

housing_market

December 18, 2022

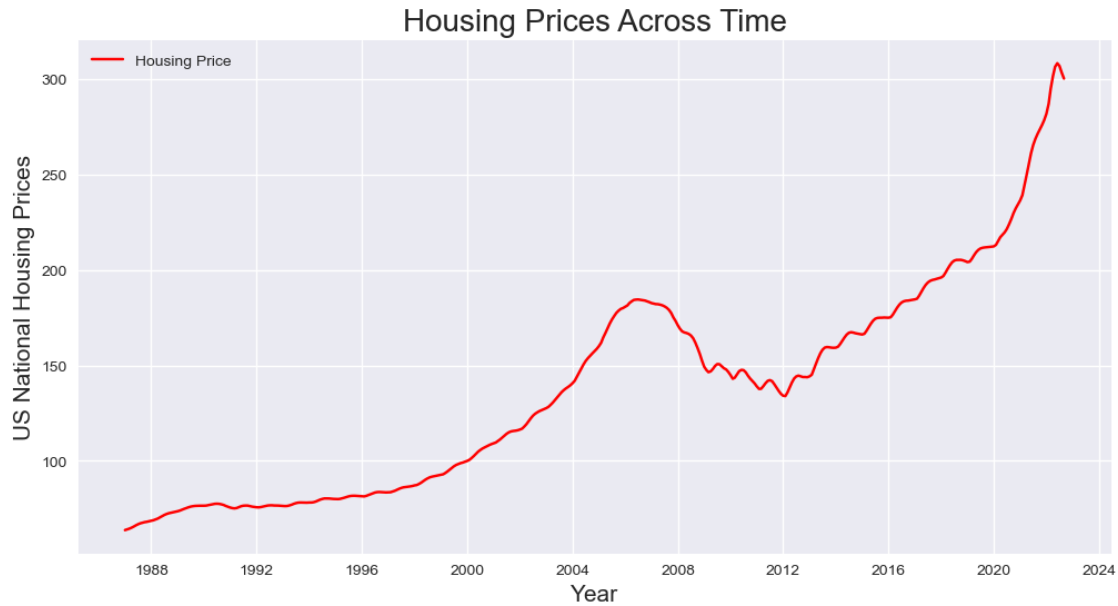
```
[ ]: import pandas as pd
import yfinance as yf
import numpy as np
from fredapi import Fred
import matplotlib.pyplot as plt
import matplotlib as mpl
import scipy.stats as scs
plt.style.use('seaborn')
%matplotlib inline
```

```
[ ]: file_path = 'C:/Users/dcste/OneDrive/Option Theory/CSUSHPINSA.xls'
```

```
[ ]: api = 'caf2a437b55be8f56406870c1bed3521'
fred = Fred(api_key= api)
data = fred.get_series('CSUSHPINSA').dropna()
```

```
[ ]: data = pd.DataFrame(data, columns = ['Prices'])
data['Monthly_Change'] = np.log(data['Prices']/data['Prices'].shift(1)).dropna()
plt.figure(figsize = (12,6))
plt.plot(data['Prices'], label = 'Housing Price', color = 'red')
plt.ylabel('US National Housing Prices', size = 15)
plt.xlabel('Year', size = 15)
plt.title('Housing Prices Across Time', size = 20)
plt.legend(loc = 'upper left')
```

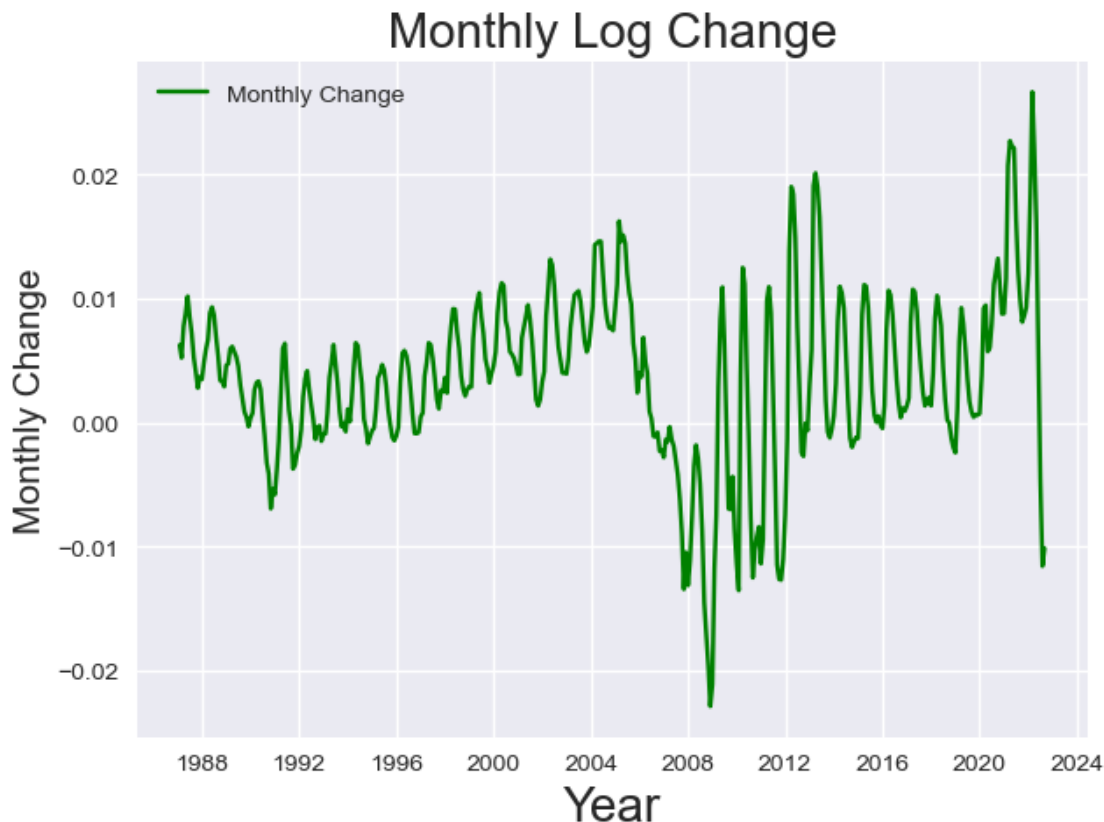
```
[ ]: <matplotlib.legend.Legend at 0x25bd57e0ee0>
```



- As you can see housing prices have sky rocketed since the pandemic began - faster than the rate of the global financial crisis in 2008. This is because interest rates were extremely low since then and people moved out of cities and bought up tons of property.
- We definitely will not have a housing crisis like in 2008, but I do believe there is going to be correction soon in the housing market- **it is already happening.**
- The average yearly price appreciation since 1988 (which I calculate below) is 4.34%

```
[ ]: plt.figure(figsize=(7,5))
plt.plot(data['Monthly_Change'], color = 'green', label = 'Monthly Change')
plt.title('Monthly Log Change', size = 20)
plt.ylabel('Monthly Change', size = 15)
plt.xlabel('Year', size = 20)
plt.legend(loc = 'upper left')
```

```
[ ]: <matplotlib.legend.Legend at 0x25bd58a0ca0>
```



```
[ ]: print('Since 1989, the annual change of housing prices is',np.
      ↳round(data['Monthly_Change'].mean()*12,8))
```

Since 1989, the annual change of housing prices is 0.04347019

```
[ ]: print('The yearly standard deviation of housing prices in America is',np.
      ↳round(data['Monthly_Change'].std()*np.sqrt(12),8))
```

The yearly standard deviation of housing prices in America is 0.02397377

```
[ ]:
```

```
[ ]: scaled_logmean = (data['Monthly_Change'].mean()*12)*20
      340*(1+scaled_logmean)
```

```
[ ]: 635.5972761790592
```

- The expected value of your home in 20 years is $\mathbb{E}(P_{20}) = 340 * (1.0438) * 20 = 635,000$
- This is based on continuously compounded returns so I do not need to raise the number to the twentieth power.
- This is based on historical national home price data, so this is an extremely rough estimate.

```
[ ]: def confidence_interval(sigma = 1, mean = 1, time_factor = 1,
    ↪initial_housing_price = 1):
    df = pd.DataFrame(index = ['Lower Limit', 'Upper Limit'], columns = ['95%
    ↪Confidence Interval of House Price', 'Gross Return'] )
    scaled_vol = sigma*np.sqrt(time_factor)
    scaled_mean = mean*time_factor
    lower_ci = np.round(scaled_mean - 1.96*(scaled_vol), 5)
    higher_ci = np.round(scaled_mean+ 1.96*(scaled_vol),5)
    df.loc['Lower Limit',:] = (1+lower_ci)*initial_housing_price
    df.loc['Upper Limit',:] = (1+higher_ci)*initial_housing_price
    df.loc['Lower Limit','Gross Return'] = (lower_ci*100).astype(str) + '%'
    df.loc['Upper Limit', 'Gross Return'] = (higher_ci*100).astype(str) + '%'
    return df
```

```
[ ]: confidence_interval(sigma = .02397377, mean = .04347019, time_factor=20,
    ↪initial_housing_price=340)
```

```
[ ]:          95% Confidence Interval of House Price Gross Return
Lower Limit          564.1484          65.926%
Upper Limit          707.0436          107.954%
```

This would be a very rough estimate based on historical price appreciation using the Case-Shiller Housing Index. - In twenty years, we can see that there is a 95% chance your home will be within that range, but other factors could also drive up the value of your home in Longmont (e.g., school zones, population change, job market). I would say that Colorado is a safe investment because of how fast it is growing relative to other states. - You certainly will not lose any money on your home because houses are always a great investment, *but trying to determine your housing price 20 years from now is definitely challenging, so hopefully you can get a better perspective on what I calculated using historical data, but always remember what has happened historically does not imply it will continue in the future.*