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REITs and Inflation: The Recent Performance of REITs During the Periods of Varying Inflation

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ABSTRACT

As the world economy began to reopen, and a sense of normality returned to many parts of the world, a new threat to the economy emerged, inflation. Since early 2020, inflation in the United States has consistently been well above the Federal Reserve's (FED) target inflation rate of 2%. This has led to many investors and individuals alike looking to hedge their bets against inflation. Traditional convention points to real estate as a hedge against inflation. This logic follows as the Consumer Price Index (CPI) heavily weighs housing in its price-level indication. However, is this really the case? In this paper, we examine the literature concerning real estate as a hedge against inflation. We specifically look at Real Estate Investment Trusts (REITs) and how they fair during periods of varying inflation and if they differ greatly from traditional stocks. Lastly, we extend the current research and present findings of REIT performance through 2020 and since the inflationary environment began with the pandemic.

Table of Contents

LIST OF TABLES

LIST OF EQUATIONS

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Chapter 1

Introduction

During the COVID-19 Pandemic, the spike in housing prices also created a buzz around REITs. As inflation began to rise in 2021, individuals and investors alike began to flock to inflation-hedging investments like real estate. Although many advisors, through traditional and social media, pushed real estate as an angel sent to fight inflation, others remained skeptical. This divide in rationale is nothing new and has remained as early as 1977 when Fama and Schwert first released their paper revealing the hedging characteristics of real estate against inflation (Fama & Schwert, 1977).

Since these findings, there has been great debate about whether or not real estate truly hedges inflation or if there are greater variables at play. In 1985, Fogler et al. commented on how although there was some positive correlation between inflation and real estate, the findings were not strong enough to remove the possibility of a random chance (Fogler et al., 1985). The debate has continued with literature finding both supporting and negating evidence utilizing a variety of real estate classes tied with various methodologies concluding in contrary findings.

The emergence of REITs has provided a fresh perspective on the hedging characteristics of real estate. REITs are best characterized as securitized real estate and are often publicly traded. REITs are fundamentally different from both traditional companies and also plain real estate. Unlike your everyday company, they have an additional set of requirements around their asset, income, and shareholder mix. Additionally, they must distribute at least 90% of their taxable income. There have been numerous studies reporting on the relationship between REITs and inflation. A recent study characterized REITs as a signal during times of inflationary shocks. They find REITs to have varying degrees of inflation correlation depending on changing

economic outlook (Connolly & Stivers, 2022). As the economy opened back up, 2021 brought a wave of increased inflation, while also bringing interest to the role of real estate and REITs. This begs the question of whether real estate, and more specifically REITs, were hedges against inflation as was so often suggested during the past few years.

In this paper, we will answer if REITs serve as hedges during the recent periods of high inflation. This question is of particular importance as investors seek to protect their buying power due to the current inflationary environment since the COVID-19 pandemic. We examine this question by performing Ordinary Least Squares regression methodology to find correlation between REIT returns from publicly traded, US REITs and CPI inflation data. We also look for correlation between private real estate and inflation using home sales price data as a proxy, to compare publicly traded REITs to private real estate. The S&P 500 index was utilized as a market proxy to find if stocks, rather than inflation, best explained REIT returns.

From our study, we find that REITs, like stocks, serve as perverse inflation hedges. Additionally, we find that REIT returns are best explained by the greater market and that private real estate, unlike REITs, can serve as a hedge against inflation. This study agrees with much of the existing literature surrounding the inflation hedging characteristics of REITs and adds more recent (post-pandemic) analysis on inflation and REITs to the literature.

Pandemic Home Pricing

As office workers shifted their meetings from class-A, center-city spaces to cluttered corners in their homes, they began to have a realization. This realization was the same as that had by parents, with their children at home, who now realized that their home cannot fit their growing family of four. People needed more space to live, work, and play during a time when traditional public spaces were limited. Hence, they began to look for larger, more suitable homes

often away from traditional cities. Markets in emerging southern regions began to boom as many realized they were not tied to the traditional hubs like New York City. Places like Miami, FL, and Denver, CO saw homes selling for large amounts over the asking price.

This phenomenon, however, was not restricted to just these markets as the nation, on average, saw a rise in the cost of housing. In the second quarter of 2020, right as the pandemic truly settled in, the US median home sale price was $322,600. By the first quarter of 2021, this had jumped to nearly $370,000, a nearly 15% increase in just three quarters (U.S. Census Bureau & U.S. Department of Housing and Urban Development, 1963). This bull market would not yet finish. In the third quarter of 2021, median home sale prices passed $400,000 for the first time ever, eventually reaching $423,600 by the last quarter of 2021. The market would top out in the third quarter of 2022 at $468,000, decreasing ever-so-slightly to $467,700 by the fourth quarter of 2022 (U.S. Census Bureau & U.S. Department of Housing and Urban Development, 1963). The market topped out 45% higher than its pandemic low. It seemed like real estate was exploding during a time when inflation was growing almost as quickly.

The Recent Rise in Inflation

The pandemic was characterized by both demand and supply constraints. Consumers were stockpiling household essentials like water, toilet paper, and household cleaners causing unprecedented demand. Many manufacturers had initially predicted a downtick in demand for many goods and stopped input orders. Additionally, these suppliers had closed many of their factories due to the lockdowns imposed by governments worldwide. This led to shortages experienced across the United States. From empty isles at grocery stores to emptier car lots, even shoppers on Amazon were struggling to find the goods they demanded. Experiencing higher

costs to run their businesses during the pandemic, tied with strong demand, sellers began to raise prices, hoping to eventually curb the demand.

Researchers have debated the cause of inflation and the importance of demand and supply shocks in the current inflationary environment. The Federal Reserve Bank of San Francisco (FRBSF) has commented that most of the inflationary pressures they measure could be attributed to supply constraints. Early in the pandemic, inflation was mostly attributed to demand-driven and ambiguous factors; however, since early 2021, supply factors have made the largest contribution to inflation (Shapiro, 2022).

REITs During the Pandemic

As both home sales prices and inflation increased, little was known about the ramifications which would be seen on publicly traded REITs and even the overall stock market. REITs extend far beyond the horizon of residential housing and provide exposure to all classes of real estate. When coupled with the fact that the most prominent REITs are publicly traded, and even in large indexes like the S&P 500, they become subject to much of the same volatility which is experienced by the greater stock market. With the current market conditions in mind, the question remained of how well REITs performed as hedges to inflation, and if they performed any differently than stocks or privately-held real estate.

Chapter 2

Literature Review

This literature review examines the return characteristics of REITs and the question of whether REITs can successfully hedge during periods of inflation. This review examines REITs through various time periods to explore potential changes which may have occurred as legislation and governance styles around REITs changed. The review is organized and divided by papers that have supporting evidence for the inflation hedging characteristics for REITs and by papers that do not. We will first examine the perverse hedging characteristics of REITs and how the argument has persisted throughout time and through changes to REITs discussing the findings proposed by Park et al. (1990), Glascock et al. (2002), and Das & Sarkar (2020). Then, we will discuss papers that make progressively stronger arguments for the inflation-hedging properties of REITs. Pierdzioch et al. (2019) and Connolly & Stivers (2022) find some supporting evidence while looking at varying economic states, while Case & Wachter (2011) make the strongest argument for the inflation-hedging characteristics of REITs.

Several papers conclude that REITs do not serve as hedges against inflation. They differ by their methodologies and time periods which they examine. In 1990, Park et al. explore the inflation-hedging characteristics of REITs, analyzing various sectors with both expected and actual inflation. The researchers utilize the methodology proposed by Fama & Schwert (1977) to conduct their analysis. They conclude that REITs are indistinguishable from traditional stocks in terms of their hedging characteristics. They add that in terms of expected inflation, there is some evidence to suggest that REITs have partial hedging properties, but they mostly are perverse hedges, just like stocks (Park et al., 1990).

This paper predates many of the governance changes experienced by REITs including the UPREIT structure established in 1992, look through provisions established by tax changes in 1993, and the self-management structure which shaped growth in REITs during the 1990s continuing until the present day. The importance of these changes is described by Ambrose & Linneman (1998) as they showcase the growth in the number and size of REITs which came since these (and other) fundamental changes to REITs during the 1990s; however, the findings from Park et al. (1990) are still relevant in recent research as even with fundamentally different REITs and simpler analyses, the hedging characteristics of REITs are still relevant to recent findings.

Taking into account these structural changes to REITs, Glascock et al. (2002) reexamine the negative relationship between REITs and inflation. The study utilizes a vector error correction model to find periods of correlation revealing that expected nor unexpected inflation signal REIT returns, going against the hypothesis that REITs are perverse hedges, like stocks, to inflation. They note that changes in the Federal Funds Rate may be a partial explanation for the relationship between REIT returns and inflation. The researchers add to the literature the importance that monetary policy plays in perverse inflation outcomes. Additional research also examines the idea that other variables have importance in predicting REIT returns.

One such variable is relative price variability (RPV) which measures the change in price levels of one asset relative to an average of assets. Das & Sarkar (2020) utilize RPV as an additional variable to inflation measures and REIT returns. They find there to be a negative relationship between inflation and REIT returns and a positive impact seen in REIT returns by RPV. They find that throughout their studied period, there are several structural changes to the relationship such as during the Great Financial Crisis to US REIT returns; however, these

changes are not seen in their UK data, whose relationships remained stable. This research supports the negative relationship between REIT returns and inflation, adding that RPV may be a better proxy for the relationship between REIT returns and inflation.

Park et al. (1990), Glascock et al. (2002), and Das & Sarkar (2020) look at extensive time periods for correlation between REITs and inflation. These methodologies help conclude the perverse hedging characteristics of REITs; however, there seems to be some gray area in the literature where alternative research methodologies both regression-based and alternative have found at least some hedging properties of REITs. Such is the case with the study conducted by Pierdzioch et al. (2019).

To address many of the criticisms of prior regression methodologies Pierdzioch et al. utilize Bayesian Additive Regressive Trees (BART) to reexamine the relationship between inflation and REIT returns. They regress REIT returns against multiple factors including expected and unexpected inflation, the S&P 500 index, and commodity indices, among other regressors. Consistent with Park et al. (1990), Glascock et al. (2002), and Das & Sarkar (2020), the researchers conclude that the general market, more than expected or unexpected inflation, better explains the return characteristics of REITs. However, they add to the literature that REITs can serve as a partial hedge against unexpected inflation risks during times of increased inflation. The researchers attribute these findings to the actions of the Federal Reserve (FED) during this time (Pierdzioch et al., 2019). Nonetheless, they did find some evidence to support the inflation-hedging characteristics of REITs.

Pierdzioch et al. (2019) revealed how variance in the economic state may result in contrary findings for hedging characteristics. This idea is discussed in depth by Connolly & Stivers (2022) who look specifically at inflation shocks, positive and negative, during weak and

strong economic times. Using quarterly CPI data, the researchers find that the strongest relationship between REITs and inflation is a partial relationship between returns when there are inflation shocks during weak economic times. Additionally, a significant finding of the researchers was the change in the relationship between inflation shocks during weak economic times and REIT returns. They find a negative relationship between the REITs and inflation during the 1980s-90s when there were concerns of stagflation, while a positive relationship existed from 2001-08 when deflation was a greater concern. This research is consistent with the initial findings of Park et al. (1990) and Glascock et al. (2002) who also revealed perverse hedging characteristics prior to the 2000s. The researchers add that no statistically significant correlation could be drawn between the two during strong economic times. Additionally, these findings are similar between stocks and inflation shocks during weak economic times. Although stocks had a weaker relationship than REITs, the researchers reveal that more work is needed to explain this relation (Connolly & Stivers, 2022).

Thus far in the literature, we have examined correlation as a means to measure the inflation properties of REITs; however, many have cautioned against the utilization of correlation for assessing assets with inflation-hedging properties. Case & Wachter (2011) note that this methodology often disregards differing inflationary environments, does not account for assets whose hedging characteristics are lagging, and although correlation measures co-movement, it does not actually measure the preservation of purchasing power. While comparing to other common asset classes, the study utilizes public REITs for their empirical analysis, ultimately finding real estate to be a practical hedge during periods of high inflation (Case & Wachter, 2011). The study argues that in terms of capital allocation, employing REITs in a portfolio can create a strong hedge during periods of inflation. Further, real estate performs as

well as, if not better than other inflation-sensitive assets. This study contributes to the literature by providing a differing perspective and methodology for analyzing the inflation-hedging characteristics of REITs. Instead of strictly measuring correlation, rather the study compares REITs against other asset classes to argue that real estate's outperformance of other asset classes during high inflation periods reveals its ability to be a strong hedge.

Examining current literature has revealed that there is no certain consensus on the hedging characteristics of REITs. There is significant research that suggests there to be a negative relationship between inflation and REIT returns; however, there is also evidence of varying strengths to support the hypothesis that REITs do exert hedging characteristics during periods of high inflation. Furthermore, when comparing REITs to other asset classes, some researchers have suggested REITs to be a strong inflation hedge, while others reveal inflation to have a small impact on REIT returns. Additionally, researchers' findings differ greatly dependent on the time period studied, attributing such changes to a variety of structural factors facing REITs.

Due to the complexity of the debate surrounding REIT returns and Inflation, an investigation into the co-movement of REIT returns and inflation during the years before and since the COVID-19 Pandemic will provide valuable insight into the recent return characteristics of REITs. This will provide REIT stakeholders like investors, REIT managers, and policymakers with a better understanding of REIT performance, allowing them to make more informed decisions as they invest in, manage, and regulate REITs.

Chapter 3

Data

In this study, we utilize several publicly available data sources which were utilized in the analysis. NAREIT publishes monthly REIT index return data. In this study, the equity REIT index return was utilized. Market data was interpreted utilizing the S&P 500 price index as a proxy through return data from the Standard & Poor's online database. Lastly, the Federal Reserve Economic Data (FRED) from the Federal Reserve Bank (FRB) Of St. Louis was the source of CPI, Treasury bills, and home sales price data. Table 1 describes the data, its source, and the sample period in more detail.

Table 1. Data Sources and Descriptions

Data	Source	Sample Period
Equity REITs Total Return Index	NAREIT	2014 – 2023
S&P 500 Price Index	Standard & Poor's	2014 – 2023
CPI - Seasonally Adjusted	FRED	2014 – 2023
1-Month Treasury Bill	FRED	2014 – 2023
Median Home Sales Price	FRED	2014 – 2022

Note that in Table 1, 2014 data is used for inflation calculations, but not in our analysis. Monthly sample data included data through February 2023, while quarterly data was used through the end of 2022. Additionally, we utilized the "Consumer Price Index for All Urban Consumers: All Items in U.S. City Average" as CPI. Lastly, Treasury bill data was "U.S. Treasury Securities at 1-Month Constant Maturity."

Fisher Inflation

To remain consistent with prior studies, this study disassembles inflation into unexpected ("real") and expected components as described by Fisher (1930). Expected and unexpected inflation is estimated as described by Fama & Gibbons (1984) and Glascock et al. (2002). In this model, inflation is defined as the CPI, and expected inflation is the difference between Treasury Bills (TB) and the expected real rate. The expected real rate is the equally weighted moving average of the trailing 12 months, or 4 quarters, of the difference between the TB rate and the change rate of CPI. Expressed below is the expected inflation at time t (EI_t):

Equation 1. Expected Monthly Inflation

$$EI_t = TB_{t-1} - \frac{1}{12}\sum_{s=t-1}^{t-12}[TB_{s-1} - CPI_s]$$

Equation 2. Expected Quarterly Inflation

$$EI_t = TB_{t-1} - \frac{1}{4}\sum_{s=t-1}^{t-4}[TB_{s-1} - CPI_s]$$

From the expected component of inflation, the unexpected inflation at time t (UEI_t) can then be derived as the difference between inflation (CPI) and expected inflation:

Equation 3. Unexpected Inflation

$$UEI_t = CPI_t - EI_t$$

Utilizing equations 1, 2, and 3, we find both unexpected and expected inflation. This data is combined with the aforenoted inflation, market, median home sales price, and REIT return data to complete our dataset. Note that when applicable, quarterly data was pulled directly from the source; else wise, each quarter was estimated at an average of the three months comprising

the quarter, and returns were determined by utilizing the closing index value 3 months prior to the quarter. In the appendix, there are tables that represent selected summary statistics for the sample data broken down for the entire sample, from 2015 through 2019, and from 2020 forward.

Chapter 4

Methodology

In this study, we examine the inflation-hedging characteristics of equity REITs by comparing the return characteristics of REITs to that of inflation, the market, and real estate during several sample periods and with different time frequencies. To measure correlation, we employ Ordinary Least Squares (OLS) regressions looking examining R-squared coefficients to analyze the degree of correlation and P-values to measure statistical significance. We do not employ any error-correcting or increasingly complex models for two primary reasons. First, the two sample periods are distinguished by the pandemic. Second, the prior literature, although utilizing a vast array of methodologies, has eventually aligned itself with two primary groups of findings regardless of methodology. Additionally, we acknowledge that Case & Wachter (2011) reveal several constraints to regression which could be addressed in further study. In this paper, our methodology is based on that described by Fama & Schwert (1977) and used by many since their initial study.

To establish our monthly and quarterly REIT return values, data from NAREIT is used. The return data represents the returns for publicly traded US equity REITs. This data is then presented in three sample series, those being: 2015-2023, 2015-2019, and 2020-2023. Note again that 2023 data is only for monthly time series which includes until February 2023. Quarterly series include the fourth quarter of 2022.

For each time series, a single variable OLS regression finds correlation between our independent variables and our dependent variable (most often, REIT returns). The equations below summarize OLS regressions. In Equation 4, Y is the dependent variable, X is the independent variable, β_0 is the intercept, β_1 is the correlation coefficient, and ε is the error term.

Equation 4. General Formula for Ordinary Least Squares

$$Y = \beta_0 + \beta_1 X + \varepsilon$$

Equation 5 and Equation 6 reveal the estimation parameters for β_0 and β_1. X_i and Y_i represent the individual observations for our independent and dependent variables, respectively. $\overline{X}$ and $\overline{Y}$ represent the means of our respective observations.

Equation 5. Formula for OLS Intercept β_0

$$\beta_0 = \bar{Y} - \beta_1 \bar{X}$$

Equation 6. Formula for OLS Coefficient β_1

$$\beta_1 = \frac{\sum_{i=1}^{i=n}(X_i - \bar{X})(Y_i - \bar{Y})}{\sum_{i=1}^{i=n}(X_i - \bar{X})^2}$$

These formulas are optimized to find the values of β_0 and β_1 which result in the minimum sum of squared differences between our observed Y values and the ones predicted by the model. We can find our R-squared value below in Equation 7. The R-square (R^2) reveals how much of our dependent variable is explained by our independent variable. In Equation 7, $\hat{Y}$ represents the predicted values for our model.

Equation 7. Formula for R-squared

$$R^2 = 1 - \frac{\sum_{i=1}^{i=n}\left(Y_i - \hat{Y}_i\right)^2}{\sum_{i=1}^{i=n}(Y_i - \bar{Y})^2}$$

In our testing, any independent variable with a p-value less than .05 was considered statistically significant as the correlation fell within the 95% confidence interval. The table below describes each of the independent variables and dependent variables tested. Note that we also tested inflation against house price data as a proxy for privately held real estate and that 2023 data was through February.

Table 2. Regressions List: Frequency, Variables, Time Samples

Frequency	Independent Variable	Dependent Variable	Time Sample
Monthly	CPI Unexpected Inflation Expected Inflation S&P 500 Return	REIT Returns	2015-2023, 2015-2019, 2020-2023
Quarterly	CPI Unexpected Inflation Expected Inflation S&P 500 Return Home Sales Price	REIT Returns	2015-2022, 2015-2019, 2020-2022
Quarterly	CPI Unexpected Inflation Expected Inflation	Home Sales Price	2015-2022, 2015-2019, 2020-2022

This methodology does have restrictions that are captured by other methodologies employed in the literature. The model, for example, does not "catch" any changes/trends that may be embedded in the time samples as may be the case with error-correcting models. Additionally, literature such as Case & Wachter (2011) suggest that regression may not reveal the entire hedging characteristics of REITs, as the impact may be delayed in returns, and additionally REITs hedging characteristics lie in their ability to outperform other asset classes during high-inflation environments. This may be where future research can extend our analysis; however, we find that this methodology is sufficient to examine co-movement.

Chapter 5

Results

OLS regressions were conducted on the independent and dependent variables listed in Table 2. This study looks to find if there is any relationship between inflation and REIT returns, which could indicate the hedging properties of REITs. From our analysis, we conclude that we cannot reject the null hypothesis that there is no relationship between REITs and inflation in all its components. This analysis included all time periods studied: 2015 - 2023, 2015 - 2019, and 2020 forward. Additionally, we find that there is statistically significant evidence to support the claim that real estate as an asset class, proxied by median home sales price, can serve as a hedge against inflation. For investors, this means that REITs do not provide the same exposure as privately held real estate in terms of hedging inflation. In the coming sections, we note additional findings in more detail.

Looking at monthly data, we find that all, but one of the dependent variables are statistically insignificant. We find from our monthly OLS results that REIT returns can best be explained by the general market and specifically the S&P 500. In our full sample (2015 – 2023), S&P 500 returns explain 28.1% of the variation in REIT returns. Additionally, pre-pandemic (2015 - 2019) S&P 500 returns explain 9.5% of the variation in REIT returns and from 2020 through 2023 the S&P 500 returns explain 64.2% of REIT returns. This means that much of the growth in REITs during and after the pandemic can be attributed to the rally in the general market and not just REITs.

Table 3. Monthly REIT Returns OLS

Sample	Monthly REIT Returns	Variable Coefficient	R-Square	P-Value
2015 - 2023	CPI	0.24867	0.00020	0.8892978
	Expected Inflation	-1.83888	0.00664	0.4250565
	Unexpected Inflation	1.76994	0.00784	0.3860848
	S&P 500	**0.78471**	**0.28143**	**1.927E-08**
2015 – 2019	CPI	-4.26372	0.04056	0.1228336
	Expected Inflation	-0.20483	0.00002	0.9737971
	Unexpected Inflation	-4.32121	0.04071	0.1221231
	S&P 500	**0.46643**	**0.09427**	**0.0170224**
2020 - 2023	CPI	2.38454	0.13003	0.4364958
	Expected Inflation	-2.33363	0.10251	0.5402432
	Unexpected Inflation	4.34392	0.22442	0.1755545
	S&P 500	**0.93631**	**0.64173**	**1.411E-05**

Note that bolded independent variables are statistically significant.

Above, Table 3 describes the full results from our monthly analysis of REIT returns. There is no statistically significant evidence to support the claim that inflation has any impact on REIT returns. This was not surprising as serval papers have concluded that REIT returns cannot be predicted using monthly inflation data and less frequent sample data is needed to see correlation.

In an analysis of quarterly REIT returns, the analysis does not find any statistically significant correlation between any of the variables tested; however, there is some evidence to support that REITs have a negative relationship with unexpected inflation and to a lesser extent with CPI. These findings are noteworthy as they are similar to some of the conclusions drawn by Connolly & Stivers (2022). One surprising factor, the analysis reveals is the statistical insignificance of the S&P 500 on quarterly REIT returns. This may be due to deviation which

occurs over a longer time sample. Over the course of a quarter, much more information dictates REIT returns, rather than just market movements.

Table 4. Quarterly REIT Returns OLS

Sample	Quarterly REIT Returns	Variable Coefficient	R-Square	P-Value
2015 - 2022	CPI	3.07314	0.02817	0.1986715
	Expected Inflation	3.28940	0.03225	0.1826322
	Unexpected Inflation	-0.28582	0.00022	0.9353580
	S&P 500	0.22604	0.09700	0.8980168
	Median Home Sales Price	-0.24847	0.00619	0.6686564
2015 – 2019	CPI	-6.52921	0.14337	0.0997038
	Expected Inflation	0.30012	0.00014	0.9612060
	Unexpected Inflation	**-8.41113**	**0.18848**	**0.0557933**
	S&P 500	-0.13575	0.00598	0.7458020
	Median Home Sales Price	-0.46356	0.04147	0.3891493
2020 - 2022	CPI	-1.34026	0.09381	0.7718199
	Expected Inflation	-3.36304	0.22229	0.4874289
	Unexpected Inflation	3.00275	0.15621	0.6278061
	S&P 500	0.97481	0.48458	0.1103608
	Median Home Sales Price	0.27752	0.05494	0.8653277

Note the bolded independent variable which follows just outside of the 95% confidence interval.

Above, Table 4 describes the results from the OLS regression on quarterly REIT returns and our selected independent variables. Included in our quarterly analysis was median home sales price data, which did not have any statistically significant correlation with REIT returns. We note that unexpected inflation had a strong negative relationship with REIT returns during the pre-pandemic sample, although these results do fall outside of our 95% confidence interval.

In our analysis, we extend beyond REIT returns to examine the characteristics of privately held real estate as a hedge against inflation. Utilizing median home sales price data as a

proxy, the analysis finds strong evidence to suggest the co-movement of real estate and inflation over the entire sample series.

Table 5. Quarterly Change in Median Home Sales Price OLS

Sample	Change in Quarterly Median Home Sales Price	Variable Coefficient	R-Square	P-Value
2015 - 2022	**CPI**	**2.13546**	**0.284736**	**0.00166**
	Expected Inflation	1.15673	0.064667	0.160168
	Unexpected Inflation	**2.84469**	**0.220269**	**0.006731**
2015 – 2019	CPI	2.61869	0.119506	0.135455
	Expected Inflation	0.42912	0.001431	0.874171
	Unexpected Inflation	3.06406	0.12961	0.118955
2020 - 2022	CPI	1.33401	0.222379	0.143112
	Expected Inflation	-0.05014	0.000288	0.960523
	Unexpected Inflation	**2.29150**	**0.39514**	**0.03831**

Note that bolded independent variables are statistically significant.

Table 5 describes the relationship between the change in quarterly median home sales price and the selected independent variables over the three selected time series. As mentioned above, generally the data suggests a positive relationship between inflation and real estate returns throughout the entire sample. One notable exception is that expected inflation does not predict real estate returns in any statistically significant way.

Looking at the pre-pandemic sample, we notice that there is no statistically significant data to suggest any correlation between inflation and real estate returns. Looking forward at the 2020 – 2022 sample, we find that unexpected inflation has a positive relationship with real estate returns, explaining 39.5% of the variance in real estate returns.

Our results suggest that there is a need for a nuanced understanding of REIT returns and inflation. Comparing between quarterly and monthly, and across the pre-pandemic and post-pandemic data sets we find varying, often contrary, findings that may suggest that inflation hedging properties cannot be generalized. Further research may focus on differentiation by REIT sector and time periods among other criteria.

Chapter 6

Conclusion

In this study, we look to establish if REITs can serve as hedges against inflation. We do this by looking at REIT returns and comparing them to inflation in terms of actual (CPI), expected, and unexpected inflation. We find that REITs are generally not hedges to inflation, as none of the inflation measures we analyzed provided a statistically significant correlation that would suggest hedging characteristics. We find that REIT returns are better explained by market forces than any other variable measured. These findings are consistent with those of Park et al. (1990), Glascock et al. (2002), Das & Sarkar (2020), and Connolly & Stivers (2022). Additionally, our study concludes that privately held real estate still exhibits strong hedging characteristics against inflation.

We note several limitations to our research. In our methodology, we utilize a regression which many others in the literature have criticized as there may be omitted variables, lagging data, and may overlook underlying trends that may have been revealed by employing error correction. Additionally, we focus on the post-COVID-19 pandemic time period, which has yet to subside, and on aggregate REIT data. Future studies could extend this research by employing other methodologies, which address the limitations of this study, and by utilizing individual REIT performance to find if there are certain REIT sectors or specific REITs which hedge inflation.

Our findings have various implications for REIT stakeholders. For investors, our results suggest that privately held real estate may be a better alternative than REITs to hedge inflation. Noting the perverse hedging characteristics of REITs, our findings suggest that REIT managers do not successfully protect against inflation risks, and thus they may need to reevaluate their

strategies during inflationary environments. Lastly, policymakers could use this information to drive changes to REIT structures. REITs were created to give investors a better and more attractive way to invest in real estate. Our findings suggest that policymakers may need to drive changes to bring public REIT returns to more closely resemble the exposure given by the private real estate market.

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Appendix

Appendix A: Summary Statistics on Monthly Sample (2015 – 2023)

	REIT Return	*CPI Return*	*S&P 500 Price Return %*	*Expected Inflation*	*Unexpected Inflation*
Mean	0.548	0.250	0.769	0.241	0.009
Standard Error	0.534	0.031	0.361	0.024	0.027
Median	0.791	0.235	1.299	0.174	0.051
Standard Deviation	5.282	0.303	3.571	0.234	0.264
Sample Variance	27.904	0.092	12.753	0.055	0.070
Kurtosis	2.462	2.240	9.057	0.235	0.584
Skewness	-0.722	0.016	-2.047	1.118	-0.731
Range	33.668	1.975	25.406	0.910	1.291
Minimum	-21.920	-0.787	-19.068	-0.105	-0.781
Maximum	11.748	1.188	6.338	0.805	0.511
Sum	53.657	24.511	75.329	23.614	0.897
Count	98	98	98	98	98

Note, all figures in monthly terms (where applicable)

Appendix B: Summary Statistics on Monthly Sample (2015 – 2019)

	REIT Return	*CPI Return*	*S&P 500 Price Return %*	*Expected Inflation*	*Unexpected Inflation*
Mean	0.658	0.151	0.763	0.144	0.007
Standard Error	0.510	0.024	0.336	0.011	0.024
Median	0.475	0.182	1.299	0.157	0.031
Standard Deviation	3.950	0.187	2.600	0.084	0.184
Sample Variance	15.603	0.035	6.761	0.007	0.034
Kurtosis	0.540	4.159	0.632	-0.818	0.690
Skewness	0.175	-1.319	-0.624	-0.444	-0.587
Range	19.973	1.148	12.767	0.295	0.945
Minimum	-8.226	-0.637	-6.596	-0.019	-0.618
Maximum	11.748	0.511	6.172	0.276	0.327
Sum	39.456	9.062	45.755	8.628	0.434
Count	60	60	60	60	60

Note, all figures in monthly terms (where applicable)

Appendix C: Summary Statistics on Monthly Sample (2020 – 2023)

	REIT Return	*CPI Return*	*S&P 500 Price Return %*	*Expected Inflation*	*Unexpected Inflation*
Mean	0.374	0.407	0.778	0.394	0.012
Standard Error	1.127	0.061	0.772	0.049	0.058
Median	1.116	0.431	1.407	0.424	0.063
Standard Deviation	6.944	0.379	4.760	0.305	0.359
Sample Variance	48.224	0.143	22.653	0.093	0.129
Kurtosis	1.372	1.964	7.351	-1.542	-0.557
Skewness	-0.861	-0.754	-2.183	-0.170	-0.681
Range	32.837	1.975	25.406	0.910	1.291
Minimum	-21.920	-0.787	-19.068	-0.105	-0.781
Maximum	10.917	1.188	6.338	0.805	0.511
Sum	14.201	15.449	29.574	14.986	0.464
Count	38	38	38	38	38

Appendix D: Summary Statistics on Quarterly Sample (2015 – 2022)

	NAREIT Equity Return	*CPI*	*Quarterly S&P Returns*	*Expected Inflation*	*Unexpected Inflation*	*Home Sales Price Change*
Mean	1.529	0.728	2.165	0.682	0.045	1.451
Standard Error	1.647	0.130	0.853	0.115	0.086	0.522
Median	1.471	0.689	2.795	0.518	0.147	2.155
Standard Deviation	9.317	0.737	4.823	0.649	0.487	2.950
Sample Variance	86.810	0.543	23.263	0.421	0.237	8.703
Kurtosis	1.883	0.719	-0.298	0.516	0.188	-0.438
Skewness	-1.004	0.319	-0.125	1.220	-0.333	-0.147
Range	43.637	3.293	21.264	2.177	2.193	12.358
Minimum	-27.304	-0.961	-8.024	-0.056	-1.081	-4.882
Maximum	16.332	2.331	13.240	2.121	1.112	7.475
Sum	48.923	23.294	69.294	21.838	1.456	46.421
Count	32	32	32	32	32	32

Appendix E: Summary Statistics on Quarterly Sample (2015 – 2019)

	NAREIT Equity Return	*CPI*	*Quarterly S&P Returns*	*Expected Inflation*	*Unexpected Inflation*	*Home Sales Price Change*
Mean	1.939	0.426	2.224	0.427	-0.001	0.488
Standard Error	1.404	0.081	0.800	0.054	0.072	0.617
Median	1.375	0.451	2.795	0.486	-0.017	0.715
Standard Deviation	6.279	0.364	3.579	0.243	0.324	2.759
Sample Variance	39.430	0.133	12.806	0.059	0.105	7.609
Kurtosis	0.507	2.718	0.051	-0.669	-0.312	-0.591
Skewness	0.126	-1.454	-0.920	-0.641	0.149	-0.120
Range	26.285	1.490	11.743	0.784	1.293	10.311
Minimum	-9.952	-0.647	-5.288	-0.027	-0.620	-4.882
Maximum	16.332	0.843	6.456	0.757	0.672	5.429
Sum	38.772	8.524	44.478	8.547	-0.023	9.757
Count	20	20	20	20	20	20

Appendix F: Summary Statistics on Quarterly Sample (2020 – 2022)

	NAREIT Equity Return	*CPI*	*Quarterly S&P Returns*	*Expected Inflation*	*Unexpected Inflation*	*Home Sales Price Change*
Mean	0.846	1.231	2.068	1.108	0.123	3.055
Standard Error	3.827	0.268	1.902	0.253	0.199	0.758
Median	3.340	1.250	1.604	1.223	0.299	3.278
Standard Deviation	13.256	0.928	6.590	0.876	0.690	2.625
Sample Variance	175.726	0.861	43.423	0.768	0.476	6.888
Kurtosis	0.296	1.706	-1.207	-1.873	-0.555	0.137
Skewness	-0.988	-1.102	0.156	-0.109	-0.714	-0.275
Range	43.618	3.293	21.264	2.177	2.193	9.420
Minimum	-27.304	-0.961	-8.024	-0.056	-1.081	-1.945
Maximum	16.314	2.331	13.240	2.121	1.112	7.475
Sum	10.151	14.770	24.817	13.290	1.479	36.663
Count	12	12	12	12	12	12

Academic Vita

Yash Patel

EDUCATION

The Pennsylvania State University | Schreyer Honors College — **State College, PA**

- *Smeal College of Business* | B.S. in Finance — *Expected Graduation, May 2023*
  Minor in Information Systems Management
- *College of the Liberal Arts* | Minor in Economics

Awards and Recognition

- 1st Place: 2022 "Carolina Case Challenge" National Case Competition (UNC) Hosted by Deloitte and Brex

PROFESSIONAL EXPERIENCE

Grant Thornton - Transactions Advisory Intern — **Denver, CO**

- Priced complex financial instruments and payout structures for companies considering mergers and acquisitions utilizing the Black-Scholes-Merton option pricing model — *Jun 2022 – Aug 2022*
- Conducted business valuations of tangible and intangible assets through income, cost, and market approaches

Enawala Management – Manager — **Carlisle, PA**

- Collaborated on implementation strategy for renovation by outlining project phases, acquiring financing for materials, and projecting benefits for corporate franchisor — *Dec 2019 – Present*
- Facilitated win-win business partnerships with travel organizations, resulting in greater revenue for the property and lower costs for travel groups by eliminating OTA fees
- Automated Microsoft Excel-based excise-tax preparation system, increasing filing efficiencies by 90%
- Implemented software solution to solve revenue and commission discrepancies with OTAs

Sagar Management Company – Manager — **New Cumberland, PA**

- Attained new contracts and created recurring revenue by negotiating with national developers — *May 2018 – Aug 2019*
- Designed, built, and supervised Internet network to enhance customer experience
- Enhanced financial report analysis process using QuickBooks Pro for data entry and reporting
- Modernized document filing procedure to create simplified and detailed cloud-based solution

CAMPUS INVOLVEMENT

Nittany Lion Consulting Group (NLCG) — **University Park, PA**

Vice President of Learning & Development — *Dec 2021 – Present*

- Developed and administered a three-credit, experiential learning program focused on consulting foundations and professional development that is offered by Penn State's Smeal College of Business to NLCG students
- Administered 43 professional development sessions with 20 partner organizations and 52 corporate professionals

Engagement Manager — *Jun 2021 – Dec 2021*

- Generated regional economic development and increased student opportunities and engagement at Penn State's research park by leading a 4-person team advising university vice presidents on driving corporate investment
- Improved technology commercialization and tenant satisfaction by delivering insights from private equity investors

Associate Consultant — *Jan 2021 – Jun 2021*

- Created a 23-page research deliverable addressing change management best practices and highlighting an implementation strategy for a leading emergency services consulting firm undertaking aggressive expansion
- Delivered process improvements to over 100 newly onboarded employees regarding integrating change management competencies into client engagements by organizing and conducting management interviews

South Asian Student Association — **University Park, PA**

Board Member; Events Chair — *Apr 2021 – May 2022*

- Generated $20,000 in funding to re-establish cultural events for Penn State University and the local community
- Raised over $3,000 to fight pediatric cancer through THON, the largest student-run philanthropy

SKILLS AND INTERESTS

Language – Conversational in Spanish, Fluent in Gujarati
Graphic Design – Worked on several Adobe-based projects in Photoshop, Illustrator, Premier, and After Effects
IT – Experience managing and developing Internet networks, PBX VoIP systems, IP-Camera systems
Hobbies – Basketball, tennis, table tennis, travel, watching documentaries