

Residential Real Estate: Correlations and Rate Sensitivity

August 2019

Key Conclusions and Implications:

- In response to investor questions, we are updating our analysis of the long-term and intermediate-term correlations between residential housing values and other asset classes, rates, and inflation. As expected, while the results did not change much, the growth outlook has. Therefore, we have looked at the data through a refreshed lens.
- **Cross-asset Correlations:** Residential real estate returns exhibit a modestly positive correlation with commercial real estate over time, but little to no correlation historically to equities or bonds, providing potential diversification benefits.
- **Correlation with Rates:** Home prices exhibit a stronger correlation to GDP growth and employment growth than interest rates due to the generally pro-cyclical nature of housing values.
- **Correlation with Economic Growth:** Interest rates and mortgage rates have a positive, but limited correlation with home price appreciation (“HPA”).
- **Correlation with Inflation:** There exists a strong positive correlation between residential real estate and inflation, especially during periods of higher than usual inflation and over multi-year periods. While inflation is range bound in the 1-2% range and unlikely to move higher in the near term, we believe investments in rental housing provide potential hedging benefits for long-term investors concerned about inflation.

Cross Asset: Little Correlation between Home Prices and Financial Assets Provides Diversification Benefits

- Looking over the past 10-, 20-, and 40-year periods, residential real estate has shown a positive correlation with commercial real estate (53% over past 40 years, and 46% over the past 10 years).¹ This makes sense given both are real assets with demand driven by economic growth and values impacted by that growth and changes in interest rates.
- However, with little to no correlation to equities or bonds, we believe residential real estate investments provides potential diversification benefits relative to these large asset classes.²
- Housing also provides diversification benefits in a portfolio that includes REITs, while limiting exposure to equity markets. Over the last 40 years, U.S. residential real estate exhibited only a 20% correlation to U.S. REITs. In addition, REITs showed a 60% correlation to equities, while residential real estate only had a 15% correlation.³

Growth and Rates: Home Prices Are More Correlated to Economic Growth than to Interest Rates

- Home prices are generally pro-cyclical, with stronger underlying economic growth offsetting higher financing costs. Since 1976, the correlation of home prices to GDP growth is nearly 63% and nearly 55% to employment growth.⁴
- On the other hand, historically, residential real estate prices have shown only a small positive correlation with 10Yr Treasury yields and 30Yr mortgage rates, ~21% and ~26%, respectively, since 1976.⁵
- Going forward, we expect that a change in the pace of economic growth, should have a more meaningful impact to the rate of HPA than movements in mortgage rates

Rates and HPA: Lower Rates Unlikely to Significantly Impact HPA Trends

- Although expectations for economic growth and interest rates have trended lower, long-term investors need to understand the relationships between housing values and economic growth, interest rates, and other asset classes.
- In our initial analysis published in 2017, we concluded that rising rates at that time were unlikely to impact HPA due to the small, positive correlation between home prices and rates. In this report, we conclude that today’s lower rates are also unlikely to significantly impact the rate of future HPA for similar reasons.

¹ Correlations based on quarterly data from Q1 1975 through Q1 2019 between FHFA All Transaction Home Price Index, NCREIF Property Index, Wilshire 5000 Index, Bloomberg Barclays Aggregate Index, and Bloomberg Barclays High Yield Index.

² Ibid.

³ Ibid.

⁴ Correlations based on quarterly data from Q1 1975 through Q1 2019 between FHFA All Transaction Home Price Index, Nominal GDP from the Bureau of Economic Analysis, and Non-farm employment from the Bureau of Labor Statistics.

⁵ Correlations based on quarterly data from Q1 1975 through Q1 2019 between FHFA All Transaction Home Price Index, 10-year Treasury yield and Freddie Mac 30-Year Fixed Rate Mortgage.

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Cross Correlation: Residential Real Estate vs. Other Assets

In our view, housing offers diversification benefits because home values exhibit low correlation with equities and fixed income securities, but a positive correlation with commercial real estate (direct and securities).

Below we present correlations from 1979-2019 over 40-, 20-, and 10-year periods. Results are derived from quarterly returns of these selected indices, which we believe represent broad investable asset classes.

Exhibit 1: Year-Over-Year Return Correlations of Residential Real Estate vs. other Assets

40 Year Correlations (Year-over-Year Returns from 1Q 1979 to 1Q 2019) ¹						
	U.S. Residential Real Estate	U.S. Commercial Real Estate TR	U.S. REITs TR	Wilshire 5000 Index TR	US Inv. Grade Bonds TR	U.S. High Yield Bonds TR
U.S. Residential Real Estate ²	–					
U.S. Commercial Real Estate TR ³	0.53	–				
U.S. REITs TR ⁴	0.20	0.17	–			
Wilshire 5000 TR ⁵	0.15	0.16	0.60	–		
U.S. Investment Grade Bonds TR ⁶	(0.10)	(0.15)	0.24	0.20	–	
U.S. High Yield Bonds TR ⁷	(0.08)	(0.26)	0.64	0.65	0.39	–

20 Year Correlations (Year-over-Year Returns from 1Q 1999 to 1Q 2019) ¹						
	U.S. Residential Real Estate	U.S. Commercial Real Estate TR	U.S. REITs TR	Wilshire 5000 Index TR	US Inv. Grade Bonds TR	U.S. High Yield Bonds TR
U.S. Residential Real Estate ²	–					
U.S. Commercial Real Estate TR ³	0.52	–				
U.S. REITs TR ⁴	0.21	0.28	–			
Wilshire 5000 TR ⁵	0.13	0.25	0.57	–		
U.S. Investment Grade Bonds TR ⁶	(0.23)	(0.19)	0.16	(0.47)	–	
U.S. High Yield Bonds TR ⁷	(0.13)	(0.20)	0.65	0.67	0.07	–

10 Year Correlations (Year-over-Year Returns from 1Q 2009 to 1Q 2019) ¹						
	U.S. Residential Real Estate	U.S. Commercial Real Estate TR	U.S. REITs TR	Wilshire 5000 Index TR	US Inv. Grade Bonds TR	U.S. High Yield Bonds TR
U.S. Residential Real Estate ²	–					
U.S. Commercial Real Estate TR ³	0.46	–				
U.S. REITs TR ⁴	(0.29)	0.08	–			
Wilshire 5000 TR ⁵	0.01	0.12	0.70	–		
U.S. Investment Grade Bonds TR ⁶	(0.72)	(0.34)	0.33	(0.18)	–	
U.S. High Yield Bonds TR ⁷	(0.56)	(0.54)	0.63	0.62	0.38	–

Source: 1. All data is quarterly since 1975 or earliest date available through Q1 2019. All data sourced from Bloomberg. 2. FHFA All Transaction Home Price Index, represents residential real estate returns. 3. NCREIF Property Index represents unleveraged real estate returns. 4. FTSE NAREIT Index tracks public market REIT returns. 5. Wilshire 5000 Index is a total return, market cap weighted index of all stocks actively traded in the US. 6. The Bloomberg Barclays Aggregate Index (formerly the Lehman Agg Index) tracks the investment grade bond market. 7. The Bloomberg Barclays High Yield Index tracks the non-investment grade bond market.

Home Prices Are More Correlated to Economic Growth than to Interest Rates

Historically, home prices have exhibited a higher correlation with economic growth metrics than interest rates or mortgage rates. Below in Exhibit 5, we illustrate the correlation of FHFA's home price index with GDP and employment, relative to the correlation of home prices to rates.

Consensus forecasts foresee a slowdown in economic growth in the near and medium term. Real GDP growth is expected to fall from +2.9% in 2018 to an average +2.0% from 2019 through 2021.⁶ In tandem, nonfarm payroll growth, which averaged +204k per month in 2018, is forecast to average +140k per month from 2019 through 2021.⁷

Going forward, we expect that a change in the pace of economic growth, should have a more meaningful impact to the rate of HPA than movements in mortgage rates.

Exhibit 2: Correlations between Home Prices, Economic Growth Metrics, and Rates, 1976-2019

Year-over-Year Correlations: 1976-2019 ¹	
	FHFA All Transaction HPI ²
Nominal GDP ³	62.8%
Employment ⁴	54.4%
10Yr Treasury ⁵	20.9%
30Yr Mortgage Rate ⁶	25.9%

Source: 1. All data is quarterly since 1975 or earliest date available through Q1 2019. All data sourced from Bloomberg. 2. FHFA All Transaction Home Price Index, represents residential real estate returns. 3. Nominal GDP from the Bureau of Economic Analysis. 4. Non-farm employment from the Bureau of Labor Statistics. 5. 10-Year Treasury yield from the Board of Governors of the Federal Reserve System (US), 10-Year Treasury Constant Maturity Rate. 6. Freddie Mac 30-Year Fixed Rate Mortgage Average in the United States from St. Louis Fed FRED database.

⁶ Bloomberg Weighted Average Consensus Forecast, 2019, 2020, and 2021 Real GDP Growth, retrieved August 14, 2019.

⁷ Bloomberg Weighted Average Consensus Forecast, 2019, 2020, and 2021 Nonfarm Payrolls, retrieved August 14, 2019.

Home Prices and Interest Rates

Over the past 40+ years, home prices have exhibited a low but positive correlation with 10Yr Treasury yields.

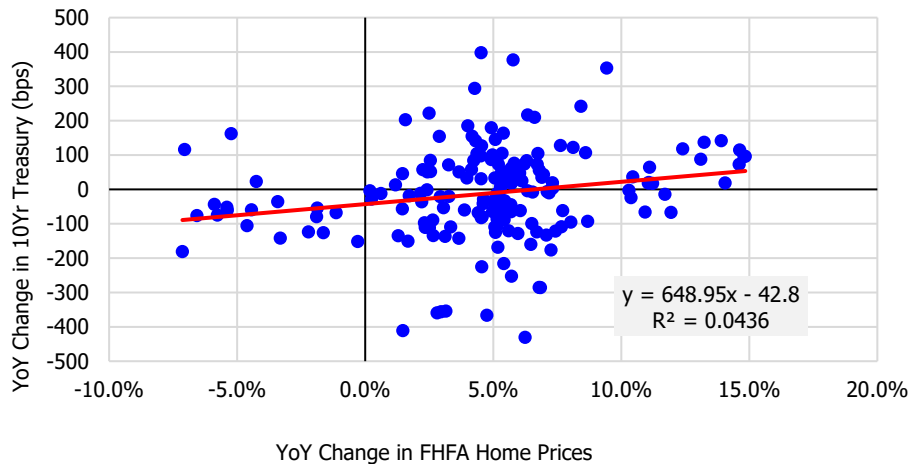
As economic growth expectations increase, Treasury yields tend to rise in tandem. Likewise, improving employment and income growth tends to increase home prices as well. An improved economic position for potential buyers tends to aid home affordability even if interest rates and mortgage rates rise.

Exhibit 3: Annual Change in FHFA Home Price Index and 10Yr Treasury Yield, 1976-2019

Correlation between Change in FHFA HPI and 10Yr Treasury Yield			
	Avg. YoY HPA Δ	Avg. YoY 10Yr Treasury Δ	Correlation with 10Yr Treasury Δ
1976-1990	7.2%	2.4bp	27.8%
1990-2000	3.3%	-25.6bp	-15.7%
2000-2019	3.7%	-16.0bp	26.5%
1976-2019	4.7%	-12.3bp	20.9%

Source: Board of Governors of the Federal Reserve System (US), 10-Year Treasury Constant Maturity Rate. U.S. Federal Housing Finance Agency, All-Transactions House Price Index for the United States, through Q1 2019.

Exhibit 4: Year-over-Year Change in FHFA Home Price Index and 10Yr Treasury Yield, 1976-2019



Source: Board of Governors of the Federal Reserve System (US), 10-Year Treasury Constant Maturity Rate. U.S. Federal Housing Finance Agency, All-Transactions House Price Index for the United States, through Q1 2019.

Home Prices and Mortgage Rates

Home prices also exhibit a modest positive correlation to mortgage rates.

Although mortgage rates impact affordability, home prices do not necessarily fall when mortgage rates rise. Like periods of rising base rates, healthy economic growth tends to offset the negative impacts to affordability from rising mortgage rates.

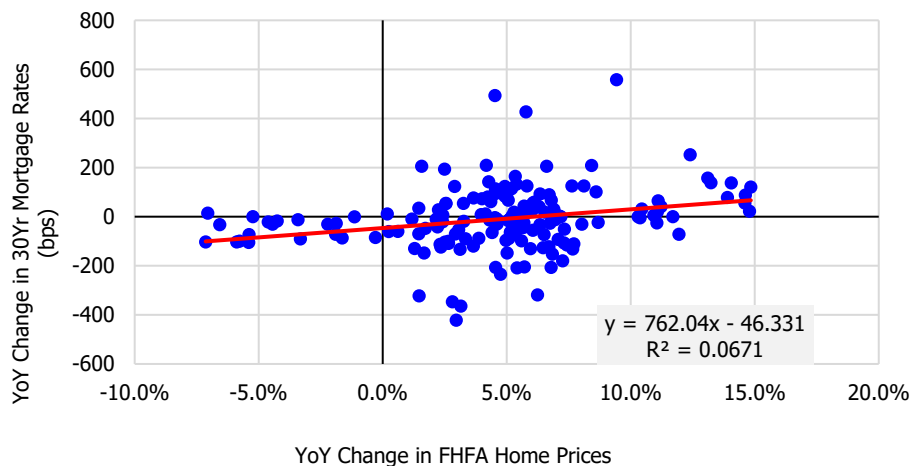
- On a year-over-year basis, HPA averaged 6.5% during periods of rising rates compared to 3.4% during periods of falling rates.⁸
- In fact, the only instances of mortgage rising rates and falling home prices occurred during the Great Financial Crisis in 2009 and 2010.⁹

Exhibit 5: Annual Change in FHFA Home Price Index and 30Yr Mortgage Rates, 1976-2019

Correlation between Change in FHFA HPI and 30Yr Mortgage Rate			
	Avg. YoY HPA Δ	Avg. YoY 30Yr Mortgage Δ	Correlation with 30Yr Mortgage Δ
1976-1990	7.2%	9.3bp	34.0%
1990-2000	3.3%	-27.1bp	-2.8%
2000-2019	3.7%	-16.2bp	30.4%
1976-2019	4.7%	-10.5bp	25.9%

Source: Freddie Mac, 30-Year Fixed Rate Mortgage Average in the United States. U.S. Federal Housing Finance Agency, All-Transactions House Price Index for the United States, through Q1 2019.

Exhibit 6: Year-Over-Year Change in FHFA Home Price Index and 30Yr Mortgage Rates, 1976-2019



Source: Freddie Mac, 30-Year Fixed Rate Mortgage Average in the United States. U.S. Federal Housing Finance Agency, All-Transactions House Price Index for the United States, as of Q1 2019.

⁸ Board of Governors of the Federal Reserve System (US), Freddie Mac, 30-Year Fixed Rate Mortgage Average in the United States. U.S. Federal Housing Finance Agency, All-Transactions House Price Index for the United States, as of Q1 2019.

⁹ Freddie Mac, 30-Year Fixed Rate Mortgage Average in the United States. U.S. Federal Housing Finance Agency, All-Transactions House Price Index for the United States, through Q1 2019.

Correlations Between PCE and Returns to Asset Classes

Below we present correlations between PCE (Personal Consumption Expenditures Price Index) and several asset classes. Several observations are important to note:

- Residential real estate (price only and including rental component) and commercial real estate showed the highest correlations with inflation over the 1976-2019 period
 - The correlations were especially high in the 1976-1990 period when inflation ran 3x higher, on average, than in the post-2000 period
- The correlations between residential real estate and inflation strengthened when we looked at the data on a rolling five-year basis
- Stocks and bonds have little to no correlation with inflation, but, in periods of higher inflation, returns are modestly negative

Estimating A Total Return Index for Residential Real Estate

Unlike many other asset classes, a reliable index of residential real estate total returns does not exist (i.e., including rental income / dividends). That said, like other asset classes, an owner of rental housing would measure their total return through both capital gains/losses coupled with income received (i.e., rents).

According to a Federal Reserve Bank of San Francisco / National Bureau of Economic Analysis paper, since 1950, 42% of total return for housing investors has come from rental income, with the other 58% from capital gains. In comparison, for equities 71% of total returns have come from capital gains.¹⁰

We believe it is reasonable that adding a rental rate component to home values would provide a more accurate measure of correlation between rental housing and inflation. Therefore, we have included a category titled Housing Total Return that couples the change in home values with the change in CPI (Consumer Price Index) rent of primary residence (multiplied by 50% to account for operating and capital expenditures to the owner of that rental residence).

While an imperfect metric, we believe it is a good indicator of the inflation hedging potential of for-rent residential real estate.

Exhibit 7: Correlations with the Personal Consumption Expenditure Price Index (PCE)

Correlations with PCE ¹							
Avg YoY PCE	Residential		Commercial RE	Equities	Bonds		
	FHFA HPI ²	Housing Total Return ³	NCREIF Property Index TR ⁴	Wilshire 5000 TR ⁵	Bloomberg Barclays Agg TR ⁶	Bloomberg Barclays HY Bonds TR ⁷	
YoY Change							
1976-2019	3.2%	43%	54%	40%	13%	-4%	7%
1976-1990	5.6%	47%	60%	85%	-2%	-55%	-54%
1990-2000	2.3%	-54%	-40%	-56%	-52%	12%	-14%
2000-2019	1.8%	15%	14%	52%	23%	-3%	11%
Rolling 5Yr Change							
1976-2019	3.2%	50%	63%	26%	22%	28%	37%

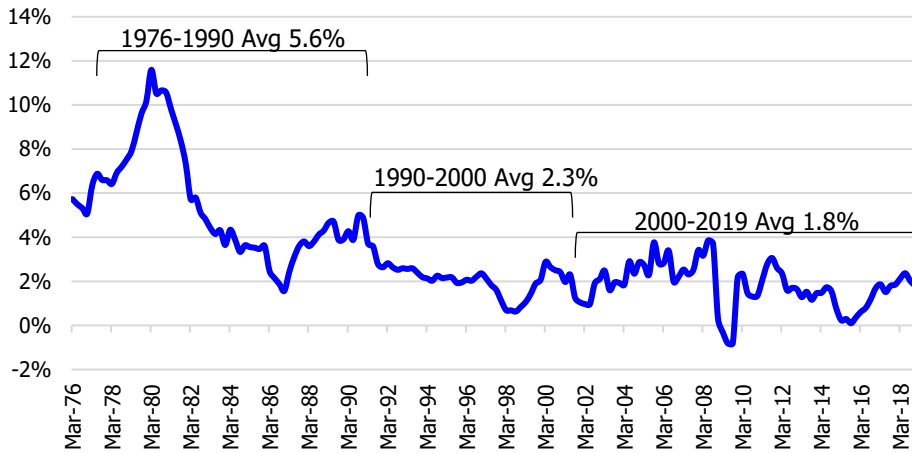
Source: All data is quarterly since 1975 or earliest date available through Q1 2019. All data sourced from Bloomberg and the St. Louis Fed FRED database. 1. PCE from Bureau of Economic Analysis, quarterly data. 2. FHFA All Transaction Home Price Index, represents residential real estate home values. 3. Housing Total Return couples the change in home prices with half of the change in owner's equivalent rent to approximate rental income growth. 4. NCREIF Property Index represents unleveraged real estate returns. 5. Wilshire 5000 Index is a total return, market cap weighted index of all stocks actively traded in the US. 6. The Bloomberg Barclays Aggregate Index (formerly the Lehman Agg Index) tracks the investment grade bond market. 7. The Bloomberg Barclays High Yield Index tracks the non-investment grade bond market.

¹⁰ Jordà, Òscar, Katharina Knoll, Dmitry Kuvshinov, Moritz Schularick, Alan M. Taylor. 2017. "The Rate of Return on Everything, 1870–2015" Federal Reserve Bank of San Francisco Working Paper 2017-25. <https://doi.org/10.24148/wp2017-25>.

Annual Inflation – Stuck in the 1-2% range

Today's level of inflation is low compared to historical levels and consensus expectations do not foresee a near-term increase. Over the past two decades, inflation has been remarkably subdued with annual PCE averaging 1.8% since 2000, compared to 2.3% between 1990 and 2000, and 5.6% between 1976 and 1990.¹¹

Exhibit 8: Average YoY PCE Inflation Rate across Periods, 1976-2019



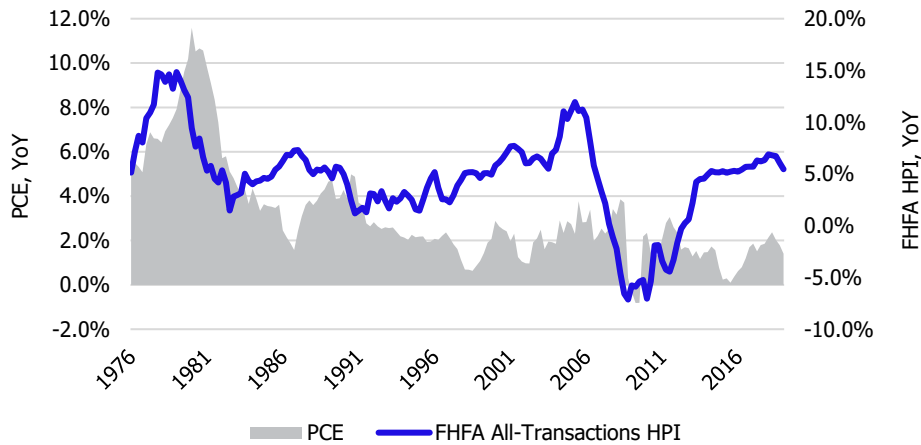
Source: Bureau of Economic Analysis, Personal Consumption Expenditures: Chain-type Price Index, through Q1 2019.

¹¹ Bureau of Economic Analysis, Personal Consumption Expenditures: Chain-type Price Index, as of Q1 2019.

Home Price Appreciation versus PCE Inflation (Year-Over-Year)

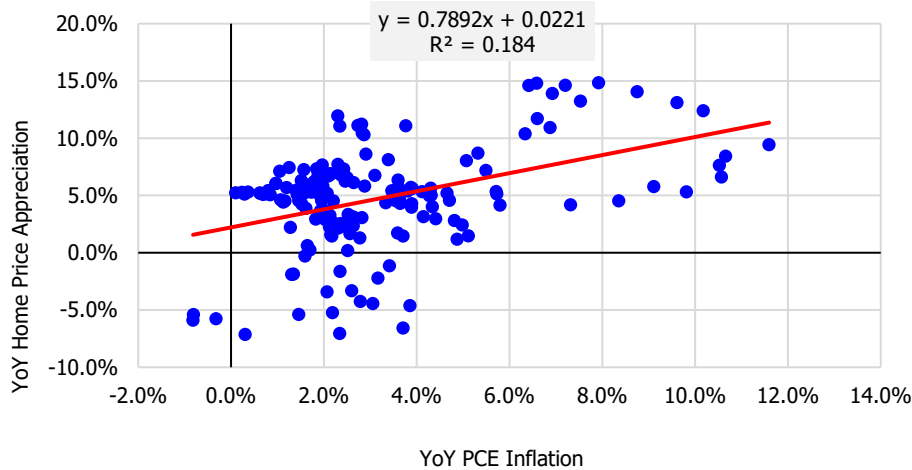
Home prices exhibit a positive correlation to PCE inflation and tend to be more highly correlated during periods of higher inflation. For example, between 1976 and 1990, inflation averaged 5.6%, and the correlation was 47%. On the other hand, between 2000 and 2019, inflation averaged 1.8% and the correlation was 15%.

Exhibit 9: Year-Over-Year Change in PCE and FHFA Home Prices, 1976-2019



Source: U.S. Bureau of Economic Analysis, Personal Consumption Expenditures: Chain-type Price Index, through Q1 2019. U.S. Federal Housing Finance Agency, All-Transactions House Price Index for the United States, through Q1 2019.

Exhibit 10: Year-Over-Year Change in PCE and FHFA Home Prices, 1976-2019

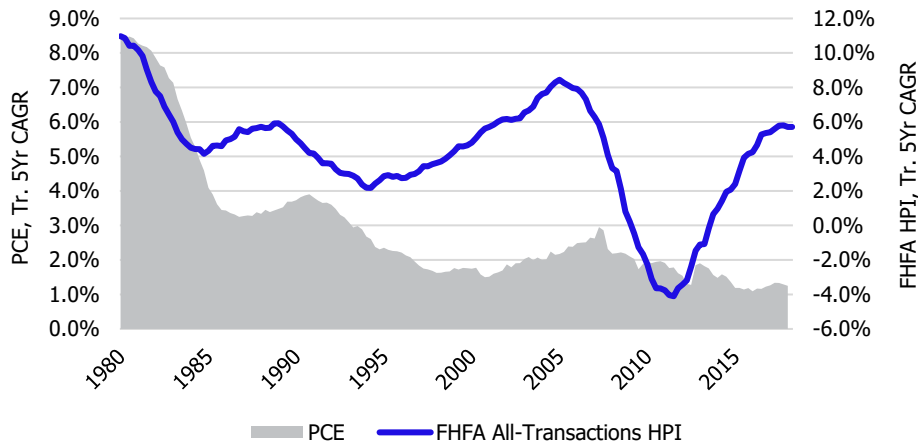


Source: U.S. Bureau of Economic Analysis, Personal Consumption Expenditures: Chain-type Price Index, through Q1 2019. U.S. Federal Housing Finance Agency, All-Transactions House Price Index for the United States, through Q1 2019.

Home Price Appreciation versus PCE Inflation (Trailing 5-Year View)

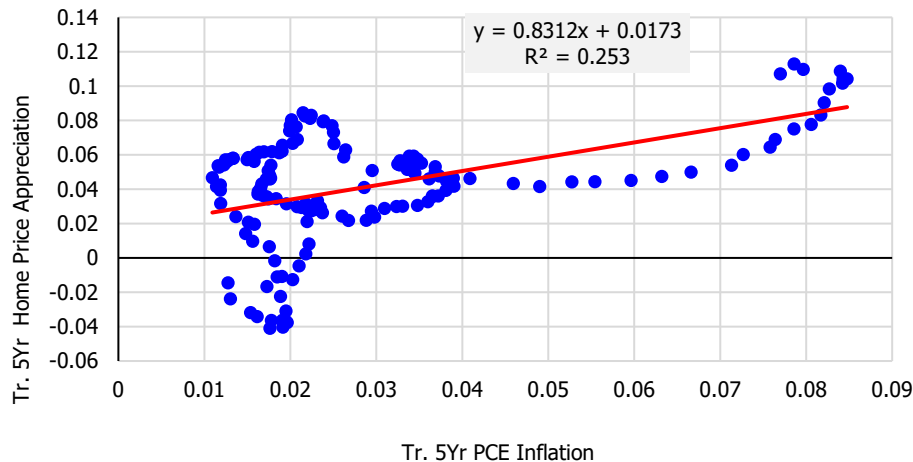
As shown below, extending the period covered to five years, increases the correlation between home prices and inflation from 43% to 50%.¹² The correlations are also stronger during periods of higher multi-year inflation.¹³

Exhibit 11: Trailing Five-Year Change in PCE and FHFA Home Price Index, 1980-2019



Source: Bureau of Economic Analysis, Personal Consumption Expenditures: Chain-type Price Index, through Q1 2019. U.S. Federal Housing Finance Agency, All-Transactions House Price Index for the United States, through Q1 2019.

Exhibit 12: Trailing Five-Year Change in PCE and FHFA Home Prices, 1980-2019



Source: Bureau of Economic Analysis, Personal Consumption Expenditures: Chain-type Price Index, through Q1 2019. U.S. Federal Housing Finance Agency, All-Transactions House Price Index for the United States, through Q1 2019.

¹² Bureau of Economic Analysis, Personal Consumption Expenditures: Chain-type Price Index, through Q1 2019. U.S. Federal Housing Finance Agency, All-Transactions House Price Index for the United States, through Q1 2019.

¹³ Ibid.

Appendix: Inflation Measures and Weightings

PCE index use to conduct correlation analysis due to smaller weighting given to shelter costs

Shelter costs make up 33% of the CPI weighting, but only 16% of the PCE weighting. Therefore, we chose PCE to conduct our previous correlation analysis. In Exhibit 13 below, we illustrate the differences in the relative weighting of both shelter and non-shelter components in each index.

Owners' equivalent rent is the largest driver of shelter costs, making up ~25% of the total CPI, while imputed rent makes up 12% of the total PCE. Although these two items are an imprecise estimate of what an owner would have spent if they rented their residence, they both heavily influence CPI and PCE. According to the Bureau of Economic Analysis:

The rental value of tenant-occupied housing and the imputed rental value of owner-occupied housing are both part of PCE housing services, reflecting the amount of money tenants spend for the service of shelter and the amount of money owner occupants would have spent had they been renting.

Owner-occupied housing is included in PCE because the NIPAs (national income and product accounts) treat the owner-occupant as if it were a rental business, or in other words, a landlord renting to him or herself. That is, BEA imputes a value for the services of owner-occupied housing (space rent) based on the rents charged for similar tenant-occupied housing, and this value is included in GDP as part of personal consumption expenditures. This imputation is necessary in order for GDP to be invariant when housing units shift between tenant occupancy and owner occupancy.¹⁴

Exhibit 13: Relative weights in the CPI and PCE

Expenditure category	Weighting			
	CPI Data		PCE Data	
	All CPI	Core CPI	PCE	Core PCE
Food	13.2%		7.1%	
Energy	7.9%		4.8%	
All items less food and energy	78.9%		88.8%	
Goods	19.4%	24.5%	31.1%	24.3%
Apparel	3.0%	3.8%	2.8%	3.1%
New vehicles	3.7%	4.7%	2.0%	2.2%
Used cars and trucks	2.4%	3.0%	1.7%	1.9%
Medical care commodities	1.7%	2.1%	4.3%	4.8%
Alcoholic beverages	1.0%	1.2%		
Tobacco and smoking products	0.7%	0.8%		
Services	59.5%	75.5%	68.9%	75.7%
Shelter	33.2%	42.1%	15.9%	17.9%
Rent of primary residence	7.9%	10.0%	4.2%	4.8%
Owners' equivalent rent of residences	23.9%	30.3%	11.6%	13.0%
Medical care services	7.0%	8.8%	16.9%	19.1%
Transportation services	5.9%	7.5%	3.2%	3.6%
Recreation Services			4.0%	4.5%
Financial Services			8.0%	9.0%

Source: Bureau of Labor Statistics, Table 1. Consumer Price Index for All Urban Consumers (CPI-U): U.S. city average, by expenditure category, June 2019. Bureau of Economic Analysis, Table 2.4.5U. Personal Consumption Expenditures by Type of Product. July 2019. Core weightings calculated by Pretium by eliminating the Food and Energy items.

¹⁴ Bureau of Economic Analysis, "Housing Services in the National Economic Accounts", September 2007.

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