GROUP WORK PROJECT #1
GROUP NUMBER: 7240

MScFE 600: FINANCIAL DATA

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Statement of integrity: By typing the names of all group members in the text boxes below, you confirm that the assignment submitted is original work produced by the group (excluding any non-contributing members identified with an "X" above).	
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Use the box below to explain any attempts to reach out to a non-contributing member. Type (N/A) if all members contributed. **Note:** You may be required to provide proof of your outreach to non-contributing members upon request.

COLLATERAL RELATED RISKS: FINANCING AND CREDIT

	Financing Challenges	Collateral Challenges
Money at a fixed rate for an unsecured purchase	Unsecured purchase means that there is no collateral. This increases the risk of default. The higher risk of unsecured loans is compensated by high interest rates.	X
Money at a floating rate for a secured purchase	In the case where a car is the secured purchase (collateral), the asset can lose its value very rapidly because of depreciation, in some cases, the automotive market can have price fluctuations, and this could bring the price of the secured purchase below the remaining loan, and the borrower could decide to default.	X
Money at a fixed rate for a business for a construction loan	The business may face risks like project delays, cost overruns, and market fluctuations, impacting the ability to repay. Additionally, liquidity risks and interest rate exposure can increase the financial burden on the borrower.	X
Publicly traded equity	X	In the case where a stock serves as collateral, there is the risk that the stock (collateral) price drops, and falls below the value of the asset that was lent, and insufficient to cover the full price. For example, this could happen because of the natural behavior (volatility) of the stock market, or if a company decides to do a stock split, then the same stock would be worth less than what was expected, and its new value may be insufficient.

Publicly traded bond	X	The bond acts as collateral, but its value is volatile due to interest rate changes and market conditions. If the bond's price drops significantly, the collateral might not be sufficient to cover the loan.
An illiquid security	X	Illiquid assets have a collateral risk. They have limited market activity which makes their sale challenging to achieve. Incase of a default, it might be difficult for the lender to value and sell the collateral.

STATISTICAL RELATED CHALLENGES: VOLATILITY AND CORRELATION

	Volatility Challenges	Correlation Challenges
Money at a fixed rate for an unsecured purchase	Factors such as inflation can lead to high volatility in the borrower's creditworthiness or income. This is likely to increase the risk of default. The lender bears a high risk since there is no collateral.	- Correlation of borrower defaults and economic downturns - Correlation between Interest Rate Changes and Credit Demand: An increase in interest rate would lead to decrease in credit demand.
Money at a floating rate for a secured purchase	There are several reasons for the real estate or automotive markets to increase its volatility, for example, during recessions or when interest rates are high people would normally stop buying cars or houses, and the decrease in the demand could cause a drop in prices, and in the opposite case, if interest rates are low, then people would buy more houses or cars.	The automotive and real estate markets are highly correlated to interest rates because when the cost of borrowing money is low, people tend to buy more things, like cars or houses. Another example of correlation is economic health because when a country's economy is growing, people feel more confident, and they also have more purchasing power.
Money at a fixed rate for a business for a construction loan	- Construction costs fluctuations may increase the raw materials - Interest rate changes affecting the overall project cost - Real estate market volatility may impact the property value	- Correlation with economic growth is directly tied to construction demand - Correlation with interest rates can affect both loan demand and project viability - Commodity prices shifts affect materials used in construction
Publicly traded equity	Stocks can experience high volatility for different reasons, for example, after bad news from a company is released, or during bad market periods, such as recessions because there is uncertainty and people start acting with fear. On the other hand, there can be low volatility during stable economic	Stocks have a high correlation with the industry the stock belongs to, when an industry has a good performance, commonly the stock will also experience a positive performance. Another example of correlation could be with gold, in this case, negative correlation because it is a

	conditions because of stable growth or low inflation.	common scenario that when gold outperforms, stocks tend to drop and vice versa.
Publicly traded bond	- Interest rate volatility leads to bond price fluctuations. - Credit spreads volatility based on the issuer's financial health. - Market conditions affect bond liquidity	- Bond prices are inversely related to interest rates. - Bonds and stocks often have a negative correlation. - Bond prices change based on the issuer's credit rating.
An illiquid security	Prices of illiquid assets fluctuate because a small number of trades can affect their market value. This leads to price instability.	Correlation between liquidity problems and the difficulty of selling illiquid securities.

IDENTIFYING DATA

1. **Money at a fixed rate for an unsecured purchase**
    a. **Data type.** Credit data such as credit ratings and interest rates. Secondly, economic data such as unemployment and inflation rates. Accounting data payment history and debt-to-income ratios.
    b. **Data processing.** Handling raw data for credit card interest rates such as annual percentage rate of credit cards. Categorizing levels for rating credit scores such as 700, 650 .
    c. **Data frequency.** The data can be monthly for payment history, interest rates, and balances, Quarterly for credit score refresh or annually for income, debt-to-income
    d. **Data class.** Consumer credit (fixed rate credit cards) Economic (Unemployment rates, inflation), Credit (Credit scores).
    e. **Data source.** Include credit card issuers, such as Visa or MasterCard, credit reporting agencies such as Equifax, Experian, or TransUnion . Also Government economic reports such as the Bureau of Labor Statistics.
    f. **Data variety.** Actual data such as actual interest rates, credit scores and Trade data such as credit card balance and payments.

2. **Money at a floating rate for a secured purchase**
    a. **Data type.** Values of the assets, such as cars or houses at different points in time. Also, data about interest rates, and credit scores.
    b. **Data processing.** Raw prices of the assets.
    c. **Data frequency.** In the case of raw asset prices we could use quarterly or annually data.
    d. **Data class.** Real estate for houses, and credit for information about the borrowers.
    e. **Data source.** For real estate we could use data from online platforms like zillow.com or cars.com, for credit scores we could use data from banks.
    f. **Data variety.** Actual data (compared to estimated data, in case of comparison with estimations).

3. **Money at a fixed rate for a business for a construction loan**
    a. **Data type:** Economic data, such as Construction Cost Index, Real Estate Prices.
    b. **Data processing:** Raw prices of materials, Levels of business credit ratings
    c. **Data frequency:** Monthly or Quarterly for construction costs, Weekly for interest rate movements
    d. **Data class:** Interest rates, Property values
    e. **Data source:** Government reports, Commercial vendors, Business financials
    f. **Data variety:** Observed Data for material prices, Estimated Data for future projections of real estate values

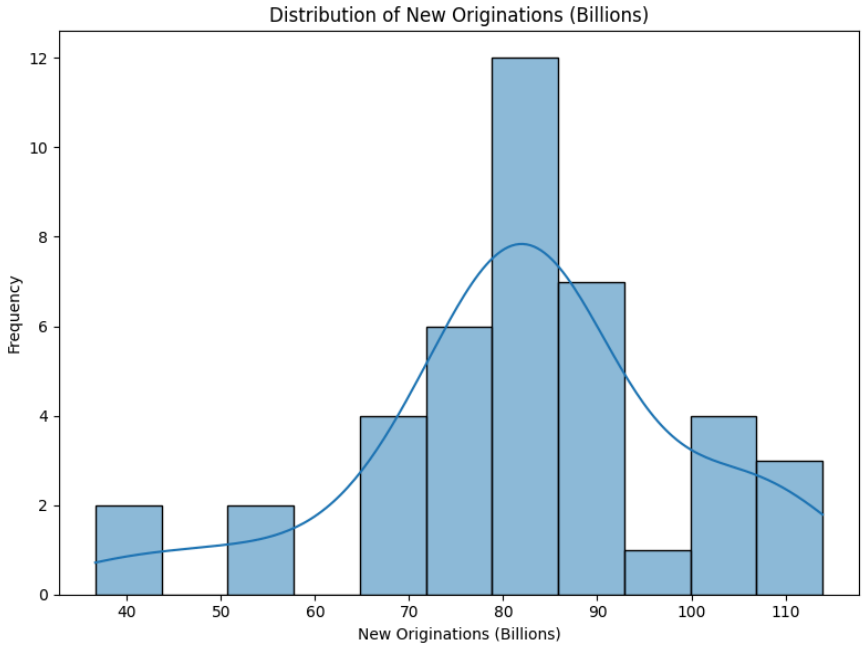
4. **Publicly traded equity**
    a. **Data type.** Assets data, such as stock prices
    b. **Data processing.** Raw prices and returns from stocks.
    c. **Data frequency.** Different frequencies could be useful, from daily to yearly returns.
    d. **Data class.** Equities.
    e. **Data source.** We could obtain data from exchanges, brokers, and data vendors.
    f. **Data variety.** Trade data.

5. **Publicly traded bond**
    a. **Data type:** Bond Prices, Ratings
    b. **Data processing:** Raw bond prices, Implied volatilities for bonds
    c. **Data frequency:** Daily (bond prices), Quarterly (credit ratings)
    d. **Data class:** Fixed Income (Bond Prices), Credit (Issuer Ratings)
    e. **Data source:** Bond Exchanges, Credit Rating Agencies (S&P, Moody's, Fitch)
    f. **Data variety:** Actual Data (Bond Prices), Modeled Data (Credit Ratings)

6. **An illiquid security**
    a. **Data type.** Rental income, housing market indices, property tax rates, and cap rate.
    b. **Data processing.** Handling raw prices such as current property value, purchase prices. Also handling levels such as zoning classifications and tax rates. Lastly, handling returns like rental income and cap rates.
    c. **Data frequency.** Illiquid data frequency can be quarterly or annual for property values and rental income, monthly for maintenance costs and vacancy rates. It can also be annual for property taxes and insurance costs
    d. **Data class.** The data classes Real estate (residential, commercial) , Fixed income (rental income), and Economic (property market indices, inflation).
    e. **Data source.** The data sources include public real estate records and government property databases. Also Real estate agencies and brokers and property appraisals and market reports, including services like Zillow, Redfin, and real estate analytics firms.
    f. **Data variety.** It includes Trade (sale prices and actual income from potentially valid rentals), Modeled data (estimated property values and cap rates), and The adjusted (house prices after renovation or improvement).

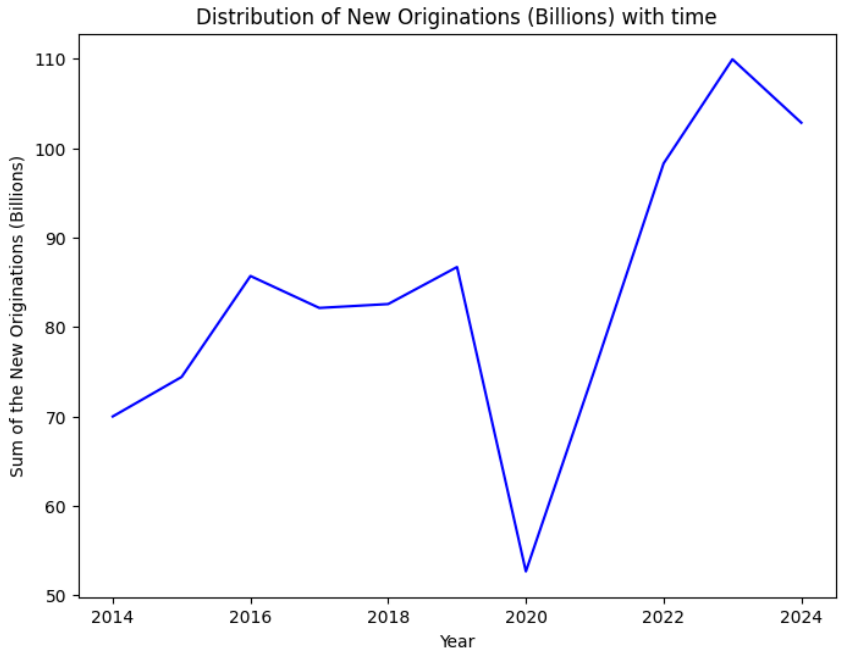
EXPLORATORY DATA ANALYSIS

1. **Money at a fixed rate for an unsecured purchase**
   a. **Distribution**



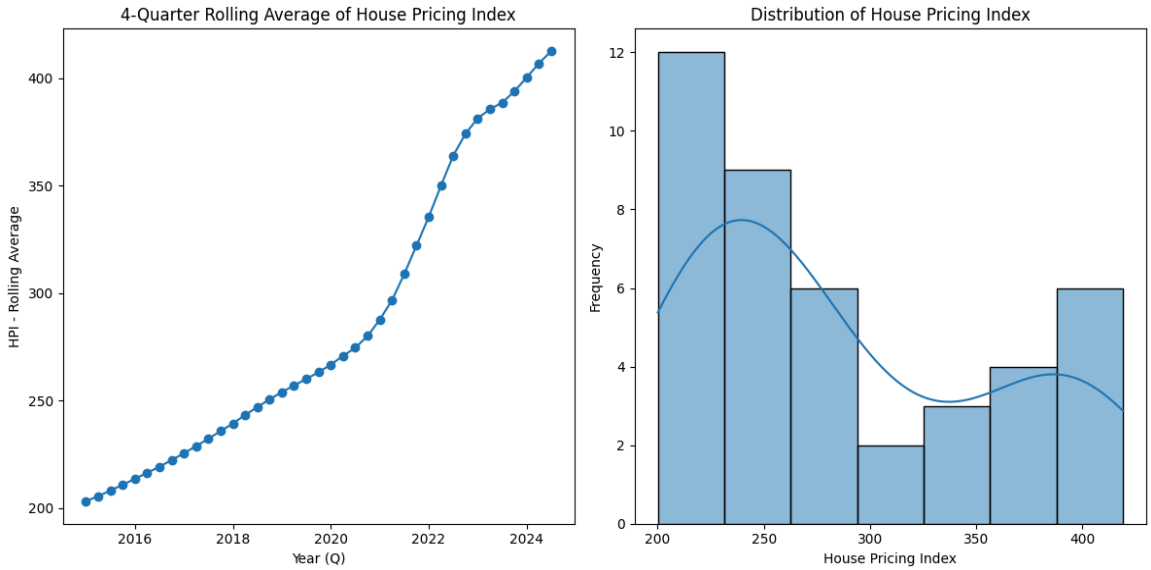
- **Distribution.** The distribution shows high frequency for the middle values. This shows that the majority of new origination is in the 80-90 billion range. The data is also right skewed since it has a longer tail on the right.

   b. **Line chart**



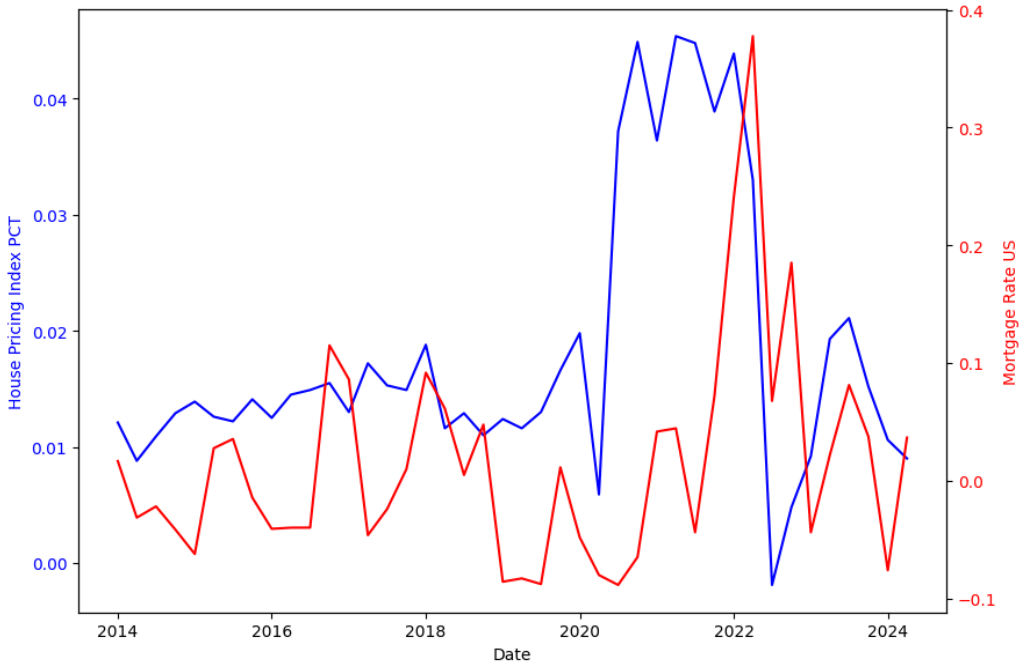
- **Line chart.** The line chart representing the sum of new originations (billions) over time has an upward trend but with a sharp decrease in 2020 followed by a sharp increase in 2021.

2. **Money at a floating rate for a secured purchase**
   a. **House Pricing Index**



- **4-Quarter Rolling Average of House Pricing Index.** As we can observe, up to 2021 there is a steady growth over the years, then the pricing index increased very rapidly.
- **Distribution of House Pricing Index.** The distribution shows a higher frequency for lower index values, and these are between 200 and 250. Also, we can observe a right-skewed distribution because of the presence of outliers around the 400 value.

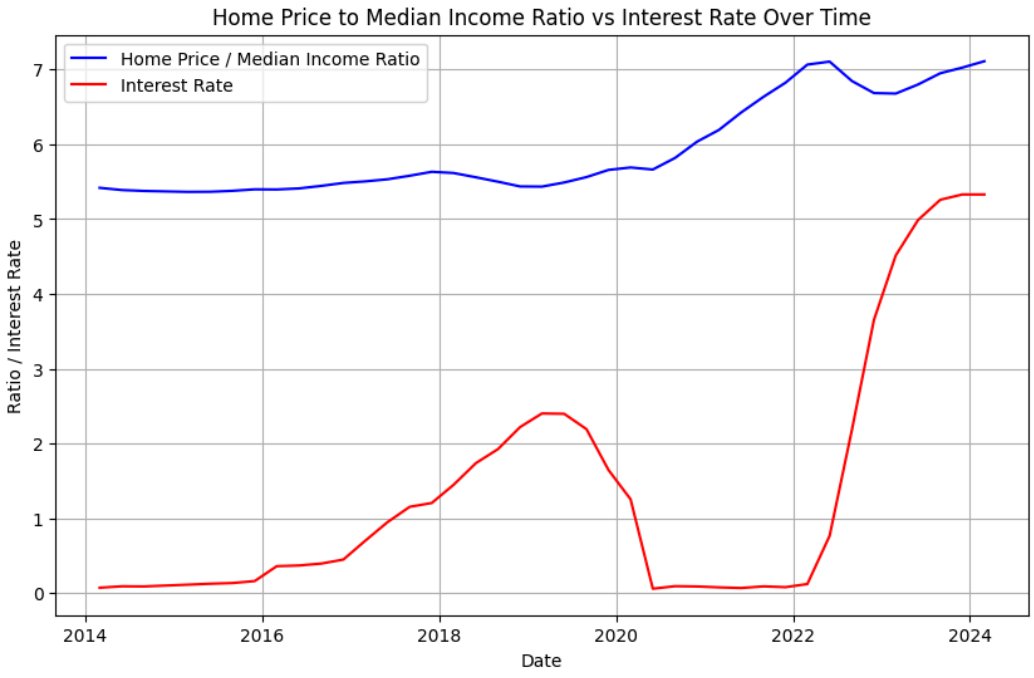
b. Changes in House Pricing Index and Mortgage Rates.



- In the House Pricing Index and Mortgage Rates graph, we can observe certain similarity in movement during periods of time, for example, around 2021-2022, there is a notable raise, just like we saw in the **4-Quarter Rolling Average of House Pricing Index** graph.

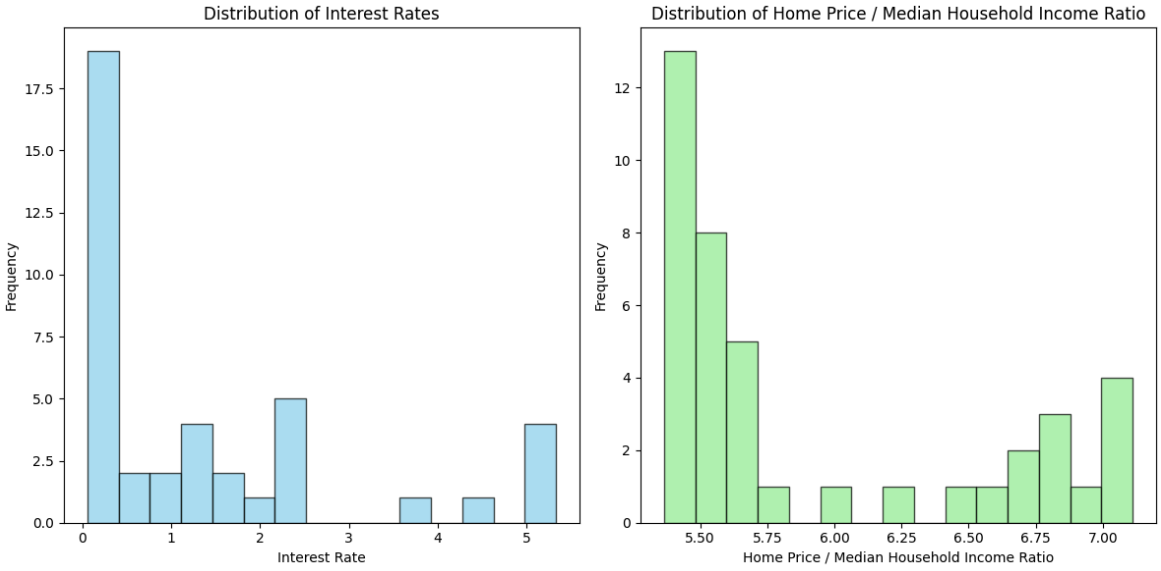
3. Money at a fixed rate for a business for a construction loan

a. Household Income Ratio with the Interest Rate



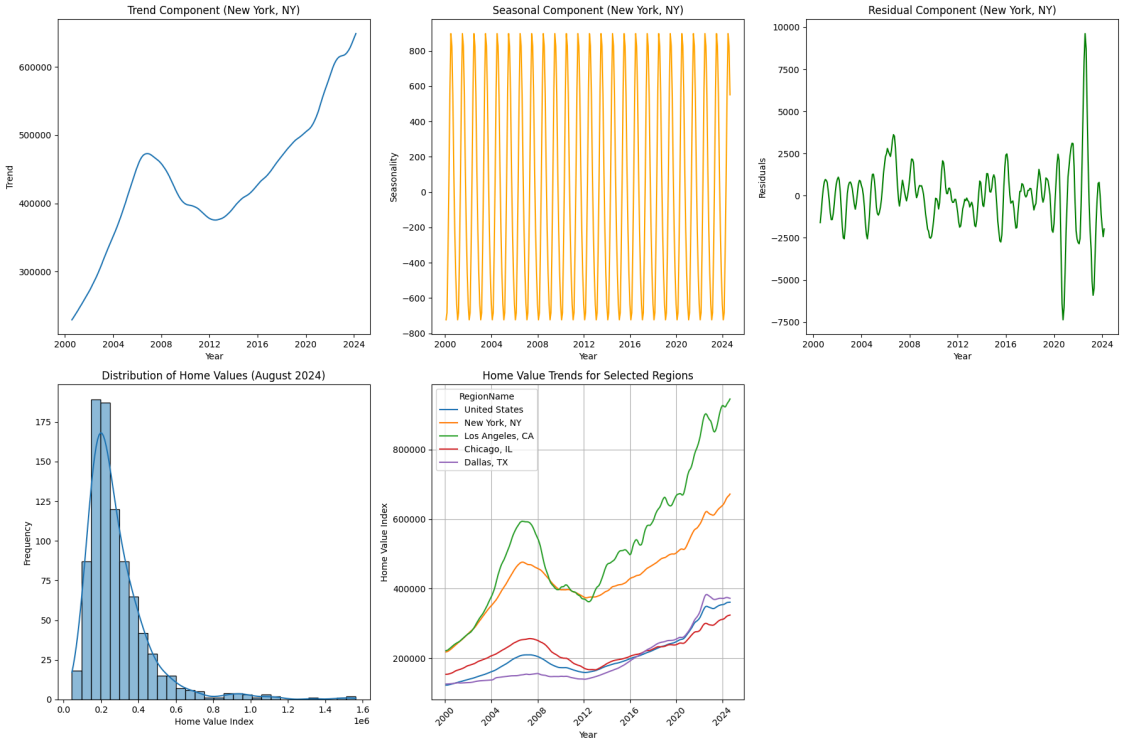
- Between 2014 and 2024, the ratio starts near 5.4 and ends close to 7. This signifies an approximate 30% increase in the ratio, suggesting homes are becoming more expensive relative to income and Home Price median Household Income Ratio shows a relatively steady upward trend over time, indicating that housing has become less affordable relative to median household income. This can be attributed to rising home prices that outpace income growth.
  This reflects a potential macroeconomic challenge, where rising interest rates -possibly due to efforts to combat inflation- are not sufficient to cool down the housing market or improve affordability for the general population.

b. Distributions comparison



- The Interest Rate distribution reveals a period of historically low rates that supported housing demand, while the Home Price household income ratio shows that housing affordability has worsened over time. Rising interest rates could have future implications for both market activity and affordability, though the housing market's sensitivity to rate changes appears to be limited thus far.

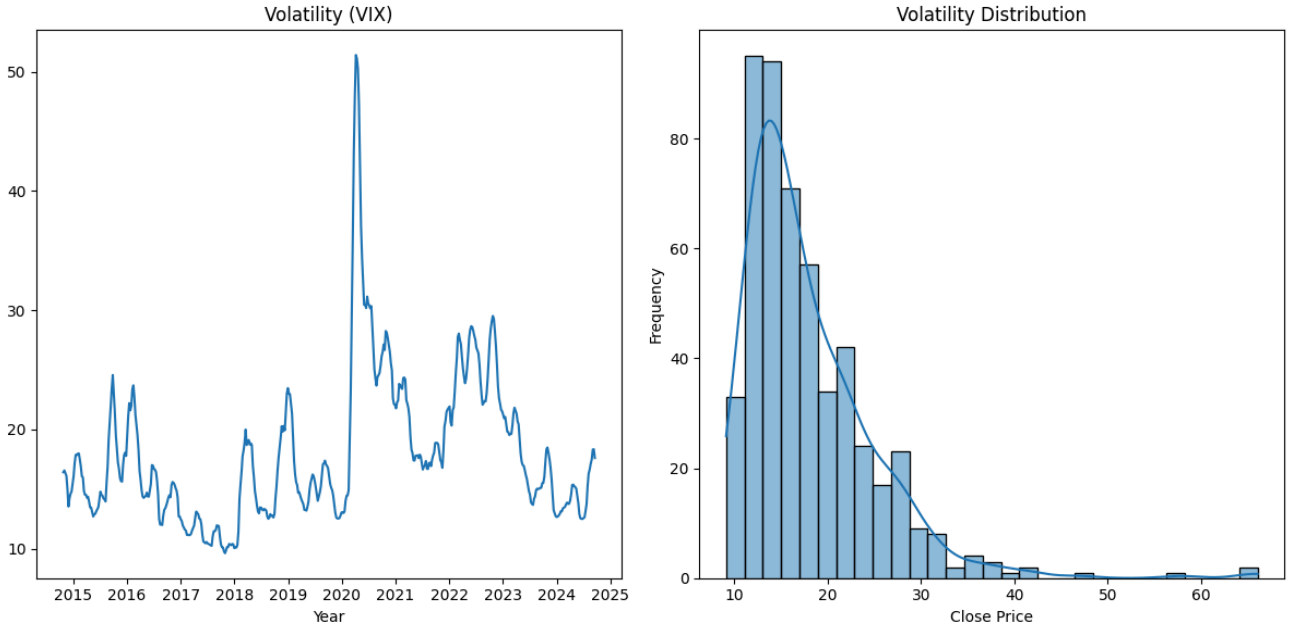
c. Detailed house Prices Analysis



- **Trend:** From 2016 to 2024, there is a significant acceleration in the growth rate of home values, suggesting increased demand possibly due to limited housing supply and economic factors affecting real estate prices.
- **Seasonality:** the seasonal component exhibits a cyclical pattern, with values oscillating yearly.
- **Residuality**: Shows deviation from the trend and seasonality. Period of volatility on 2020-2021 due to external shocks like COVID-19
- **Distribution:** The distribution of home values is right-skewed, with most regions having lower home values.
- **Home values:** Divergence across selected regions, however we can state that there is a constant uptrend.

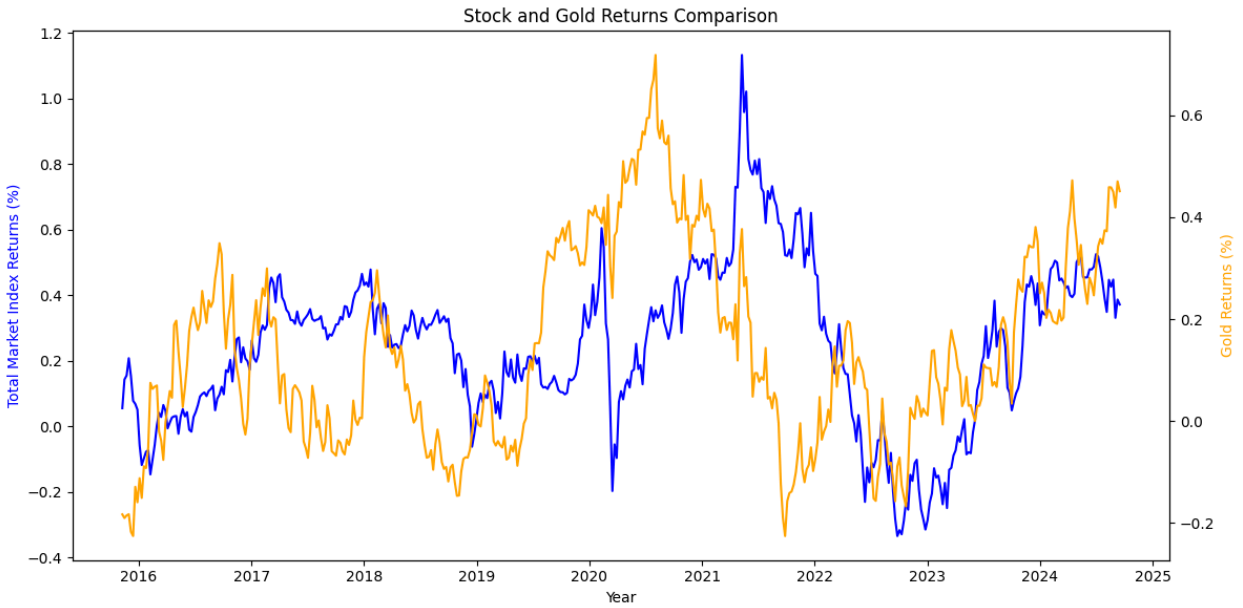
4. Publicly traded equity

a. Volatility



- **Distribution of the Volatility Index.** We can observe that the distribution has a higher frequency in lower values, between 10 and 20, but there is presence of middle and extreme values, and this could be caused because of extreme events.
- **Volatility Line Chart.** This chart also reflects what we saw in the distribution chart, in which there are certain extreme events, such as in 2020, but there is more presence in mid and lower values.

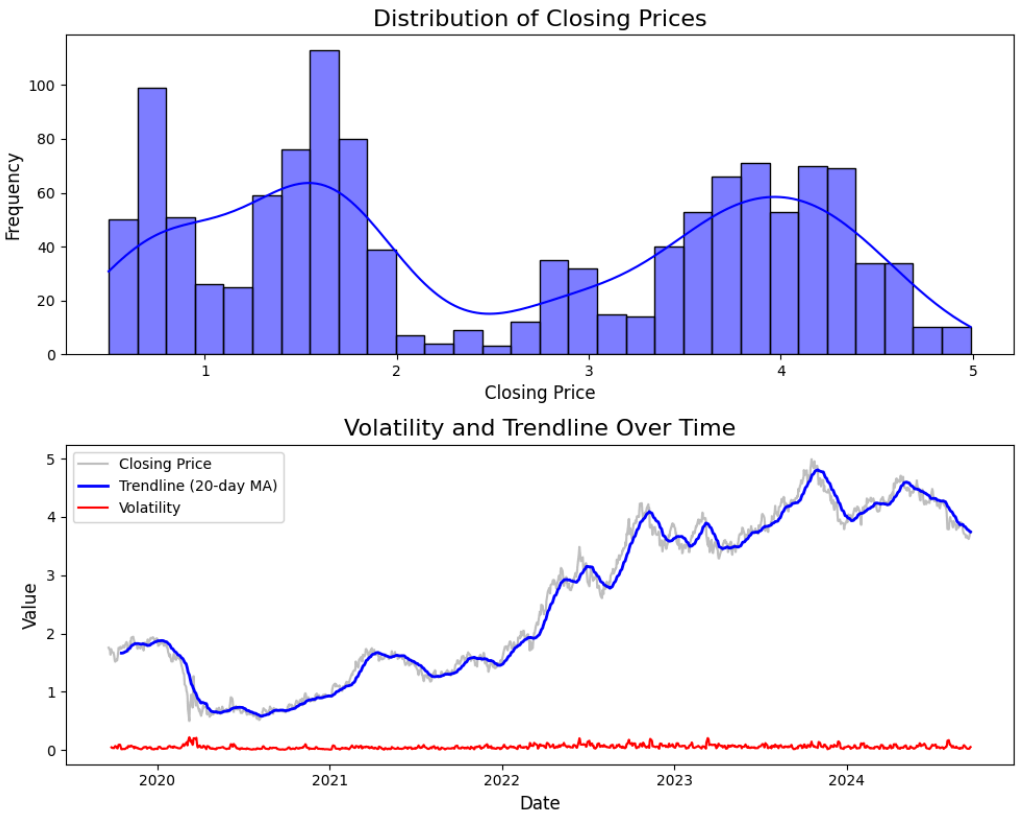
b. Stocks (Total Market Index) and Gold



- When comparing gold with the total market index, for this purpose, representing equities, we can observe a high negative relationship, because they normally move in opposite directions. Also, there exists a certain delay in stocks because gold shows the movement first, and then stocks move in the opposite direction after some period.

5. Publicly traded bond

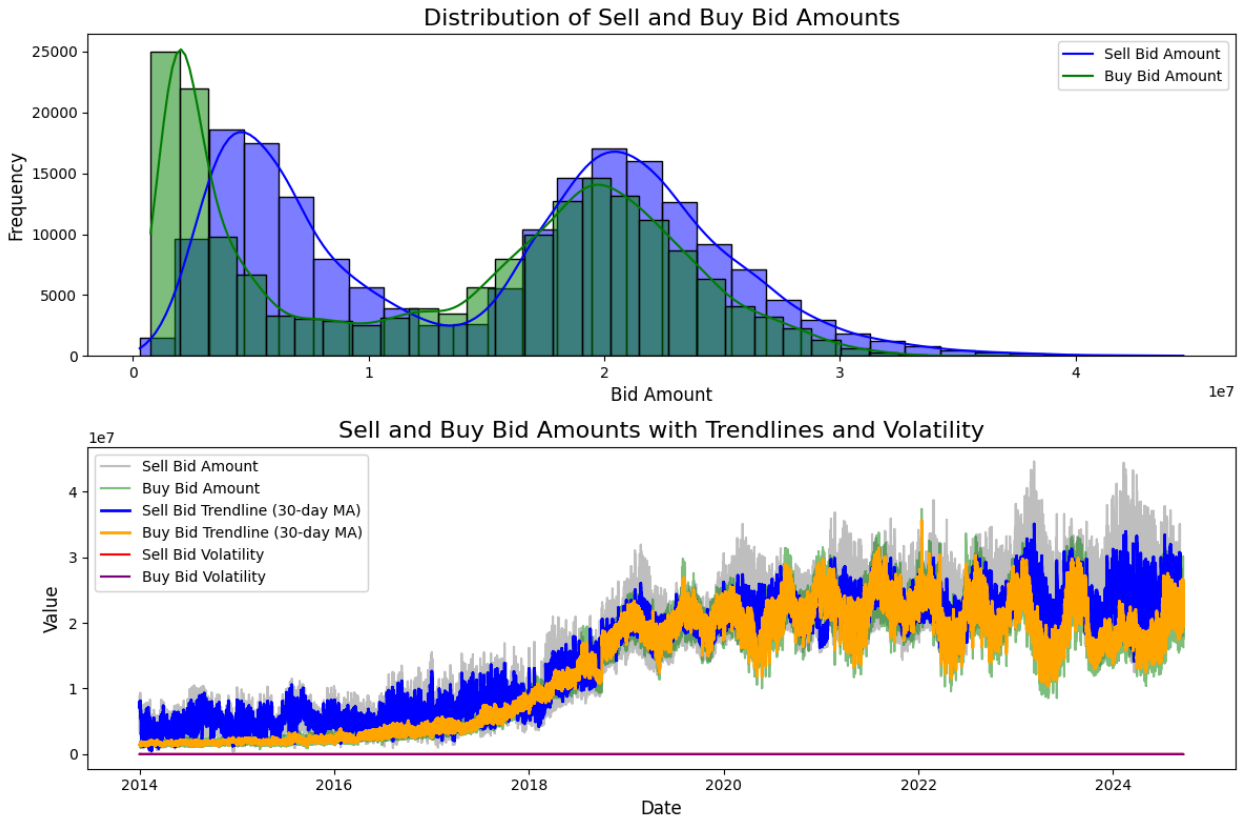
a. Bond Prices Treasury 10 yrs:



- **Distribution.** Shows a multimodal distribution, with several peaks, indicating that the bond's price tends to hover around certain levels rather than following a normal distribution.
- **Volatility and trendline.** Volatility remains consistently low, expected from a governamental asset. The trendline shows a steady upward trajectory over time, reflecting increasing demand for the bond.

6. An illiquid security

Japan Electric Power Exchange (JEPX) (2014-2024)



- **Distribution of Sell and Buy bid amounts:** It shows that a big number of the bids made for both sell and buy are concentrated at lower amounts, with few high-value bids.
- **Volatility and trendline:** Both the sell bid amount and the buy bid amount have trended upwards. The volatility and the 30 day moving averages increase with time.

DESCRIBE HOW THE DATA CAN HELP TO MEET THE CHALLENGE

1. **Money at a fixed rate for an unsecured purchase.** The histogram shows clearly that most new credit card loans are near 80 billion dollars. The distribution looks normal but there is a small skew toward the right side which has bigger numbers. There are not as many very large loans being made. This information is crucial for borrowers because it tells borrowers about the usual loan sizes in the credit card. It also shows that lenders usually give loans close to 80 billion dollars but there are few instances when some loans are high which might have been caused by changes in the market.

   The Distribution of New originations over time shows new credit card loans from 2014 to 2024 and also shows important trends from it. Firstly, between 2014 and 2019, new loan amounts grew slowly going up to about 90 billion. But in 2020, there was a very sharp drop to around 54 million. This drop **can likely** have been caused by COVID-19 pandemic. It shows how bad the economy was and how people borrowed less during those tough times.

   After that drop, the economy recovered back quickly from 2021 to 2023. New originations went up to about 110 billion. This increase could have been caused by investors spending more as things got better after COVID 19 or weakened borrowing rules.

   The distribution and the time series of new credit card loans show that the lending market is strong and changes with the economy. This data shows how the lending market can bounce back, but also how it can be affected by big economic events. By looking at these patterns, lenders can guess when the market will grow or shrink. This helps them change their plans to stay safe or grab good chances.

2. **Money at a floating rate for a secured purchase.** With the explored data we can conclude that houses are increasing their cost very rapidly in the last few years, and this could serve as an indicator that in case of using a house as collateral, it is less likely that it will decrease its value, at least in the near future.

   Another variable to consider is the pricing index because according to the distribution graph, the most frequent values are on the lower side, and just some of them have higher values. This information it's important to determine the documents needed to lend money, especially if these have high values, for example, comparing the behavior of people with high incomes and no defaults when lending similar amounts of money.

   Also, when comparing mortgage rates with the house pricing index, we can observe that there are certain periods where both move close, especially when the movements are extreme. This information could be helpful when there exists extreme changes in mortgage rates, and to determine if it's likely that houses will increase their value.

3. **Money at a fixed rate for a business for a construction loan.** The analysis of both interest rates and the Home Price median Household Income Ratio shows a clear trend of declining housing affordability over the past decade. From 2014 to 2020, historically low interest rates helped fuel rising home prices, as reflected by the increasing Home Price / Income Ratio. Despite low borrowing costs, home prices outpaced income growth, making housing progressively less accessible. However, even with the sharp rise in interest rates since 2020, home prices have not significantly adjusted downward, which continues to strain affordability for new buyers.

   As interest rates have climbed, homebuyers now face the double burden of higher mortgage costs and elevated home prices. The recent spike in interest rates to around 5% reflects efforts to curb inflation, but it has yet to impact the housing market meaningfully. Supply shortages and strong demand seem to be maintaining upward pressure on prices. The result is an ongoing affordability challenge where homes remain out of reach for many median-income households. Without a significant market correction or wage growth, this affordability gap will likely persist, posing difficult questions for policymakers and buyers alike.

4. **Publicly traded equity.** When observing the volatility data of the last 10 years, the distribution and line graphs shows that it is more likely that volatility is in the low or mid values, but there exists some extreme events, this information could serve to determine the time horizon for investments because in the long term, we could expect less volatility, in average, but stocks could experience higher volatility because of extreme events in the short term.

   Also, when comparing equities (for this purpose, the Total Market Index was used), and gold, we can observe that there is a negative correlation between these, this could be helpful to determine the trend when one of these starts changing direction, we could assume that the other will also change its direction. For example, if gold starts changing its direction and increases in value, then we could assume that a stock price could drop.

5. **Publicly traded bond.** In the context of publicly traded Treasury bonds, the data provides clear support for their use as collateral in securities lending. The low volatility of the bonds, as shown by the rolling standard deviation, minimizes the risk of collateral losing value during the lending period. This stability is a key advantage, as it reassures lenders that the bonds will retain their worth throughout the transaction. The upward trendline in bond prices, driven by market demand for safe assets, further strengthens the appeal of these bonds, suggesting that their value will likely increase over time.

   Additionally, the distribution of closing prices reveals that Treasury bonds have predictable price behaviors, clustered around certain levels. This predictability allows lenders to confidently structure lending terms, knowing that the bond prices are unlikely to experience significant volatility. Overall, the data supports the view that Treasury bonds are an ideal collateral choice due to their stability, predictable trends, and low risk profile.

6. **An illiquid security.** In this case, the Japan Electric security's bid amounts show a lot of ups and downs along with less trading activity, as we can see in the second graph. The distribution of how both buy and sell bid amounts are spread out tells us that smaller bids more and larger bids are few. When there is high volatility in the market, there are fewer willing to make big bids. This shows the growing problems with trading.

   The trendlines and volatility graph shows that the volatility of both buy and sell bids changes a lot over time. During periods of very high volatility, the security shows bigger changes in bid amounts. This means JEPX is pretty sensitive to what's happening in the market. Increased volatility means that it is tough to trade at stable bid amounts. This makes JEPS illiquid. The VIX is one of the solid indicators of how illiquid this JEPX is.

   With this data, lenders and other potential investors can easily see potential issues with liquidity when they notice the VIX climbing. This can help them change their plans or their amount of investment.

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Sections worked

Isaac Mukeli Kamami:
- Money at a fixed rate for an unsecured purchase
- An illiquid security

Carlos Ferney Gil Martinez:
- Money at a fixed rate for a business for a construction loan
- Publicly traded bond

Santiago Alonso Falconi Leon:
- Money at a floating rate for a secured purchase
- Publicly traded equity