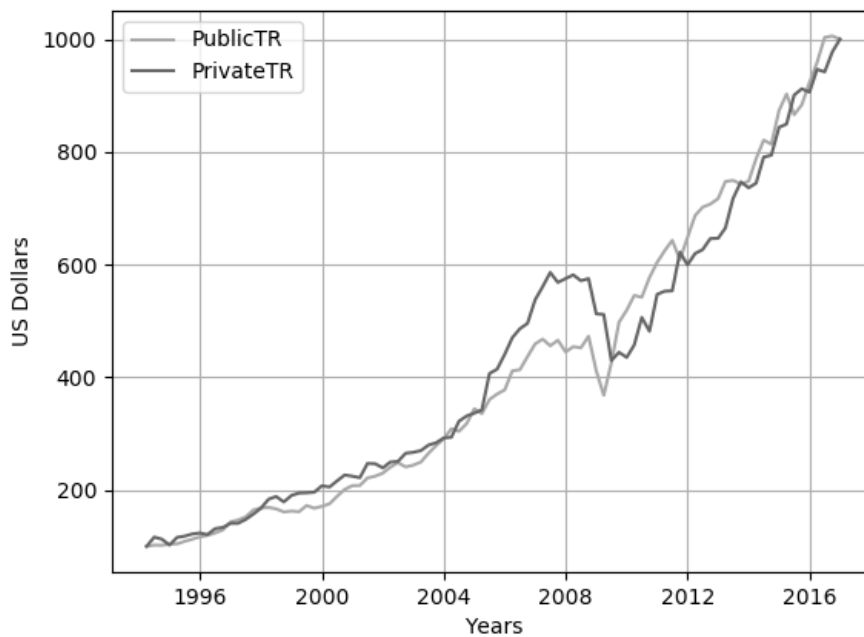


Figure 7: Returns of Public and Private Real Estate equities, adjusted for property type, leverage and appraisal smoothing, from 1994 to 2016. Indexed at Q2 1994 on $100.

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[13]Interestingly, the industrial and residential property types in this research still perform higher than the aggregate mean annual return of all properties i.e. 8.97%, building a strong case for core property REITs over non-core REITs.

# 6 Results

## 6.1 FNERTR versus PublicTR

Firstly, we'll dive into the details of our own constructed index (which we'll call PublicTR) and compare this with the FTSE NAREIT All Equity REITs Total Return Index (FNERTR). Recall from chapter five that our aim with the construction of our own index was to closely follow the FNERTR. The main difference between the FNERTR and our index is that we only make use of core property types, whereas the FNERTR includes a total of 12 different property types, as shown in table 2.
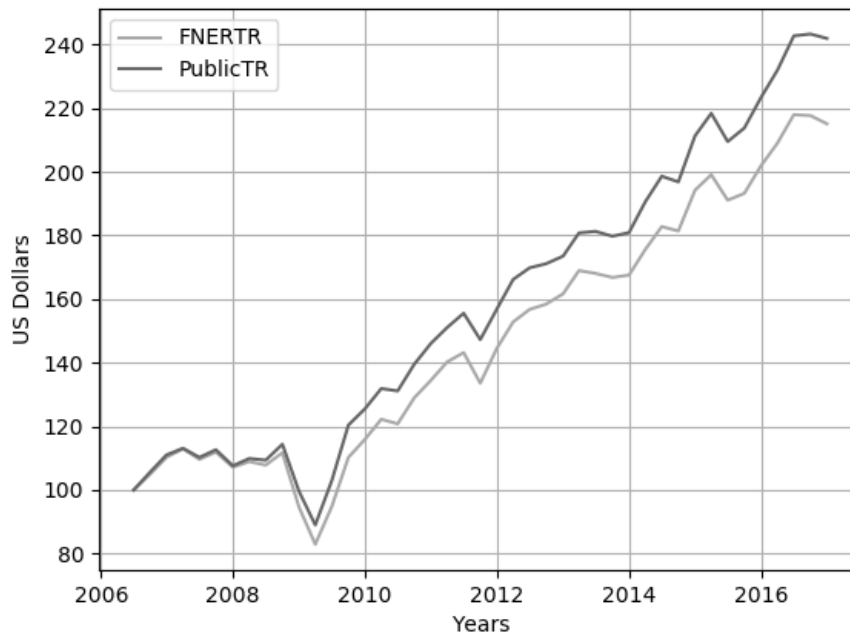


Figure 8: Returns of the FNERTR index and our own PublicTR index, both adjusted for leverage. Indexed at Q3 2006 at $100.

We compare the FNERTR index with the PublicTR index by delevering the FNERTR index the same way we delevered the PublicTR index. We use the formula as composed by Modigliani and Miller (1958). For the leverage ratio we use the Total Debt to Total Assets metric that we find on Bloomberg.

|  | Mean (%) | Std. Dev | Correlation |
|---|---|---|---|
| FNERTR 2006 - 2016 | 7.975 | 11.183 | |
| PublicTR 2006 - 2016 | 9.050 | 10.662 | 0.99199 |

Table 5: Comparing the FTSE NAREIT All Equity REITs Index with our own constructed index

Unfortunately, Bloomberg only has data for this ratio from Q3 2006 onward, so that's where the comparison starts. For consistency and convenience, we use the cost of debt that we have used to construct the PublicTR index, the yield of this cost of debt is illustrated in figure 2. The return comparison between the two indices is portrayed in figure 8. As one can see from the illustration, both return graphs are very similar, with our own index slightly outperforming the FNERTR.

Table 5 shows the annual mean returns from the FNERTR and our own PublicTR index. We used quarterly returns from Q3 2006 until Q4 2016, which yields a sample size of 42 observations per index. Although this sample size is very low and unfortunately won't yield much interesting statistical results, we observe that the indices are very similar, with a correlation of 0.99199. This correlation is calculated as follows:

$$Correl(x, y) = \frac{\sum (x - \bar{x}))(y - \bar{y})}{\sqrt{\sum (x - \bar{x})^2 \sum (y - \bar{y})^2}} \tag{4}$$

Where $\bar{x}$ and $\bar{x}$ are the sample means of the quarterly returns per index, and $x$ and $y$ are the returns at a certain quarter.

The correlation is rather high, which makes us confident that our PublicTR index, constituting of 229 REITs, is a relevant index to use for our main research.

However, in this subsection we still want to address the annual outperformance of more than 100 basis points from our own index as compared to the NAREIT. Recall that the biggest difference between the two indices are that the NAREIT includes broader range of property types. Naturally, we want to

find out if this difference is likely to explain the difference in return. Looking at previous research, core property REITs seem to outperform non-core REITs. Pagliari et al. (2005) observe an 123 basis points annual outperformance of core REITs versus non-core from 1981 until 2001, and Ling and Naranjo (2015) find a 32 basis points difference between 1994 and 2012, but also in favor of core property REITs. We will can therefore assume that the return difference observed in figure 8 is because of the outperformance of core property REITs over non-core property REITs.

## 6.2  Public versus Private

As one can see in figure 7, there's no obvious outperformance of either of the two restated indices. Over the entire time frame, we observe an absolute minimum outperformance of private real estate over public, by 1.6 basis points annually.

| | Mean (%) | t-test | p-value | Std. Dev | F test | p-value | Autocorrelation |
| | (a) | (b) | (c) | (d) | (e) | (f) | (g) |
|---|---|---|---|---|---|---|---|
| PublicTR 1994 - 2016 | 10.618 | | | 8.677 | | * | 0.104 |
| PrivateTR 1994 - 2016 | 10.783 | -0.059 | 0.953 | 10.467 | 0.687 | 0.077 | -0.184 |
| PublicTR 1994 - 2001 | 11.080 | | | 6.372 | | *** | 0.136 |
| PrivateTR 1994 - 2001 | 11.794 | -0.222 | 0.826 | 10.957 | 0.338 | 0.004 | -0.285 |
| PublicTR 2002 - 2016 | 10.379 | | | 9.704 | | | 0.097 |
| PrivateTR 2002 - 2016 | 10.168 | 0.057 | 0.955 | 10.286 | 0.890 | 0.656 | -0.130 |

Table 6: Returns and test statistics for the constructed public and private index.

Table 6 illustrates a comprehensive picture of the performance of the two return series, over the entire time frame and specific for two separate time frames. Column (a) boasts the average annual return, denominated in percentages. Column (b) and (c) represent the test statistic of a paired t-test and its respective p-value. Column (d) features the standard deviation, which is the standard

that we use to measure the volatility of the index series. Columns (e) and (f) represent the test statistic of an F test and its corresponding p-value. Column (g) signifies the autocorrelation per return index, calculated using quarterly returns.

The main question of this research is to determine whether public and private real estate equities differ in terms of return and risk. We have divided this main question into two hypotheses, namely;

**Hypothesis 1:** The returns between public and private real estate differ significantly.

**Hypothesis 2:** The volatilities between public and private real estate differ significantly.

Regarding hypothesis 1, the irrefutable answer is that the returns do not differ significantly. Over the 1994 - 2016 we observe a 1.6 basis point out performance of private real estate. Not only is this outperformance negligibly low in absolute terms, a paired t-test results in a test statistic of -0.059 and an associated p-value of 0.953 prove that this outperformance (if one can even call it an outperformance) is extremely insignificant. We reject the hypothesis that the returns between the restated series differ significantly.

Concerning the second hypothesis, we observe a considerably higher standard deviation of the NCREIF (i.e. PrivateTR) series compared to the NAREIT series (10.467 and 8.677 respectively). To test the difference statistically, we make use of an F test to compare the sample variances of the restated return series. This produces a test statistic of 0.687, which implies a fairly low p-value of 0.0768. Therefore, we conclude that the respective volatilities of public and private real estate equities over the entire time frame differs significantly, in the sense that the volatility of public real estate is statistically lower and thus preferred over private real estate. Based on the entire sample, we confirm the hypothesis that the volatilities between public and private real estate are

significant. In the subperiods from 1994 to 2001 and from 2002 to 2016, we observe outcome differentials regarding the volatilities. Specifically, we find the volatility of private real estate from 1994 to 2001 to be significantly higher than the volatility of public - with a significance of $> 99\%$. From 2002 to 2016 the difference is not significant. Therefore we believe that the there's an obvious trend towards parity on risk between the two asset classes.

The main reason that we included two subperiods, however, is because we want to look at different time frames in order to answer hypothesis 3;

**Hypothesis 3:** There's no trend towards a return differential of zero, because REITs, by their very nature, will always provide a higher return than private real estate.

Pagliari et al. (2005) suggested in their research that the outperformance of REITs will be noticeable for any time frame. Our research, as presented by table 6 convincingly debunks this suggestion. The only subperiod over which we detect a higher return differential from REITs, is from 2002 to 2016, when the restated NAREIT exceeds annual mean returns of the NCREIF by a mere 2 basispoints. We therefore reject hypothesis 3, as we have seen a return differential of zero.[14]

## 6.3  Autocorrelation

Our results regarding autocorrelation are similar to those of Ling and Naranjo (2015), who find a moderate positive autocorrelation for their restated REITs series from 1994 to 2012, and a moderate negative autocorrelation for their NCREIF series in that same period. Pagliari et al. (2005) find more or less similar results on autocorrelation (which in their research is called serial correlation) when the time period is limited to their most recent era of investigation, i.e. 1993 - 2001. A low positive correlation means that a value is almost a

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[14]We must make the side note that we didn't observe an outperformance on any time frame, not even from 1994 to 2001, whereas Pagliari et al. (2005) did observe an outperformance of public over private in that period. We are therefore not confident that their dataset would yield the same zero return differential in later periods.

random process, and the dash of positive autocorrelation suggests that there's some sequencing involved. This is usually the case for stock returns - hence we observe similar autocorrelation with our REITs. A low negative autocorrelation means that the process is still pretty random, the difference being that a negative value is a little more likely to be preceded with a positive value and vice versa and thus there's no sequencing observed - which makes sense for a non-public market like our NCREIF index.

## 6.4   Returns per property type

Now that we have discussed the differences on the macro level, we will zoom in on the differences in property types. We have briefly discussed NCREIF sector returns in the last chapter, in which figure 6 displays the return differentials between the core property types of the transaction based NCREIF indices. We observed an obvious outperformance of residential properties and an underperformance of office properties. These findings were consistent with existing research on the subject. We take our own REITs index, PublicTR, and slice it into the different sectors. The results can be seen in figure 9.

We observe a underperformance of residential REITs compared to the other properties, which is exactly in contrast with the NCREIF returns. Although research is limited on this subject, we refer again to Ling and Naranjo (2015), who find similar results. They see an outperformance of unlevered private residential real estate and an underperformance of unlevered public residential real estate, from 1994 to 2012. Ling and Naranjo (2015) also find a slightly lower volatility for residential REITs compared to other property types, which is the best explanation we are able to find for the observed difference.[15]

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[15]Cotter and Roll (2015) talk about the huge difference in volatility, stating that levered residential REITs are considerably more volatile than and levered private residential real estate, which is measured using the the Case-Shiller (SCS) database. The explanations they come up with to explain the difference have to do with the differences in indexing between the two, and unfortunately does not supply us with an explanation of the observed return difference between the residential REIT and residential NCREIF index.
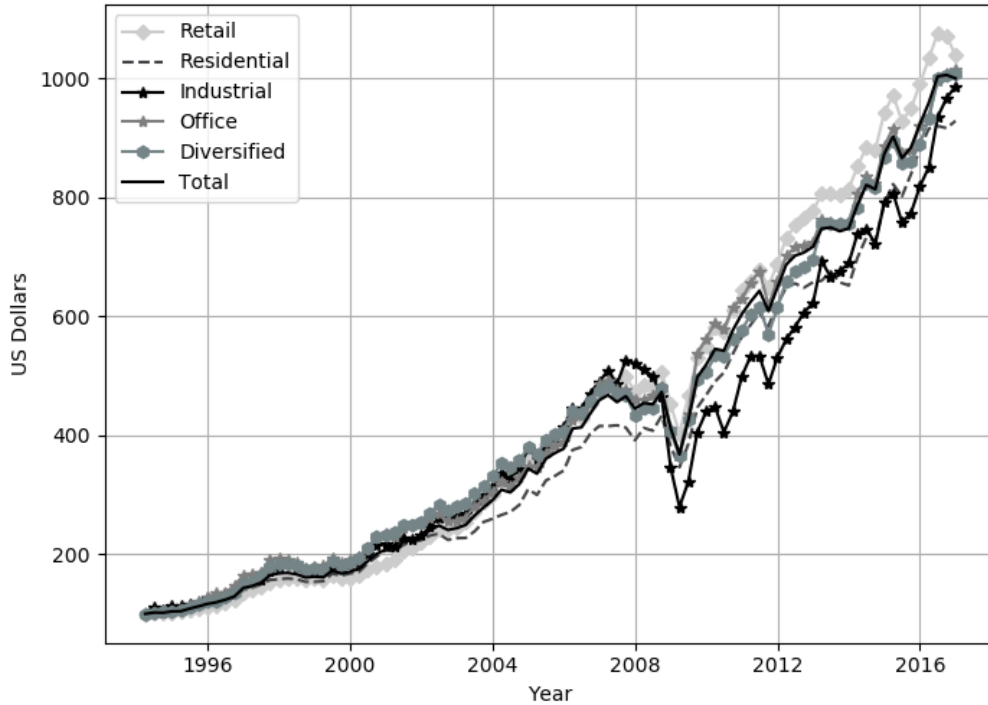
Figure 9: The return of all the core property REITs included in the PublicTR index. Indexed at $100 on Q2 1994.

# 7    Conclusions and Discussion

The main question of this research was to find out whether public and private real estate differs in terms of risk and return. We have constructed out own REITs index, PublicTR, which is a market-weighted, delevered total return index that constitutes of 229 unique U.S. REITs over the time period of 1994 to 2016. We compared this index to the delevered FTSE NAREIT All Equity REITs Index for the period of 2006 to 2016 and found a correlation of 0.99782, which gives us reason to believe we have found a relevant index that would give us the opportunity to compare REITs with public real estate over a time period of 23 years.

The property composition of the 229 core property REITs was used to

restate the NCREIF private real estate index so that the indices had identical property compositions. Because we used the transaction based index (TBI) of the NCREIF Property Index, we didn't have to adjust for appraisal smoothing anymore. Moreover, the TBI was already delevered.

We used a time frame from 1994 to 2016 to compare the two indices and did not find a significant return differential between the two assets. However, we did find that private real estate had a higher risk profile, measured in terms of volatility. We divided the sample into two subperiods and found that this risk differential didn't hold in the more recent 2002 - 2016 era.

We also investigated the separate property types, as we compared the performances of sector returns to the aggregate index return. We found an outperformance of residential real estate relatively to the TBI index. Conversely, we found an underperformance of residential REITs relatavily to our PublicTR index, which we link to the lower volatility of delevered residential REITs compared to other sectors.

Concluding, we believe that public and private real estate equities in the US have made a shift towards parity in recent years and do not find a convincing outperformance of either of the two asset classes. Considering the lower management costs and slightly lower standard deviation in returns, we slightly prefer REITs over private real estate.

## 7.1 Limitations

### 7.1.1 Managerial differences and governance

In order to be qualified as one, REITs have to adhere to stringent regulation, the most prominent rule being that REITs have to payout atleast 90% of profit in dividend payments. This very structure puts a lot of limitations on the power of managers. Whereas management of a 'regular' listed company deals with the classic trade-off between investing profits or make dividend payments, does management of a REIT not have to make this often difficult decision. Because a REIT will be seen as an efficient market product, poor managerial performance will still result in a change in management. Sirmans et al. (2006)

find that when management is changed due to poor REIT performance, the managerial change saluted by the market through an appreciation of the asset. Private real estate is not nearly as efficient, meaning that a management that is poorly performing might stay in power for years.

## 7.2  Over-adjusting the indices

Ang et al. (2013) contend the creation of a perfect analogous comparison between securitized and direct real estate. They argue that they won't adjust for autocorrelations or volatility induced by the appraisal process unlike most of the above described studies. They rather preserve those idiosyncratic characteristics as these differences make up the very nature of the return and risk differential and is precisely the interesting part worth investigating. Using this argument, we might have over-adjusted the indices to create this vacuum of two perfectly similar indices, and maybe because of that, our results are very similar. The limitation in this might be that we might have adjusted too much, and embracing some of the differences as suggested by Ang et al. (2013) might not be a bad idea.

## 7.3  Further research

We have looked at national US data, which is a macro level. However, multiple researches suggests looking to Real Estate returns on a micro level might show severely different results (e.g. Ling et al. (2016b)). Differences observed between those geographical locations seem substantial and for that reason, we believe that this investigating differences in real estate returns across regions might yield interesting results.

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