Commercial Real Estate as an Asset Class*

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Abstract

We survey the properties of commercial real estate (CRE) as an asset class. We first illustrate its importance relative to the US economy and to other asset classes. We then discuss CRE ownership patterns over time. While the academic literature has emphasized Real Estate Investment Trusts (REITs), about two thirds of CRE is owner-occupied. We next study the return properties of CRE indices, indices on particular property types, and discuss what is known about the returns to individual properties. We briefly discuss CRE debt before turning to property derivatives.

JEL: G11, G12, R33.

Keywords: Commercial Real Estate, Corporate Real Estate, Property Returns, REITs, Portfolio Diversification.

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1 The Importance of Commercial Real Estate

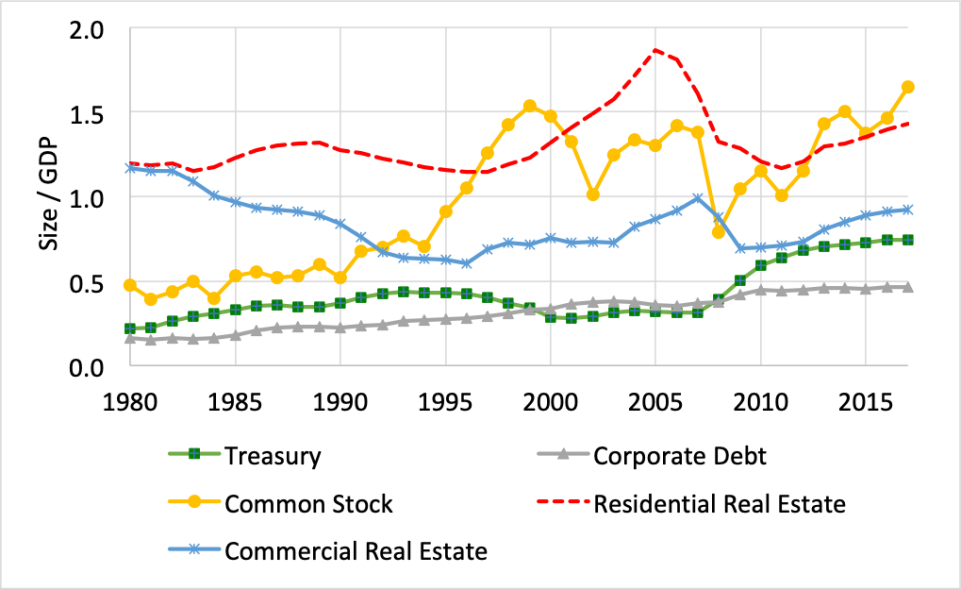
Commercial real estate (CRE) represents an important asset class in the portfolios of pension funds, life insurance companies, sovereign wealth funds, and other institutional investors. High net worth individuals also invest in commercial real estate. Unlike the public markets in which other assets like common stock trade in, commercial real estate transactions take place in private, illiquid markets.

The nature of real estate markets, in which properties are bought and sold in deals between a private buyer and a private seller, means that it is more difficult to obtain pricing and trading data on commercial real estate. Furthermore, the heterogeneous nature of real estate and the fact that a particular property trades only infrequently and irregularly through time has made it more difficult to adequately document and understand the pricing dynamics of commercial real estate.

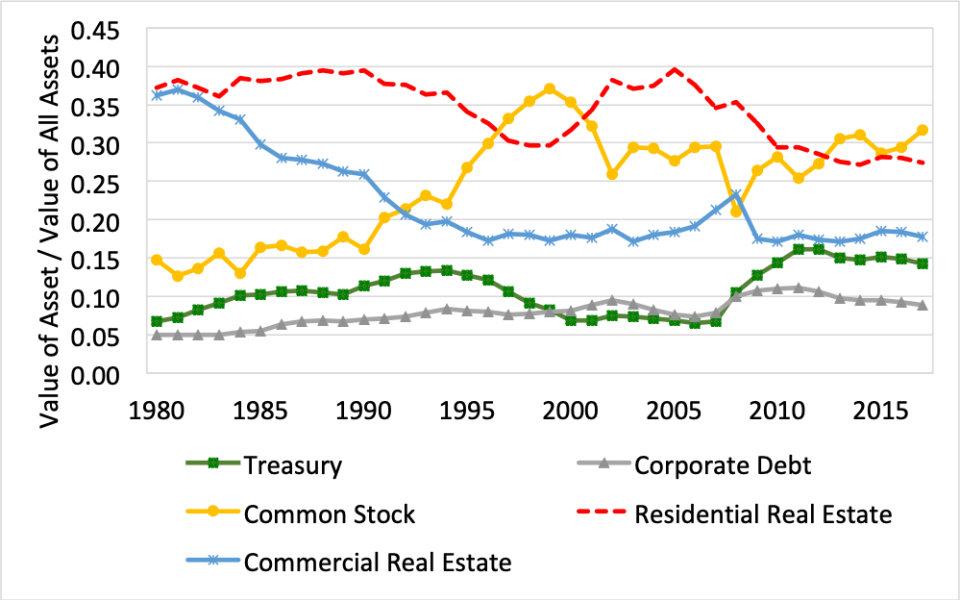
The importance of commercial real estate in U.S. financial markets is illustrated in Figure 1. There we display the amount outstanding of U.S. CRE at market value annually from 1980 to 2017.[1] Alongside, we provide corresponding data for U.S. Treasuries, common stock, and corporate debt. We also present the amount of residential real estate outstanding at market value given its similarities to commercial real estate and the fact that residential real estate represents the largest investment for most individuals. For ease of comparison across these five asset classes, we express the amounts outstanding of a particular asset class as a fraction of that year's GDP as well as a fraction of the total value of all five assets. If we view these five asset classes as comprising the investable universe from the perspective of an U.S. investor, Panel b) of the graph depicts the weights of the resultant value-weighted portfolio.

[1]Throughout this article, we focus on data from the US commercial real estate market.

Figure 1: US Asset Classes, 1980-2016



(a) As Share of GDP



(b) As Share of Assets

Notes: 1) CRE is measured as the sum of LM105035005.Q Nonfinancial corporate business real estate at market value and LM11035035.Q Nonfinancial noncorporate business real estate at market value both from Federal Reserve Flow of Funds. 2) US Treasuries is interest bearing marketable coupon debt including floating rate notes issued by the U.S. Treasury and is from SIFMA.org. 3) Common stock is the market capitalization of all U.S. domestically listed companies and is from the World Federation of Exchanges. 4) Corporate debt includes all non-convertible debt, MTNs, and Yankee bonds and is from SIFMA.org. 5) Residential real estate is Measured by LM155035005.Q Household and nonprofit organizations real estate at market value from Federal Reserve Flow of Funds. 6) US GDP is GDPA from the U.S. Bureau of Economic Analysis.

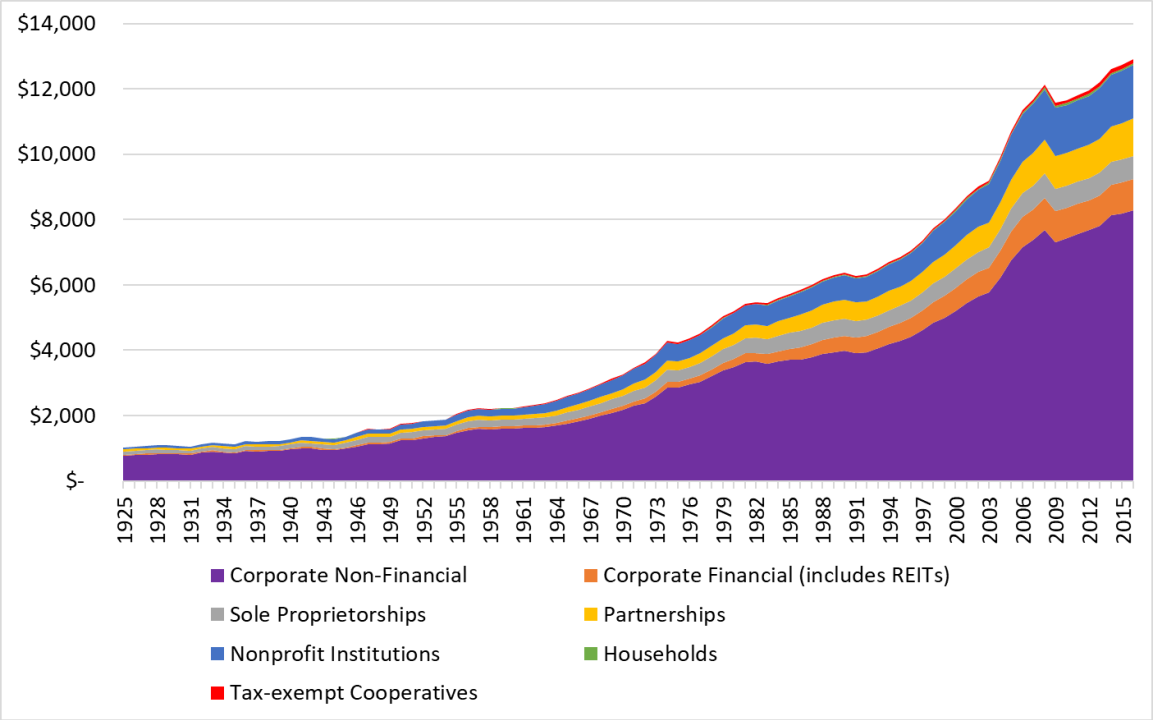
From Panel a) of Figure 1 we see that in 1980 CRE along with residential real estate represented the largest asset classes in the U.S. relative to GDP. The amounts outstanding of the other asset classes were much smaller, with the amount outstanding of U.S. common stock exceeding that of Treasuries and corporate debt. Subsequently, the amounts outstanding of commercial and residential real estate grew, but at a rate slower than the amounts outstanding of common stock, Treasuries and corporate debt. So much so that today common stock represents the largest asset class in the U.S., slightly larger than residential real estate outstanding, while the amount of Treasuries outstanding is almost comparable to that of CRE. In this Figure, we see the stock market bubble and subsequent correction between the late 1990s and early 2000s as well as the run-up in residential real estate valuations in the early to mid 2000s followed by the Great Recession. We also note that the relative value of CRE declined in the first part of our sample, due to the downturn in commercial property prices in the early 1990s, but has remained fairly stable since the mid 1990s. Overall, while non-CRE asset classes have grown, commercial real estate remains an important asset class in the U.S. investment landscape.

From the perspective of an investor seeking to allocate their wealth across these five asset classes, we can ask whether CRE offers a reduction in the investor's overall risk exposure. Hedging and overall risk reduction is often stated as being an important reason for investing in commercial real estate. We find that the standard deviation of a value-weighted portfolio that includes CRE (i.e., taking the the weights from Panel b) of Figure 1) over the 1980-2017 time period is 15% lower than the standard deviation of a value-weighted portfolio that excludes CRE. This is due to the fact that CRE offers enough diversification benefits to reduce the overall volatility of the portfolio. In fact, in the second half of our sample, 1997-2017, the reduction in the standard deviation of the portfolio that includes CRE is accompanied by a 15% increase in the Sharpe ratio (from 0.27 to 0.31). Firstenberg, Ross, and Zisler (1988) make a somewhat similar point about the optimal weight of commercial real estate in an investor's portfolio but using data from 1969 to 1985.

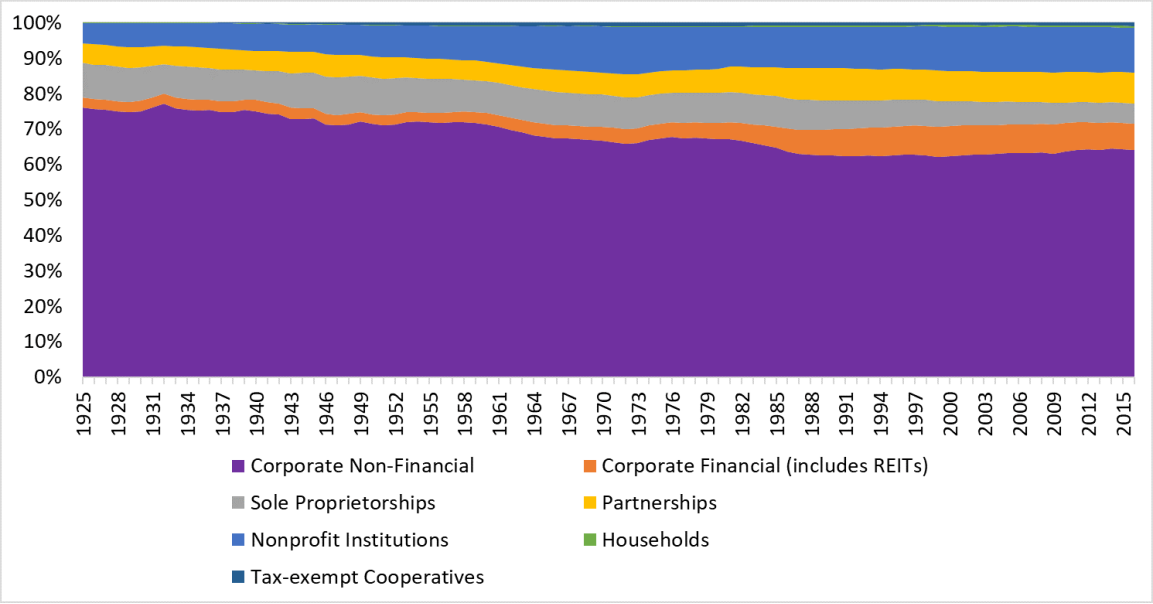
2 Who Owns Commercial Real Estate?

Panel a) of Figure 2 shows the amount of nonresidential real estate held by various institutions from 1925 to 2016. We exclude real estate directly owned by the government. The stock of nonresidential real estate is valued at slightly over $12 trillion as of the writing of this review. Corporations that use it as an input into production own most of the private nonresidential real estate. This has been true since at least 1925. Panel b) of Figure 2 plots the shares of the total stock of nonresidential real estate over time. While the share of commercial real estate held by non-financial corporations has trended down slightly since 1925, it still stands at 64%. The decrease in the share held by non-financial corporations has largely come from an increase in the share held by financial corporations, particularly after the 1986 Tax Reform Act which led to an expansion in the share of real estate held by REITs. Still, as of 2016, corporate financial firms only held 7% of the stock of US commercial real estate, down from a peak of 9% in 2000. There has also been a significant increase in the share held by nonprofit institutions. While in 1925, nonprofit institutions held just 6%, by 2016 they held 13% of the stock of nonresidential real estate.

Figure 2: US Non-Residential Structures, 1925-2016



(a) Stock in Billions of 2012 USD

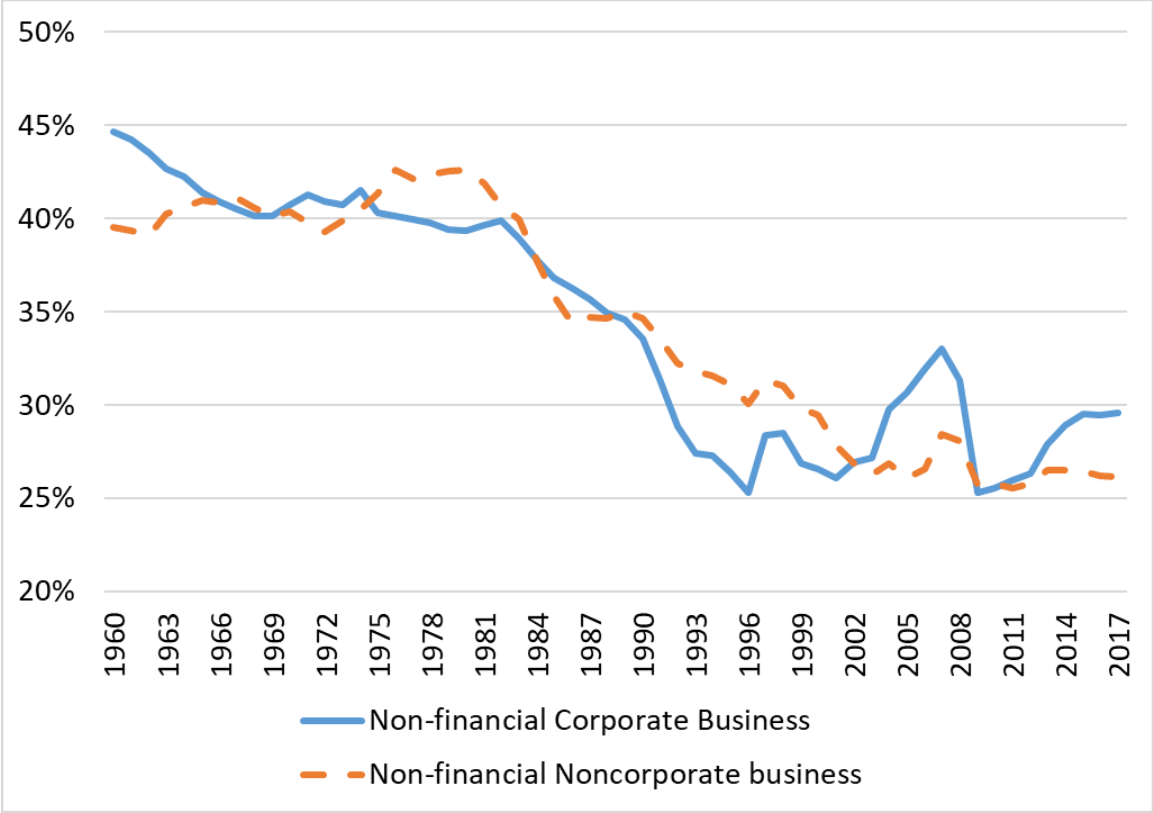


(b) Shares

Notes: 1) Figure plots current-cost net stock of private nonresidential structure taken from BEA Table 4.1. 2) GDP Deflator for 1925-1928 assumed to be equal to 1929 value since there is no deflator available for 1925-1928.

Not only are corporate non-financial holdings of commercial real estate a large share of the total stock, as Figure 3 shows, they are a large share of the assets of non-financial firms. As of 2017, nonresidential structures accounted for almost 30% of the assets of both non-financial corporate and non-corporate businesses. Commercial real estate is a declining share of firms' assets, however. From 1960 to the mid-1980s, commercial real estate accounted for roughly 40% of non-financial firms' assets. This decreasing share reflects the fact that firms are more likely to rent their real estate assets rather than own.

Figure 3: Real Estate as a Share of Firms' Assets



Notes: 1) Figure plots nonresidential real estate assets as a share of total assets. 2) Share for Non-financial Corporate Business may include a small amount of residential real estate. 3) Source: Tables S4 and S5 of Financial Accounts of the United States available from the BEA.

Given the size of the corporate real estate market, a large literature has investigated the function real estate performs for corporations. Ambrose (1990) tests whether the market prices corporate real estate assets differently from other corporate assets. Tuzel (2010) shows how the slow depreciation of real estate affects stock returns. Tuzel and Zhang (2017) explore how variation in real estate prices across cities affects firm risk. Gan (2007), Chaney, Sraer, and Thesmar (2012), and Wu, Gyourko, and Deng (2015) study how firms' ability to use CRE as collateral affects firm investment. Campello and Giambona (2013) and Cvijanović (2014) show how real estate holdings affect firm capital structure. Benmelech, Garmaise, and Moskowitz (2005) look at how the redeployability of firms' CRE holdings affect the structure of their loans. Ambrose, Diop, and Yoshida (2017) analyze how corporate real estate holdings interact with product market competition and firm risk. Mao (2017) illustrates the relation between corporate real estate holdings and firm innovation.

While unquestionably important, the focus of this review is commercial real estate *as an asset class* so that we cannot thoroughly review the literature on corporate real estate here. While firms may use their CRE as collateral, real estate held by corporations is not an asset class in the sense of being easily investible by an outside investor. Despite owning the majority of the stock of CRE, corporate users are a small share of total transactions in CRE. Ghent (2018) finds that users made less than 3% of CRE purchases over the 2001-2015 period indicating that corporations purchase real estate and then hold it for a very long period. Often, the reason they choose to own rather than rent relates to the specificity of the asset they require. We also cannot easily measure the returns on real estate held by corporations for their own use. In the remainder of this review, we therefore focus on real estate that firms hold to lease to other firms rather than to use themselves.

Differences between Public and Private Real Estate

The richest data on CRE often comes from REITs because they are publicly traded. The empirical REIT literature is voluminous, partly because of the data availability

for this segment of the market. It is therefore of interest to know how representative the properties REITs own are of the universe of CRE. Table 1, reproduced from the data presented by Ghent (2018), shows how the properties purchased by REITs differ from those purchased by private investors. REITs concentrate their purchases in the retail segment of the market, buy slightly larger and younger properties on average. However, there is no difference in the quality of properties bought by REITs and non-REIT investors.

Table 1: REIT and non-REIT CRE Purchases

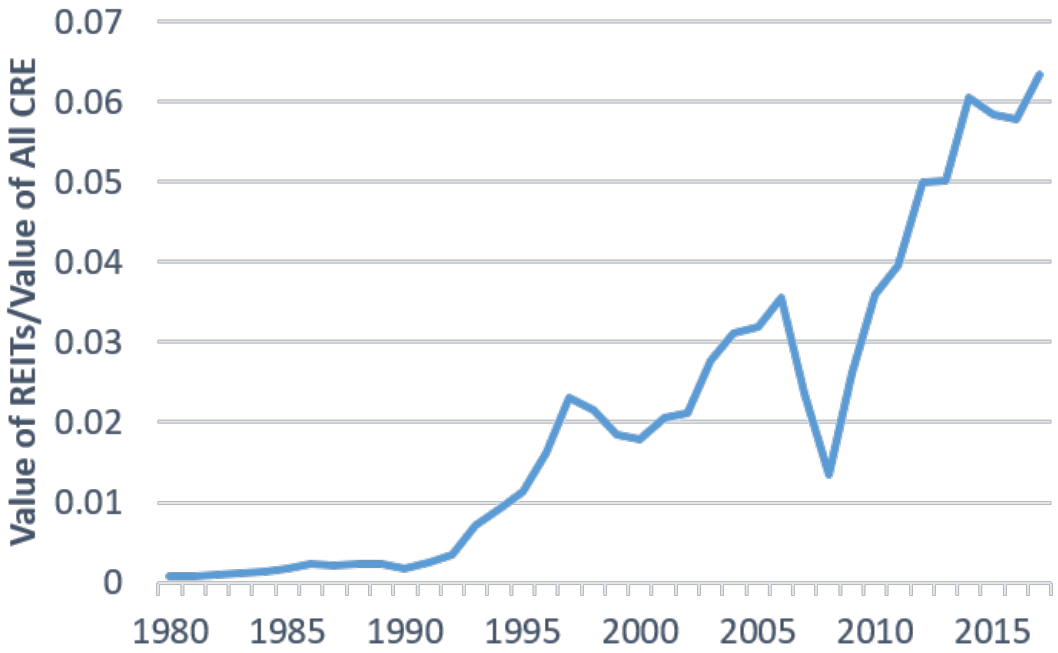
Variable	Obs	Mean	Median	Std. Dev.	Min	Max
Panel A: All Transactions						
YearBlt	124,059	1978.5	1985.0	26.7	1111.0	2020.0
Units	131,082	104	51	169	0	5500
QScoreNat	110,665	0.56	0.58	0.29	0	1
development	131,739	0.02	0.00	0.15	0	1
office	131,739	0.33	0.00	0.47	0	1
industrial	131,739	0.35	0.00	0.48	0	1
retail	131,739	0.32	0.00	0.47	0	1
Panel B: REIT Purchases						
YearBlt	10,586	1987.8	1991.0	20.2	1635.0	2016.0
Units	11,393	158	98	211	1	4348
QScoreNat	8,792	0.56	0.57	0.27	0	1
development	11,432	0.03	0.00	0.17	0	1
office	11,432	0.27	0.00	0.44	0	1
industrial	11,432	0.33	0.00	0.47	0	1
retail	11,432	0.39	0.00	0.49	0	1

Notes: 1) YearBlt is the year the property was built or is anticipated to be completed in the case or properties still under development. 2) Units is the number of square feet in 1000s. 3) QScoreNat is the proprietary RCA measure of the quality of the property. 4) $development$ takes a value of 1 if the property is under one year of age at the time of purchase. 5) $office$ takes a value of 1 if the property is an office property; $industrial$ and $retail$ are similarly defined. The underlying data, presented in Ghent (2018), come from RCA and cover 39 US MSAs from 2001 to 2015.

While there are not obvious observable differences in property purchased by REIT and non-REIT investors other than size and property type, Mühlhofer (2013) points out that REITs select properties primarily based on their net rental income, rather than expected capital appreciation, because they are prohibited by law from holding properties primarily for resale. One of the requirements to be a REIT, for example, is

a minimum holding period of four years. In the next section, we discuss differences in the returns of publicly and privately held real estate.

Figure 4: REIT Market as a Fraction of All Commercial Real Estate, 1980-2017



Notes: 1) Figure plots the market capitalization of US REITs as a fraction of the value of total commercial real estate in the US for the period 1980–2017. The market capitalization of REITs is from CRSP-ZIMAN. The value of the US commercial real estate market is as in previous graphs.

Publicly held real estate companies represent a small but growing fraction of the CRE market. To illustrate this fact, in Figure 4, we display the market capitalization of all REITs as a percentage of the US CRE market. The value of REITs has increased from less than 1% to slightly over 6% of all CRE. The growth was slow in the 1980s to early 1990s but has accelerated in the second part of the sample period. The 2007-2009 financial crisis had a significant effect on REIT prices. Among the factors that can explain the dip in the REIT share are that publicly traded companies were particularly hard hit by the crisis, the effect of leverage on equity returns, and that lower valuations of privately held companies were not fully captured during that period.

It might come as a surprise that REITs, despite their recent growth and promi-

nence in academic research, still represent a small fraction of the CRE universe. In other words, CRE is much more than REITs. The over-representation of REIT-related papers is undoubtedly related to the availability of high quality data for public companies, providing researchers with the opportunity to investigate issues in corporate finance (e.g., Hite, Owers, and Rogers (1984), Howe and Shilling (1988), and Ling and Ryngaert (1997)) and asset pricing (e.g., Liu and Mei (1992)). Data for privately held CRE companies is much harder to gather. This is true for prices and returns and even more so for information related to ownership, property characteristics (e.g., size of property, type, condition, depreciation, or occupancy), and financing. Yet, the economic magnitude of the non-REIT CRE sector makes it difficult to ignore if we are to fully understand commercial real estate as an asset class. In the next section, we address the empirical challenges of working with non-REIT CRE data.

3 Commercial Real Estate Returns

Returns on CRE Indices

Panel A of Table 2 displays summary statistics for the returns on CRE indices from five data sources. The first three returns series are the National Council of Real Estate Investment Fiduciaries (NCREIF) Property Index (NPI), Real Capital Analytic's (RCA) Commercial Property Price Index (CPPI), and CoStar's Commercial Repeat Sales Index (CCRSI). These series represent the returns of portfolios of privately held CRE and aggregate unlevered property-level returns. The remaining two return series are from the National Association of Real Investment Trusts (NAREIT) and CRSP-ZIMAN and are two widely used REIT indices that cover publicly traded CRE. We do not adjust the REIT series for their use of leverage so that they are not directly comparable to the privately held CRE series.

We provide statistics for total returns and, when the data are available, both their price appreciation and income components. We report these statistics for the entire sample period a particular series is available. In an online appendix, we provide

the summary statistics for a much shorter sample period from 2002 to 2017 that is common across all of the indices. The NCREIF and RCA series are available at a quarterly frequency while the remaining series are at a monthly frequency. Means and standard deviations are in annualized percentages.

Table 2: Summary Statistics on CRE Index Returns

Panel A: Returns on CRE Indices					
	NCREIF	CPPI (RCA)	NAREIT	ZIMAN	CCRSI (COSTAR)
	TotRet	TotRet	TotRet	TotRet	PriceRet
Mean	9.0	11.9	10.7	11.9	5.5
StdDev	4.2	5.2	17.4	16.5	5.1
AR(1)	0.782	0.937	0.061	0.095	0.661
Skew	-2.14	-1.60	-0.39	-0.81	-0.98
Freq	4	4	12	12	12
N	162	64	556	456	267
Sample	1978.1-2018.2	2002.1-2018.1	1972.1-2018.4	1980.1-2017.12	1996.1-2018.4

Panel B: Income and Price Appreciation Returns on CRE Indices								
	NCREIF	CPPI	NAREIT	ZIMAN	NCREIF	CPPI	NAREIT	ZIMAN
	IncRet	IncRet	IncRet	IncRet	PrRet	PrRet	PrRet	PrRet
Mean	7.05	7.30	7.74	6.92	1.97	4.54	2.91	5.00
StdDev	0.65	0.30	1.43	0.96	4.09	5.26	17.26	16.43
AR(1)	0.989	0.951	0.088	-0.047	0.777	0.940	0.067	0.105
Skew	-0.37	0.77	4.98	0.89	-2.03	-1.60	-0.41	-0.81

Panel C: Macroeconomic Variables							
	CPI_INF	TB3M	TB10Y	CS	GZ	VW Ret	
Mean	3.45	3.49	5.83	3.69	1.81	10.69	
StdDev	1.20	0.91	0.82	1.73	0.28	15.18	
AR(1)	0.57	0.99	1.00	0.93	0.97	0.07	
Skew	0.62	1.04	0.89	-0.91	2.39	-0.54	
Freq	12	12	12	12	12	12	
N	858	1016	785	377	524	651	
Sample	1947.2-2018.7	1934.1-2018.8	1953.4-2018.8	1987.2-2018.6	1973.1-2016.8	1964.1-2018.3	

Notes: The Table displays summary statistics of the five most widely used commercial real estate indices discussed in the text. Panel A contains the results for total returns (TotRet), whenever available. In Panel B, we show the statistics for the income return (IncRet) and price appreciation (PrRet) parts. The following macroeconomic and finance variables are summarized in Panel C: CPI inflation (CPI_INF), three-month Treasury bill yield (TB3M), 10-year Treasury bond yield (TB10Y), the appreciation of the Case-Shiller repeat residential real estate sales index (CS), the Gilchrist and Zakrajšek (2012) spread, and the return to the CRSP value-weighted index (VW Ret).

The average return of privately held CRE is between 9.0% (NCREIF) and 11.9% (RCA). The difference of approximately 3% is not due to the different corresponding sample periods (see appendix) but rather may reflect a difference in the risk characteristics of these indices. In particular, the standard deviation of NCREIF returns is lower (4.2%) than that of the RCA returns (5.2%). Some of these differences, however, may reflect the fact that the CPPI is a repeat sales index while the NPI returns reflect the use of appraisals and exhibit smoothing as a result. By contrast, the average CoStar return is much lower because it does not include an income return component. For publicly held CRE, the average return is between 10.7% (NAREIT) and 11.9% (ZIMAN). In the common sample period (see appendix), the two indices have comparable average returns of about 12%. From Panel A we also see across all indices that CRE index returns are negatively skewed with total returns of the NPI being most negatively skewed.

Panel B decomposes CRE total returns into their income and price appreciation components. The income return component is remarkably similar across indices. At about 7%, income returns represent a significant fraction of total CRE returns. Income returns also exhibit low volatility with relatively little and, in most cases, positive skewness. These results also characterize the publicly traded NAREIT and ZIMAN indices. Given it's relatively large size and little volatility, the income return component of total CRE returns is particularly appealing from a risk-return perspective.

Turning our attention to the price appreciation component of total CRE returns, average price appreciation is between 2.0% (NCREIF) and 4.5% (RCA) for privately held CRE. For publicly held CRE, the average price appreciation ranges between 2.9% (NAREIT) and 5.0% (Ziman). These results indicate that the price appreciation component varies across the indices as well as the fact that price appreciation in CRE is sensitive to the sample period being considered. Comparing Panel A with Panel B, we see that most of the total variance and negative skewness of the total CRE returns is due to the corresponding price appreciation component. It is the price appreciation component that makes CRE investments risky.

In light of the significant search and other transaction costs present in the privately held CRE market, we see in Panel A that the first-order serial correlations of the total returns of privately held CRE indices are high. Total returns of publicly held CRE indices, by contrast, have low first-order serial correlation, in the range of 0.04 to 0.06, reflecting the efficiency of capital markets. The first-order serial correlation patterns of total CRE returns also characterize the first-order serial correlation patterns of their corresponding price appreciation components. The AR(1) coefficient is close to one for the income component of privately held CRE returns but close to zero for the income component of publicly held CRE returns.

Looking across the five CRE return series, the largest differences are between privately and publicly held indices. We summarize the differences as follows: (i) the average total return of CRE is in the range of 9% to 12% per year; (ii) publicly held CRE returns have higher volatility (iii) privately held CRE returns have large downside risk which makes it a riskier investment than suggested by its low variance; (iv) the income component of private and publicly held indices is about 7% and exhibits little volatility; (v) price appreciation accounts for 2% to 4.5% of total returns and is more volatile; and (vi) the serial correlation of privately held CRE returns is large and positive, capturing the significant frictions prevailing in that market. For publicly held CRE returns, by contrast, the serial correlation is close to zero as expected given the efficiency of capital markets.

To place CRE into a broader financial and macroeconomic environment, we now focus on one privately held CRE index (NCREIF) and one publicly held CRE index (NAREIT) and consider their relation to a variety of other financial and macroeconomic variables. Panel C of Table 2 shows the summary statistics of the following six macroeconomic and finance variables: CPI inflation (CPI_INF), three-month Treasury bill yield (TB3M), 10-year Treasury bond yield (TB10Y), the appreciation of the Case-Shiller repeat residential real estate sales index (CS), the Gilchrist and Zakrajšek (2012) spread and the return to the CRSP value-weighted index (VW). CPI inflation, the three-month Tbill yield, and growth in the Case and Shiller index have comparable averages, 3.45%, 3.49%, and 3.69%, respectively. The average GZ spread is 1.81%,

the average 10-year Treasury bond yield is 5.83%, and the VW return is 10.69%. The macroeconomic series are all persistent with the exception of the inflation rate. The CS index exhibits a significant negative skew, similar to the CRE indices.

The average returns of the NCREIF and NAREIT indices exceed that of the 10-year Treasury bond and are comparable to the average value-weighted stock market return (VW).[2] At first glance, the high mean return and low variance of return to the NCREIF index might seem surprising. However, its large average return might be compensation for the negative skewness and significant downside risk in that portfolio.

Table 3: Granger Causality Tests Between NCREIF and NAREIT Returns

DepVar	Const	NCREIF(-1)	NAREIT(-1)	NCREIF(-2)	NAREIT(-2)	NCREIF(-3)	NAREIT(-3)
NCREIF	0.004	0.586	0.024	0.284	0.013	-0.107	0.013
t-NW	1.92	4.72	2.43	2.64	1.09	-1.14	0.98
NAREIT	0.035	0.994	0.089	-0.507	-0.174	-0.807	-0.017
t-NW	3.40	0.90	1.27	-0.51	-1.77	-1.90	-0.28

Notes: 1) VAR(3) 2) t-NW denotes that we calculated t-stats using Newey-West standard errors.

The CRE literature has emphasized the efficiency of capital markets in impounding information into REIT returns[3], leading to them being close to serially uncorrelated. The implication is that NCREIF returns will be slower to respond to economic shocks. The different time series properties of NCREIF and NAREIT returns in Table 2 support these claims.

A direct way of investigating the efficiency of capital markets is to run Granger causality tests between privately and publicly held CRE returns. To do so, we estimate vector autoregressions (VARs) of NCREIF and NAREIT returns at quarterly horizons. The results are displayed in Table 3. There we see that NAREIT returns forecast NCREIF returns one-quarter ahead when controlling for lagged NCREIF returns. The reported t-statistics use Newey-West standard errors with an automatic

[2]Anderson, Clayton, MacKinnon, and Sharma (2005) argue that REIT returns behave very much like small cap value stocks in other industries.

[3]See, for example, Fisher, Gatzlaff, Geltner, and Haurin (2003), Riddiough, Moriarty, and Yeatman (2005), and Yavas and Yildirim (2011).

lag selection. Conversely, NCREIF returns do not forecast NAREIT returns. Interestingly, when we estimate a VAR with two quarterly lags, NAREIT returns lagged two quarters also significantly forecast NCREIF returns. In other words, the frictions in the privately held CRE market are significant enough to induce up to six months of lag in price adjustment. Lags larger than two quarters are insignificant. These results support the efficiency of capital markets and emphasize the significant frictions that exist in the privately held CRE market. The reported results are all in-sample because our short dataset does not allow us to conduct an out-of-sample comparison.

We are not the first to investigate the relation between public and private CRE returns; a large literature has examined this issue. For example, Riddiough et al. (2005) compare unlevered REIT returns with NCREIF returns after adjusting for partial-year financial data, differences in property type mix, and fees. They conclude that, after these adjustments, public CRE returns exceed private CRE returns by approximately three percentage points. However, Riddiough et al. (2005) do not adjust for appraisal-smoothing in the NCREIF data. Pagliari, Scherer, and Monopoli (2005) do adjust for appraisal smoothing but not fees, and find comparable private and public market returns. Ling and Naranjo (2015) use a version of the NCREIF data that mitigates the appraisal-smoothing problem and still find that REITs outperform private CRE but by a much more modest amount than what Riddiough et al. (2005) find. Consistent with our findings in Table 3, Gyourko and Keim (1992), Yavas and Yildirim (2011) and Ling and Naranjo (2015) find that REIT returns lead private market CRE returns. Boudry, Coulson, Kallberg, and Liu (2012) find that the relation between REIT and private CRE returns is tighter at longer horizons.

The CRE literature conjectures that expected returns vary over time due to changes in the state of the economy (see, for example, Plazzi, Torous, and Valkanov (2010)). While expected returns are not directly observable, one might indirectly capture their time variation using state variables that proxy for changes in the investment opportunity set. Following this line of reasoning, researchers have investigated whether various economic variables are able to capture future fluctuations in, or forecast, CRE returns (see, for example, Ghysels, Plazzi, Valkanov, and Torous (2013) and the refer-

ences cited therein).

We revisit these results in Table 4. In particular, we ask whether the following state variables forecast next-quarter NCREIF or NAREIT returns: NCREIF log income return, NAREIT log dividend yield, log CPI, log three-month Treasury yield, log 10-year Treasury yield, log VW stock return, log GZ spread, and log Case-Shiller return. Inflation, interest rates, and the stock market return are clearly relevant variables when gauging the state of the economy. For NAREIT returns, the log dividend yield provides a good proxy for time variation in expected returns (Campbell and Shiller (1988) and many REIT predictability papers). In the case of the NCREIF index, we use the log income return as a predictor.[4] All regressions include one lag of the forecasted return in addition to the single predictor. We only report the coefficient on the predictor and its NW t-statistic.

We see that several state variables forecast NCREIF total returns. Consistent with the results of Plazzi et al. (2010), the NCREIF total return is forecasted by its income return and the relation is statistically significant.[5] The US stock market return, the GZ spread, and the Case and Shiller index are all statistically significant forecaster of NCREIF returns at the 5% significance level or better.

Table 4: Forecasting NCREIF and NAREIT Returns with Other State Variables

DepVar	NCREIF Inc(-1)	NAREIT DIVYLD(-1)	CPI Inf(-1)	TB3m(-1)	TB10(-1)	VW RET(-1)	GZ(-1)	CS(-1)
NCREIF	0.70	-0.45	0.15	0.03	0.03	0.03	-1.45	0.28
t-NW	1.77	-0.78	1.61	0.31	0.36	1.80	-2.02	1.75
NAREIT	3.34	5.67	1.70	0.29	0.66	0.09	-1.98	0.74
t-NW	1.42	1.72	1.60	0.48	1.03	0.50	-0.43	0.88

Notes: t-NW denotes that we calculated t-stats using Newey-West standard errors.

By comparison, the time variation of NAREIT returns is not nearly as forecastable.

[4]We run all forecasting regressions at quarterly frequency, as we want to be able to compare the NCREIF and NAREIT results. For NAREIT returns, the predictability regressions can also be run at monthly horizons, as is done in most of the NAREIT literature. We were interested in the robustness of the predictability returns at quarterly horizons.

[5]The positive relation is not mechanical, as the total return can be decomposed into income and price return, both of which can have their own time series dynamics. In the appendix, we in fact show that the price return is negatively correlated with future NCREIF returns.

The best forecaster is NAREIT's dividend yield, consistent with the arguments in Campbell and Shiller (1988). None of the other conditioning variables capture future variation in NAREIT returns. The results in Table 4 imply that NCREIF expected returns and prices are more exposed to cyclical variation in business cycle variables than are the NAREIT expected returns.

Table 5: Do NCREIF and NAREIT returns Lead Other Macro Variables?

DepVar	NCREIF (-1)	NAREIT (-1)
INF	0.041	-0.005
t-NW	1.401	-0.622
T10Y	0.006	0.001
t-NW	1.194	0.746
T3M	**0.018**	0.003
t-NW	**2.257**	1.387
VW	-0.102	-0.056
t-NW	-0.459	-0.639
GZ	**0.013**	-0.001
t-NW	**1.965**	-0.745
CS	-0.055	0.004
t-NW	-1.513	0.311

Notes: t-NW denotes that we calculated t-stats using Newey-West standard errors.

Do commercial real estate prices forecast changes in the aggregate economy? To answer this question, we run Granger causality tests that are reverse to those in Table 4 and investigate whether NCREIF and NAREIT returns forecast macroeconomic and other state variables. These regressions include one lag of the forecasted variable, as most of these variables are serially correlated (see Table 2). While the residential real estate literature finds that fluctuations in real estate quantities, such as housing starts, rather than prices contain information about the future state of the macroeconomy[6], we now investigate if the same holds true for CRE. If we once again take the perspective that equity markets are efficient, we conjecture that NAREIT returns should contain more information about the future state of the economy than NCREIF returns.

[6]See, for example, Leamer (2007), Ghent and Owyang (2010), and Strauss (2013).

The results of the reverse Granger causality tests are provided in Table 5. NAREIT returns do not forecast the macroeconomic and stock market variables. We find, however, that NCREIF returns forecast the three-month Tbill yield and the GZ spread. These findings are surprising as the three-month Tbill yield and the GZ spread are the two variables that best forecast the state of the economy (Campbell and Ammer (1993) and Gilchrist and Zakrajšek (2012)). By definition, they should not be forecasted by any other variable. This finding suggests that NCREIF returns contain information about the state of the economy that is reflected in lags of the leading macroeconomic forecasters. Why this might be the case is an interesting question for further investigation.

Returns by Property Type

The CRE industry has traditionally classified properties into Core and non-Core types. For example, NCREIF defines Apartments, Freestanding Retail, Industrial, Office, Regional Malls, and Shopping Centers as Core property types while Health Care, Lodging-Resorts, Manufactured Homes, and Self Storage are defined as non-Core property types (see, for example, Pagliari et al. (2005)). Investors often perceive Core property types as well as properties located in the Central Business District (CBD) of major markets to be less risky.

Table 6 examines the return properties of REITs focused on different property types. All the returns of core property types have higher means and standard deviations than the S&P 500. The average returns of core property types are all in the range of 10% to 15% annually with standard deviations ranging from 18% to 29%. Of the core property types, only Free Standing Retail has a statistically significant alpha but is only significant at the 10% level. Industrial and Office have betas of 1. Apartments have a beta of 0.6 while Retail property types have betas ranging from 0.5 to 0.8.

Overall, the returns on REITs focusing on non-core properties do not indicate that non-core properties are any riskier than core properties. Furthermore, the returns of

non-core properties may be less cyclical than those of core properties. Of the non-core property types, Health Care, Manufactured Homes, and Self Storage all have betas of around 0.5 while Lodging has a beta of 1.2 consistent with vacation expenditures being highly cyclical. Lodging REITS have also returned an average of only 9% per year with a standard deviation of 30%. In contrast, Self Storage has the highest average returns at 16.4% per year with a standard deviation slightly below that of most core property types. Furthermore, Self Storage has a statistically significant alpha. However, the alpha is only 77 basis points per year. Finally, REITs of property types with high average returns tend to have low betas. This "betting-against-beta" anomalous behavior, which has been pointed out for non-REIT equities by Frazzini and Pedersen (2014), is particularly pronounced for non-core REITs. In particular, Lodging-Resorts has a large beta of 1.21 and a low average return of 9.4%, whereas Health Care, Manufactured Homes, and Self Storage have betas of around 0.5 but their returns are 12.5% or higher.[7]

Table 6: Monthly REIT Index Returns by Property Type, 1994-2018

		Average	Std. Dev.	Beta	Alpha
Core	Apartments	12.6	19.4	0.64	0.39
	Free Standing Retail	13.2	17.8	0.47	0.53*
	Industrial	14.1	29.4	1.00	0.34
	Office	12.3	20.9	1.00	0.34
	Regional Malls	13.8	25.2	0.81	0.41
	Shopping Centers	10.3	21.5	0.70	0.17
Non-Core	Health Care	12.5	20.4	0.54	0.43
	Lodging-Resorts	9.4	29.7	1.21	-0.15
	Manufactured Homes	12.9	17.9	0.50	0.48*
	Self Storage	16.4	19.5	0.51	0.77***
	S&P 500	10.0	14.9		
	10-yr US Treasury	4.2	0.5		

Notes: 1) Returns are annualized. 2) For Alpha, * and *** denote statistically significant at the 10% and 1% levels for a two-sided test. 3) Core and non-Core property type designations from Pagliari et al. (2005) which in turn are based on NCREIF classifications.

[7]See Van Nieuwerburgh (forthcoming) for additional analysis of returns by property type.

Property-Level Returns

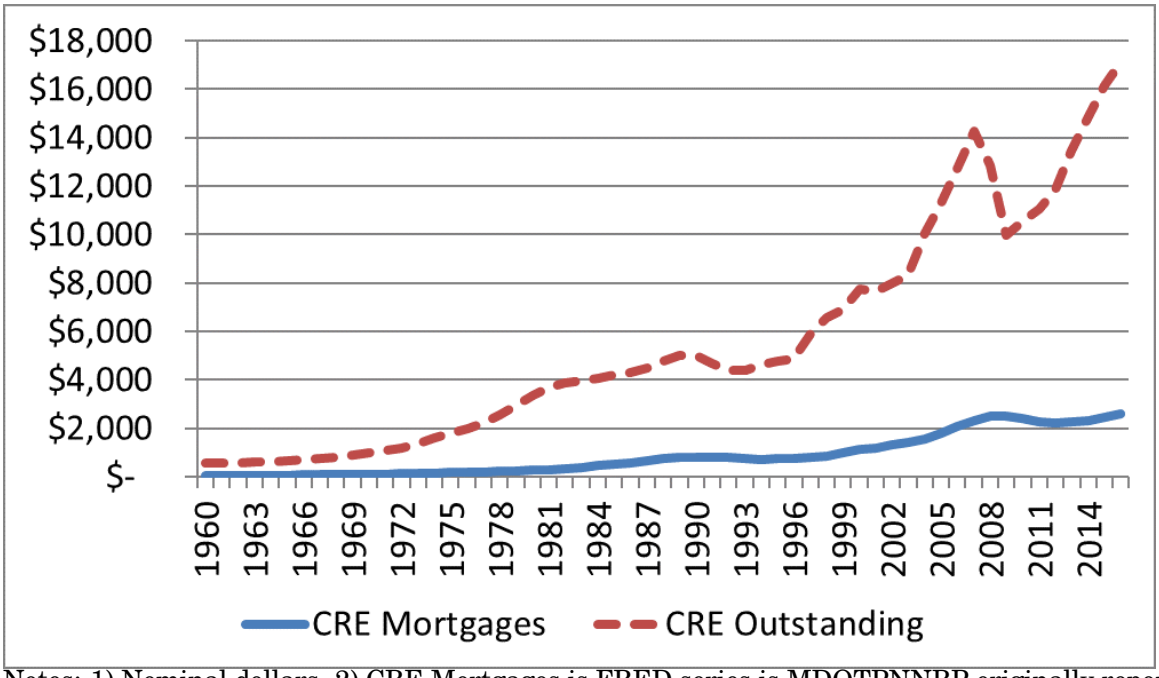
Much less is known about property-level returns than about index returns. Measuring property-level returns is difficult both because property NOIs are rarely reported and because of the scarcity of transactions. Ghent (2018) finds that only about 5% of the US CRE stock transacts in any given year. In contrast, turnover in the corporate bond market is about 50% annually according to Duffie, Gârleanu, and Pedersen (2007). Because properties are heterogeneous and transact infrequently, analysts frequently use appraisal values to construct property-level returns. Unfortunately, for the same reason that returns themselves are difficult to measure in private CRE, appraisal values are often quite far from the actual price at which commercial property transacts. For example, Cannon and Cole (2011) find that appraisal values are, on average, 12% different from actual sales prices.

Sagi (2017) highlights the difficulties of measuring CRE returns on individual properties given the selection of which properties transact in a search model. What is often referred to as transaction risk constitutes one of the largest, if not *the* largest source of risk in CRE investing. A further reason to analyze property-level returns is that, as Plazzi, Torous, and Valkanov (2011) show, exploiting property characteristics can improve performance of commercial property portfolios.

4 CRE Debt

We turn now to how firms finance the purchase of CRE. Figure 5 shows that the stock of commercial mortgages has never amounted to more than 25% of the stock of CRE. In part, this is because of the high share of corporate real estate discussed in Section 2. While corporations do borrow against their CRE assets (see, for example, Campello and Giambona (2013)), they often do so using unsecured debt rather than mortgages. Indeed, of all CRE mortgages originated by banks, only 33% of them are on owner-occupied property (Black, Krainer, and Nichols (2017)). Given that owner-occupiers account for almost two-thirds of CRE, most corporate real estate is financed with unsecured debt rather than mortgages.

Figure 5: Stock of Mortgages on US CRE vs. CRE in Billions of Current USD



Notes: 1) Nominal dollars. 2) CRE Mortgages is FRED series is MDOTPNNRP originally reported in millions of USD 3) CRE is the sum of US Financial Accounts series LM115035035.A and LM105035005.A originally reported in millions of USD.

Thus, a more relevant question for a CRE investor that is not a corporate user is how *real estate* firms finance their CRE. Fortunately there is a rich literature on the leverage of real estate firms. The literature finds that US equity REITs operate at approximately 35-50% leverage.[8] Unlike US REITs, international REITs often have legal maximums on their leverage (see Table 2 of Packer, Riddiough, and Shek (2014)). Riddiough and Steiner (forthcoming) report that about 63% of US REITs debt is mortgage debt with the remainder being unsecured.

Private CRE operates at slightly lower leverage than REITs on average. In a sample of global private equity funds, Alcock, Baum, Colley, and Steiner (2013) report an average leverage ratio of about 30%. Curiously, riskier funds that market themselves as Opportunity or Value-Add, have higher leverage than Core funds.[9]

Mortgage Debt Sources

While banks and conduits are major sources of both CRE and residential real estate debt, life insurance companies are also a major source of CRE debt. Specialized CRE finance companies are also a significant source of CRE mortgage lending. Ghent and Valkanov (2016) report that, over the 2005-2012 period, depository institutions accounted for just over 50% of originations with the balance coming from loans in Commercial Mortgage-Backed Securities (CMBS), life insurers, and other non-bank lenders.

CRE debt is much less likely to be securitized than residential debt. At the peak of securitization, CMBS loans accounted for less than 30% of CRE mortgages and constituted a negligible share of commercial mortgages until the mid-1990s (see Figure 1 of Black et al. (2017)). Development loans are almost never financed with securitized loans, likely because of the high degree of monitoring they require (Ghent and Valka-

[8] See, for example Sun, Titman, and Twite (2015), Pavlov, Steiner, and Wachter (2018), and Riddiough and Steiner (forthcoming).

[9] While the terms are not precisely defined, Opportunity and Value-Add funds invest in riskier properties in addition to using more leverage. Core funds usually invest only in properties with high occupancy rates and often further restrict themselves to properties in the Central Business District (CBD), major metro areas, and/or large properties. Pagliari (forthcoming) argues that Opportunity and Value-Add funds underperform Core funds after adjusting for leverage.

nov (2016)). In general, securitized loans allow the borrower to go to a higher Loan-to-Value (LTV) than loans lenders hold on their balance sheet (Black et al. (2017)). Furthermore, borrowers are more likely to have to seek CMBS financing for a large loan since lenders do not want to expose themselves to the idiosyncratic risk of a very large loan (Ghent and Valkanov (2016)). Finally, CMBS loans almost always require the borrower to defease the loan if the borrower wants to prepay (Dierker, Quan, and Torous (2005)). While CRE loans usually provide the lender with some sort of prepayment protection, full defeasance may be especially onerous for the borrower.

Anecdotally, borrowers report that the main reason they opt for a loan from a securitized lender rather than a balance sheet lender is the higher leverage permitted on CMBS loans. Furthermore, CMBS loans are also universally non-recourse while some balance sheet loans permit the lender recourse under certain circumstances (e.g., when the borrower triggers a 'bad boy' clause). Borrowers weigh these benefits against the inflexibility of CMBS loans. In addition to more flexible prepayment penalties, a CMBS loan may not allow the borrower to change any of the leases or tenants or might require the trustee to approve any significant change.

CRE Debt Maturities and Amortization

Unlike residential loans, most CRE mortgages are not fully amortizing. They also have much shorter terms. Typically, borrowers will finance a fully stabilized property (i.e., one not under development or major renovations and with an occupancy rate above 90%) with a so-called 'permanent' loan that has a maturity of 7-10 years. See Black et al. (2017) for the distribution of maturities of CRE loans on bank and CMBS loans.

5 Commercial Property Derivatives

Derivatives play an important role in today's financial markets. For example, derivatives have proved to be an effective tool in managing the risks associated with an

underlying asset. Derivatives also improve the efficiency of the market for the underlying asset by allowing investors to take positions in the asset at a lower cost and subject to lower transaction costs. In the case of commercial real estate, property derivatives would allow investors to synthetically gain or minimize exposure to a particular property market without incurring the substantial search and closing costs associated with a commercial real estate transaction. Unfortunately, while option contracts, both calls and puts, are available for most REITs, the market for derivatives written on privately held property is nearly non-existent.

The recent history of property derivatives in the US is rather brief. The first property derivatives trade in the US did not occur until April 2005 through Credit Suisse's exclusive two-year agreement with NCREIF to use the NPI. There were two to three trades in 2005 and "a few more" trades in 2006 but Credit Suisse's license expired later in 2006. Subsequently, in October 2007, Chicago Mercantile Exchange (CME) launched trading in futures and options on the S&P/Global Real Analytics commercial real estate indexes (SPCREX). The production of SPCREX ceased by December 2008.

Property derivatives have enjoyed more acceptance in the UK. There regulatory changes in 2002 jump started a nascent property derivatives market. In particular, the former Financial Services Authority (FSA) allowed life insurance companies, who own the majority of commercial real estate in the UK, to include real estate swaps and forwards as admissible assets in the computing of their solvency ratios. In 2004 Inland Revenue standardized the taxation of property derivatives and allowed losses through the use of derivatives to be offset against capital gains. By 2004, twenty-one investment banks had acquired licenses to use Investment Property Databank (IPD) indices to offer property derivatives, primarily total return swaps, in the UK. The IPD swaps market grew rapidly in the UK thereafter, peaking at 265 contracts ($\pounds$3.5 billion notional) written in the first quarter of 2008. The market then, like in the US, became a victim of the financial crisis.

There are a number of reasons why the UK property derivatives market was more

successful than its US counterpart. These reasons may offer clues as to what is needed to launch a successful property derivative market in the US. First, the U.K. commercial real estate market is less geographically fragmented which contributes to more effective hedging and less basis risk. It is also the case that, unlike the US, there is a widespread acceptance of a single index (IPD) that covers a majority of UK property market. The demand of UK property funds for property derivatives was a key driver of the market's development as these funds played a significant role in driving the necessary regulatory and accounting changes. By contrast, portfolio managers and pension funds in the US did not actively seek out derivative products suggesting that more effort in educating end users in the US of the benefits of property derivatives is needed. Finally, property transaction costs are higher in the U.K. making property derivatives more attractive.

6 Conclusions

Commercial real estate is a large and important asset class in the US investment landscape. Compared to common stock, corporate debt, or Treasury instruments, however, commercial properties are heterogeneous in their characteristics and trade infrequently over time. When trades do occur, they are usually between a private buyer and private seller. As a result, it is more difficult to document various features of the commercial real estate market, especially the pricing dynamics of commercial properties.

Notwithstanding these inherent data limitations, we have put forward a comprehensive survey of commercial real estate as an asset class. What is particularly noteworthy about commercial real estate is that there exist both public as well as private commercial real estate markets. We compare publicly held REITs to privately held commercial real estate and establish the important diversification benefits that result from adding commercial real estate to portfolios invested in other assets.

This survey has concentrated on the US commercial real estate market. However, commercial real estate is an important asset class globally. Commercial property mar-

kets exist throughout the world. Investment in these markets provide investors with additional opportunities to avail themselves of the diversification benefits of commercial real estate.

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A Appendix

Table 7: Summary Statistics of CRE Index Returns over Common Sample Period

	NCREIF			CPPI (RCA)			CCRSI (COSTAR)			NAREIT			ZIMAN		
	TotRet	PrRet	IncRet	TotRet	PrRet	IncRet	TotRet	PrRet	IncRet	TotRet	PrRet	IncRet	TotRet	PrRet	IncRet
Mean	8.79	2.81	5.98	11.86	4.54	7.31		4.87		12.05	6.90	5.14	11.97	6.59	5.38
StdDev	5.09	5.05	0.53	5.22	5.26	0.30		5.03		20.71	20.60	0.79	20.52	20.40	0.92
AR(1)	0.85	0.85	0.96	0.94	0.94	0.95		0.71		0.05	0.05	-0.21	0.06	0.06	-0.20
Skew	-2.50	-2.46	0.66	-1.60	-1.60	0.76		-1.59		-0.93	-0.94	0.75	-0.95	-0.98	1.73
Freq		4			4			12			12			12	
N		64			64			192			192			192	
Sample		2002.1-2017.4			2002.1-2017.4			2002.1-2017.12			2002.1-2017.12			2002.1-2017.12	

	CPI_INF	TB3M	TB10Y	CS	VW Ret	GZ
Mean	2.10	1.21	3.28	3.33	10.69	2.54
StdDev	1.07	0.44	0.31	2.25	15.18	0.32
AR(1)	0.45	0.99	0.98	0.93	0.07	0.96
Skew	-1.35	1.33	0.05	-0.68	-0.54	2.52
Freq	12	12	12	12	12	12
N	192	192	192	192	651	176
Sample		2002.1-2017.12				2002.1-2016.8

Table 8: Additional Predictive Regressions

DepVar	NCREIF Price(-1)	NAREIT Price(-1)	NAREIT Inc(-1)
NCREIF	-0.71	0.02	0.02
t-NW	-1.78	2.07	0.12
NAREIT	-0.24	-0.39	0.40
t-NW	-0.66	-0.42	0.45

Notes: t-NW denotes that we calculated t-stats using Newey-West standard errors.