The Hybrid Nature of Real Estate Trusts

Thomas J. Emmerling[1], Crocker H. Liu[2], Yildiray Yildirim[3]

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ABSTRACT

When do real estate trusts exhibit superior performance, when they mimic the underlying real estate or when they behave like stock? We test whether real estate trusts outperform common stock only when it mimics underlying property fundamentals. We also explore what capital market conditions correspond to and/or contribute to when securitized real estate behaves more like underlying property fundamentals. To explore this issue, we examine the investment performance of real estate trusts over the Great Depression and also the Great Recession. A distinguishing feature of our study is that we are the first to analyze the investment performance of real estate trusts (RETs), the predecessor to modern day real estate investment trusts (REITs), which traded over the late 19th and early 20th century. We compare the behavior and performance of RETs to REITs in the process. We find evidence consistent with the notion that securitized real estate exhibits superior performance only when it mimics the direct real estate market. This performance is fueled in part by cheaper borrowing costs, greater availability of debt and equity financing, and loosening credit standards. With the advent of a crisis, securitized real estate exhibits a greater co-movement with common stock. When this occurs, real estate behaves in a similar fashion to common stock and any abnormal performance disappears. This corresponds to tighter lending conditions and higher borrowing costs. We also show that RETs behave in a similar fashion to REITs.

Keywords: Great Depression, Great Recession, Real Estate Trusts, REIT, and Real Estate Cycles

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[1] M&T Bank Corporation, Buffalo, NY, 14203, E-mail: tom.emmerling@gmail.com
[2] Cornell University, School of Hotel Administration, Ithaca, NY 14853,, E-mail: chl62@cornell.edu
[3] Baruch College, City University of New York, 137 E 22nd Street, NY 10010, E-mail: yildiray.yildirim@baruch.cuny.edu
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1. Introduction

The purpose of this study is to examine the hybrid nature of real estate trusts. In particular, when does securitized real estate mimic underlying property fundamentals and does this behavior have an impact on its relative investment performance? What capital market conditions correspond to and/or contribute to the manner in which securitized real estate behaves? We examine these questions relative to two complete economic cycles, the Great Depression and the Great Recession to see if we can observe common themes underlying real estate investment performance.

Real estate trusts (RETs) are the predecessors of modern day real estate investment trusts (REITs). These business trusts arose in mid-19th century Boston as an investment vehicle designed to hold real estate as the result of a Massachusetts law that forbade corporations from developing and owning real estate other than its own buildings that they occupied. Although the academic literature does recognize their existence, no academic research exists on RETs. However, some institutional details about RETs are known. Wendt (1973) reports that over the 1921-1930 period, real estate securities offerings comprised approximately 2.2% of all common stock offerings on average with $410.4 million raised in total. Over the same time period, the total amount of money raised through common stock offerings totaled approximately $19 billion. Minot (1925) notes that RETs were designed for small investors and other trustees to acquire an interest in centrally located commercial real estate. Although retail properties were favored since most of the value was in the land instead of the buildings, RETs also invested in apartments, hotels, office buildings, and industrial properties.

The real estate trust share was free of Federal income taxes and Federal capital stock taxes. Minot further goes on to observe that "for Boston trust funds for about 35 years, and when selected with reasonable discrimination they have paid dividends regularly and at lowly but constantly increasing rates through the panics of 1893 and 1907 and through the World War and the deflation period following." There is some evidence that pension funds did invest in RETs. For example, RETs comprised 4.5% of the Harvard University's $15.3 million investment portfolio in 1906 with a dividend yield of 3.7%[4]. To put this dividend yield in perspective, the current dividend yield on the FTSE NAREIT All Equity REIT Index is 3.85% as of January 8, 2016[5]. According to Dockser (1962) RETs played a prominent role in the development of Greater Boston and were also responsible for the development of Midwest and Far West cities including but not limited to Detroit, Chicago, Minneapolis, St. Paul, Kansas City, Omaha, Duluth and Seattle.

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[4]Official Register of Harvard University, Volume 5(7), April 15, 1908. Reports of the President and the Treasurer of Harvard College 1906-1907. Mortgages and Equity Real Estate accounted for an additional 8.5% and 15.8% respectively for a total real estate exposure of 28.9%.

[5]REITs Continue to Provide Attractive Dividend Yields (https://www.reit.com/media/nareit-media/reits-continue-provide-attractive-dividend-yields)

In 1935, the Morrissey decision (*Morrissey versus Commissioner of Internal Revenue*) was the first of a series of decisions[6] all occurring in 1935 in which the Supreme Court of the United States denied "pass-through" treatment to holders of transferable shares of beneficial interest in trusts. As a result of these decisions, real estate trusts were subject to double taxation. The income of the real estate trust was no longer taxed only at the beneficiary level. As such, most real estate trusts disappeared or changed their organizational form on or after 1937.

Our study contributes to the existing literature in several ways. We are the first to analyze the investment performance of real estate trusts (RETs), the predecessor to modern day real estate investment trusts (REITs), which traded over the late 19th and early 20th century. We are also able to compare the performance of securitized equity real estate over two notable crises, the Great Depression and the Great Recession. This comparison allows us to examine if common capital market factors were linked to investment performance over both crisis periods. Finally, we can gain insights into the question of what happens to the performance of RETs if double taxation occurs since RETs became subject to corporate taxes in 1935 as the result of the Supreme Court's Morrissey decision.

We compare the behavior and performance of RETs to REITs. Our sample of monthly stock prices for RETs is hand collected from different publications. We find evidence consistent with the notion that securitized real estate exhibits superior performance only when it mimics the direct real estate market. This performance is fueled in part by cheaper borrowing costs, greater availability of debt and equity financing, and loosening credit standards. With the advent of a crisis, securitized real estate exhibits a greater co-movement with common stock. When this occurs, real estate behaves in a similar fashion to common stock and any abnormal performance disappears. This corresponds to tighter lending conditions and higher borrowing costs. We also show that RETs behave in a similar fashion to REITs.

The rest of the paper is organized as follows. Section 2 reviews the literature related to REIT performances and real estate cycles and Section 3 presents the data and our empirical methodology. Sections 4 and 5 provide the results and vector autoregression analysis for robustness check. Section 6 concludes.

2. Literature Review

Our study builds on several strands of literature. The first set of studies involves the historical behavior of real estate from the mid-19th century through the Great Depression and the aftermath in the early 20th century. Nicholas and Scherbina (2013) develop a transactions-based hedonic real estate price index for Manhattan over the 1920-1939 period. Although the composition of

[6]According to Cody (1975), the others cases that were all decided in 1935 included Swanson v. Commissioner, 296 U.S. 362 (1935) and Helvering v. Coleman-Gilbert Associates, 296 U.S. 369 (1935). In the former case, the co-owners of an apartment building created a trust to deal with the property held taxable as an association while the latter case involved the creation of a trust by owners of various apartment buildings to own and operate the buildings held taxable as an association.

the index is primarily residential in nature (single family and multi-family), it does include a small portion of commercial properties. Using this index, the authors show that real estate reached a peak in 1926, declined and then reached its highest peak in 1929. However, the authors also note that the stock market outperformed the residential real estate market over this time period. Wheaton, Baranski, and Templeton (2009) provide a complementary view of Manhattan commercial real estate using a limited database of 86 repeat sale transactions for office properties from 1899 to 1999. They find that commercial real estate prices fell over the period from 1899 to 1919 and then subsequently rose reaching a peak in 1929 that was similar to 1899 levels before crashing again. They also find that most of the buildings were originally constructed during the 1890-1929 period. Another finding of the study is that the value of commercial real estate has remained relatively stable in real dollars e.g., real estate has appreciated at the same rate as inflation.

In contrast to the previous studies, which focus on underlying real estate, Goetzmann and Newman (2010) discuss the commercial real estate mortgage bond market in the 1920s providing documentation that commercial mortgages were securitized and traded during this period. These securities were bought by ordinary investors. Securitization leads to an increase in credit availability which Mian and Sufi (2009) argue boosts prices during a boom. While her focus is on Manhattan residential mortgages during the Great Depression, the findings of Ghent (2011) appear to suggest that commercial lenders would be unlikely to make concessionary modifications to distressed loans over this time period even if these loans were securitized making foreclosure the most likely option for distressed loans.

The current study is also similar in spirit to studies that examine the extent to which REITs are hybrid vehicles including whether the real estate factor is priced. Liu and Mei (1992) as well was Clayton and MacKinnon (2003) are representative of this class of studies. Liu and Mei (1992) decompose REIT returns into expected and unexpected excess returns and show that expected excess returns for equity REITs are not only predictable but also are partly driven by a commercial real estate pricing factor vis-a-vis cap rates. Clayton and MacKinnon (2003) do a slightly different decomposition of REIT returns using a multi-factor model consisting of large cap stocks, small cap stocks, bonds and real estate that are first orthogonalized. They find that during the REIT boom of the early 1990s, REITs were primarily driven by both small cap stock and real estate related factors. Unfortunately, neither study includes the period leading up to and also subsequent to the Great Recession where there was a run-up in REIT prices and performance followed by a market crash. Although these studies do not address whether REITs outperformed stocks (using Jensen's alpha), both studies are consistent with the notion that REITs tend to reflect real estate during REIT booms. While the study of Liu and Mei (1922) use transaction-based cap rates, Clayton and MacKinnon (2003) use appraised based index. These studies suggest that the testable implication of our current study which is that REITs outperform stocks when REITs have a closer link to the underlying real estate. While the Clayton and MacKinnon (2003) orthogonal approach fixes the relationship between asset classes for the entire sample or the 6-year quarterly sub-period examined, our rolling window approach allows for time variation in the relationship we are studying.

Also applicable to the current study are studies that focus on the drivers of REIT performance. For example, Sun et al (2015), finds that REITs with higher leverage, more variable interest rate, and shorter maturity debt have poorer relative price performance during the financial crisis. These REITs also tended to sell more property and issue more equity at unattractive prices. The authors suggest that this performance is consistent with a pure leverage effect as well as financial distress costs. Focusing on the financial crisis period of 2007-2009, Chung et al (2016) find that the implied REIT return volatility is able to predict future REIT performance e.g., the higher the implied volatility, the lower the future REIT returns. The intuition for this is that REITs are subject to high default risk in a financial crisis given higher leverage ratios combined with mandatory cash distributions which make it difficult for REITs to de-lever when banks reduce the supply of credit. As uncertainty about the availability of credit increases, the authors argue that REIT stock prices should decline, leading to a decline in stocks returns. The authors further find that the implied volatility increases more when REIT stock returns fall than when REIT stock returns rise.

A final group of studies that are related to our study are those that explore the nature of real estate cycles. Plazzi et al (2008) is a representative study in this genre. Focusing on commercial real estate returns and rents, the authors construct a risk metric using the cross-sectional dispersions of returns and growth in rents. They find that their risk metric is time-varying. The authors find that macroeconomic variables that can account for these time-series fluctuations include the term and credit spreads, inflation and the short rate of interest. They also find that their risk metric exhibits an asymmetrically larger response to negative economic shocks. They suggest that this might be due to credit channel effects impacting the availability of external debt financing. The authors also find that idiosyncratic fluctuations are priced in the commercial real estate market.

3. Data and Methodology

A. Data Sample

Our sample of monthly stock prices for real estate trusts (RETs) are hand collected from *The Commercial and Financial Chronicle: Bank and Quotation Section*[7] and its successor publication, *Bank and Quotation Record*. Although we searched for dividends associated with these RETs, these publications as well as publications such as the *Manual of Statistics* and *Moody's Bank and Financial Record* do not report information on dividends. While this is

[7]Although prices for real estate trusts date back to 1895, we did not have access to those volumes in our respective libraries. The earliest price data for real estate trusts that are available to the authors is from June 1902.

unfortunate, we argue that prices should reflect the present value of future dividend payments in addition to accounting for most of the return volatility. For the more recent period (1991 – 2015) we use the monthly National Association of Real Estate Investment Trusts (NAREIT) All Equity REIT Price Index[8] to better compare the performance of RETs to REITs.

We use the aggregate assessed property values for Boston, Chicago, New York City, and Philadelphia taken from the State and City Section supplement to *The Commercial and Financial Chronicle: Bank and Quotation Section*[9] to construct our real estate market proxy for the period prior to, during and subsequent to the Great Depression between 1837 and 1941. The assessed property values are adjusted to reflect the estimate of market value since the assessed values are calculated as a percent of market value and these percentages change over time. While we recognize that using assessed value is a noisy proxy arising from measurement errors, we are interested in the general real estate price trend over this time period. Clapp and Giaccotto (1992) have found that the price trend estimated from assessed value and repeat sales methodology are similar. Using assessed value is appealing since it includes commercial properties, which RETs hold in addition to single-family properties. For commercial real estate data for the period prior to, during and subsequent to the Great Recession, we obtain equally weighted (and value weighted) repeat sales indices from the CoStar[10] website between 1998 and 2016.

Information on commercial mortgage interest rates and new real estate stocks and bonds issued corresponding to the Great Depression era is taken from the *Commercial and Financial Chronicle*. Commercial mortgage interest rates are continuously reported from May 1922 through January 1932[11]. In contrast, new real estate stocks and bonds issued including initial public offerings and secondary offerings are reported monthly from April 1919 through December 1940.

For REITs during the Great Recession period, the monthly interest rate on commercial real estate is obtained from Lehman Brothers (March 1998-August 2007) and the Cushman Wakefield Sonnenblick Goldman (September 2007-July 2015) publication *Capital Market Update* while real estate offering data is from the NAREIT website[12]. Data on the 10-year constant maturity

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[8] https://www.reit.com/investing/index-data/monthly-index-values-returns

[9] The *State and City Supplement*, which in later years was called the *State and Municipal Compendium*, was published twice a year - summer (May or June) and winter (November or December). We chose Boston, Chicago, New York City and Philadelphia since these are the only cities for which complete assessed values are available over our study period. More specifically, assessed values are available on a yearly basis for Boston from 1908-1939, Chicago from 1837-1941, New York City from 1903-1941, and Philadelphia from 1915-1941. The assessed values reported for Chicago are identical to that reported in Homer Hoyt's (1933), *A Hundred Years of Land Values in Chicago*.

[10] http://www.costargroup.com/costar-news/ccrsi. Data on commercial real estate repeat sale indices are also available from Real Capital Analytics at https://www.rcanalytics.com. We chose to use the CoStar data given its longer historical time period.

[11] For the three months of missing interest rate data – October 1922, January 1923, and April 1923 – we use the average of the interest rate in the prior month (t-1) and the subsequent month (t+1). Although interest rates are reported until February 1933, the rates are reported sporadically subsequent to January 1932.

[12] https://www.reit.com/data-research/data/reit-capital-offerings

Treasury bond, the Consumer Price Index, the Standard and Poor's (S&P) 500 total return and price indices are from the Global Financial Data[13] database.

The value of non-residential buildings for the period from January 1920 through December 1940 is from various editions of the *Survey of Current Business*, the Value of Contracts Awarded: Commercial buildings and Industrial buildings. For the period from January 1993 to present, we use the Census website[14] to obtain the monthly Value of Private Nonresidential Construction Put in Place (Seasonally Adjusted Annual Rate). The value of construction put in place is a measure of the value of construction installed or erected at the site during a given period. Construction put in place also represents the contribution to the U.S. economy from building construction. It is a key input into the nation's Gross Domestic Product (GDP). This is also an indicator of supply coming on-line in the near future. As the demand for real estate increases, the value of construction put in place also increases with a lag. From the *Survey of Current Business*, we also obtain the monthly construction cost index (CCI) as originally reported in the Engineering News-Record (ENR) for the period December 1920 through December 1940. For the more recent period from January 2005 through December 2015, the index is taken from various issues of *Engineering News-Record* (ENR) as reported in either the Construction Economics or the Building Index section. The ENR CCI is an average 20-city national index that has a materials and labor component that reflects "200 hours of common labor at the 20-city average of common labor rates, plus 25 cwt of standard structural steel shapes at the mill price prior to 1996 and the fabricated 20-city price from 1996, plus 1.128 tons of Portland cement at the 20-city price, plus 1,088 board-ft of 2 x 4 lumber at the 20-city price.[15]"

Total loans and investments associated with all banks reported on a monthly basis are obtained from the Federal Reserve publication Banking and Monetary Statistics[16], No. 48-Weekly Reporting Member Banks in 101 Leading Cities-Principal Assets and Liabilities, Weekly and Monthly for the 1919-1941 period. For later periods, the data is accessed through the St. Louis Fed website[17]. The composition of bank portfolios e.g., the proportions of assets held in marketable securities (invested in treasury bills and notes) relative to the total of loans and leases on a seasonally adjusted basis is one metric of credit availability. The metric provides investors with a sense of when the real estate market is heating up. As the investment to loans ratio declines, banks are allocating relatively more money to loans e.g., credit availability increases which helps to drive real estate prices higher. The nonresidential, non-farm annual value of private construction put in place from 1915-1970 is taken from *Historical Statistics of the United*

[13]The Global Financial Data database includes data on stock markets from 1690, exchange rates from 1590, interest rates from 1700, commodities from 1500, and inflation from 1264.

[14]https://www.census.gov/construction/c30/historical_data.html. Alternatively, the data can be obtained from https://fred.stlouisfed.org/graph/?id=TLNRESCONS,#

[15]http://www.enr.com/economics

[16]Federal Reserve Archive (https://fraser.stlouisfed.org/title/38)

[17]For data on Total Loans (http://research.stlouisfed.org/fred2/series/LOANS/downloaddata) and for investments held by all banks (http://research.stlouisfed.org/fred2/series/INVEST/downloaddata)

States: Colonial Times to 1970[18], Series N 1-29 Value of New Private and Public Construction Put in Place: 1915 to 1970 (Used Private Nonresidential buildings (excluding farms), Total. From 1993 onwards, the Census website[19] is used to obtain the continuation of the C-30 series. The value of construction put in place is a measure of the value of construction installed or erected at the site during a given period. Construction put in place also represents the contribution to the U.S. economy from building construction. It is a key input into the nation's Gross Domestic Product (GDP). This is also an indicator of supply coming on-line in the near future. As the demand for real estate increases, the value of construction put in place also increases with a lag.

B. Methodology

Our RETs dataset consists of monthly bid/ask share price information from May 1902-December 1940 across 580 companies. However, for any given month, only a subset of these companies report prices (bid, ask, or both). Since our dataset is limited to share price information, we construct an equally weighted price index value at each month from May 1902 to December 1940.

To construct our RET price series for an arbitrarily chosen starting value of 100, we first obtain an equally weighted RET return series. As such, for each month from June 1902 until December 1940, we first identify those companies with a current price listed as well as some past price listed. If there is a past price listed, then we use to the most recent past price in our monthly return calculation. With regard to price, if both a bid and an ask price are given, we use the average bid/ask price as its listed price. If only a bid or ask price is given, we take this value as the share price. Next, with the subset of companies we've identified two prices (i.e., current and most recent past price) for, we compute each company's share price return. Then, with each company's share price return, we compute the equally weighted average of all computed returns. Finally, we identify this computed average return as the equally weighted return for RETs over the past month.

Our REITs dataset consists of monthly returns for all real estate companies in the CRSP database with SIC identifier code 6798 from January 1991 to December 2015. To keep our analysis consistent across time periods, we use REIT returns computed without dividends. Next, for each month between February 1991-December 2015, we search for all REIT companies with a listed return. With this subset of returns, we then compute the equally weighted average REIT return. Finally, from this list of monthly average returns, we construct the REIT price index using the arbitrary starting value 100 on January 1991.

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[18] http://www2.census.gov/prod2/statcomp/documents/HistoricalStatisticsoftheUnitedStates1789-1945.pdf
[19] https://www.census.gov/construction/c30/historical_data.html

To evaluate the historical investment opportunity for securitized real estate, we consider both RET's and REIT's performance relative to the overall market (using the S&P index as a proxy). To this end, we regress RETs/REITs excess return $R_t^e - R_t^f$, on the excess return of the market $R_t^{m,e}$

$$R_t^e = \alpha + \beta R_t^{m,e} + \varepsilon_t.$$

To compute excess returns, we use the historical 90-day Treasury Bill return as a proxy for the risk-free rate. Alpha and beta values above are estimated through our time period by using the intercept and slope coefficient in a regression over the previous 60 months. We refer to α in this model as the 1-factor alpha (or 1-factor outperformance) measure.

Additionally, we also consider both RET's and REIT's performance within a two-factor model. More specifically, we examine the any additional excess returns of these real estate investments after controlling for both S&P excess return as well as underlying real estate performance. More specifically, we consider

$$R_t^e = \alpha + \beta_m R_t^{m,e} + \beta_{re} R_{t*}^{re,e} + \varepsilon_t.$$

The third term on the right-hand side above is the excess return on underlying real estate. For the RET era, this term is the monthly[20] return of an equal/value weighted combination of the values of commercial real estate for Boston, Chicago, and New York City (1904-1939). For the REIT era, we use historical monthly equal- and value-weighted returns for commercial real estate from Costar (January 1998-February 2016) and RCA (December 2000-February 2016). We denote the time by t* since we consider excess real estate returns at various periods of time up to and including time t. We introduce this possibility into the model due to the well-known lead/lag relationship between REITs and underlying real estate values.

4. Results

A. RETs and REITs as Hybrid Securities

As our initial point of departure, we first explore the extent to which real estate trusts (RETs) are linked to direct real estate and also to common stock. Panel A of Figure 1 shows the co-movement of our equally weighted RET price index to the Nicholas and Scherbina (2013) nominal real estate price index. The correlation coefficient between these two series is approximately .52 and is statistically significant at the 1% level. Since the Nicholas and

[20] The value of commercial real estate for Boston, Chicago, and New York City are annually recorded values. From these annual values, we compute equal- and value-weighted returns using two methods: (1) simple division by 12, and (2) interpolation using SAS PROC EXPAND. Sources for commercial real estate values are: Boston—*The Commercial and Financial Chronicle*, Chicago—*Chicago Daily New Almanac,* and New York City— *The Commercial and Financial Chronicle*.

Scherbina (2013) index primarily reflects single-family and multifamily residential albeit a small portion of the index is comprised of commercial real estate, we also compare the RET price index to annual assessed value of commercial real estate for Boston, Chicago, and New York City combined. Since our RET index is monthly while the value weighted commercial real estate market series is annual, we divide the annual values by 12. Alternatively, the Chow-Lin (1971) interpolation procedure is used to obtain assessed values on a monthly frequency. Figure 2 displays the result of using each monthly conversion procedure relative to the real estate trust price index. A comparison of Panel A and Panel B shows that both conversion procedures result in a similar trend for the underlying real estate assessed values. Consistent with Panel A in Figure 1, both panels of Figure 2 show that real estate trusts are linked to the underlying real estate. Both Figure 1 and Figure 2 also show that subsequent to 1932, the underlying real estate values remain relatively stable while real estate trust prices continue to decline, especially after 1935. This is not necessarily surprising since RET returns did not recover after 1934Q4 due in part to the Morrissey ruling in 1935 which allowed RETs to be taxed at the trust level similar to regular corporations.

Panel B of Figure 1 shows that REITs, like their RET predecessor, are linked to the underlying real estate. A significant positive correlation of .75 evidences this although the figure shows that REITs are a leading indicator of underlying real estate consistent with prior studies such as Gyourko and Keim (1992). This lead-lag relationship is not as pronounced in Panel A of Figure 1.

We next provide cursory evidence that both RETs and REITs also co-move with common stocks. Panel A of Figure 3 shows that RETs exhibit a positive (.72) and statistically significant contemporaneous correlation with other common stock. Panel B of Figure 3 also confirms this is also the case for REITs although the correlation is somewhat stronger (.83). Taken together, Figure 1 through Figure 3 provide evidence that real estate trusts and their successors, REITs, are a hybrid vehicle that behave both like direct real estate and also common stock.

B. The Extent to Which RET (REIT) Performance is tied to Stock and/or Real Estate

A natural question that arises as a result of the preceding cursory examination is whether RETs and REITs exhibit abnormal performance after either the underlying stock market and/or real estate market fundamentals are taken into account. Ex-ante, we expect RETs (REITs) to exhibit neither superior nor inferior performance (Jensen alpha = 0) after both stock and real estate fundamentals are accounted for.

To address this question, we first calculate and plot the t values associated with the pseudo-Jensen's alpha for RETs calculated using excess stock market returns (one factor model)[21] using an 84 month rolling window. We next calculate and plot the pseudo-RET Jensen's alpha for a

[21]Excess stock market returns is calculated as the return on the S&P500 minus the return on the 90 day Treasury bond.

two factor model using excess stock market returns and excess real estate market returns. We use each of our two monthly conversion procedures to calculate real estate market returns. We show the results of the second conversion procedure only given that the results are similar. Since prior studies have shown that securitized real estate tends to be a leading indicator of the underlying real estate (see Gyourko and Keim (1992), Liu and Mei (1992)), the monthly real estate data is lead 9 months[22] such that it is "as if" we can observe real estate and RET data on a contemporaneous basis.

Figure 4 displays the t-statistics associated with both a one factor and also a two factor Jensen alpha for RETs. The graph reveals that RETs underperformed the stock market over the 1919-1922 period and also the period subsequent to 1934. RETs significantly outperformed the stock market from 1926 through 1930. When both a stock market and an underlying real estate market factor are both included, RETs exhibited underperformance over the 1910-1911 period and also subsequent to 1934. RETs outperformed both the stock market and the underlying real estate market in contrast over the 1928-1930 time period. The addition of the real estate factor eliminates the underperformance of RETs over the 1919-1922 period. The inclusion of the real estate factor also indicates that although RETs did not underperform the stock market over the 1910-1911 period, RETs did underperform the underlying real estate market during this period. To put the performance of RETs in a historical context, rapid economic growth in excess of 4% characterized the period from 1890 until 1910 when a sharp decline in the growth rate (2.8%) occurred. After 1910, total nonresidential fixed business investment demand declined as a result of decreased investment in commercial buildings (see Vatter etal (1995)). The post-World War I recession defined the 1919-1922 period; A brief recession of only 7 months (August 1918 to March 1919) was followed by a more severe recession that started in January 1920 and ended around July 1921.[23] The period of the roaring twenties followed with the great bull market in stocks commencing in 1928. On October 29, 1929 the stock market crashed signaling the start of the 10-year Great Depression. While Nicholas and Scherbina note that Manhattan real estate reached their apex in the third quarter of 1929, Figure 4 shows that direct real estate did not decline until after 1930 which could account for why RETs exhibited superior performance over the 1928-1930 period. As previously stated, RET returns did not recover after 1934Q4 due in part to the Morrissey ruling in 1935 which allowed RETs to be taxed at the trust level.

Using the same methodology, we also calculate Jensen alphas for REITs with respect to both a one factor and two factor model using an 84 month rolling window. In contrast to the RET era, we are able to obtain monthly commercial real estate data for the modern era. Figure 5 plots the T values of the Pseudo-Jensen alphas using a one factor model and alternatively 2 factor model along with the critical t-values at the 10% level of significance. REITs outperforms the S&P500 from mid-2006 through the first couple of months of 2007. REITs continue to exhibit superior performance over this period even after a commercial real estate factor is included. However, the

[22]We also tried other lead times. The results are similar.
[23]http://www.nber.org/cycles/cyclesmain.html

magnitude of alpha (and also the T-statistic) is lower although still statistically significant. The period in question (mid-2006 to the first couple of months of 2007) coincides with the expansion of REIT asset holdings which peaked at 14% per year during 2006-2007 according to Ling et al (2016).

C. Comparing RETs versus REITs during their Respective Crises

We are also interested whether the price movement for real estate trusts prior to, during, and subsequent to the Great Depression was similar to the price behavior REITs exhibited during the recent financial crisis. To make this exercise comparable we used equally weighted monthly data consisting only of price appreciation with both the RET and REIT indices having a starting value of 100. We also used the consumer price index to deflate price so prices are reported in real terms. The result of this exercise in Figure 6 shows that the behavior of the respective real prices juxtaposed over the two time periods is surprisingly similar in terms of their co-movement although their amplitudes differ so that we can't conclude that the real prices come from the same distribution[24]. There is a greater real price gain associated with the Great Depression (371.56%) relative to the Great Recession (115%). In terms of price decline, prices appear to decline approximately 60% on average during the Depression. Depending on the time period, prices declined -38% to -76% during the great Recession. Although prices did decline by -86% from April 1930 through January 1941, we are unable to disentangle the effect of the Morrissey ruling which made RETs subject to taxes at the firm level and the general decline in the price of RETs.

D. Capital Market Conditions When RETs (REITs) Outperform Stocks

We now provide a cursory look at capital market conditions that correspond to the performance of real estate given evidence (Mian and Sufi (2009)) that increased credit availability boosts real estate prices during a boom. We recognize that positive commercial real estate performance and favorable lending conditions is endogenous; a positive feedback loop should exist. The empirical analysis that controls for this endogeneity will thus follow this cursory examination. Not surprisingly, Panel A of Figure 7 shows that RETs perform better when the relatively cheaper borrowing cost exists in general. An inverse co-movement exists for the period from May 1922 through January 1932. Panel B of Figure 7, in contrast, shows a slightly positive link between the two factor Jensen alpha for REITs and the interest rate on commercial real estate over the period from January 2005 through July 2015. While this positive link is unexpected, an inverse relationship did exist over the January 2005 through December 2011 period as shown in Panel C. Towards the latter half of 2011, the REIT market rebounded with the underlying commercial real estate market also recovering.

[24] We calculate a two-sample t test on the difference in real price means for RETs and REITs. The t-test is significant with a T-statistic of 20.32, σ =3.12, and μ_1-μ_2 = 63.44.

Another indicator of credit availability is the composition of bank portfolios e.g., the proportions of assets held in marketable securities (invested in treasury bills and notes) relative to the total of loans and leases on a seasonally adjusted basis. The metric provides investors with a sense of when the real estate market is heating up. As the investment-to-loans ratio declines, banks are allocating relatively more money to loans e.g., credit availability increases which helps to drive real estate prices higher. Figure 8 shows that as credit availability from banks, so too does RET and REIT investment performance. The correlation is stronger during the period that includes the Great Depression (April 1919 – March 1938) relative to the period that includes the Great Recession (January 2005 – December 2015). A closer look at the data reveals that the standard deviation of the investment-to-loans ratio is relatively more volatile during the Great Depression era relative to the Great Recession period ($\sigma_{1919.04\,-1938.03} = .442$ versus $\sigma_{2005.01\,-2015.12} = .025$). Although the mean of the investment-to-loans ratio is also relatively higher during the earlier era ($\mu_{1919.04\,-1938.03} = .64$ versus $\mu_{2005.01\,-2015.12} = .35$), the median of the ratio is similar in both periods ($\text{median}_{1919.04\,-1938.03} = .39$ versus $\text{median}_{2005.01\,-2015.12} = .36$). This suggests that banks tended to maintain the same relative composition of investments to loans in their portfolios during the Great Recession relative to the Great Depression period. Figure 9 provides further granularity of the co-movement of the investment-to-loans ratio relative to Jensen alpha for RETs and REITs using a two factor model. Panel A of Figure 9 shows that the investment-to-loans ratio was relatively stationary from April 1919 through October 1930 and then the ratio rose reaching a peak at July 1936 before starting to decline. Stated differently, banks tended to maintain the same relative composition of investments to loans until October 1930 after which they made more loans investing less in Treasury assets. Subsequent to July 1936, banks became more risk averse investing more in safe assets. In contrast, Panel B of Figure 9 shows that the investment-to-loans ratio declined until January 2009 and then rebounded January 2010 after which it became relatively stationary indicating that banks became more risk averse putting relatively more of their dollars into safe assets until January 2009 then for a year afterwards increased their lending before maintaining their portfolio composition at a constant ratio.

New real estate securities issued provides yet another perspective of capital market conditions in which to gauge the performance of RETs and REITs. Panel A of Figure 10 shows that new real estate securities tend to be issued during times when RETs exhibit better relative performance. A comparison of Panel B with Panel C of the Figure 10 also shows that this is also the case for REITs up to the end of 2011. From 2012 onwards, capital raised for real estate securities has increased while relative REIT performance (relative to the S&P500 and underlying commercial real estate) has diverged at times.

E. Construction Activity When RETs (REITs) Outperform Stocks

We next focus our attention on conditions in the market for space associated with RET and REIT performance. Ex-ante, we should expect an increase in construction activity when a hot market exists for RETs (REITs). Panel A of Figure 11 shows that construction activity increases following a rise in abnormal RET returns. In contrast, construction activity did not necessarily co-move in a positive manner with a rise in abnormal REIT returns during the Great Recession. In particular, the value of nonresidential construction put in place rose with REIT returns during the boom and to a more limited extent during the early phase of the crash. However, after June 2008, an inverse relationship existed. Nonresidential construction spending continue to rise while abnormal REIT returns continued their downward spiral until 2014 when they once again turned positive.

In addition to new supply coming online in the near future, we also consider the monthly growth rate of construction costs given the recent work of Plazzi, Torous, and Valkanov (2010). We looked at the lag of the monthly growth rate in construction costs – 1 month and 2 months – as well as the contemporaneous growth rate relative to our Jensen alpha using a two factor model. The results were similar regardless of whether we used a lag or the contemporaneous growth rate in construction cost. For both the Great Depression era (Panel A) and the Great Recession era (Panel B), Figure 12 shows that the growth rate in construction cost appears to be uncorrelated to Jensen alpha in general. This result was somewhat surprising since ex-ante we would expect the price of commercial buildings to co-move with construction costs. This appears to suggest that perhaps the price of the land as opposed to buildings is what Jensen alpha is capturing.

6. Vector Autoregression Analysis

In this section, we conduct a vector autoregression (VAR) analysis with the goal of determining the interrelationships among the RET/REIT outperformance measure α and several contemporaneous real estate specific variables. In particular, we seek statistical evidence either for or against outperformance (α) relating directly to underlying real estate fundamentals.

In each real estate trust era (RET/REIT), we consider a 5-variable VAR model:

$$x_t = A_0 + A_1 x_{t-1} + A_2 x_{t-2} + \cdots + A_p x_{t-p} + e_t,$$

where

x_t = (5 × 1) vector of variables, A_0 = (5 × 1) vector of intercept terms,

A_i = (5 × 5) matrix of coefficients, e_t = (5 × 1) vector of error terms, individually serially uncorrelated,

p = lag length.

Our VAR estimation method follows Enders (2015); it starts with a methodology to determine the appropriate lag length p. While many different methods of lag length selection can be followed, we use a common criteria, the Akaike Information Critiria (AIC), where

$$AIC = T \ln |\Sigma| + 2N,$$

where $|\Sigma| = E[e_t e'_t]$, a (5×5) symmetric covariance matrix and N is the total number of parameters estimated in all of the VAR equations. If each equation in the 5-variable VAR has p lags and an intercept, then N=25*p+5.

Instead of using the standard VAR representation above, it is often preferable to analyze the VAR using a structural representation, i.e., with orthogonalized innovations. In other words, it is preferable to consider an innovations process ε_t where $E[\varepsilon_t \varepsilon'_t] = I$ and I is the 5x5 identity matrix. The link between the original innovations process e_t and the orthogonalized process ε_t is through a (5×5) matrix G. More specifically, we seek a matrix G such that $e_t = G\varepsilon_t$. One popular choice of G is the Choleski matrix, i.e., where G is lower triangular with positive diagonal elements. This matrix is referred to the Choleski matrix since $\Sigma = GG'$. Even though using the Choleski matrix describes a one-to-one correspondence between e_t and ε_t, it imposes a structural ordering for the VAR system, which may not hold in reality. Rather than impose such an ordering on the VAR, we identify a matrix G using the common Sims-Bernanke Decomposition method. Such a method avoids assuming a set of ad hoc restrictions on the relationships between variable terms in the VAR such as in the Choleski decomposition (see Enders (2015), Chapter 5.12)

Upon fitting the matrix G using the Sims-Bernanke Decomposition method we can calculate the impulse responses from one standard deviation positive shocks ε_t to each of the variables. Of course, since the impulse response functions are constructed using estimated coefficients, there is a clear concern that they also contain error. Thus, we also utilize a Monte Carlo Integration scheme to estimate 95% confidence intervals for our impulse response estimate.

A. Real Estate Trust (RET) Era

For this period, we consider the fitted rolling intercept α_t reflecting the out- performance of RETs (relative to the S&P Index) along with the four monthly, historical variables that we obtain from the Commercial and Financial Chronicle: (1) Interest Rate on Real Estate Bonds (ir_t), (2) Investment-to-Loans Ratio (il_t), (3) New Real Estate Security Issues (sec_t), and (4) Non-residential Building Values (bv_t). In Figure 13, we see that the outperformance of RETs relative to the S&P began after the first quarter of 1922 and increased to its peak at the advent of the Great Depression in 1929. As expected, the Great Depression coincided with a dramatic decline in outperformance leading to considerable underperformance from 1932 until the end of the time window. In Figure 9 Panel A, the investment-to-loans ratio experienced a dramatic increase from 1919 to 1940. Not surprisingly, the period of the Great Depression coincides with a dramatic increase in this ratio as banks increased their exposure to safe assets relative to risky real estate loans thus removing liquidity from the real estate market. From Figure 13, we see that from 1922 to 1932, interest rates for real estate ranged from 5-7% and were relatively stable and downward trending. New issuances of real estate securities, in Figure 10 Panel A, exhibited a considerable run-up during the 1920's adding further liquidity to the market. This was followed by a precipitous fall over the course of the Great Depression era which further limited liquidity. Nonresidential building values, in Figure 11 Panel A, also trended upward during the 1920's then fell dramatically beginning in 1929. However, this trend only lasted until half way through the 1930's when values increased quickly and generally remained at these higher values until the end of the time window.

In estimating our model, we first determine the appropriate lag length using the common AIC criterion. Here, we find an optimal lag length of 2. Using this lag length, we next estimate the VAR parameters in standard form as displayed above. Since the standard form representation contains only predetermined variables and the error terms are assumed to be serially uncorrelated with constant variance, we can estimate the VAR using OLS. In Figure 15, we display the F-statistics for the VAR coefficients.

Recall, we prefer to work with the structural for of the VAR system since it contains the orthogonalized innovations ε_t. To obtain this representation, we need to map the estimated standard representation back to the structural one. To do so, we need to identify at least $(5^2 - 5)/2 = 10$ coefficients in the G matrix. First, since we do not have a reason to over-identify the VAR system, we attempt to impose 10 restrictions, i.e., exact identification, on the matrix. To inform the coefficient choice, leading to a successful estimation, we rely on the covariance/correlation matrix for the residuals appearing in Figure 16. Figure 17 shows the results of the decomposition used to determine the matrix G. Using the coefficient estimates appearing in Figure 17, we can now construct the impulse response functions for our structural 5-variable VAR system.

Figures 18-22 display the impulse response functions for the estimated 5-variable VAR. Figure 18 displays the response of the interest rate il_t to a unit shock in the other four variables. In this graph, we see that a shock to α_t leads to a decrease in the interest rate for real estate bonds. Moreover, Figure 23 shows that this point estimate negative effect is robust, i.e., the estimate lies within 95% confidence intervals. Unexpected outperformance (relative to the S&P) attributable to real estate may induce increased demand leading to higher prices for real estate bonds and, thus, lower interest rate levels. In Figure 20, we see the effect of variable shocks to the level of new real estate securities sec_t. Specifically, a shock to α_t leads to a robust, higher level of real estate security issues. As a possible reason, if α_t represents the outperformance attributable to real estate, then demand for new real estate securities can be expected to increase in response.

Similarly, the effect of real estate building values, bv_t, follows with a robust, positive expected lift when α_t is attributable to real estate; see Figure 21 and Figure 23. Finally, in Figure 19, the investment-to-loan, il_t decreases in response to a shock in α_t. Again, if α_t is attributable to real estate, then this effect is expected. Higher outperformance from real estate induces greater demand for real estate, which leads to an increase in loans relative to the investments. Although expected, however, this effect is not completely robust to within a 95% level of confidence, see Figure 23.

In summary, we find robust evidence in three out of four real estate variables linking the outperformance variable to underlying real estate fundamentals. Even though the investment-to-loan variable response was not robust, its point estimate response did display the expected effect supporting the link to the underlying real estate.

B. Real Estate Investment Trust (REIT) Era

For the modern era, we consider the fitted rolling intercept α_t reflecting the out- performance of REITs (relative to the S&P 500) along with the same four monthly, historical variables that we obtained from the sources listed in our data section. From Figure 24, outperformance of REITs relative to the S&P 500 follows a similar trend to its early 20th century RETs counterpart. Namely, REIT alpha expansion coincided with rising equity markets, whereas contraction and underperformance occurred alongside dramatic declines in economic output. From Figure 9 Panel B, the investment-to-loans ratio was relatively stable from 2005-2015 and reflected the expected trend over this period. Specifically, this ratio steadily declined leading up to 2009 and afterwards trended upward reflecting a preference for safe assets in lieu of real estate. Figure 24 shows that interest rates on real estate bonds trended downward since the beginning of 2009 until 2015. Prior to this period, interest rates rose considerably (from below 6% to above 8%) reflecting the real estate boom leading up to 2009. In Figure 10 Panels B and C, new real estate security issues experienced considerable volatility from 2015-2015. Surprisingly, the trend of this time series does not seem to follow the pro-cyclical trend apparent during the 1919-1940 period. Finally, from Figure 11 Panel B, nonresidential building values have generally trended higher over 2005-2015. As expected, this series steadily increased from 2005 through 2009 and by 2015 fully recovered the losses suffered during the Great Recession.

We follow the same VAR estimation approach as in the RET era. Using the AIC criterion, we determine an optimal lag length of 1. Figures 26 and 27 then show the results of the OLS estimation using the one-lag 5-variable VAR system. As before, we use the correlation matrix of the OLS (found in Figure 27) to inform the choice of restrictions for exact identification of the structural VAR representation. Figure 28 displays the results of Sims-Bernanke method to estimate the G matrix relating the standard VAR representation to the structural one.

Figure 29 displays the response of the interest rate il_t to a unit shock in the other four variables.

In this graph, we see that a shock to α_t leads to a decrease and then increase in the interest rate for real estate bonds. However, Figure 34 shows that this mixed effect is not statistically significant. In Figure 31, we see the effect of variable shocks to the level of new real estate securities sec_t. Specifically, a shock to α_t initially leads to higher level of real estate security issues. As a possible reason, if α_t represents outperformance attributable to real estate, then the demand for new real estate securities can be expected to increase in response. From Figure 34, we see that this effect is not statistically significant after several steps. In contrast, the effect of real estate building values, bv_t, follows with a robust, expected positive lift when α_t is attributable to real estate; see Figure 32 and Figure 34. Continuing, both Figure 30 and Figure 34 show that the investment-to-loans, il_t decreases robustly in response to a shock in α_t. Again, if α_t is attributable to real estate, then this effect is expected. Higher outperformance from real estate induces greater demand for real estate, which leads to an increase in loans relative to the investments. Finally, Figure 31 and Figure 34 show that the effect of a shock in α_t on new real estate security issues is not statistically significant.

As with our analysis of RETs during the early 20th century, we find evidence linking real estate investment trust outperformance to underlying real estate values. For example, real estate building values respond to a positive shock in REIT outperformance with a robust, positive change. Additionally, the investment-to-loans ratio responds to a same positive shock to alpha with a statistically significant decrease in the investment-to-loans ratio. According to the fitted VAR model, nonresidential building values also respond to a positive alpha shock with higher subsequent values. However, this effect is not statistically robust. Importantly, when the effect is mixed (such as with the interest rate on real estate bonds) the effect is not statistically significant. Finally, we emphasize that the two VAR estimations we conducted above do not impose any ad hoc restrictions for identifying the structural VAR equations. Rather, we let the correlations of the estimated residuals of the standard VAR representation inform our choice of coefficients needed to obtain the impulse response functions.

7. Conclusion

The aim of this study is to investigate the hybrid nature of both the real estate trusts and REITs, particularly their relative performances to stock market and underlying property fundamentals. To achieve this, we use hand collected RETs from different trade publications between 1902-1940 and REIT's data from NAREIT to cover the modern era. We first document that real estate trusts are linked to the underlying real estate. Figure 2 shows that subsequent to 1931, the underlying real estate values remain relatively stable while real estate trust prices continue to decline sharply, especially after 1935. The rationale for this divergence is the 1935 Morrisey ruling, which caused RETs to lose their tax-exempt status. Next, we document RETs outperformed the stock market over the 1919-1922 period and also the period subsequent to 1934.

Lastly, we study the RETs versus REITs during their respective crises. We document that there is a greater real price gain prior to the Great Depression (371.56%) relative to the Great Recession (115%). In terms of price decline, prices appear to decline approximately 60% on average during the Depression.

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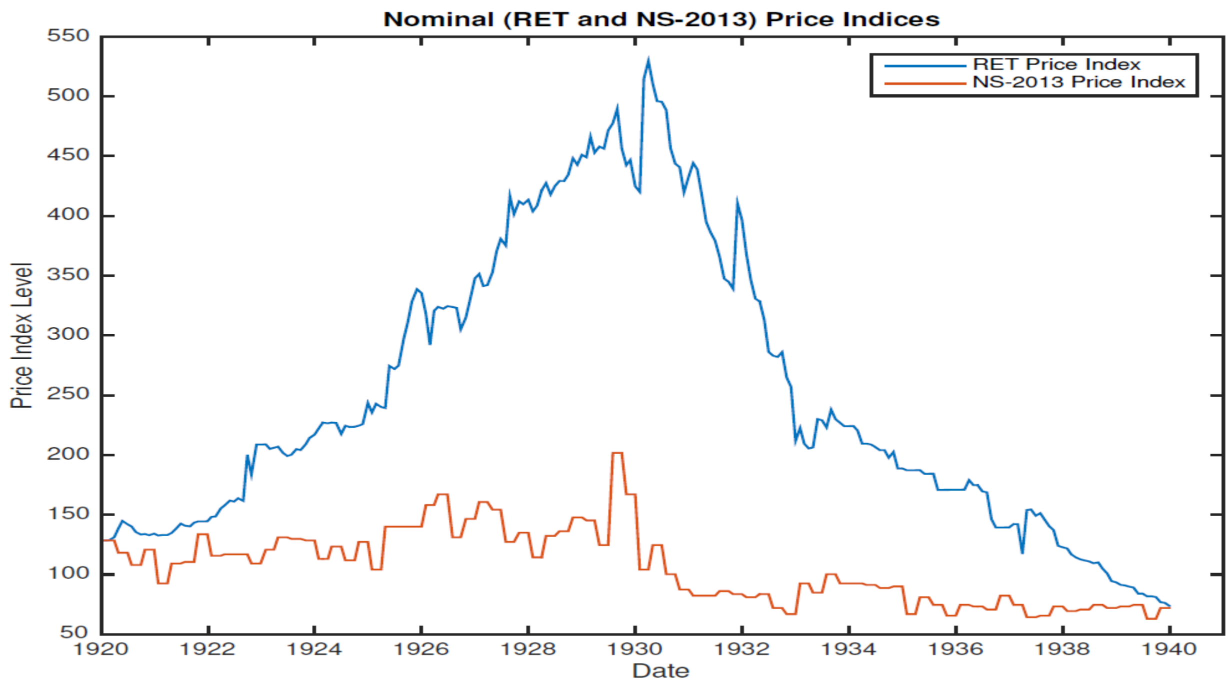
Figure 1: Comparison of Real Estate Trusts to Underlying Real Estate

Panel A. 1920-1940 (correlation: 0.517, p-value: 7.69 x 10^{-18}). Nominal RET (equally-weighted) price index computed using only price appreciation, i.e., without dividends to the Nicholas Scherbina (2013) nominal real estate price index. Monthly data was utilized for the RET index. Both indices assume a starting value of 128.54 for January 1920.



Panel B. January 1998-December 2015 (correlation: 0.75, p-value: 4.06 x 10^{-40}). Monthly nominal REITs index along with the Costar nominal equally-weighted composite index value.

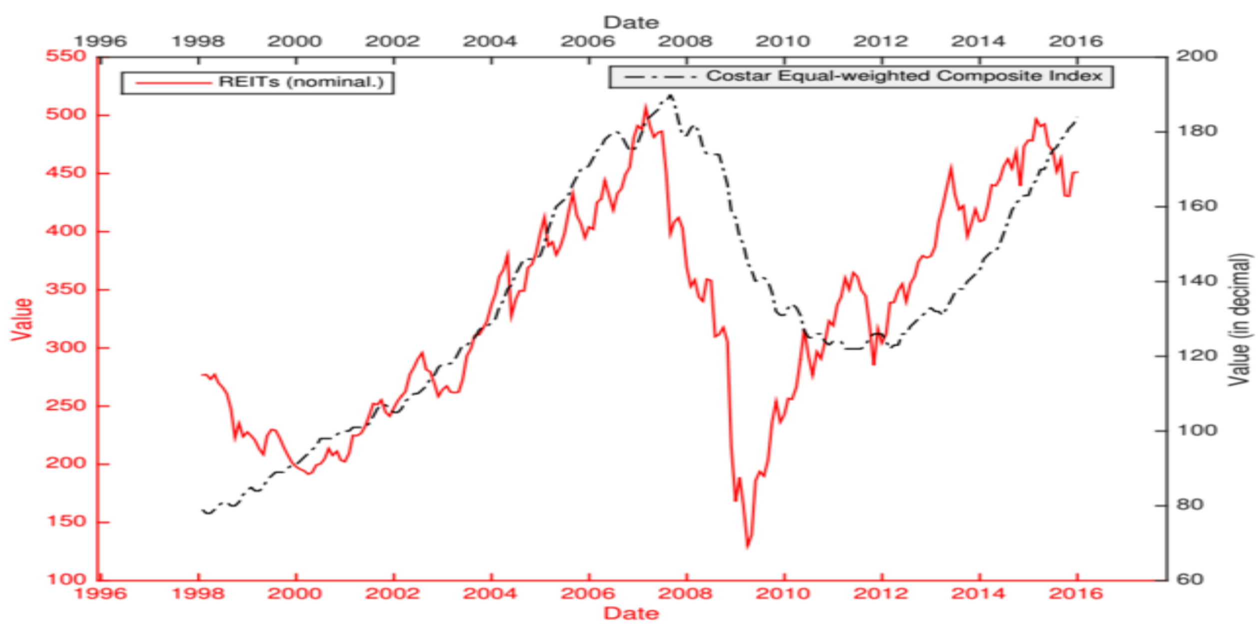
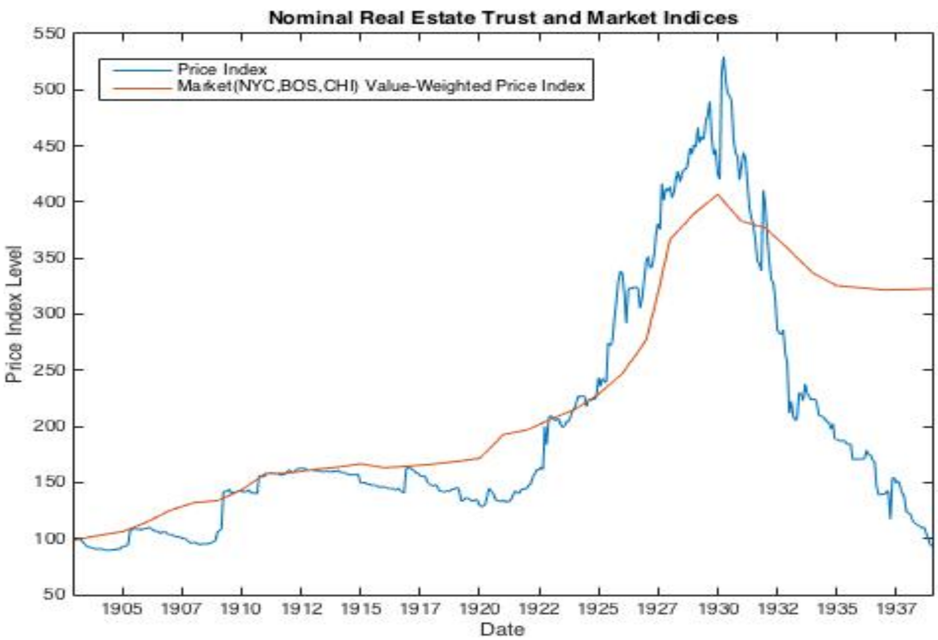


Figure 2: RETs vs Underlying Real Estate Value (1902-1940)

Annual assessed real estate value for Boston, Chicago, and New York City combined relative to monthly price index of real estate trusts. Annual assessed values are divided by 12 in Panel A. Panel B shows monthly assessed values using the Chow-Lin (1971) interpolation procedure.

Panel A: Annual assessed real estate value divided by 12



Panel B: Monthly interpolation of annual assessed real estate value

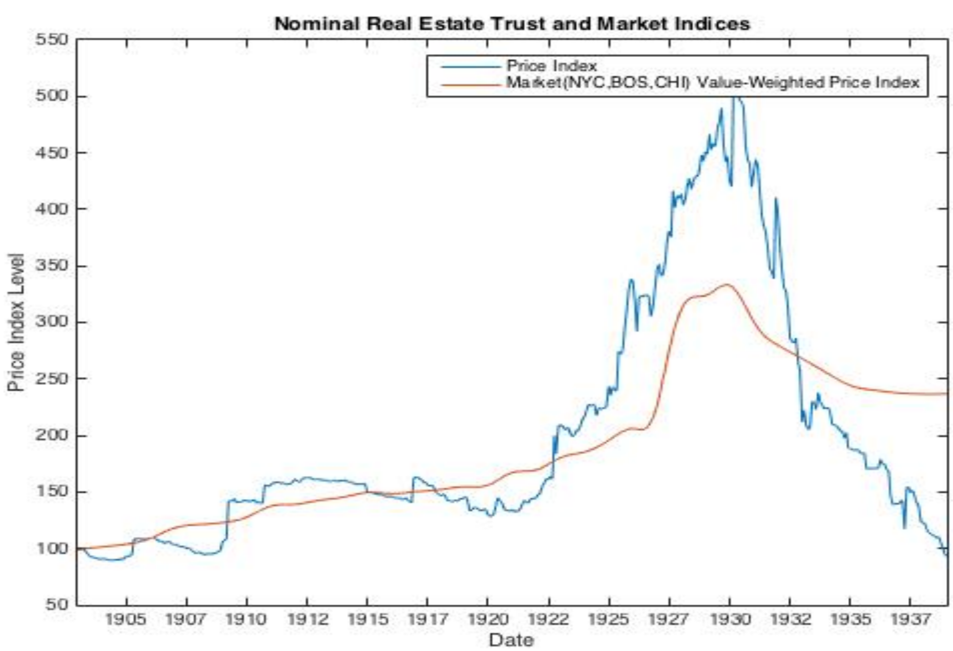
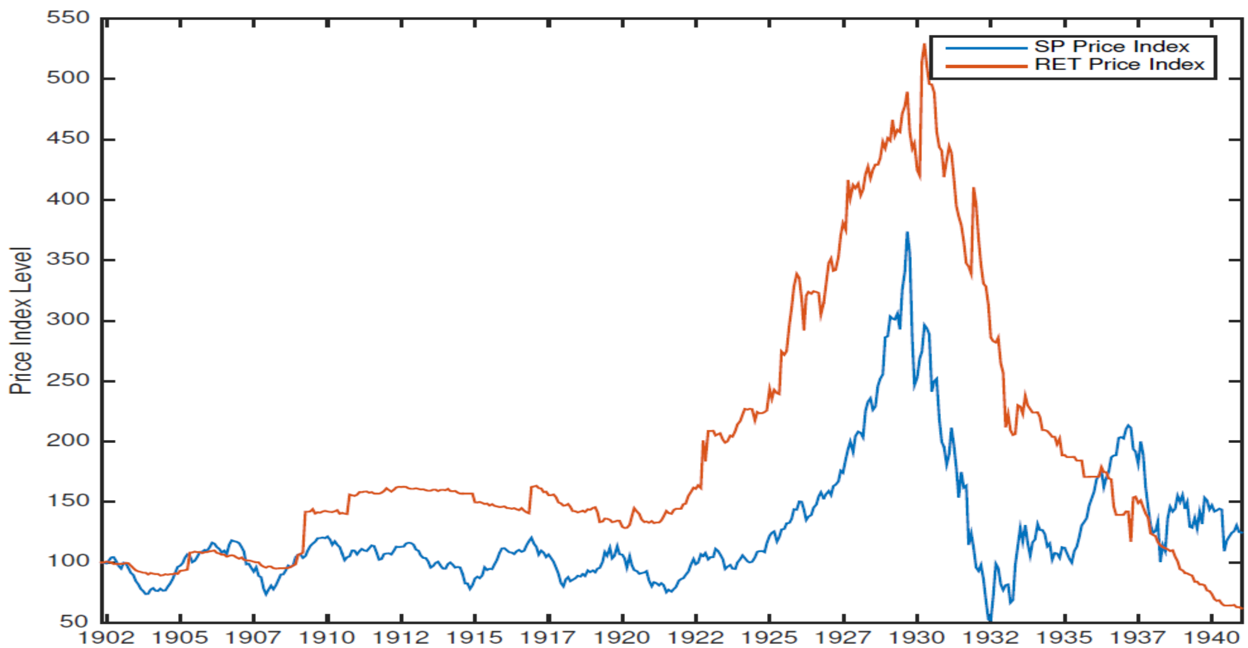


Figure 3: Nominal S&P and RET (REIT) Price Indices

The figures display the price of the nominal S&P (Standard and Poor) value-weighted index and the nominal equally-weighted real estate index. The monthly RET and REIT indices are each constructed using only price appreciation. Both indices assume a starting value of 100.

Panel A. 1902-1940 (correlation: 0.717, p-value: 1.15 x 10^{-74})



Panel B. 1991-2015 (correlation: 0.83, p-value: 4.15 x 10^{-76})

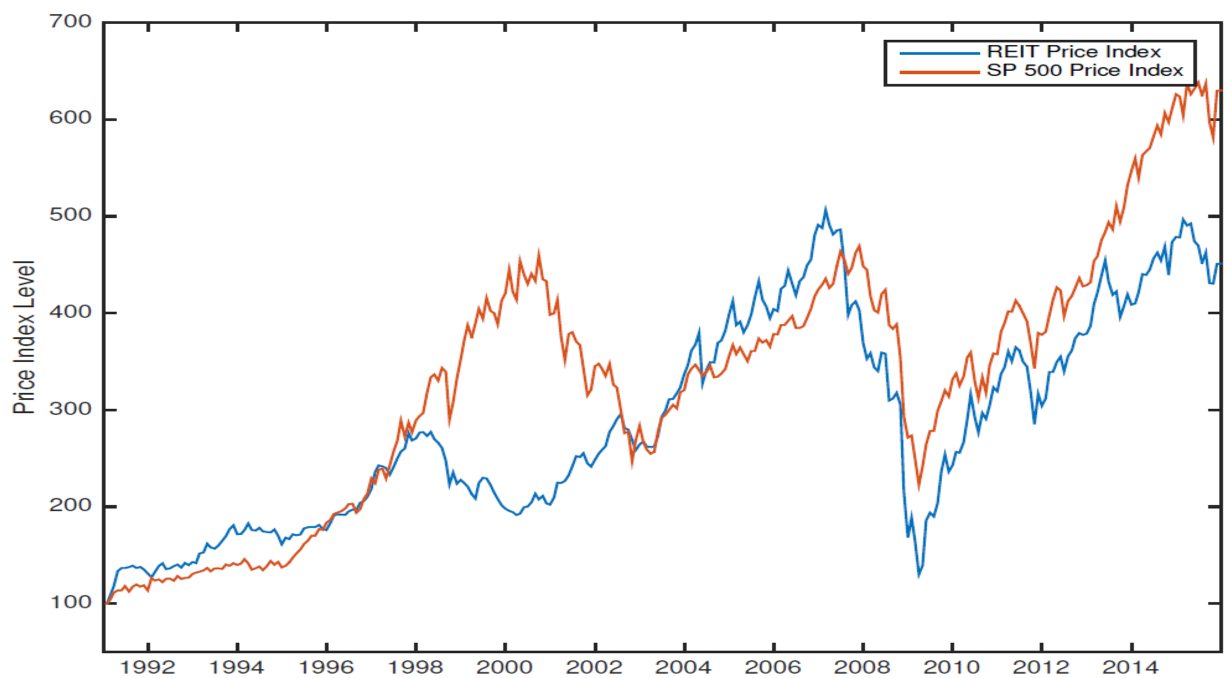


Figure 4: T Values for Pseudo-Jensen's RET Alpha using 1 Factor and 2 Factor Models

The monthly pseudo-Jensen's alpha for real estate trusts (RETs) are calculated by regressing the excess return of RETs on the excess return of the stock market (one factor model) with the return on the 90-day Treasury Bill used as the proxy for the risk-free rate. The regression $R_t^e = \alpha + \beta R_t^{m,e} + \varepsilon_t$ is estimated on a rolling basis using the previous seven years (84 months). We also use a rolling two factor model $R_t^e = \alpha + \beta_m R_t^{m,e} + \beta_{re} R_{t*}^{re,e} + \varepsilon_t$ to calculate Jensen's alpha using the excess return of the stock market and also the excess return on the underlying real estate market. Annual real estate values are converted to monthly values using the Chow-Lin (1971) interpolation procedure.

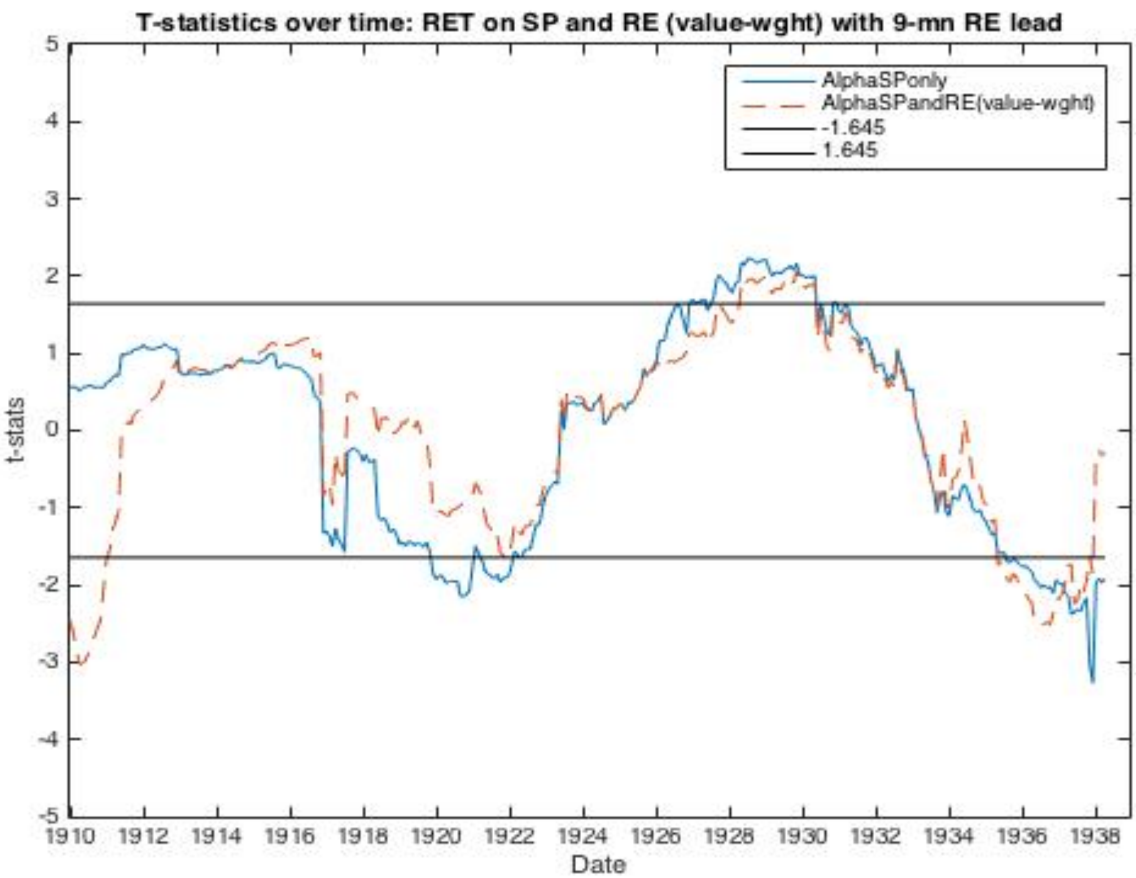


Figure 5: T Values for Pseudo-Jensen's REIT Alpha using a 1 Factor and 2 Factor Models

The monthly pseudo-Jensen's alpha for real estate trusts (RETs) are calculated by regressing the excess return of RETs on the excess return of the stock market (one factor model) with the return on the 90-day Treasury Bill used as the proxy for the risk-free rate. The regression $R_t^e = \alpha + \beta R_t^{m,e} + \varepsilon_t$ is estimated on a rolling basis using the previous seven years (84 months). We also use a rolling two factor model $R_t^e = \alpha + \beta_m R_t^{m,e} + \beta_{re} R_{t*}^{re,e} + \varepsilon_t$ to calculate Jensen's alpha using the excess return of the stock market and also the excess return on the underlying real estate market using monthly CoStar data.

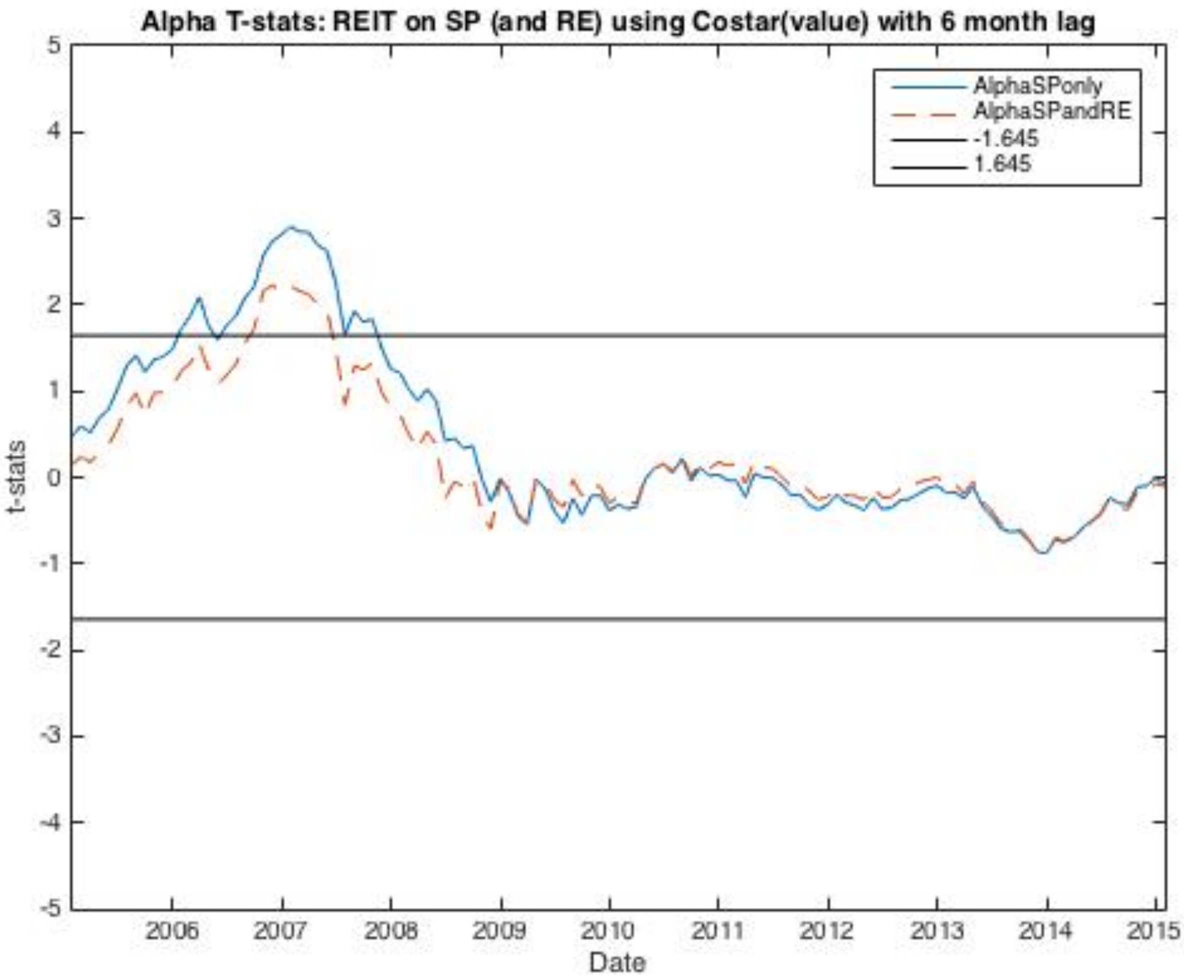


Figure 6: Real Estate Trusts Compared to REITs

This figure displays the real price history of the real RET (equally-weighted) index from 1902-1940 along with the real REIT (equally-weighted) index from 1991-2015. The indices were constructed using only price appreciation, i.e., without dividends. Monthly data was utilized. We use CPI returns to deflate price. Both indices have a starting value of 100.

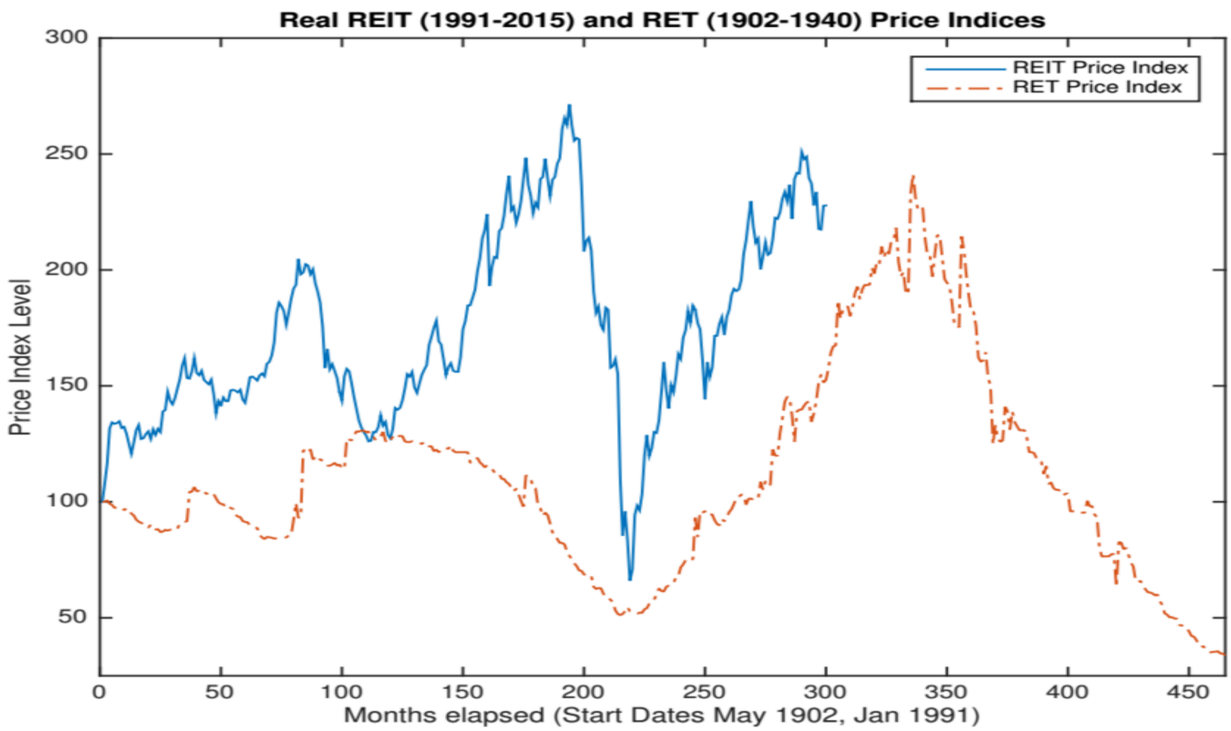
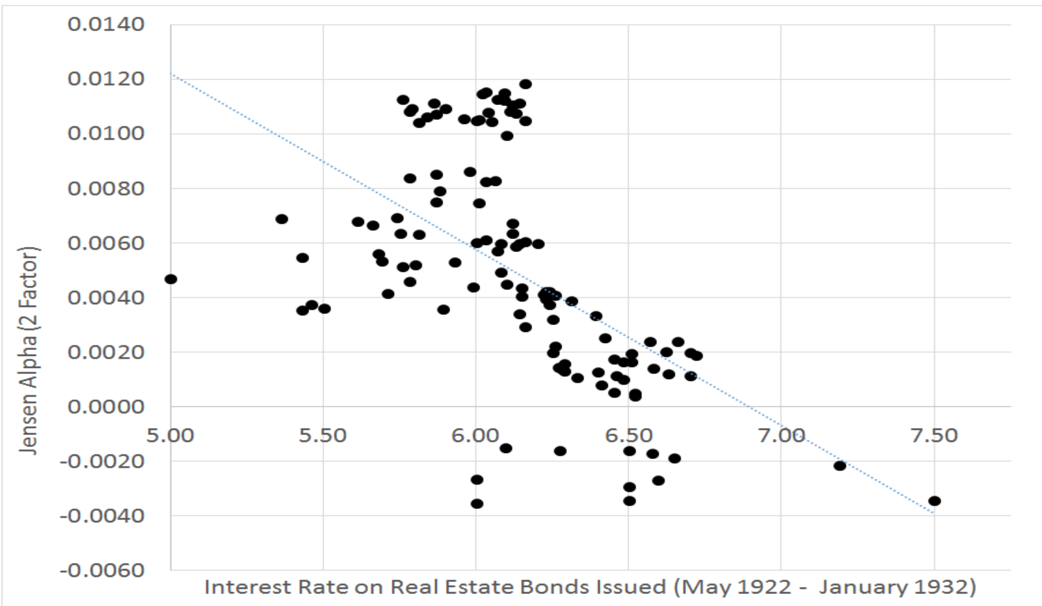


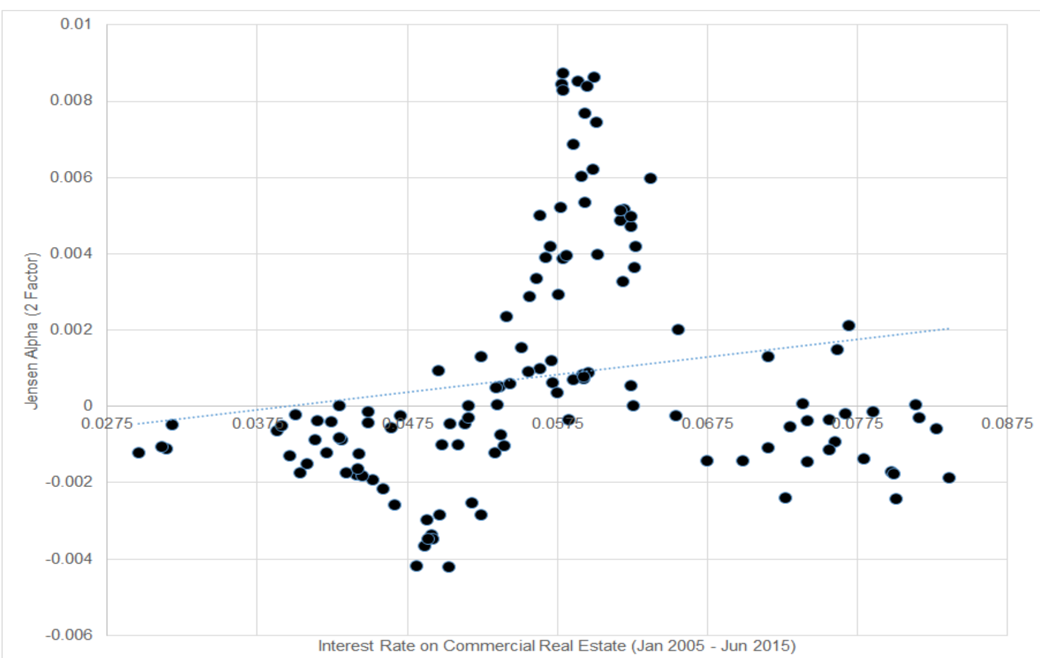
Figure 7: Jensen's Alpha and the Interest Rate on Newly Issued Real Estate Bonds

The figures compare the rolling 84-month RET or REIT alpha using a 2 factor model to borrowing cost. As the proxy for the borrowing cost, the monthly interest rate on new real estate bonds issued from May 1922 to January 1932 is used for RETs while the monthly interest rate on commercial real estate from Lehman Brothers (March 1998-August 2007) and Cushman Wakefield Sonnenblick Goldman (September 2007-July 2015) is used for REITs.

Panel A. 1922 – 1932 (correlation: -.56, p-value: 8.189 x 10^{-11})



Panel B. 2005 – 2015 (correlation: 0.18, p-value: .043)



Panel C. 2005 – 2011 (correlation: -.40, p-value: .00014)

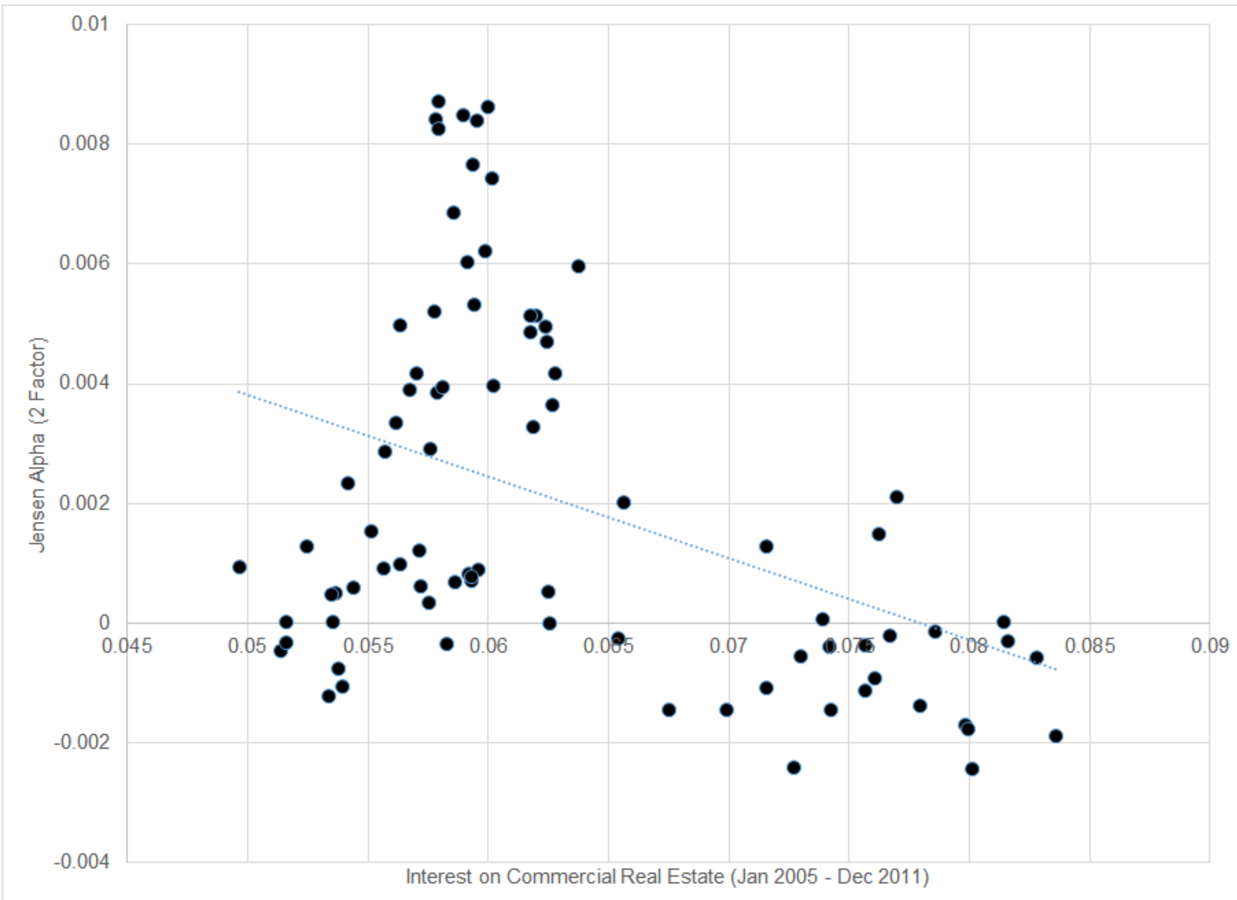
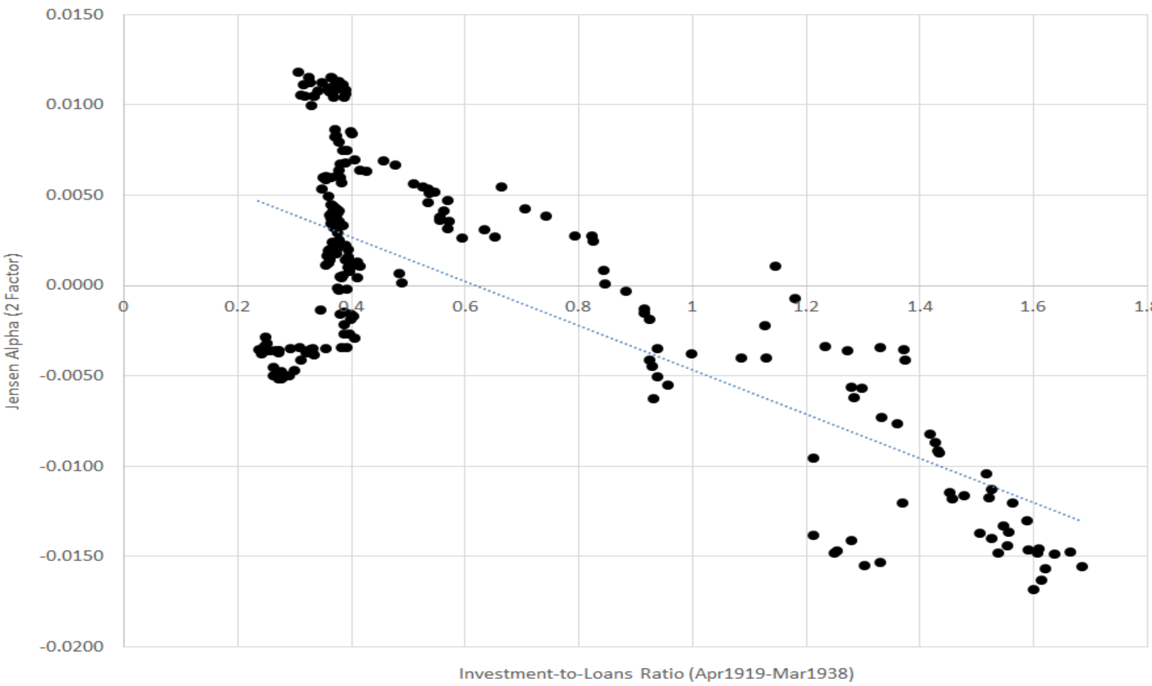


Figure 8: Jensen's Alpha and the Availability of Bank Credit

The figures compare the rolling 84-month RET or REIT alpha using a 2 factor model to investment-to-loans ratio which is a proxy for the availability of bank credit.

Panel A. Apr 1919 – Mar 1938 (correlation: -.74, p-value: .000)



Panel B. Jan 2005 – Dec 2015 (correlation: -.40, p-value: .000)

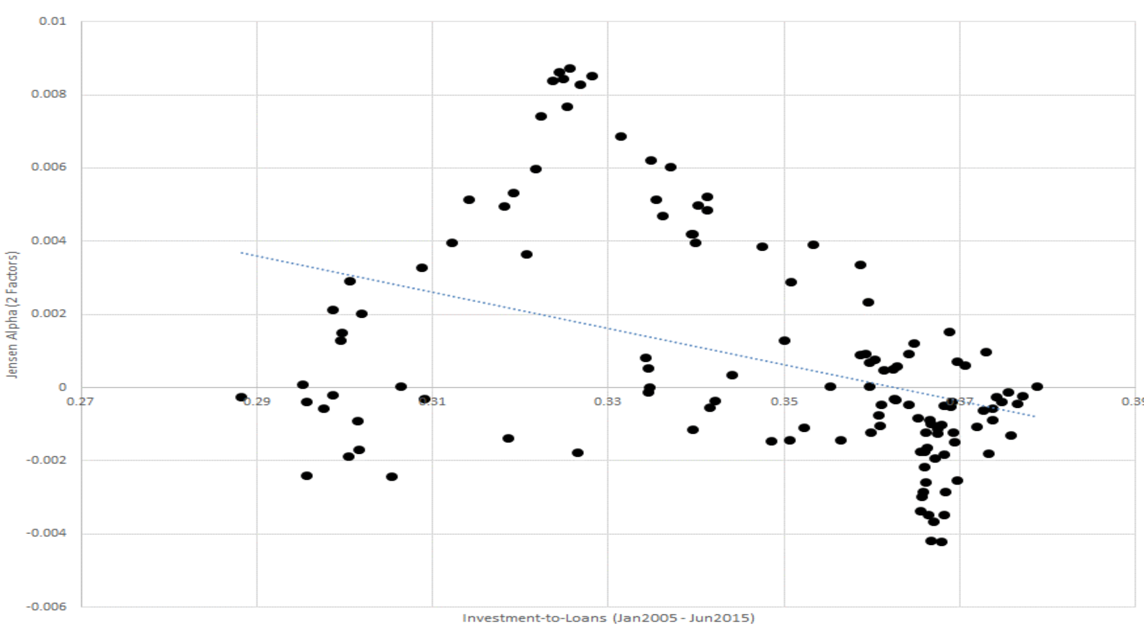
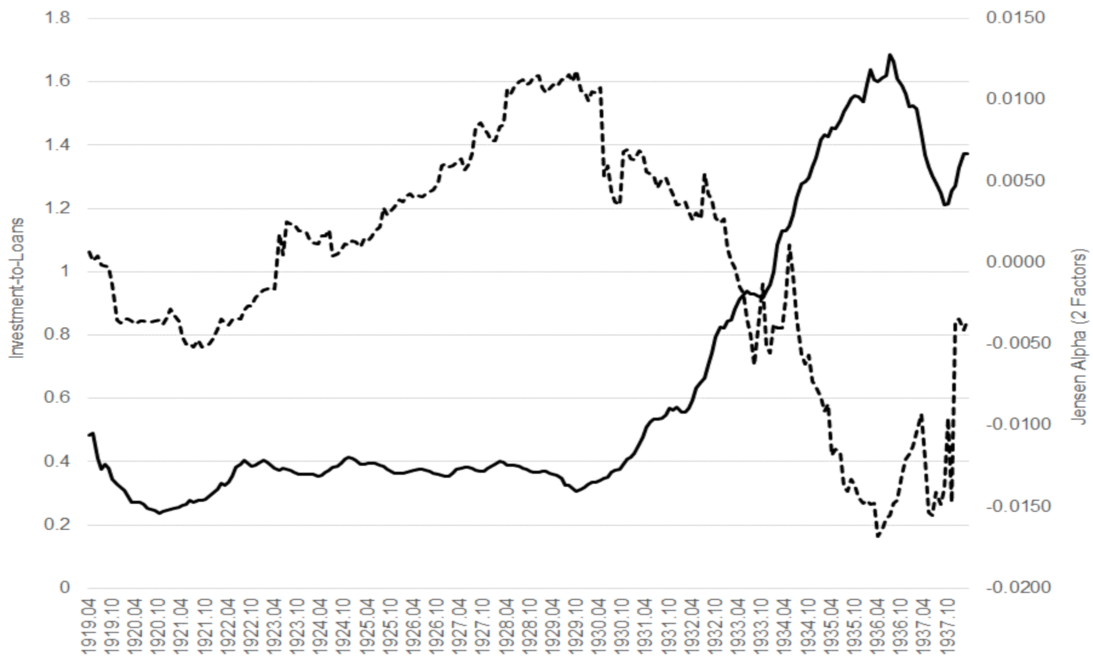


Figure 9: Investment-to-Loans Ratio

The figures compare the rolling 84-month RET or REIT alpha using a 2 factor model to the investment-to-loans ratio. As the investment-to-loans ratio rises (falls), banks become more (less) risk averse investing more in safe assets such as Treasury securities (loans).

Panel A. Apr 1919 – Mar 1938 (correlation: 0.60, p-value: .000)



Panel B. Jan 2005 – Dec 2015 (correlation: -.40, p-value: .000)

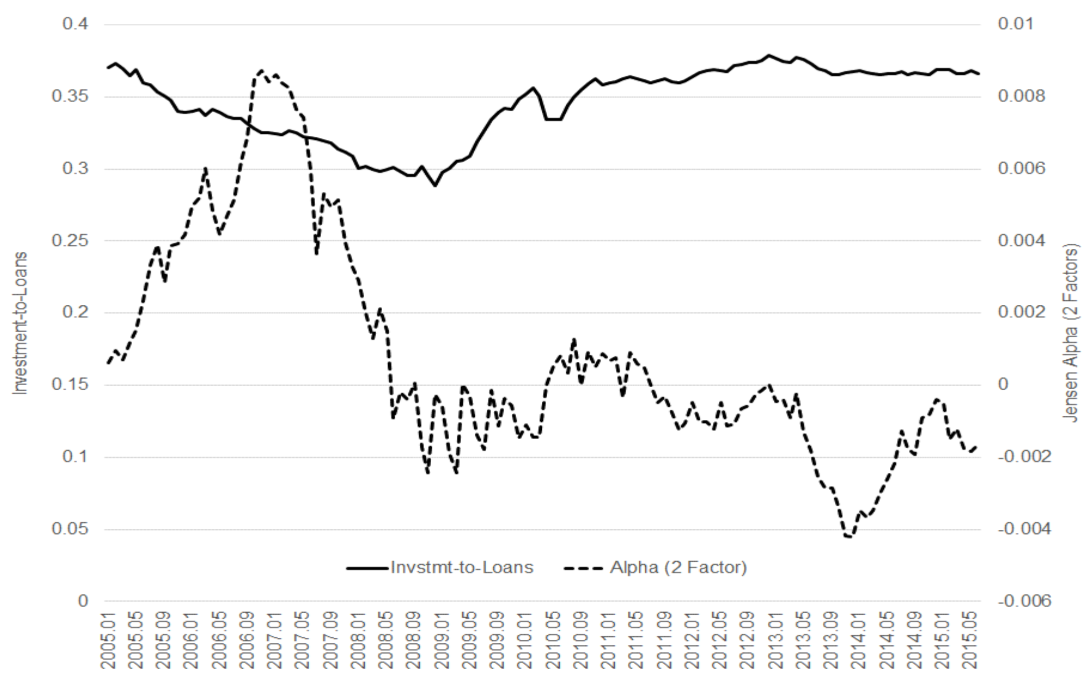
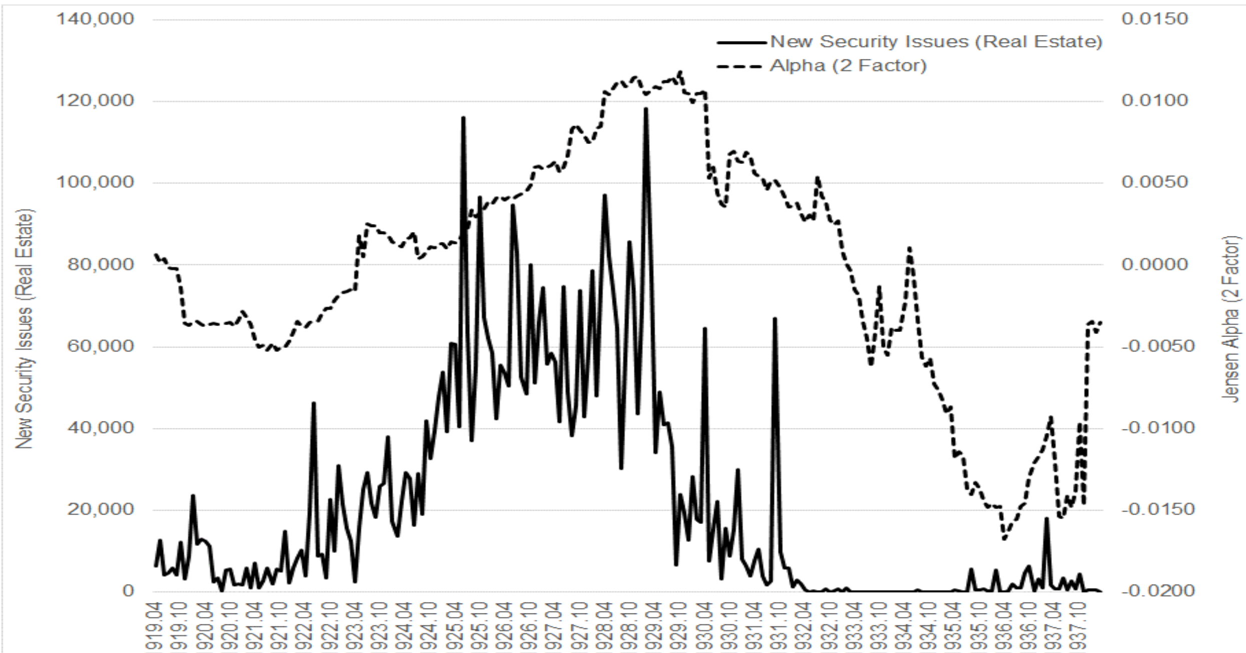


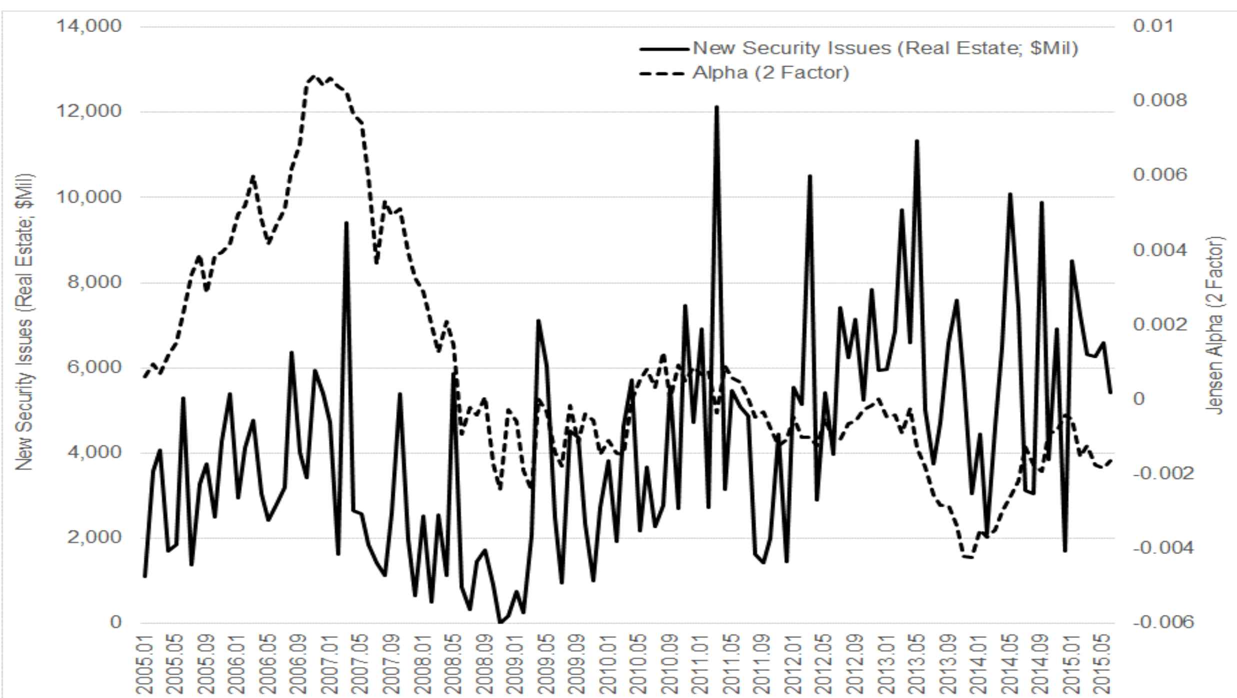
Figure 10: Jensen's Alpha and Newly Issued Real Estate Securities

The figures compare the rolling 84-month RET or REIT alpha using a 2 factor model to new real estate stock and bond issues which include initial public offerings, and secondary offerings.

Panel A. Apr 1919 – Mar 1938 (correlation: 0.60, p-value: .000)



Panel B. Jan 1996 – Dec 2015 (correlation: -.15, p-value: .09377)



Panel C. Jan 2005 – Dec 2011 (correlation: 0.20, p-value: .065)

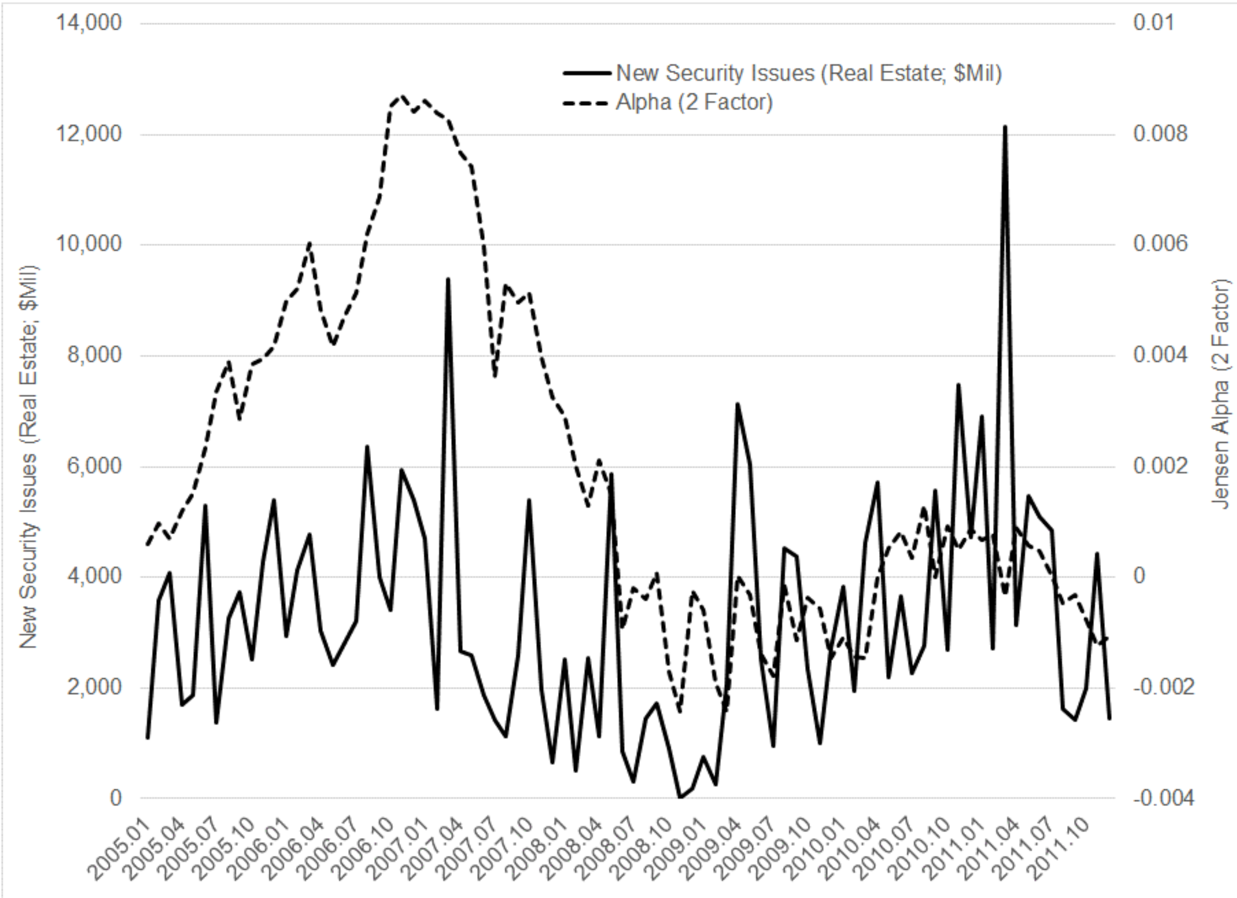
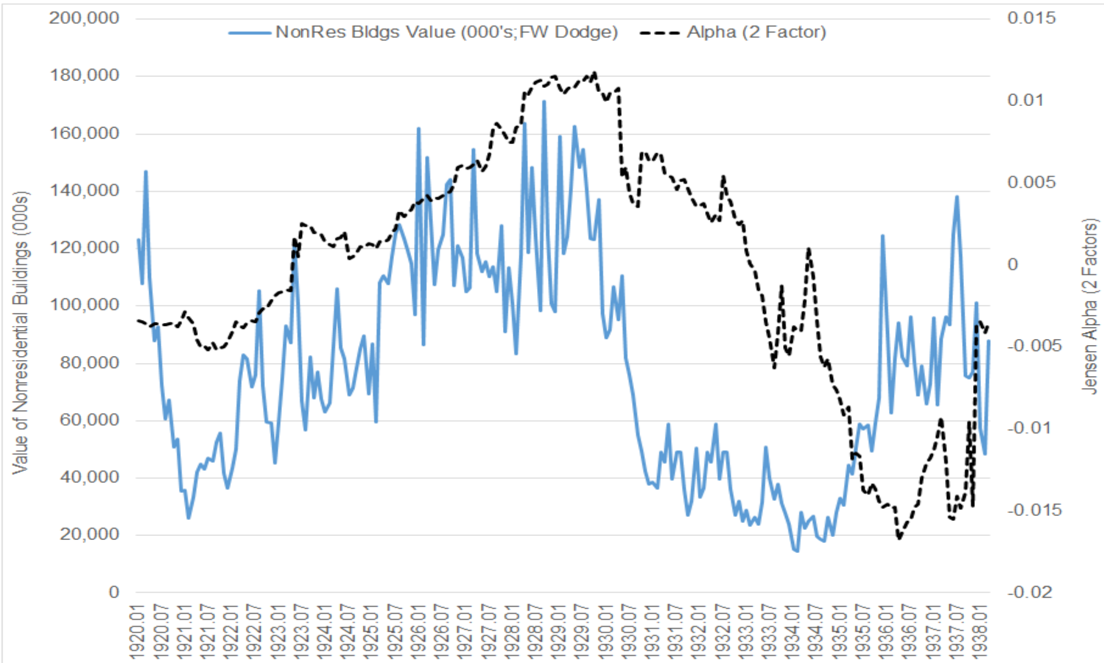


Figure 11: Construction Put in Place and Jensen's Alpha

The figures compare the rolling 84-month RET or REIT alpha using a 2 factor model using a 9 month lead to the value of nonresidential buildings put in place.

Panel A. Jan 1920 – Mar 1938 (correlation: 0.36, p-value: $5.53*10^{-8}$)



Panel B. Jan 2005 – Jun 2015 (correlation: -.17, p-value: .057)

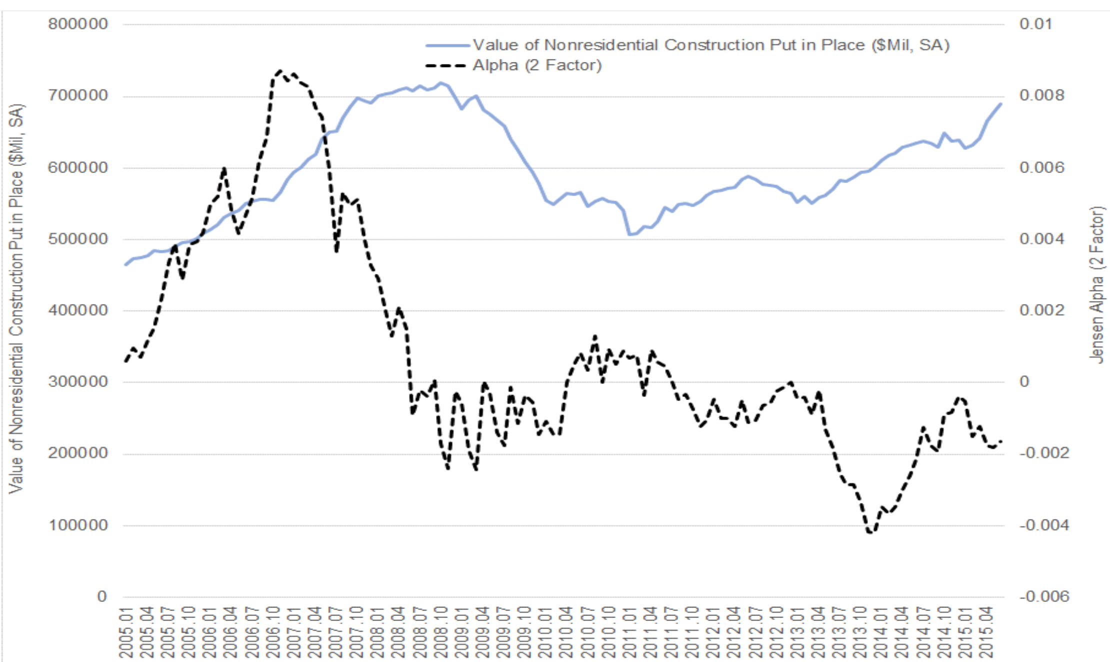
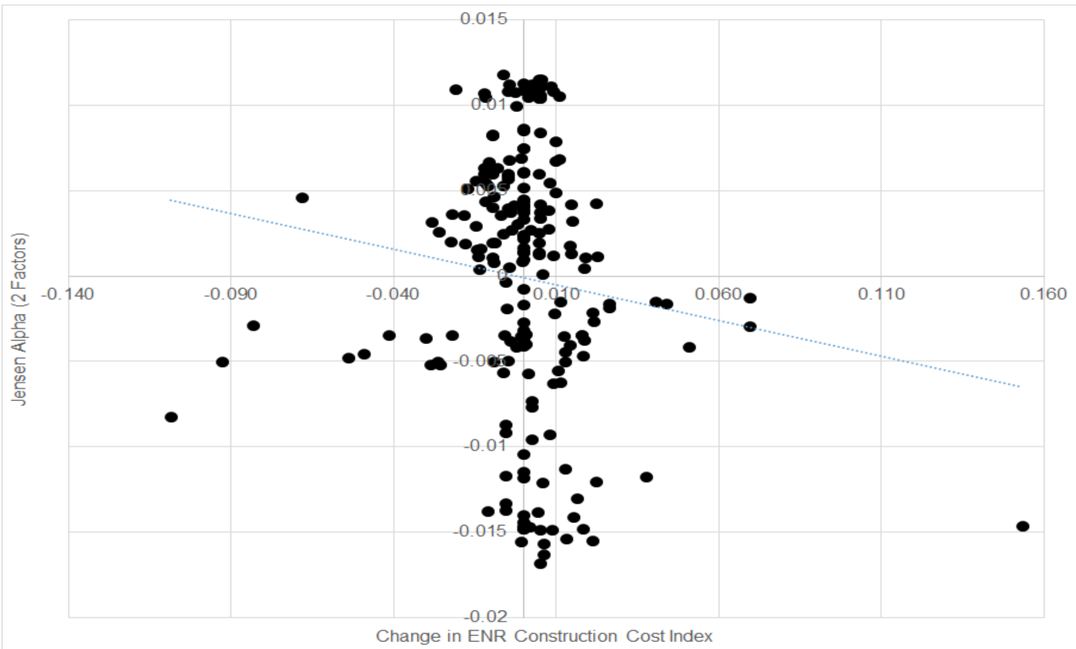


Figure 12: Growth in Construction Cost and Jensen's Alpha

The figures compare the rolling 84-month RET or REIT alpha using a 2 factor model using a 9 month lead to the change in monthly construction cost using the Engineering News-Record construction cost index.

Panel A. Jan 1921 – Mar 1938 (correlation: -0.12, p-value: .08)



Panel B. Jan 2005 – Jun 2015 (correlation: 0.06, p-value: .48)

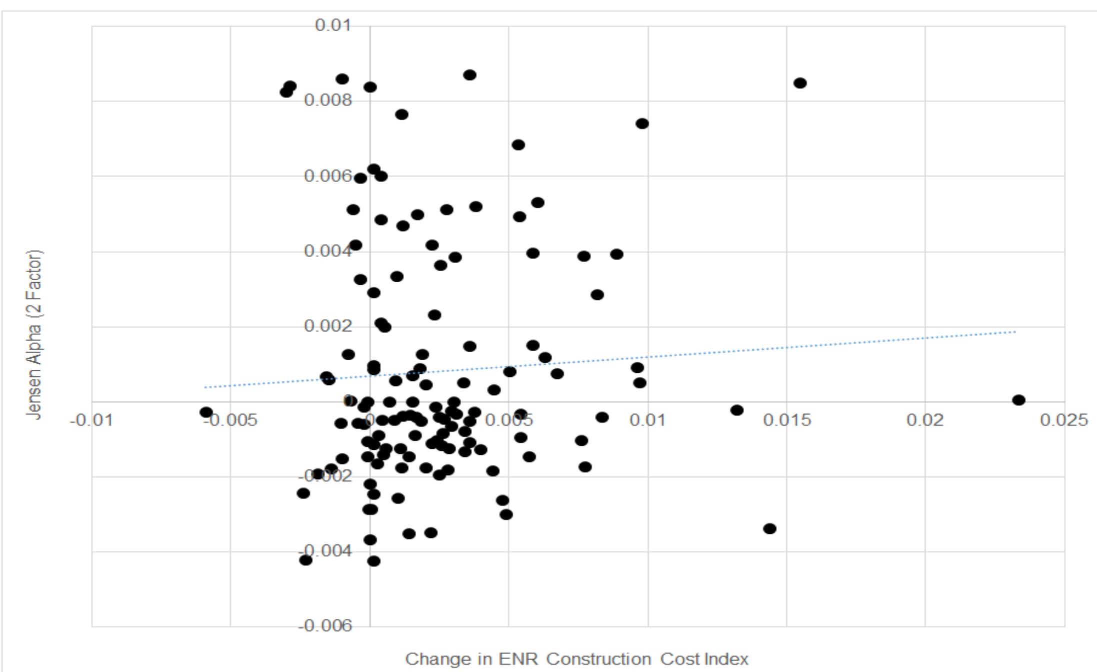


Figure 13: One Factor Jensen's Alpha

The figure displays the rolling 84-month RET alpha using a 1-factor (SP excess return) model from April 1919 to November 1940.

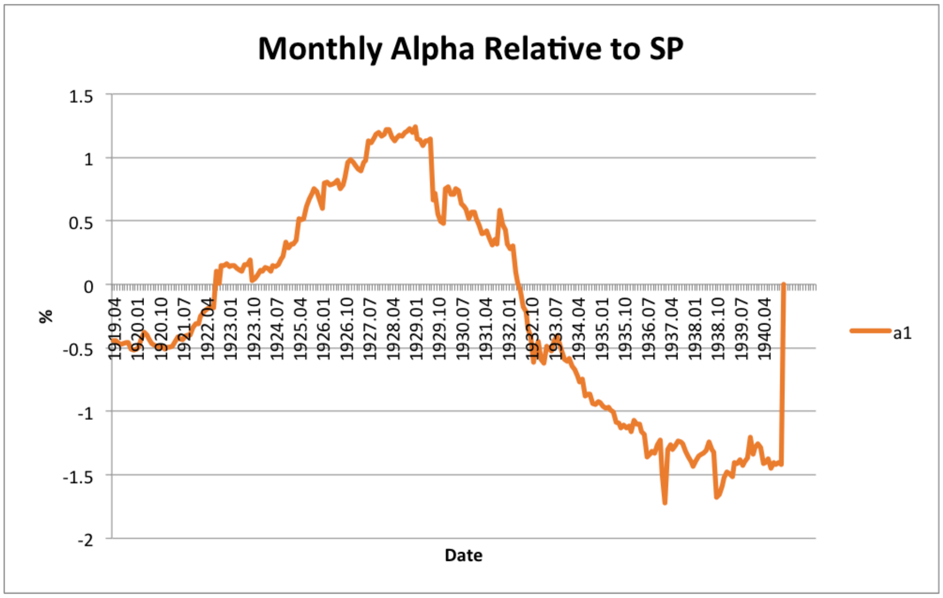


Figure 14: Interest Rate on Real Estate Bonds

The figure displays a time series of the prevailing interest rate on real estate bonds obtained from the *Commercial and Financial Chronicle* from May 1922 to February 1933.

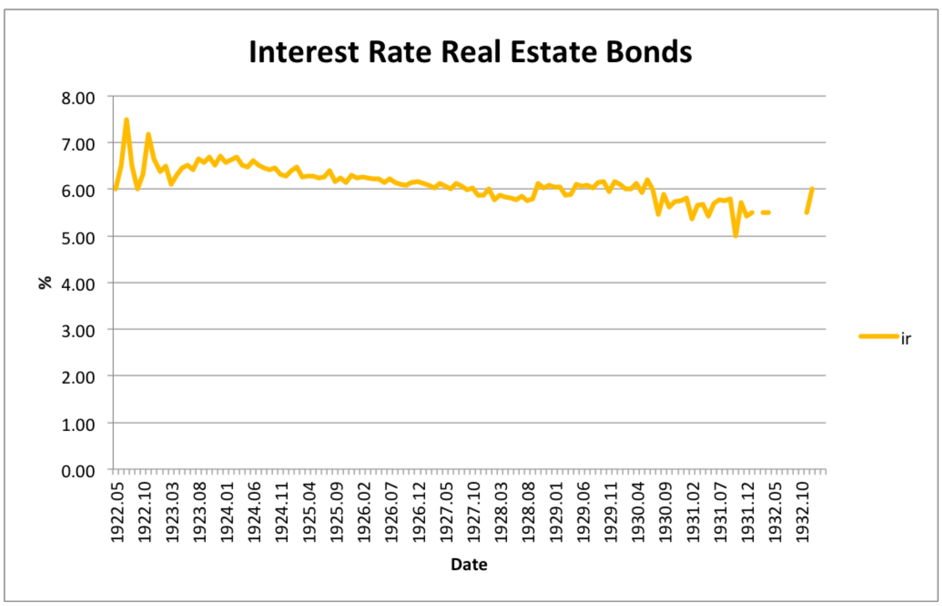


Figure 15: F-statistics VAR for RETs Era

The figure displays the F-statistics for the (OLS) estimation of the VAR for the RETs Era.

VAR/System - Estimation by Least Squares

F-Tests, Dependent Variable IR

Variable	F-Statistic	Signif
IR	3.2469	0.0428701
IL	9.2734	0.0001968
SEC	4.2957	0.0161243
BV	1.2043	0.3040598
A1	18.5652	0.0000001

F-Tests, Dependent Variable IL

Variable	F-Statistic	Signif
IR	7.0921	0.0012961
IL	1159.5461	0
SEC	0.5346	0.587491
BV	5.0945	0.0077497
A1	1.6603	0.195086

F-Tests, Dependent Variable SEC

Variable	F-Statistic	Signif
IR	3.4101	0.0367751
IL	2.1716	0.1191391
SEC	4.8094	0.0100533
BV	1.1958	0.3065861
A1	6.9848	0.0014246

F-Tests, Dependent Variable BV

Variable	F-Statistic	Signif
IR	1.9133	0.1527522
IL	0.9643	0.3846263
SEC	4.1338	0.0187286
BV	8.6768	0.0003273
A1	2.3815	0.0974341

F-Tests, Dependent Variable A1

Variable	F-Statistic	Signif
IR	1.4798	0.2324357
IL	2.7406	0.0691972
SEC	2.59	0.0798524
BV	0.9431	0.392729
A1	207.9275	0

Figure 16: Residual Covariance/Correlation Matrix for RETs Era

The table below shows the covariance/correlation estimated matrix for the residuals for the 5 variable VAR during the RETs Era.

	IR	IL	SEC	BV	α_t
IR	0.036767	-0.31535161	0.22312305	0.03465759	-0.14877096
IL	-0.000361	0.000036	0.06936175	-0.14153147	0.10641665
SEC	766.047296	7.409028	320602965.9	0.18087124	0.10512464
BV	122.290358	-15.537351	59596367.48	338635919.2	0.01048539
α_t	-0.000022	0.000000	1.433644	0.146962	0.000001

Figure 17: Sims-Bernanke Decomposition

The table below shows the results of the Sims-Bernanke Decomposition for the 5-variable VAR during the RETs Era.

Covariance Model-Concentrated Likelihood - Estimation by BFGS
Convergence in 87 Iterations. Final criterion was 0.0000062 <= 0.0000100
Observations: 115
Log Likelihood: −1458.8163
Log Likelihood Unrestricted: −1450.2998

Estimate	Variable	Coeff	Std Error	T-Stat	Signif
1	G11	513.288773	315.001999	1.62948	0.1032119
2	G12	5250.62937	3626.221241	1.44796	0.14762777
3	G13	-0.00143	0.000983	-1.45535	0.1455727
4	G15	18382.02452	196.296723	93.64407	0
5	G22	3241721.496	1.00001	3241687.639	0
6	G23	-0.106032	0.10156	-1.04404	0.29646841
7	G24	0.167398	0.09654	1.73398	0.08292186
8	G31	766.038032	1	766.03802	0
9	G33	320602966.2	1.026544	3.12E+08	0
10	G34	59596365.81	1.516511	39298331.53	0
11	G41	122.293446	1	122.29345	0
12	G44	338635919.2	1	3.39E+08	0
13	G52	40373.67088	4.413337	9148.10577	0
14	G53	-0.890437	0.787017	-1.13141	0.2578837
15	G55	198917999.8	1	1.99E+08	0

Figure 18: RETs Impulse Response of Interest Rate

The figure below shows the impulse response function the interest rate on real estate bonds to shocks in the four other variables: Investment/Loan (Inv/Loan), new real estate security offerings (Sec), Nonresidential Building Values (BldgValue), 1-factor α_t (Alpha1).

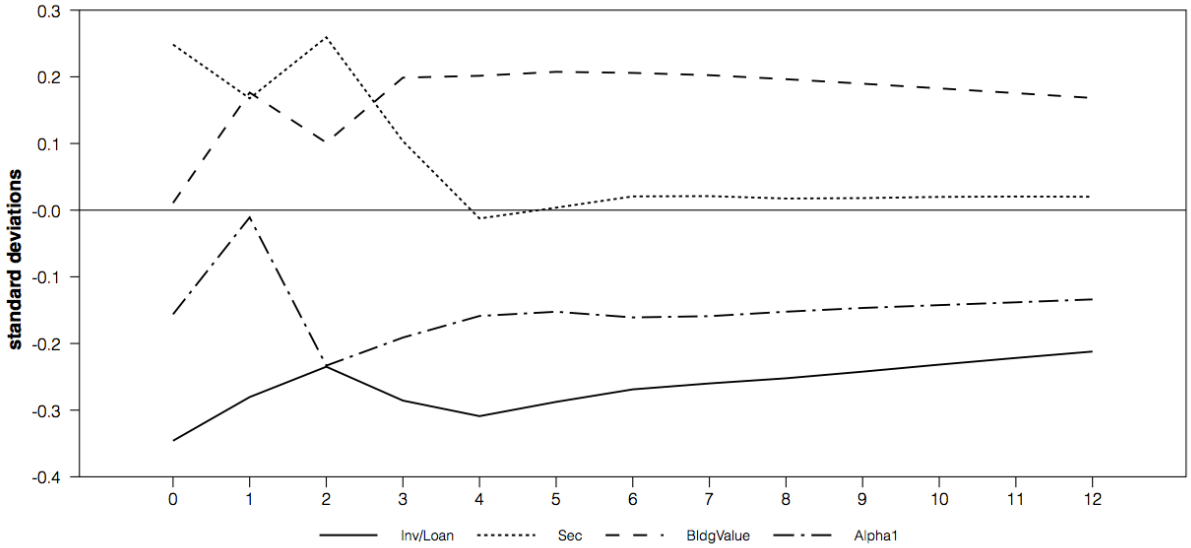


Figure Responses of Interest Rate to the Four Shocks

Figure 19: RETs Impulse Response of Investment-to-Loans Ratio

The figure below shows the impulse response function the interest rate on real estate bonds to shocks in the four other variables: Interest Rate (Int Rate), new real estate security offerings (Sec), Nonresidential Building Values (BldgValue), 1-factor α_t (Alpha1).

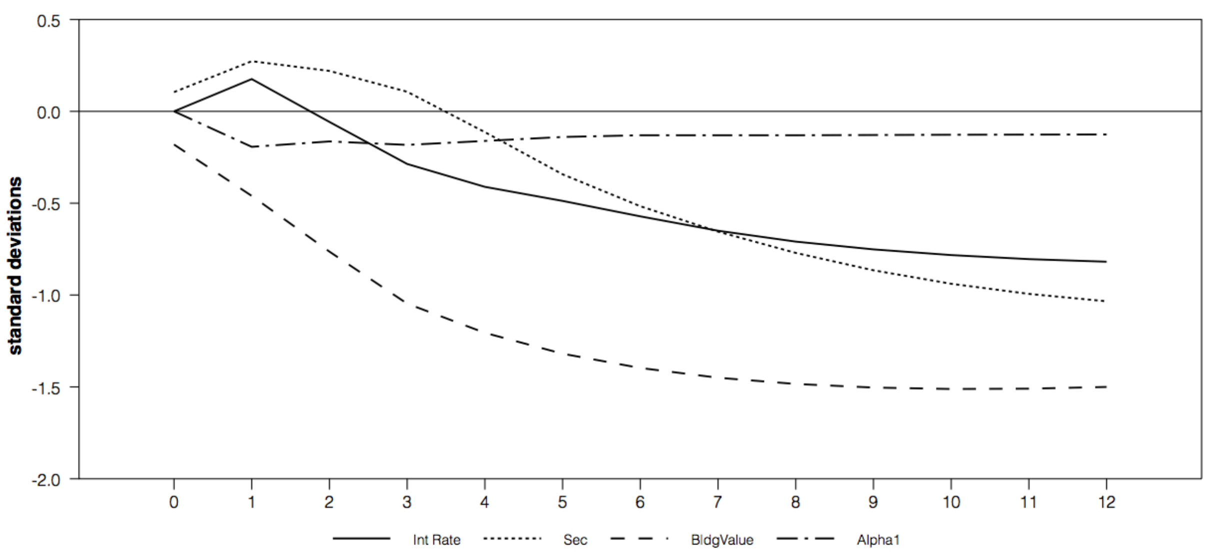


Figure Responses of Investment/Loan to the Four Shocks

Figure 20: RETs Impulse Response of New Real Estate Security Offerings

The figure below shows the impulse response function the interest rate on real estate bonds to shocks in the four other variables: Interest Rate (Int Rate), Investment-to-Loan ratio (Inv/Loan), Nonresidential Building Values (BldgValue), 1-factor α_t (Alpha1).

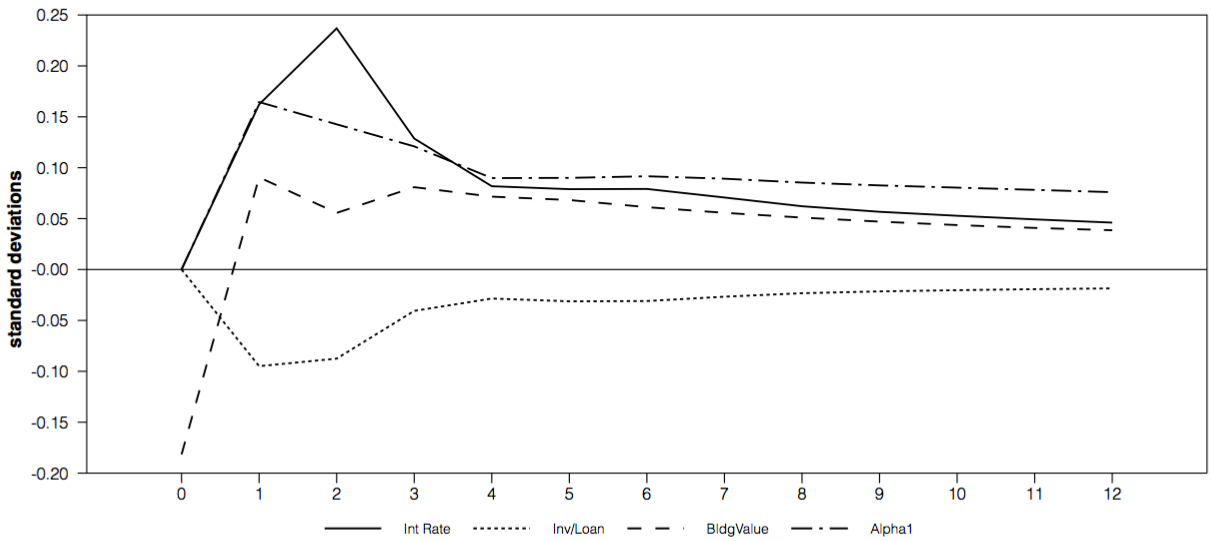


Figure Responses of New RE Securities to the Four Shocks

Figure 21: RETs Impulse Response of Nonresidential Building Values

The figure below shows the impulse response function the interest rate on real estate bonds to shocks in the four other variables: Interest Rate (Int Rate), Investment-to-Loan ratio (Inv/Loan), new real estate security offerings (Sec), 1-factor α_t (Alpha1).

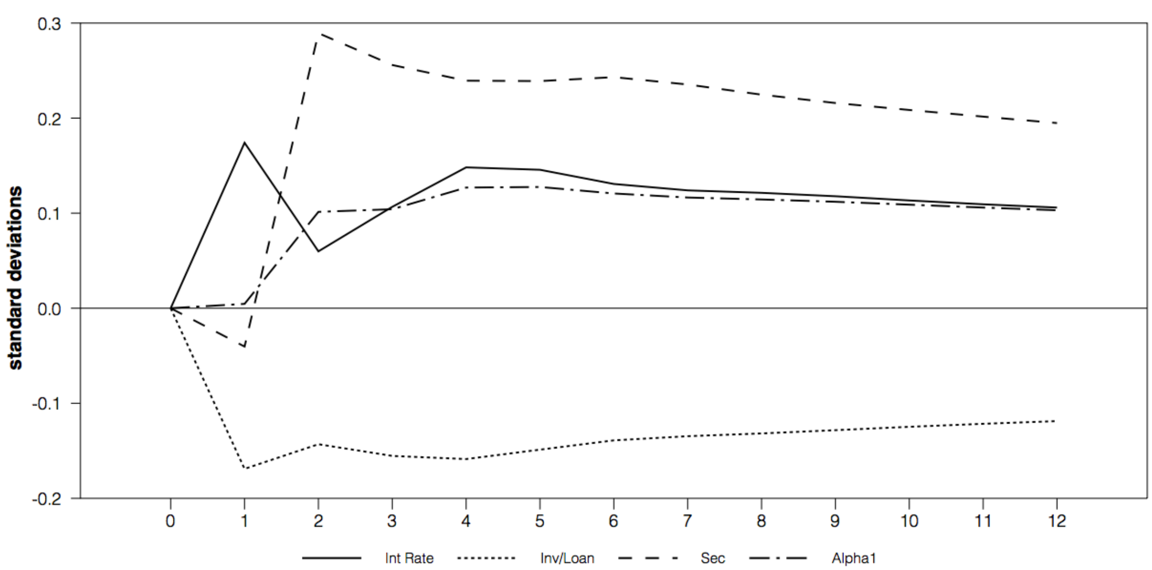


Figure Responses of Bldg Value to the Four Shocks

Figure 22: RETs Impulse Response of α_t

The figure below shows the impulse response function the interest rate on real estate bonds to shocks in the four other variables: Interest Rate (Int Rate), Investment-to-Loan ratio (Inv/Loan), new real estate security offerings (Sec), Nonresidential Building Values (BldgValue).

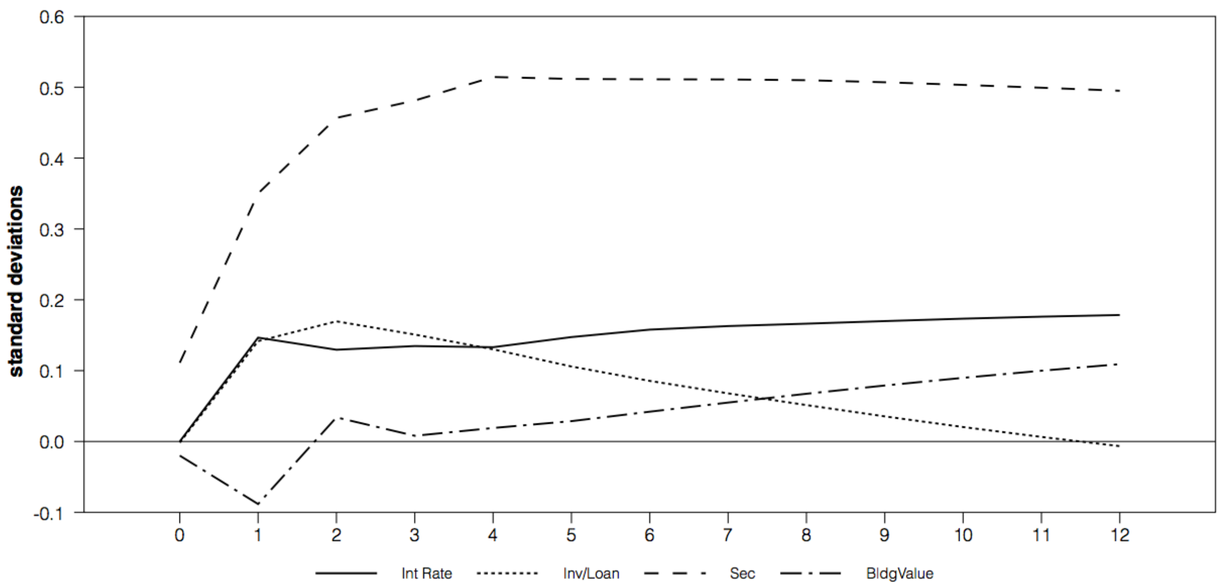


Figure Responses of alpha1 to the Four Shocks

Figure 23: Robust Impulse Response Functions

The figure below impulse response functions along with 95% error bands computed using Monte Carlo Integration. The VAR variables are: Interest Rate (Int Rate), Investment-to-Loan ratio (Inv/Loan), new real estate security offerings (Sec), Nonresidential Building Values (BldgValue), and one-factor alpha (A1)

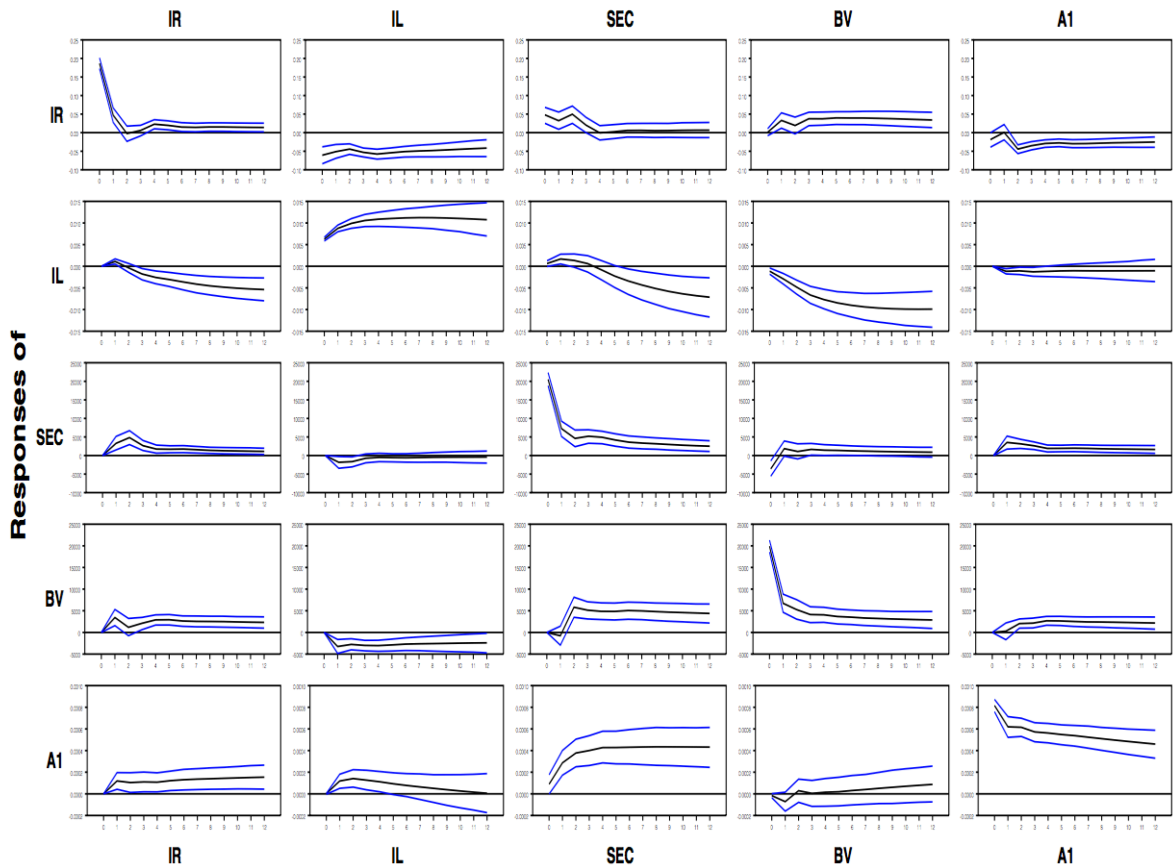


Figure 24: One Factor Jensen's Alpha

The figure displays the rolling 84-month REIT alpha using a 1-factor (S&P 500 excess return) model from January 2005 to June 2015.

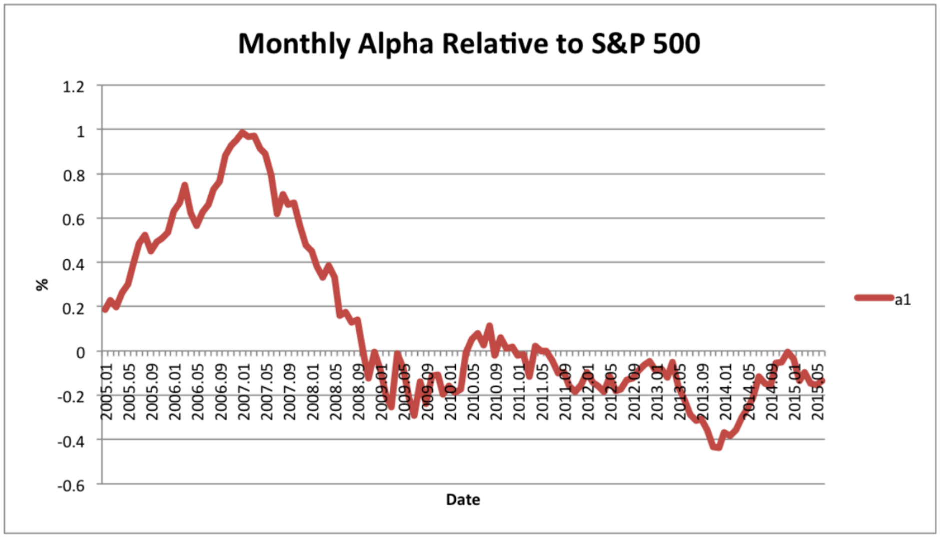


Figure 25: Interest Rate on Real Estate Bonds

The figure displays a time series of the prevailing interest rate on real estate bonds obtained from the *Commercial and Financial Chronicle* from January 2005 to June 2015.

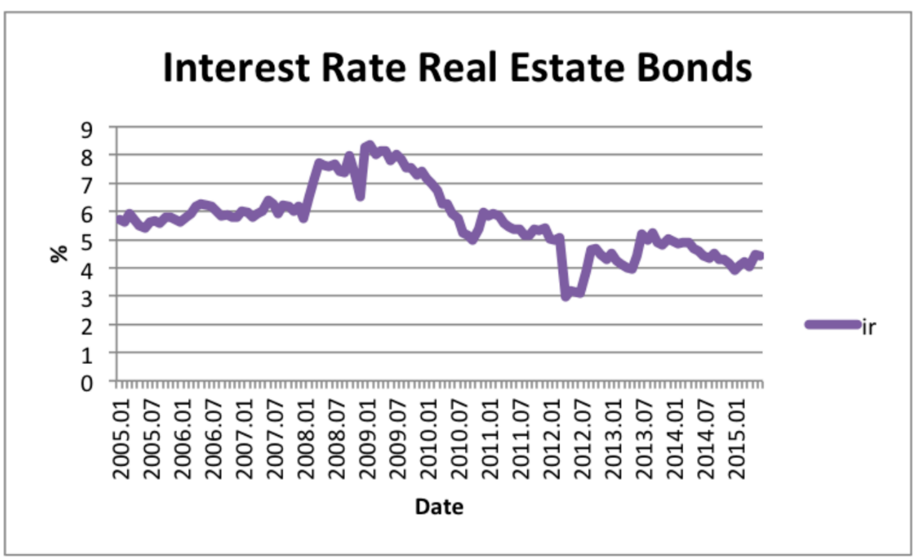


Figure 26: F-statistics VAR for REITs Era

The figure displays the F-statistics for the (OLS) estimation of the VAR for the REITs Era.

VAR/System - Estimation by Least Squares

F-Tests, Dependent Variable IR
Variable F-Statistic Signif
****

IR	208.5541	0
IL	10.0737	0.0019146
SEC	1.1802	0.2795037
BV	2.2983	0.1321658
A1	1.9733	0.1627052

F-Tests, Dependent Variable IL
Variable F-Statistic Signif
****

IR	0.6289	0.4293355
IL	444.9272	0
SEC	1.8131	0.1807015
BV	2.2364	0.1374381
A1	12.4799	0.0005864

F-Tests, Dependent Variable SEC
Variable F-Statistic Signif
****

IR	0.2118	0.6462013
IL	6.4715	0.0122429
SEC	0.0301	0.8624603
BV	2.5088	0.1158673
A1	0.8166	0.3680046

F-Tests, Dependent Variable BV
Variable F-Statistic Signif
****

IR	4.5344	0.03528
IL	0.0129	0.9097599
SEC	2.38E-03	0.9611994
BV	2024.383	0
A1	7.1593	0.0085086

F-Tests, Dependent Variable A1
Variable F-Statistic Signif
****

IR	1.30E-03	0.9713287
IL	0.0729	0.7875649
SEC	0.0543	0.8161496
BV	3.236	0.0745693
A1	1188.2828	0

Figure 27: Residual Covariance/Correlation Matrix for REITs Era

The table below shows the covariance/correlation estimated matrix for the residuals for the 5 variable VAR during the REITs Era.

	IR	IL	SEC	BV	α_t
IR	0.000011	0.13535929	0.00677237	-0.11789366	-0.13771472
IL	0.000002	0.000012	0.05569352	-0.19793449	-0.26498389
SEC	0.048092	0.411963	4489213.998	-0.0883054	0.02674655
BV	-3.36167	-5.879024	-1591796.126	72381917.28	0.00798382
α_1	0	-0.000001	0.039528	0.047378	0

Figure 28: Sims-Bernanke Decomposition

The table below shows the results of the Sims-Bernanke Decomposition for the 5-variable VAR during the REITs Era.

Covariance Model-Concentrated Likelihood - Estimation by BFGS Convergence in 11 Iterations. Final criterion was 0.0000049 <= 0.0000100 Observations 125
Log Likelihood −897.3037 Log Likelihood Unrestricted −636.9100

Estimate	Variable	Coeff	Std Error	T-Stat	Signif
1	G11	2866836.302	1.004329	2854478.557	0
2	G12	-387729.5462	1.001686	-387077.0529	0
3	G14	0.100744	0.099186	1.01571	0.30976911
4	G15	1382825.308	1.017516	1359020.929	0
5	G21	-216357.1121	1.018588	-212408.8342	0
6	G22	2697776.709	0.999635	2698760.977	0
7	G24	0.20907	0.097071	2.15378	0.03125758
8	G32	0.411963	1	0.41196	0.68036634
9	G33	4489213.998	1.012441	4434048.131	0
10	G34	-1591796.126	1.095012	-1453679.61	0
11	G42	-5.677912	1	-5.67791	0.00000001
12	G44	72381917.28	1	72381917.28	0
13	G51	21827955.6	0.968022	22549018.96	0
14	G52	35857402	0.910514	39381490.82	0
15	G55	62001427.08	0.698441	88771234.35	0

Figure 29: RETs Impulse Response of Interest Rate

The figure below shows the impulse response function the interest rate on real estate bonds to shocks in the four other variables: Investment/Loan (Inv/Loan), new real estate security offerings (Sec), Nonresidential Building Values (BldgValue), 1-factor α_t (Alpha1).

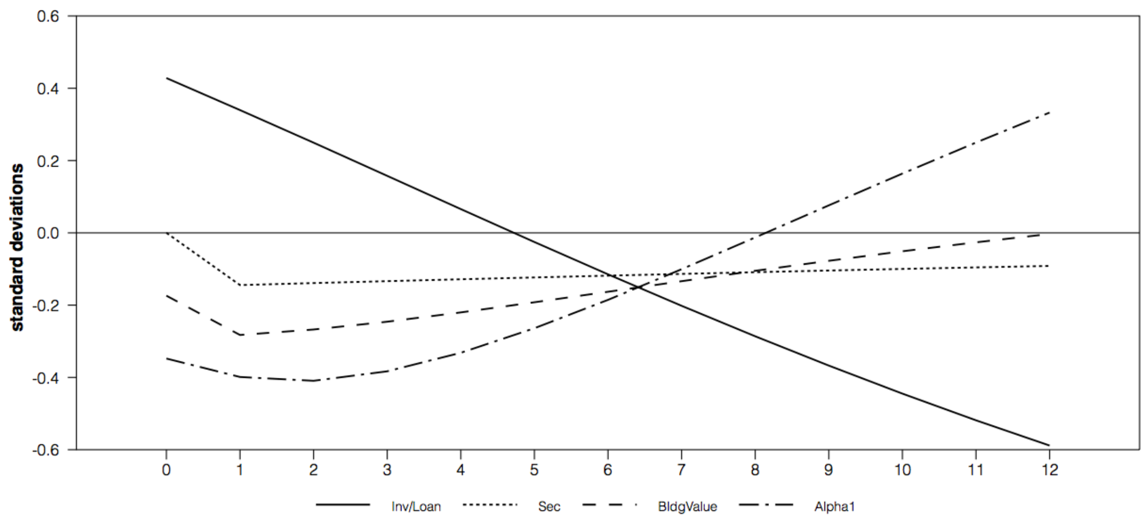


Figure Responses of Interest Rate to the Four Shocks

Figure 30: REITs Impulse Response of Investment-to-Loans Ratio

The figure below shows the impulse response function the interest rate on real estate bonds to shocks in the four other variables: Interest Rate (Int Rate), new real estate security offerings (Sec), Nonresidential Building Values (BldgValue), 1-factor α_t (Alpha1).

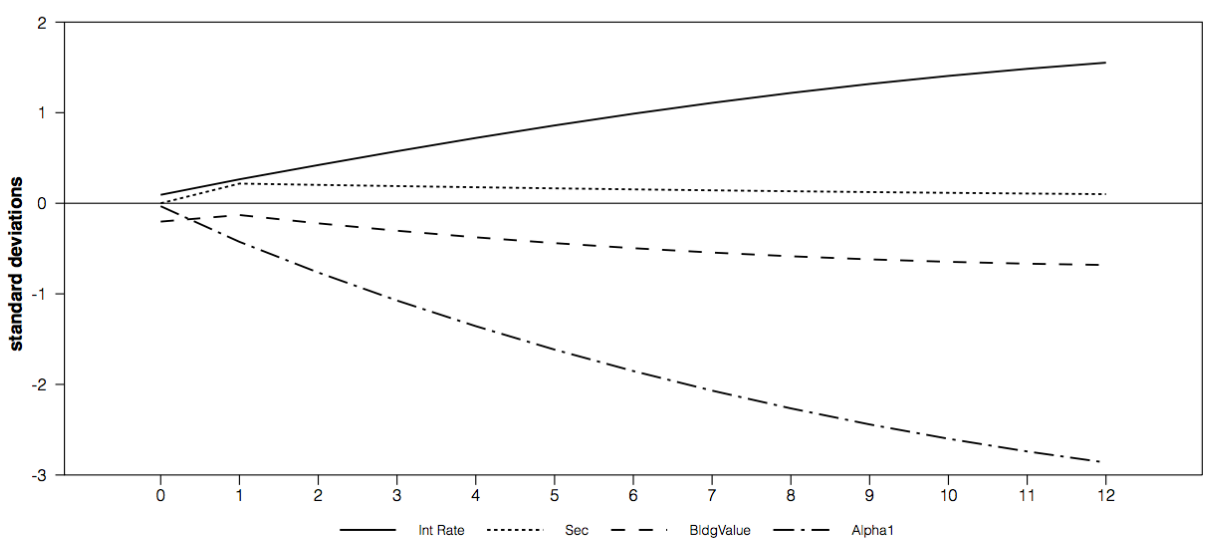


Figure Responses of Investment/Loan to the Four Shocks

Figure 31: REITs Impulse Response of New Real Estate Security Offerings

The figure below shows the impulse response function the interest rate on real estate bonds to shocks in the four other variables: Interest Rate (Int Rate), Investment-to-Loan ratio (Inv/Loan), Nonresidential Building Values (BldgValue), 1-factor α_t (Alpha1).

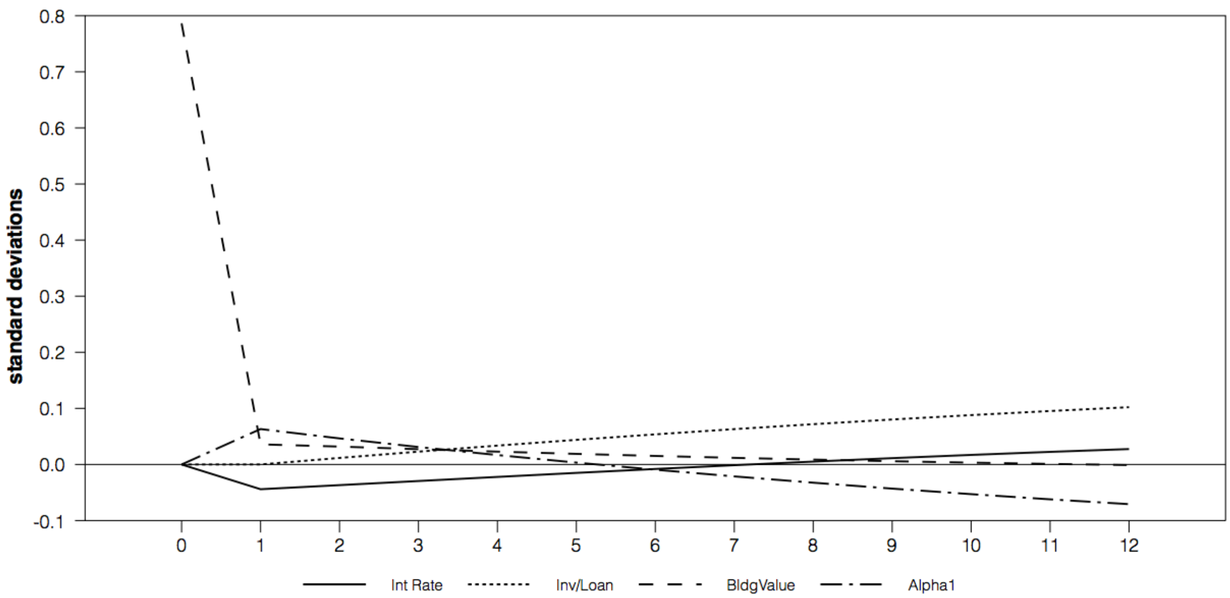


Figure Responses of New RE Securities to the Four Shocks

Figure 32: REITs Impulse Response of Nonresidential Building Values

The figure below shows the impulse response function the interest rate on real estate bonds to shocks in the four other variables: Interest Rate (Int Rate), Investment-to-Loan ratio (Inv/Loan), new real estate security offerings (Sec), 1-factor α_t (Alpha1).

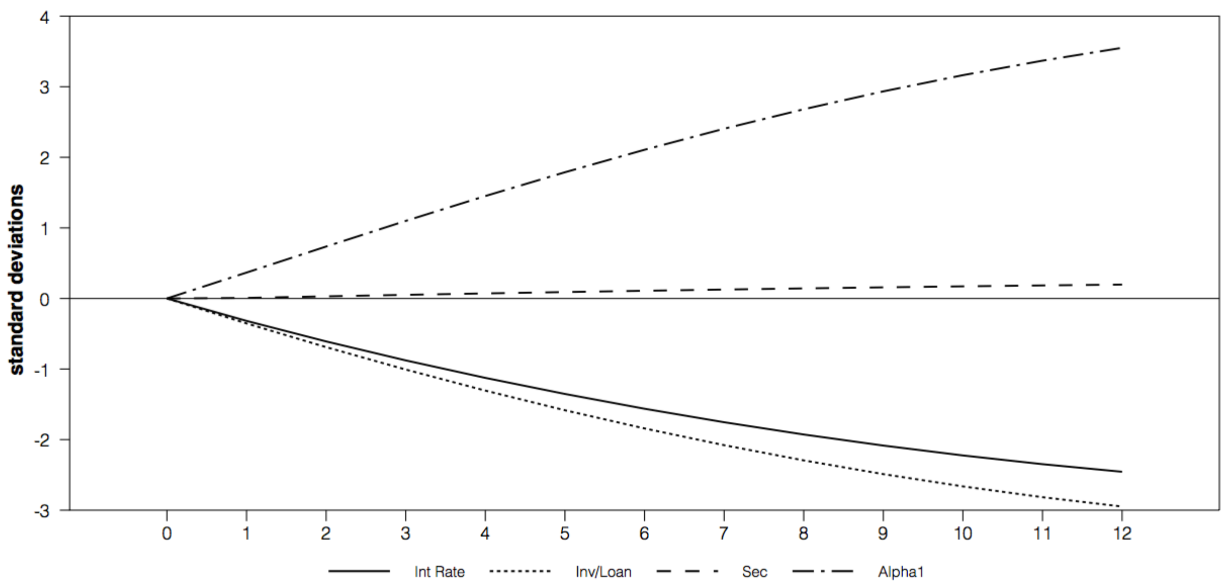


Figure Responses of Bldg Value to the Four Shocks

Figure 33: REITs Impulse Response of α_t

The figure below shows the impulse response function the interest rate on real estate bonds to shocks in the four other variables: Interest Rate (Int Rate), Investment-to-Loan ratio (Inv/Loan), new real estate security offerings (Sec), Nonresidential Building Values (BldgValue).

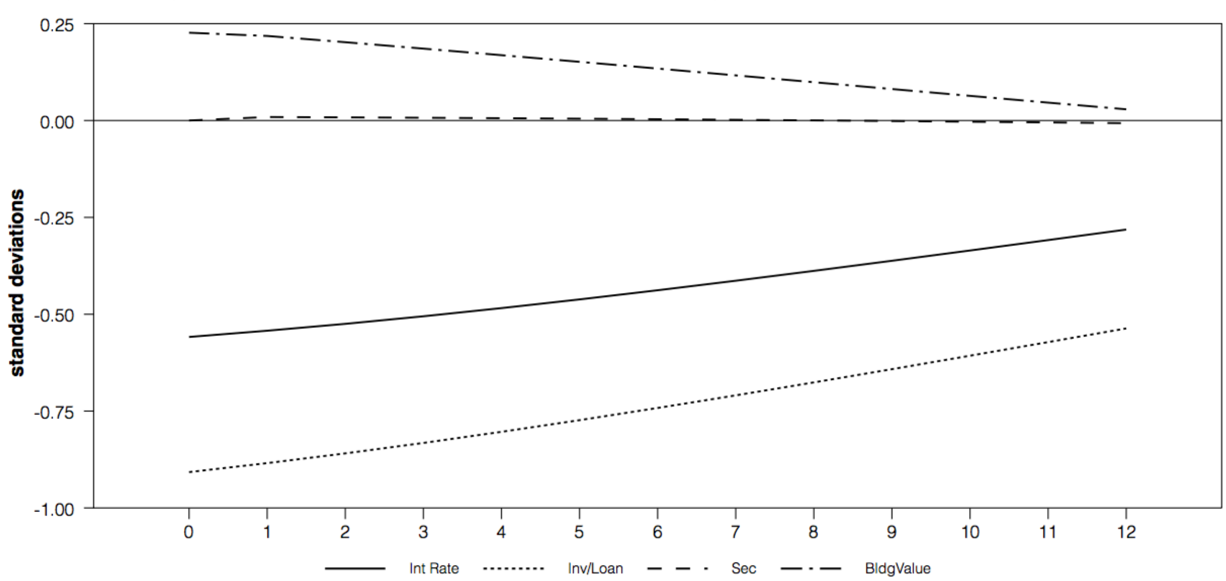


Figure Responses of alpha1 to the Four Shocks

Figure 34: Robust Impulse Response Functions

The figure below impulse response functions along with 95% error bands computed using Monte Carlo Integration. The VAR variables are: Interest Rate (Int Rate), Investment-to-Loan ratio (Inv/Loan), new real estate security offerings (Sec), Nonresidential Building Values (BldgValue), and one-factor alpha (A1).