Macroeconomic Forecasts, 1Q2023
Domestic Metrics

Prepared by: Capitalytics, LLC
P. O. Box 381162
Birmingham, AL 35242

Table of Contents

Summary

The economy of the United States is at a crossroads. The Federal Reserve has continued to increase interest rate targets (which is having the intended effects), and the employment situation is holding steady. Is there evidence that the economy has started to decline? Recent hiring has been slow (although there is not a pattern yet regarding a decrease in hiring), and several markets that were red-hot during the pandemic are starting to cool (such as the housing market). However, many of the issues that were troubling the economy during the height of the pandemic have cleared. Supply chain issues have calmed and commodity prices have stabilized. Although we have been more pessimistic than optimistic about the state of the economy moving forward, it's difficult to put a finger on exactly where or how the wheels will fall off the economy. We have argued that the economy is currently experiencing a growth recession (similar to the argument forwarded by Krugman following the 2008 housing crisis[1]), and we've likely been in a growth recession since the start of the pandemic. There is not enough evidence to suggest that we are incorrect about this assessment.

At the end of the day, however, it really doesn't matter if the US is in a recession; we are seeing the markets trying to regain a more solid footing. The price of housing is falling back to pre-pandemic levels, driven by both demand side (a decrease in real income) and supply-side (a decrease in new housing permits and a decrease in inventories) elements. Rental rates for housing continue to increase, putting the renting population in a bind.

Inflation is still the primary concern of the current economy. Inflation rates are higher than wage growth, pushing real wages down. We have seen gas prices return to pre-pandemic levels, but have not seen the same for food for neither cook-at-home nor eat-out-restaurants.

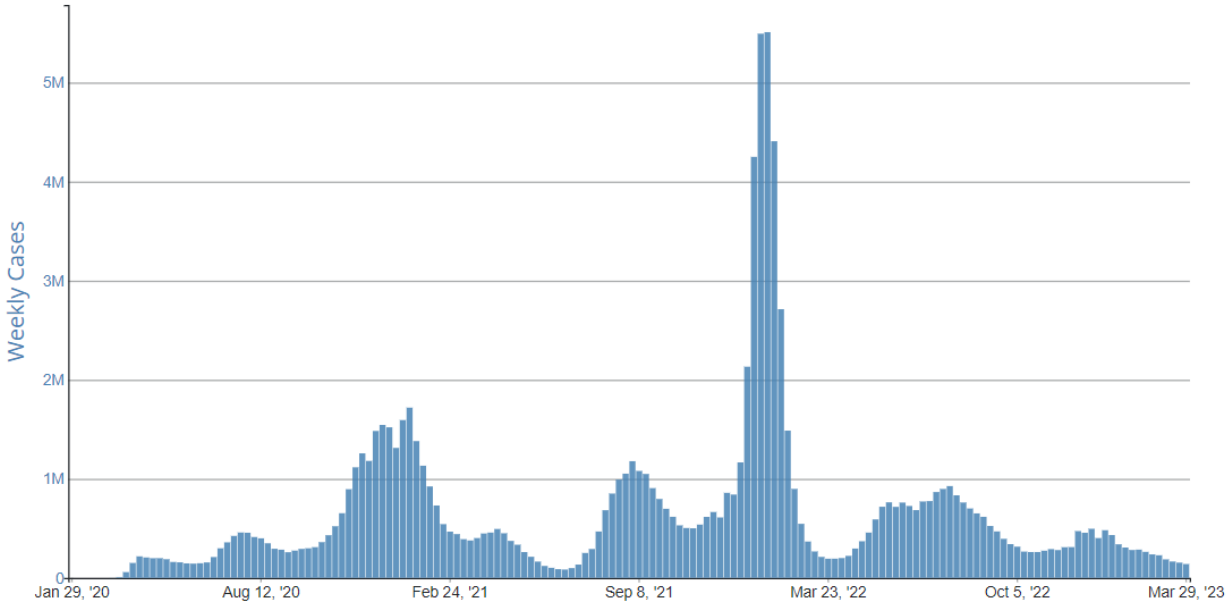
The unemployment rate is still below and stable at less than 4%. The labor force participation rate, however, is also stabilized at levels below the pre-pandemic mark. The lack of available workers is creating a gap between the needs of employers and employees. This employer-employee mismatch is not likely to subside soon. We predict that some former workers who have been "sitting it out" will re-enter the market and push the unemployment rate up, which could signal the US as being in a recession.

[1] See https://money.cnn.com/2008/03/14/news/economy/krugman_subprime.fortune/index.htm and https://www.lobservateur.com/2020/05/16/kruman-what-did-we-learn-from-the-2008-financial-crisis-that-can-help-us-now/

State of Affairs

For the last three years, we've started each report with an examination of the number of new COVID-19 cases. Although COVID isn't the front-page story of the current economic trends it is important to keep an eye on this trend. (See Figure 1.) We believe that the country is now operating in a "steady-state" situation[2] where the number of new cases will be relatively stable for the foreseeable future (in the absence of a new variant or outbreak of a COVID related illness), and we acknowledge that COVID is one of the underlying causes (along with the conflict between Russia and Ukraine) of the inflationary pressures the country is experiencing.

Figure 1: Weekly Average of New COVID Cases in the United States



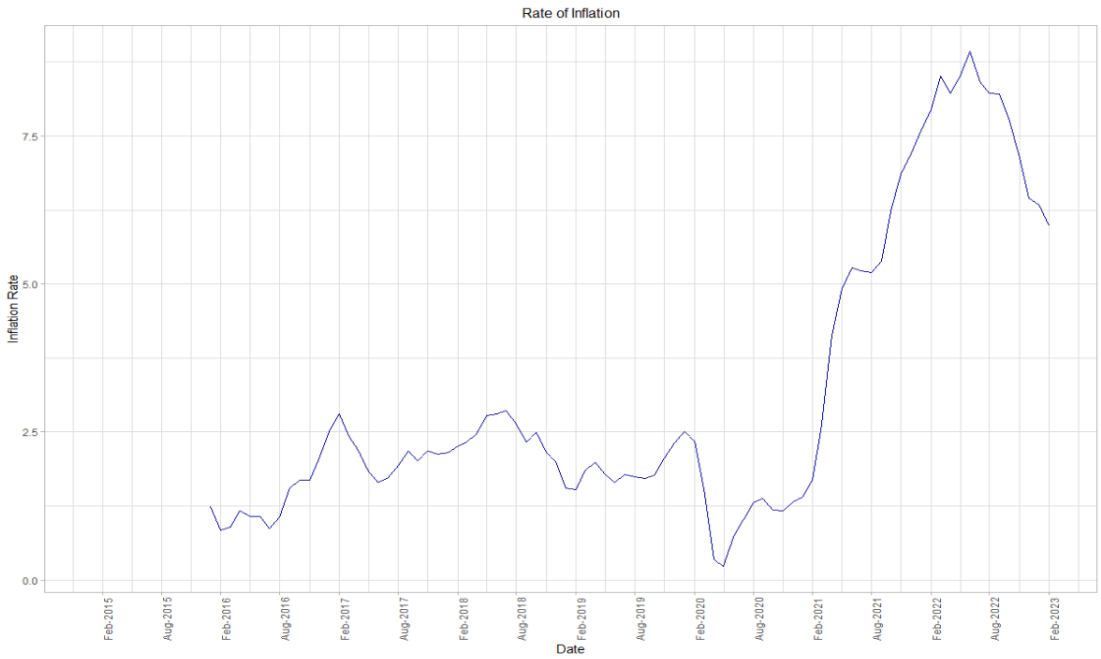
Source: Centers for Disease Control & Prevention (https://www.cdc.org): https://covid.cdc.gov/covid-data-tracker)

[2] https://www.kff.org/coronavirus-covid-19/issue-brief/what-happens-when-covid-19-emergency-declarations-end-implications-for-coverage-costs-and-access/

Inflation

The primary concerns of the economy are related to inflation and the policy responses to inflation. We believe that consumers are acutely aware of the prices changes in three areas: energy[3], food[4], and housing[5]. We have entered into a period of dis-inflation (where price increases are becoming smaller). We begin by discussing overall inflation in the US. (See Figure 2.)

Figure 2: National Overall Rate of Inflation, 2008-Present



The continued increase in the Federal Funds target rate by the Federal Reserve seems to be having an impact on inflation. Although the rate of inflation is still 350 basis points higher than the Fed's 3% target, the rate of inflation has been trending down for the last 9 months. The Fed's most recent 25 bp movement (May 17, 2023) indicates that the Fed is going to continue the contractionary policy until there are prolonged signs that the economy has entered a recessionary state.

Inflation: Fuel

Because fuel and food are two of the biggest components in consumer's budgets, it is critical to understand the inflationary aspects of these areas. Table 1 and Figure 3 highlight the issues that are troubling consumers.

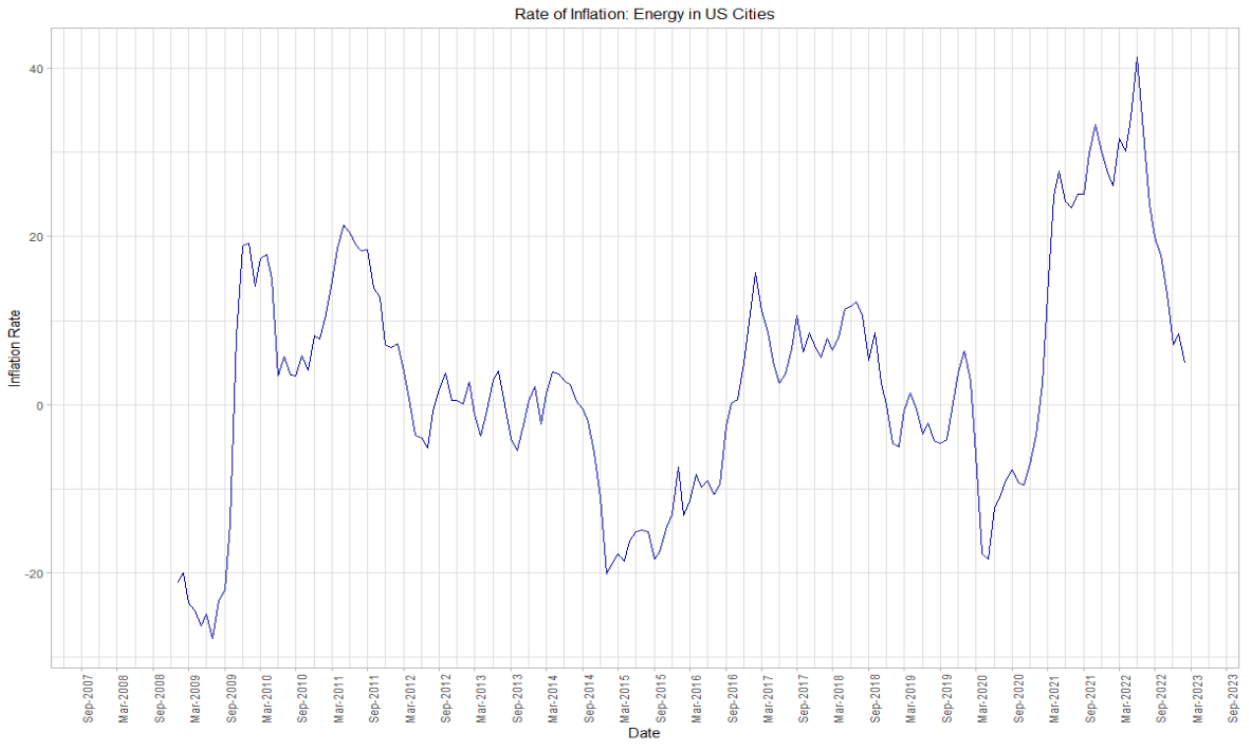
[3] https://www.bloomberg.com/news/articles/2022-06-09/gasoline-food-and-power-inflation-slam-us-households-and-it-could-get-worse
[4] ibid
[5] https://money.com/housing-market-cooldown-signs-predictions/?ref=/housing-market-correction-federal-reserve/

Table 1: Average Gas Prices (per Gallon) in US, as of April 4, 2023

	Regular	Mid-Grade	Premium	Diesel	E85
Current Avg.	$3.507	$3.928	$4.252	$4.207	$2.895
Yesterday Avg.	$3.506	$3.929	$4.250	$4.204	$2.891
Week Ago Avg.	$3.435	$3.862	$4.184	$4.238	$2.800
Month Ago Avg.	$3.399	$3.823	$4.148	$4.387	$2.769
Year Ago Avg.	$4.189	$4.592	$4.871	$5.092	$3.640

Source: https://gasprices.aaa.com

Figure 3: US National Energy Price Inflation, 2009-Present



Source: Author's calculation

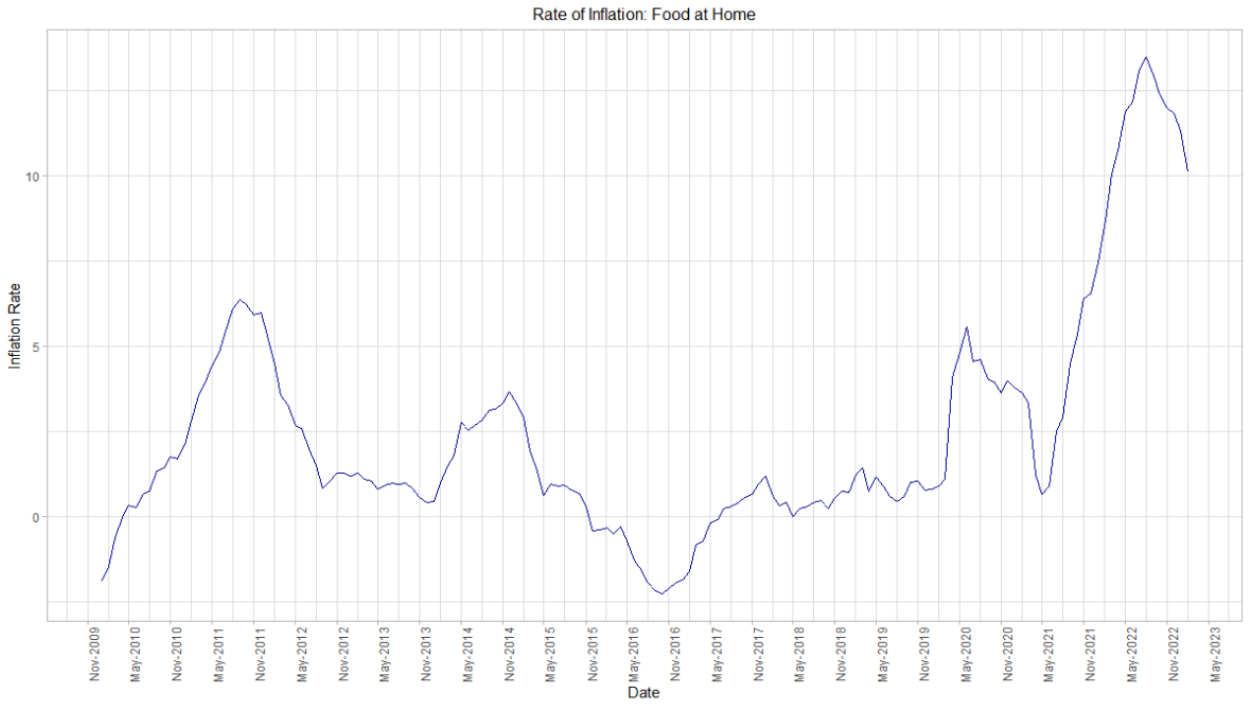
The current rate of inflation for gas prices is falling as of this writing -- that is, we are experiencing dis-inflation. The price per gallon for gasoline decreased so dramatically during the recession that a return to "normal" will correspond to quite high inflation rates. The year-over-year price changes peaked during the Spring of 2022, but the average price has fallen to levels fairly consistent with the price we

saw just prior to the pandemic. We anticipate that average prices will remain between $3.40/gallon and $3.90/gallon throughout the next quarter, which would be consistent with lower inflationary pressures.

Inflation: Food

Although food inflation is not as high as gas-price inflation, the US is experiencing the highest year-over-year food price inflation seen since 1980 (~10% annual inflation, per Figure 4). The supply-chain issues that the US experienced early in the pandemic, from meat-processing closures[6] to trucking and logistics[7] issues have continued to cause disruptions in the food supply chain, increasing production and transportation costs and contributing to overall inflationary trends. The recent down-ward trend in food-at-home prices is a welcome relief for many consumers. We anticipate that the economy will continue to experience downward pressure in food-at-home (grocery store) prices. However, lower levels of inflation do not translate into deflation – eggs, milk, and other staples are costing more relative to the start of the pandemic and there is little reason to believe that these prices will return to pre-pandemic levels.

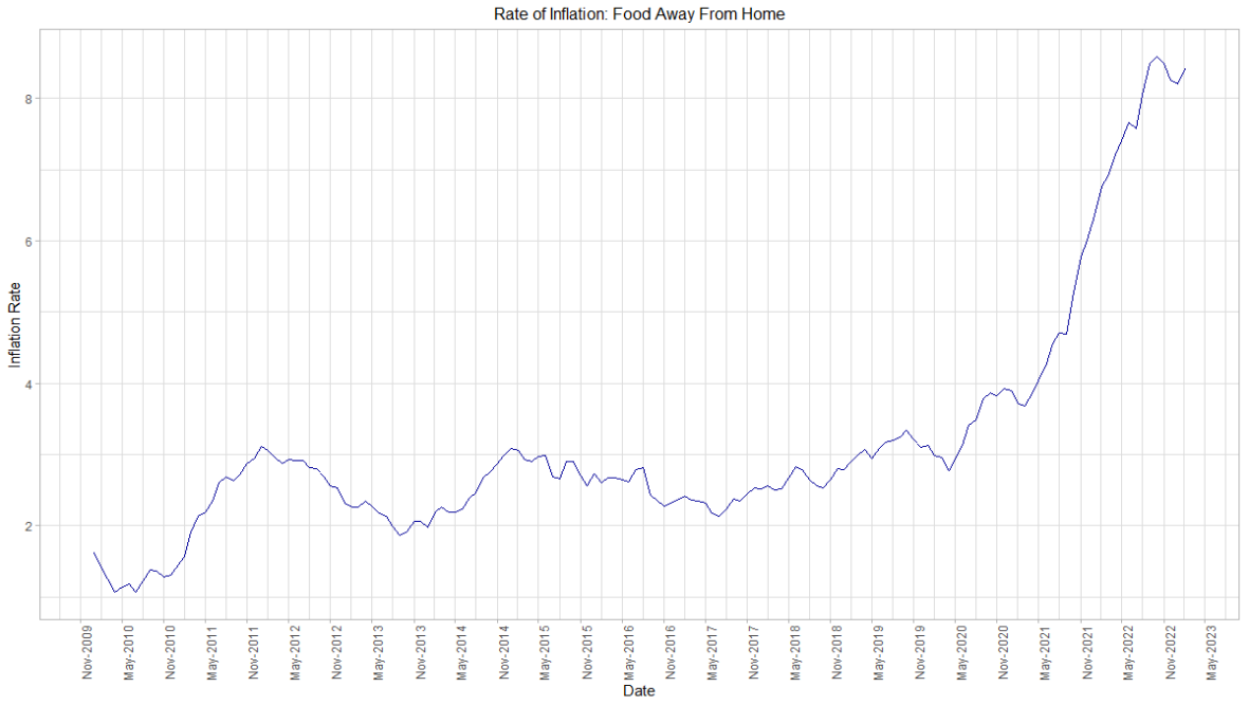
Figure 4: US National Food Price Inflation (at Home), 2000-Present



Source: Federal Reserve Economic Database (https://fred.stlouisfed.org/

[6] https://www.cnn.com/2020/04/26/business/meat-processing-plants-coronavirus/index.html
[7] https://www.redwoodlogistics.com/five-challenges-in-food-and-beverage-supply-chains/

Figure 5: US National Prepared Food Price Inflation (Away from Home), 2008-Present



Source: Federal Reserve Economic Database (https://fred.stlouisfed.org/)

The price inflation of food away from home (restaurant meals) is smaller than that for food consumed in home. (See Figure 5.) In 1980, the US experienced year-over-year inflation for food away from the home at rates above 10%. The availability of less-expensive "fast food" options in the US and creates a system with a little less upward pressure than we saw in 1980 and lower inflationary rates relative to food in the home. Regardless, this type of inflation has a significant negative impact on consumer's budgets. The trend we are seeing for grocery-store prices is not seen in restaurant meal prices – the prices of food-away-from-home is holding steady near 8.5% annually.

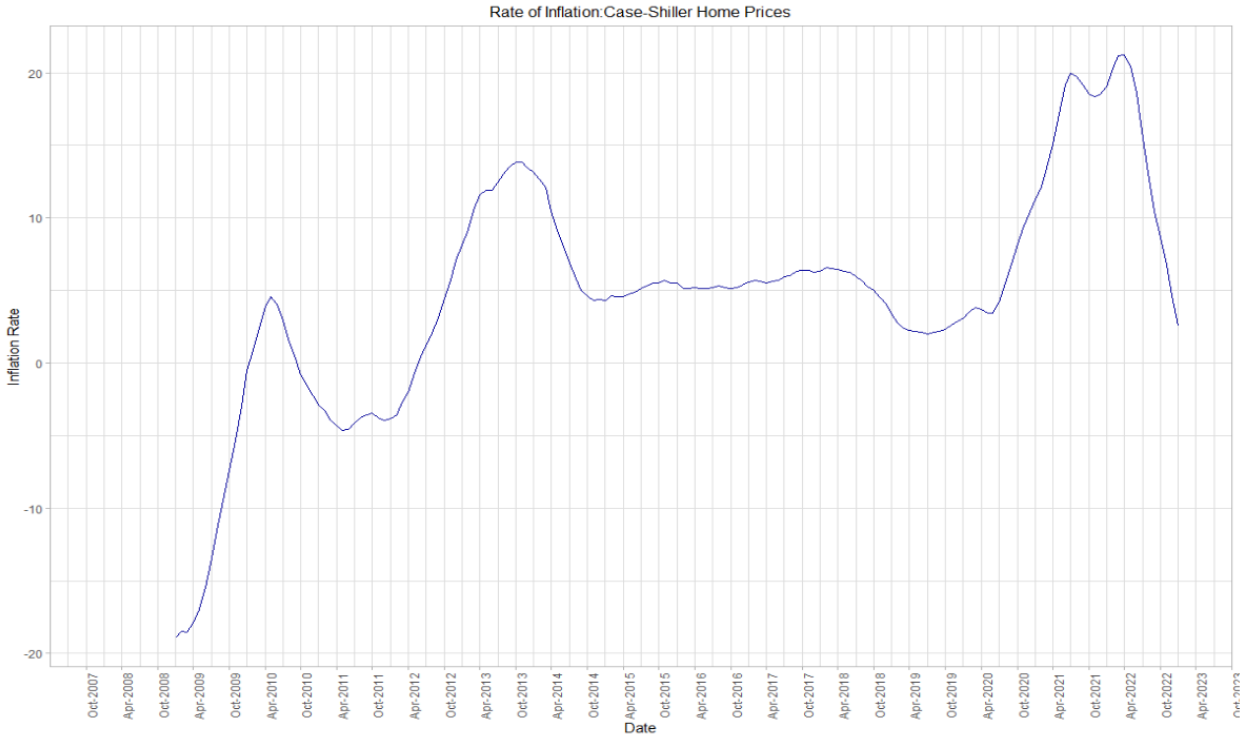
Inflation: Housing

Since early in the pandemic, the US has seen an upward spike in the price of single-family housing units. However, we are starting to see a reversal of this trend. An increase in inventories through the first half of 2022 have led to some downward pressure in prices. The dramatic increase in the Federal Funds target rate and, as a result, the increase in mortgage rates, has led to a decrease in the quantity demand for housing and is pushing down the price for homes. (See Figure 6.)

Figure 6: US National Residential Housing Inventory, February 2018-November 2022

Source: Redfin (https://www.redfin.com/news/data-center/)

Figure 7: US National Home Price Inflation Case-Shiller, 2009-Present



Source: Federal Reserve Economic Database (https://fred.stlouisfed.org/)

The Case-Shiller home price index (Figure 7) has shown a dramatic decrease in prices. We can also see the dramatic decrease in prices by examining the median sales price of houses (Figure 8) as well as the year-over-year change in the median price of housing (which is now slightly negative per Figure 9). Per Figure 10, new housing permits are also down substantially since early-2022. The price of housing is falling and the market is shifting, although just slightly, from a seller's market to a buyer's market. The rental cost of housing, however, has continued to increase. We are not confident that rental prices will fall or settle anytime in the near future. The relatively high mortgage rates (Figure 11) are pushing away potential "buyers", creating a larger rental pool and rental home demand. The increased demand for rental homes and the inability (or, perhaps, weariness) of new-home-buyers will continue to put upward pressure on rental prices. (See Figure 12 and Figure 13.)

Figure 8: Median Sales Price

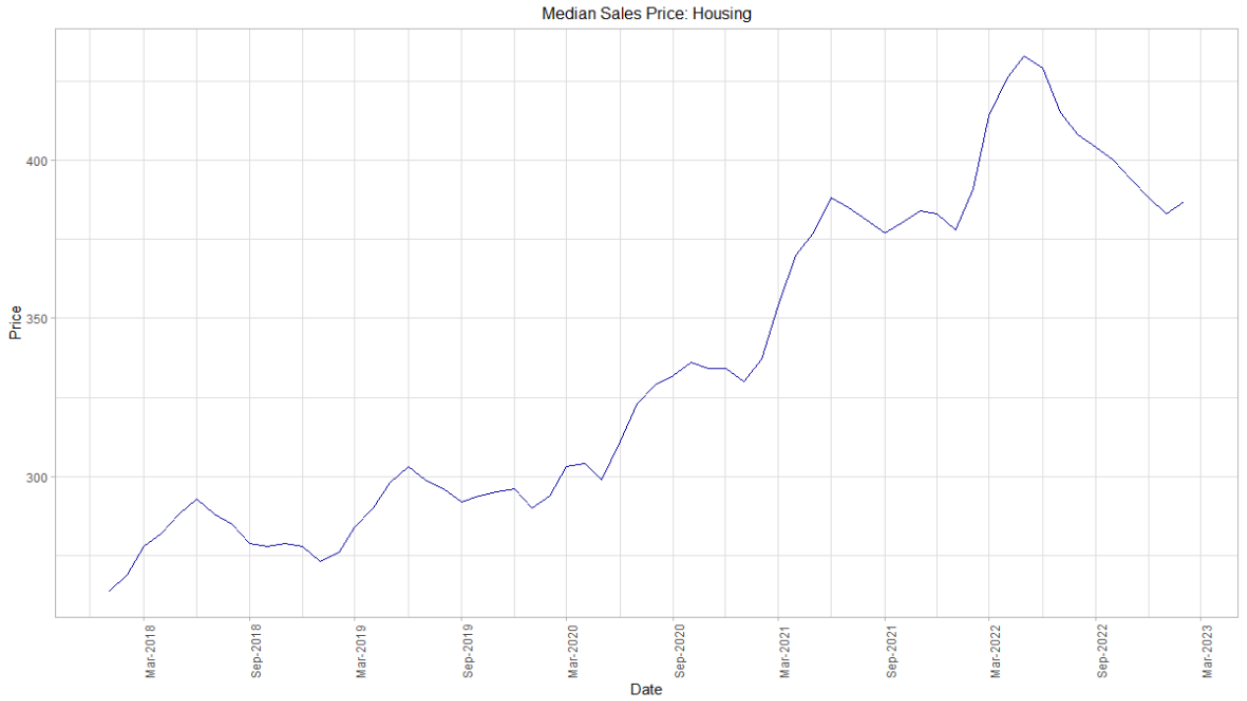
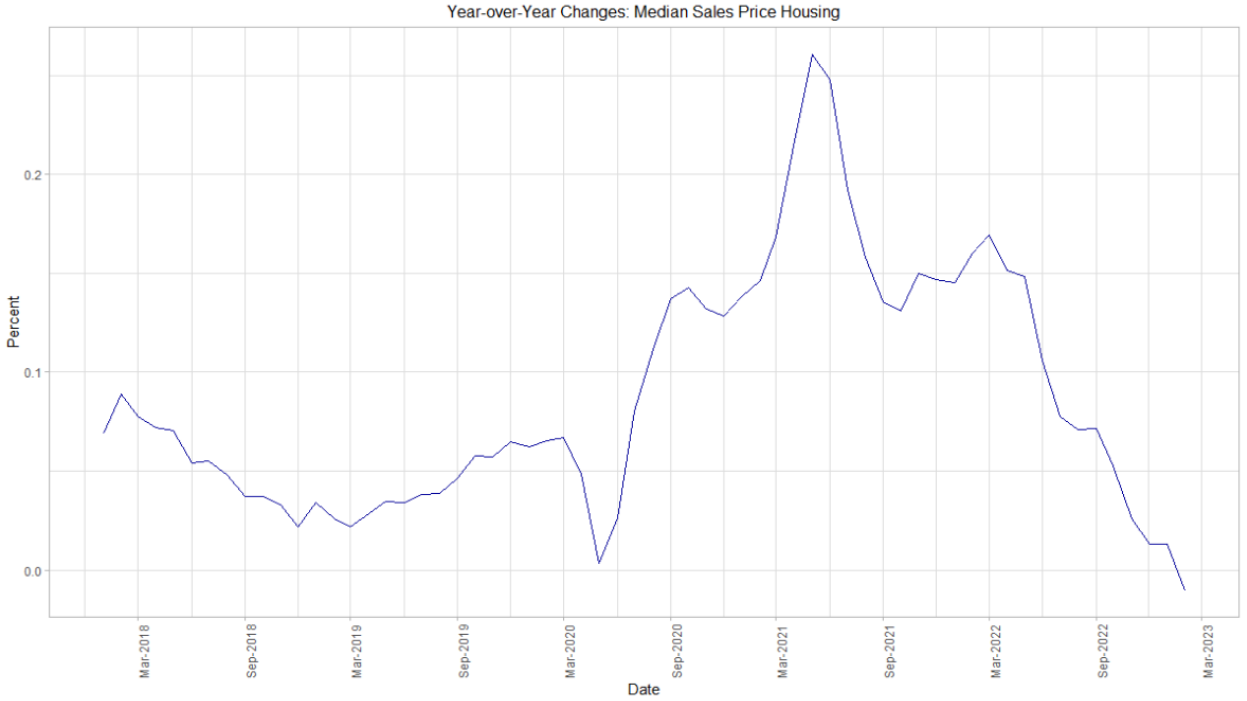
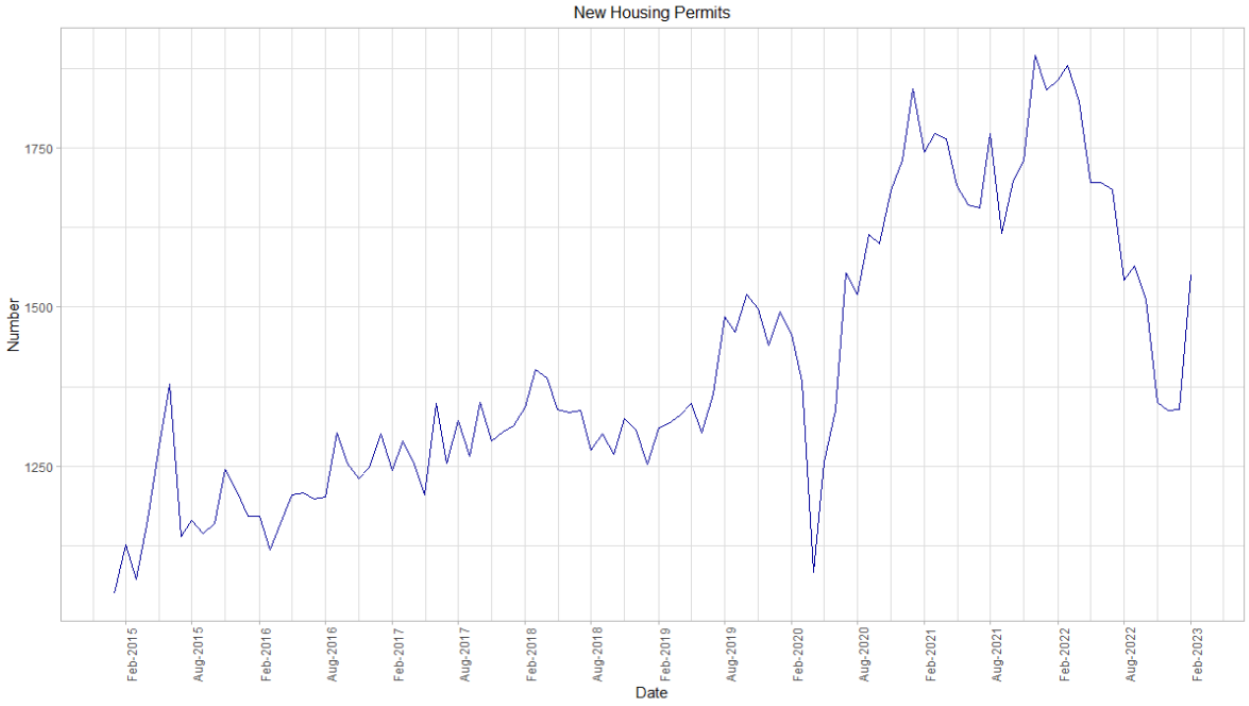


Figure 9: US National Home Price Inflation (Redfin), Feb 2018-Nov 2022



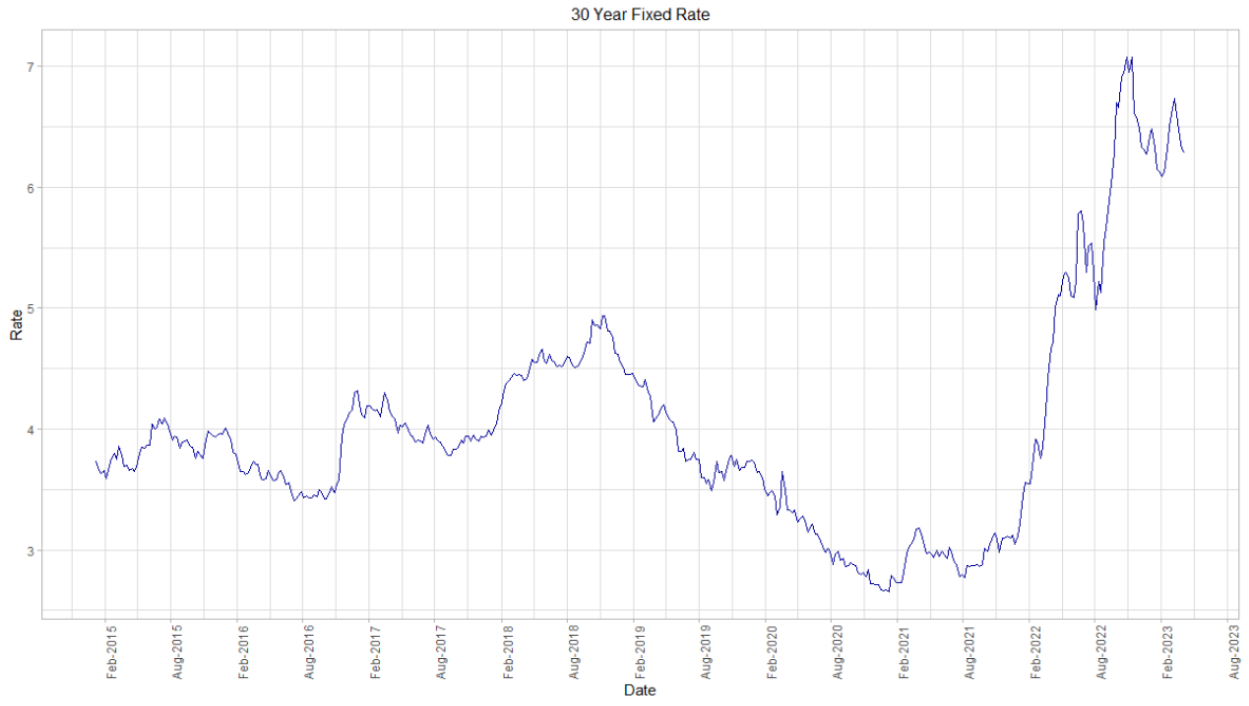
Source: Redfin (https://www.redfin.com/news/data-center/)

Figure 10: US National New Home Construction Permits, January 2015-Present



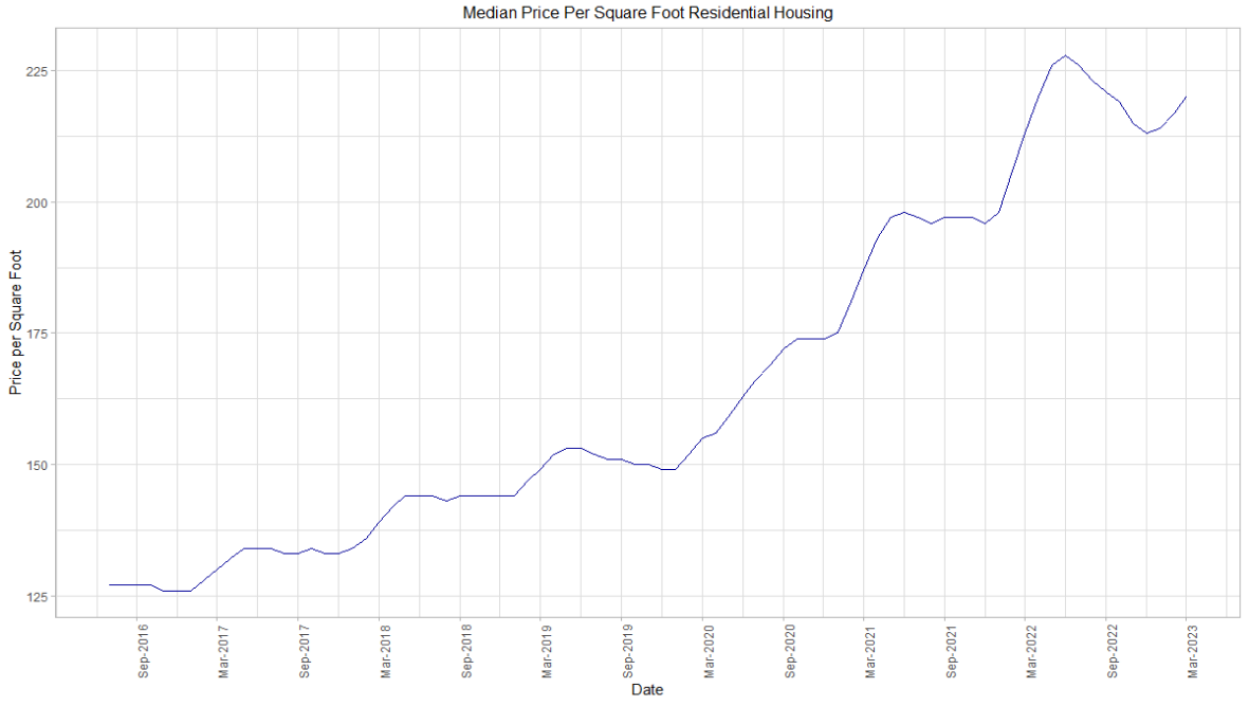
Source: Federal Reserve Economic Database (https://fred.stlouisfed.org/)

Figure 11: 30-year Fixed Mortgage Rate



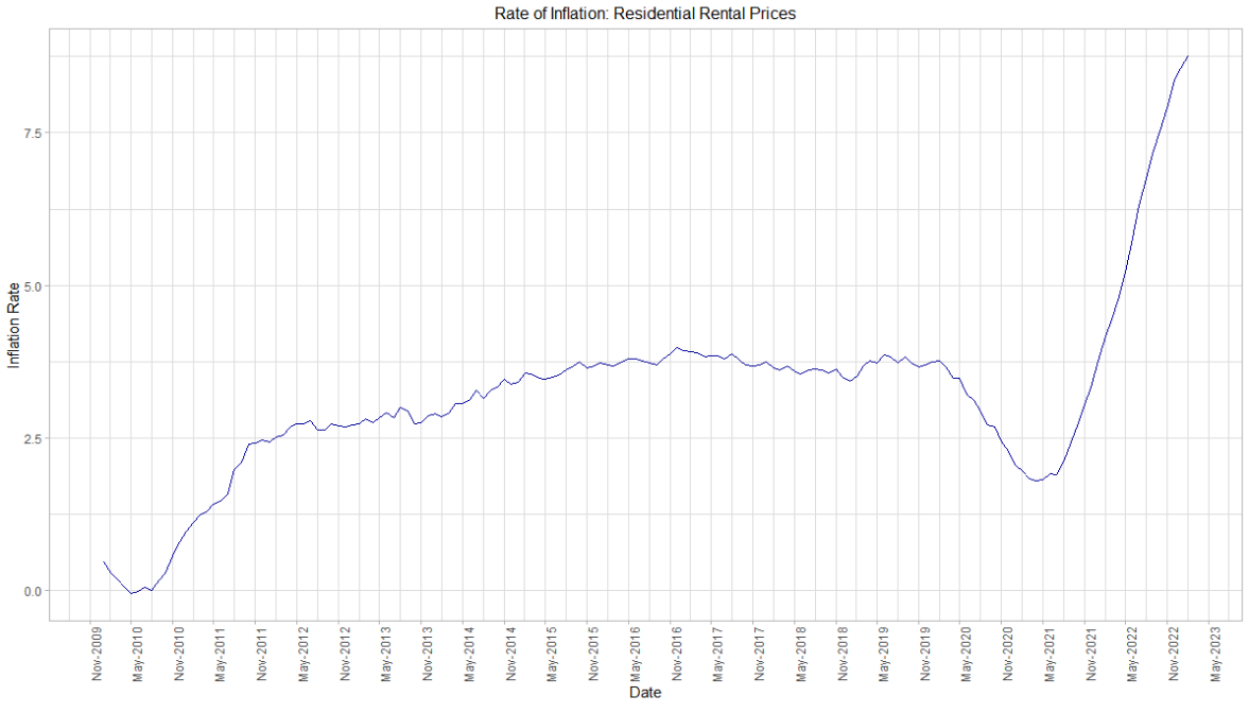
Source: Federal Reserve Economic Database (https://fred.stlouisfed.org/)

Figure 12: US National Residential Median Price per Square Foot, July 2016-Present



Source: Federal Reserve Economic Database (https://fred.stlouisfed.org/)

Figure 13: US National Residential Rental Prices, 2008-Present

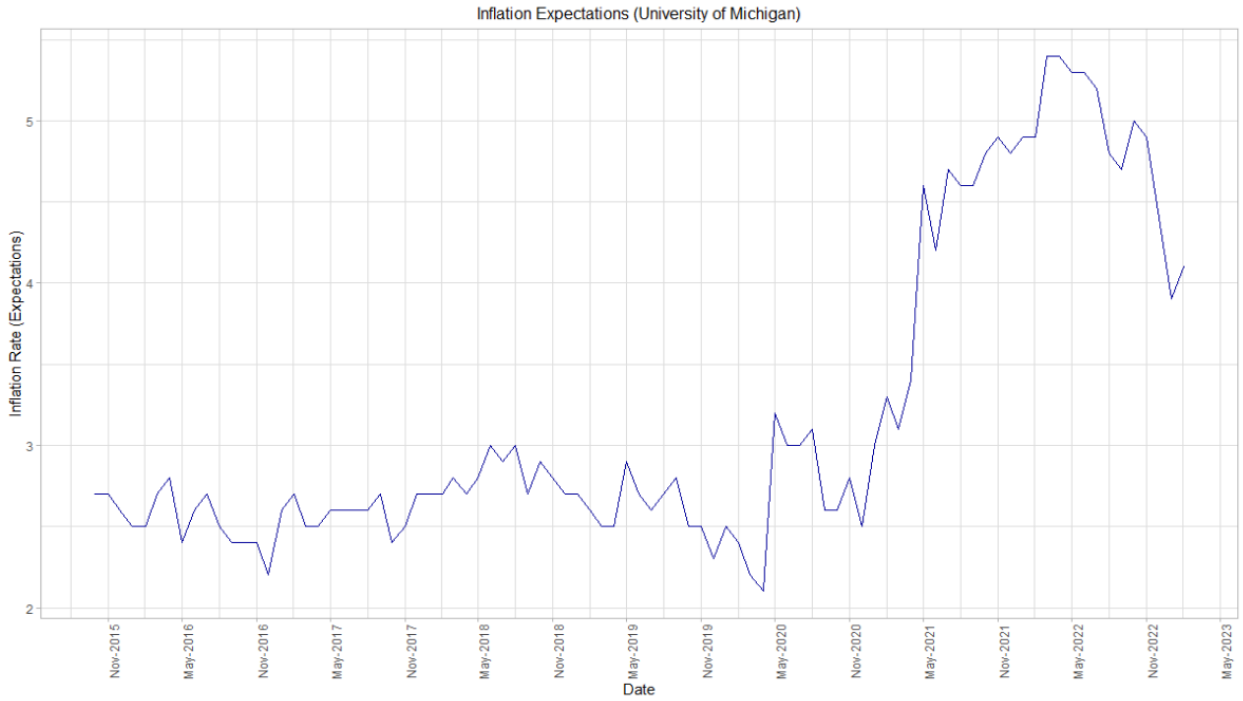


Source: Federal Reserve Economic Database (https://fred.stlouisfed.org/)

Inflation: Summary

Consumers are extremely aware of the inflationary trends of the US. The inflationary expectations (as shown in Figure 14 and Figure 15, from the University of Michigan) suggest that consumers have anticipated that inflation will start to fall by small amounts. This is probably less reflective of an awareness of how Federal Reserve Bank policies work and more a reflection that consumers have heard that an increase in interest rates "should" control inflationary trends. The Fed's policy has been broadly covered, by media sources on the left and right sides of the aisle (i.e., CNN[8], Fox[9], and Newsmax[10]); consumers have been alerted to these policies and range of outcomes stemming from these policies (e.g., a recession[11]). Perhaps because of these revelations (or because consumers are having difficulties with their budgets), consumer confidence in the economy has continued to decline. However, there is a recent sliver of hope: we are seeing inflationary pressures easing and are starting to see a rebound in consumer confidence.

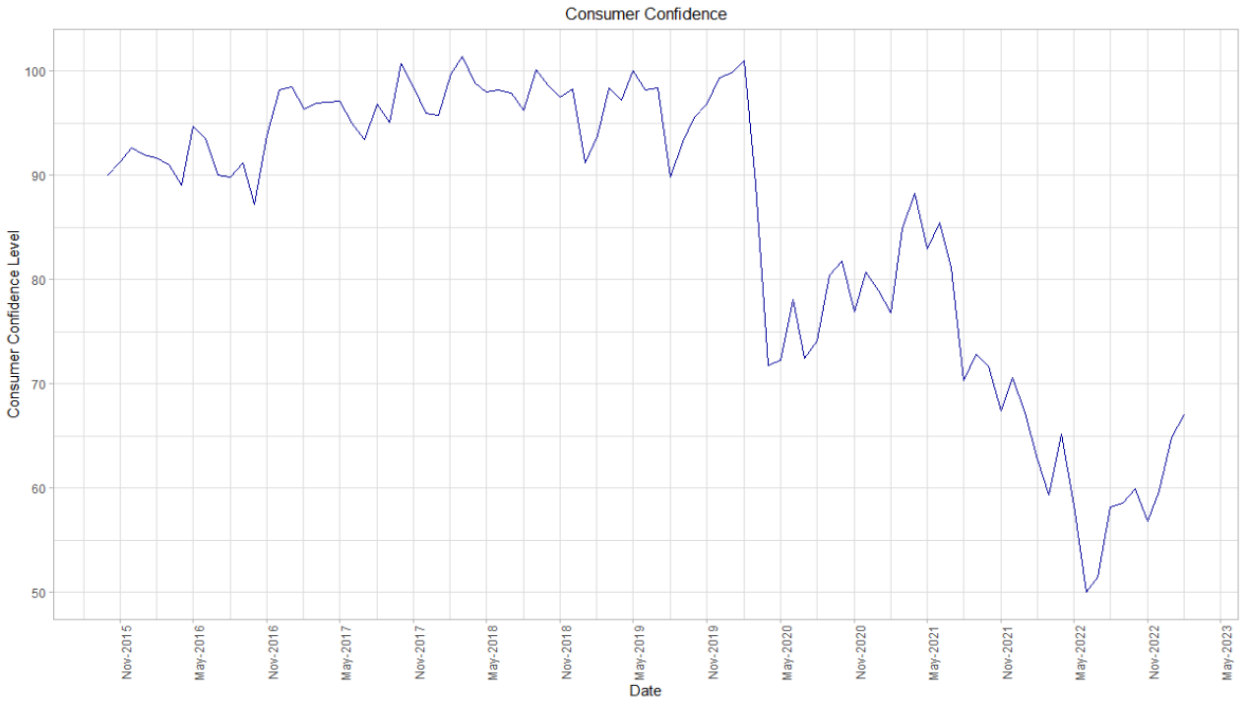
Figure 14: US Consumer Inflation Expectations



Source: Federal Reserve Economic Database (https://fred.stlouisfed.org/)

[8] https://www.cnn.com/2022/06/15/economy/fed-rate-hike-decision-june/index.html
[9] https://www.foxbusiness.com/economy/fed-could-break-economy-aggressive-rate-hike-campaign-analyst-says
[10] https://www.newsmax.com/finance/streettalk/federal-reserve-75-basis-point-rate-hike-inflation-jerome-powell-recession/2022/06/15/id/1074589/
[11] Supra 16, 17, and 18

Figure 15: US National Consumer Confidence

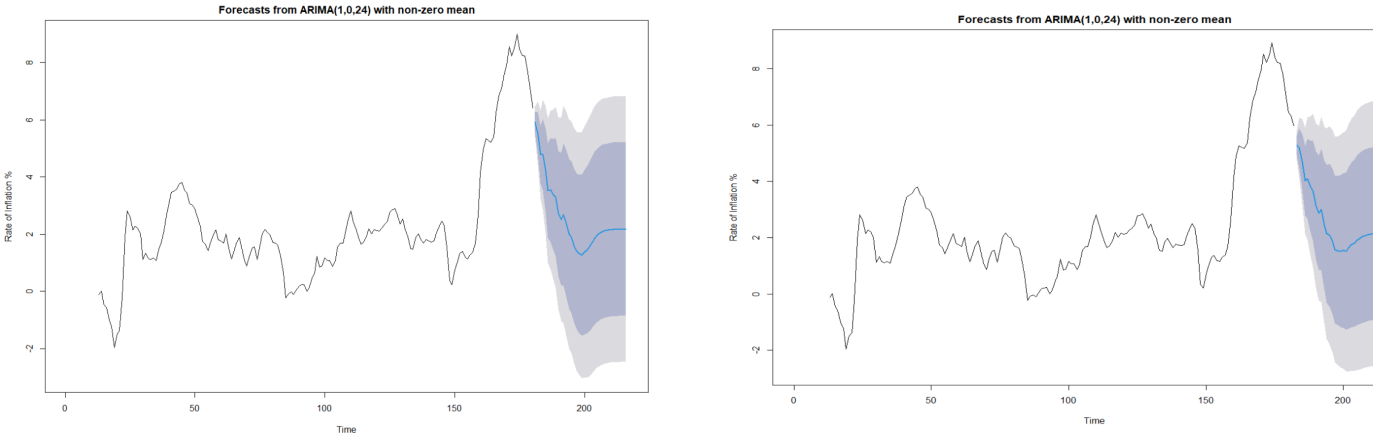


Source: Federal Reserve Economic Database (https://fred.stlouisfed.org/)

Our models (both the 24-month and 36-month horizon) for forecasting inflation have proven to be true for the movement in inflation (See Figure 16 and Source: Authors' calculations based on CPI

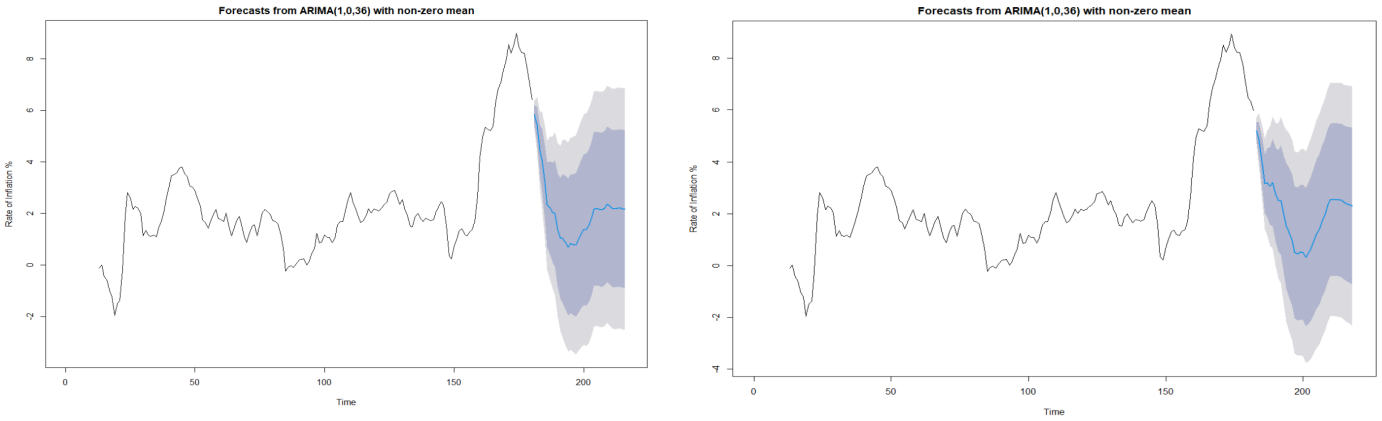
Figure 17.) Our models continue to predict that inflation in the US will move toward 6% this Summer and perhaps land at 5.25 – 5.75% by the end of 2023. (ref. Figure 18)

Figure 16: 24-month ARIMA Model for US Inflation: Prediction from Q3 (Left Panel) and Current Prediction (Right Panel)



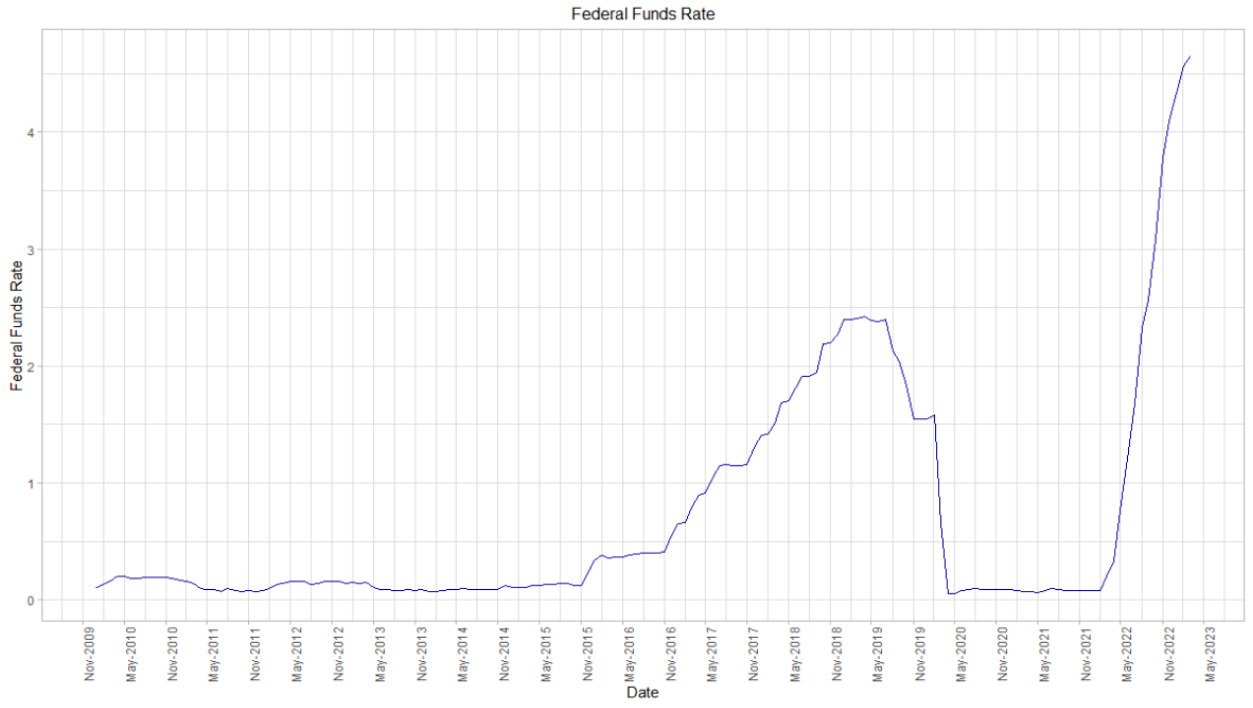
Source: Authors' calculations based on CPI

Figure 17: 36-month ARIMA Model for US Inflation: Prediction from Q3 (Left Panel) and Current Prediction (Right Panel)



Source: Authors' calculations based on CPI

Figure 18: Effective Federal Funds Rate, 2010-Present



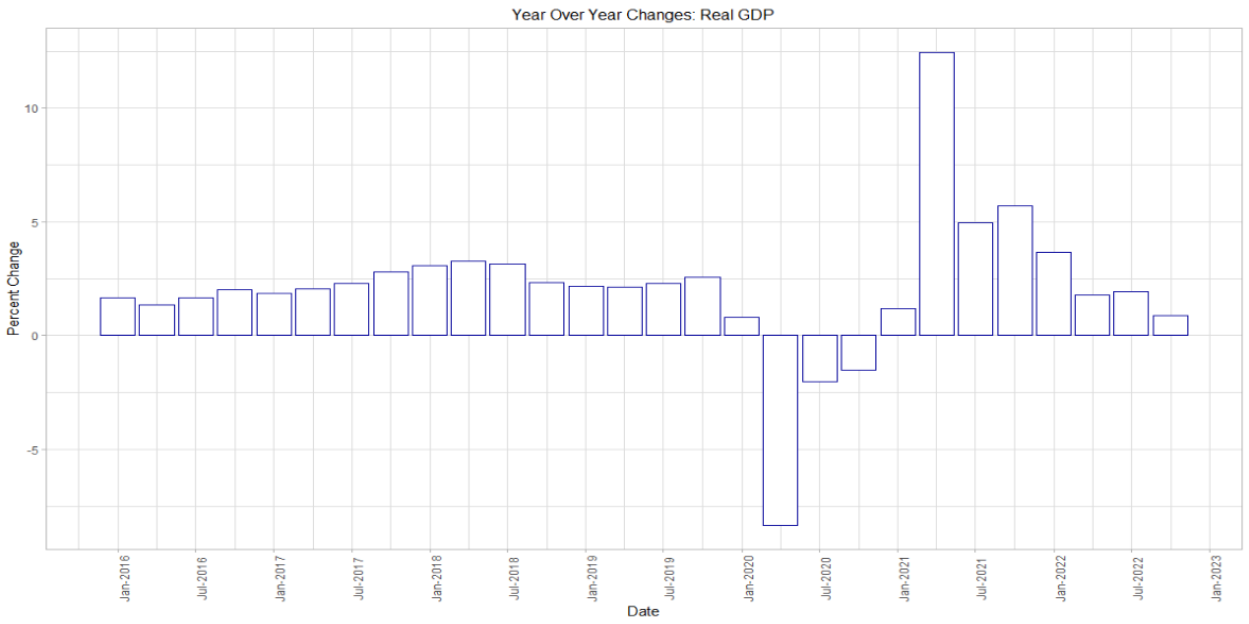
Source: Federal Reserve Economic Database (https://fred.stlouisfed.org/)

Macroeconomic Indicators: Other

The Real GDP of the United States is still growing, although we did experience two periods of negative quarter-over-quarter growth for the real GDP during 1Q2022 and 2Q2022 (see Figure 19 and Figure 20). Although the definition of a recession isn't technically tied to this metric, it is important to note that the US real GDP did "freeze" at the beginning of last year. The size of this negative growth is comparable to what we saw in this same period in 2011 and 2014 and isn't a concern by itself. When we look at this

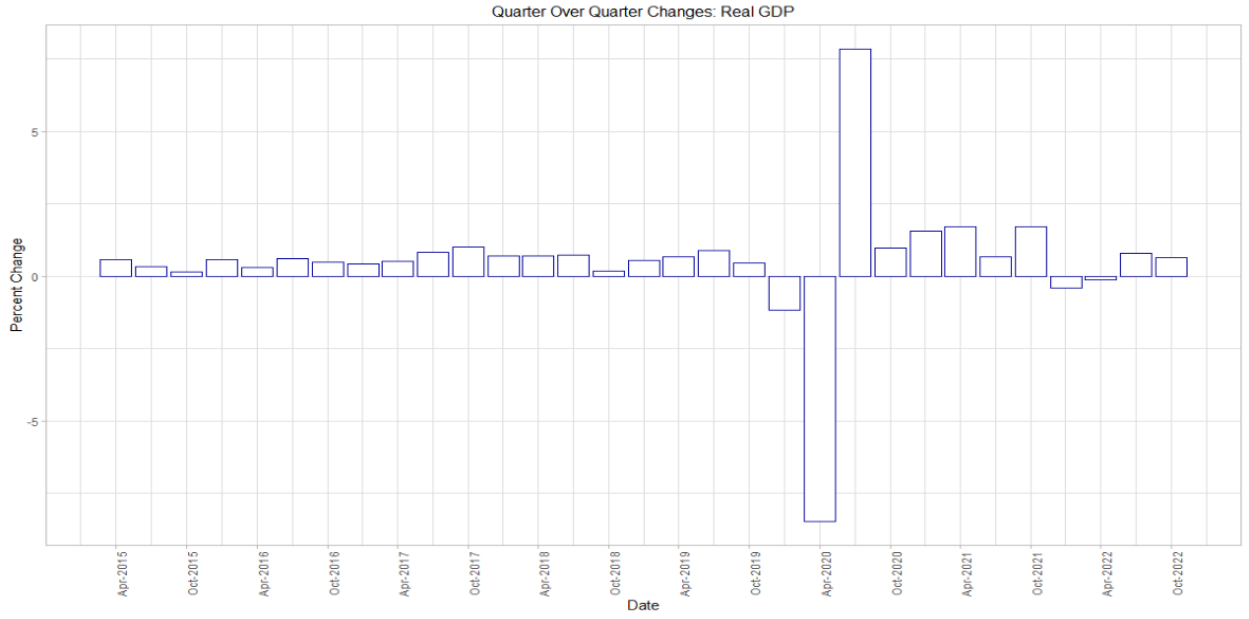
trend in conjunction with the high inflationary element of the economy, the lack of labor-force participation, and the depressed market returns for the last year (-18% returns for the S&P for 2022), ***we conclude that the US is operating in a growth recession.***

Figure 19: Y/Y Change in Real GDP



Source: Federal Reserve Economic Database (https://fred.stlouisfed.org/)

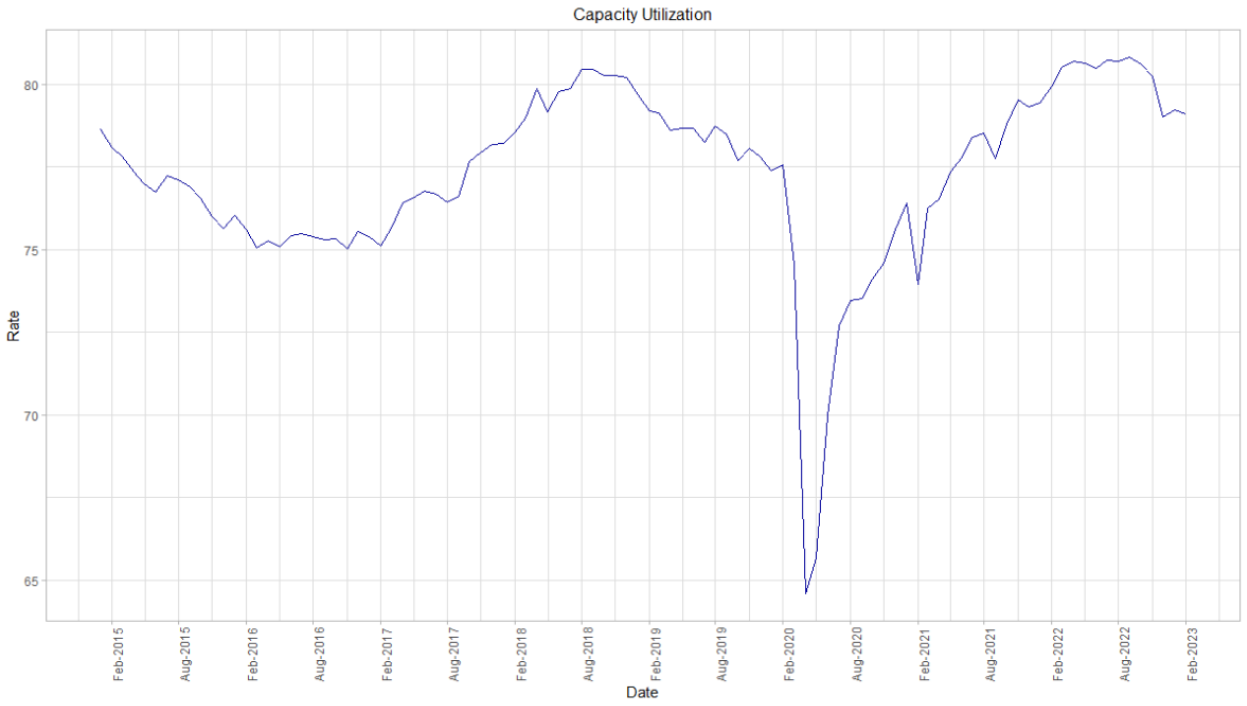
Figure 20: Q/Q % Change in Real GDP



Source: Federal Reserve Economic Database (https://fred.stlouisfed.org)

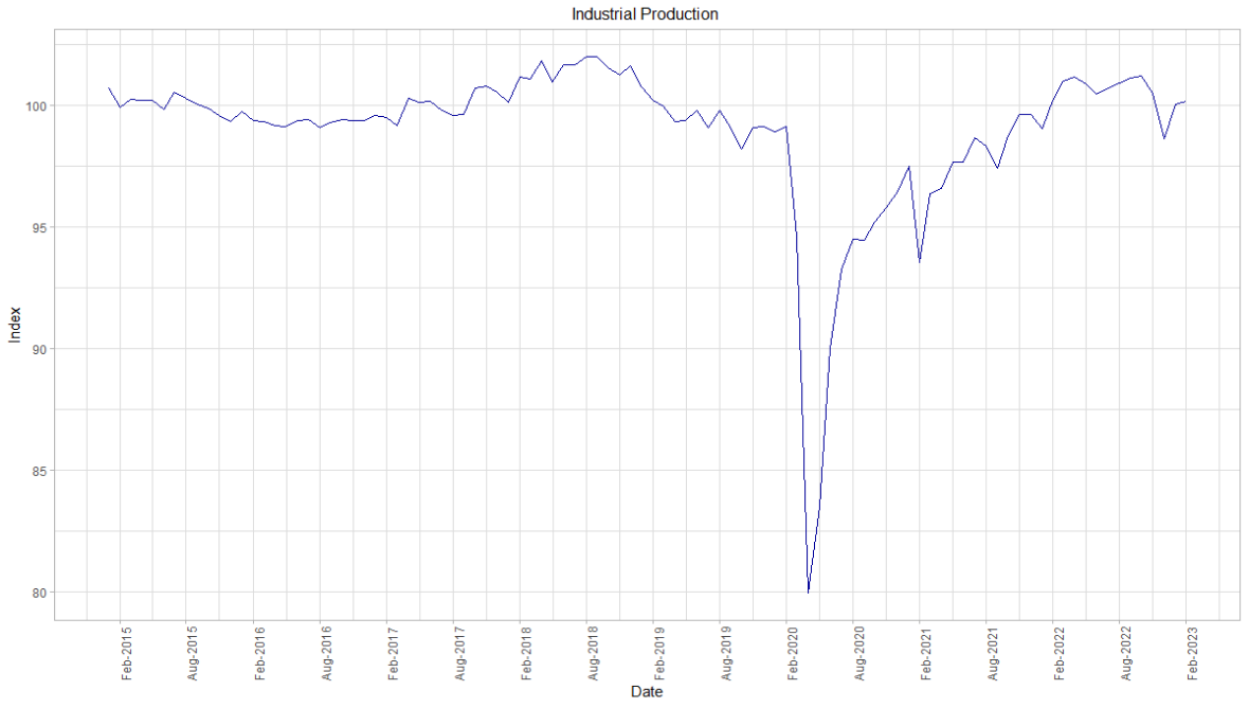
Figure 21 and Figure 22 identify capacity utilization and industrial production have reached and surpassed pre-pandemic levels. We will need to keep a closer eye on these trends; historically, downward trends in these indicators are consistent with economic recessions.

Figure 21: Capacity Utilization



Source: Federal Reserve Economic Database (https://fred.stlouisfed.org)

Figure 22: Industrial Production Index

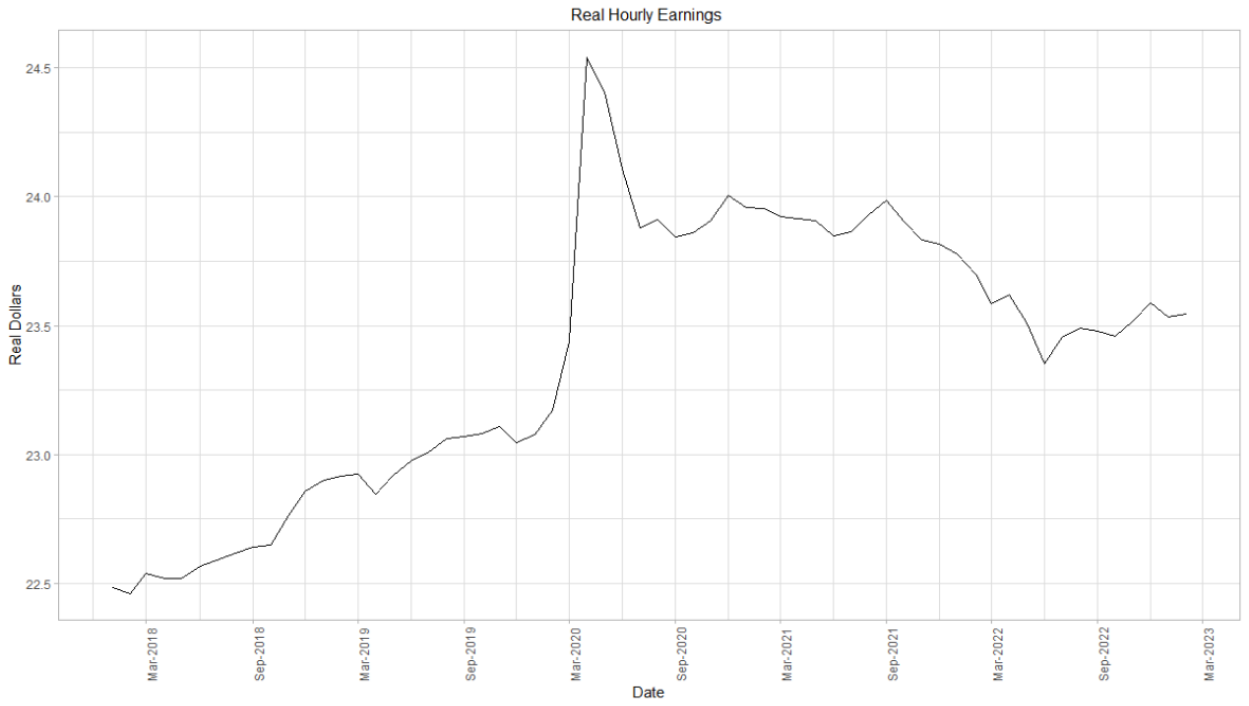


Source: Federal Reserve Economic Database (https://fred.stlouisfed.org)

Inflations & Real Wages

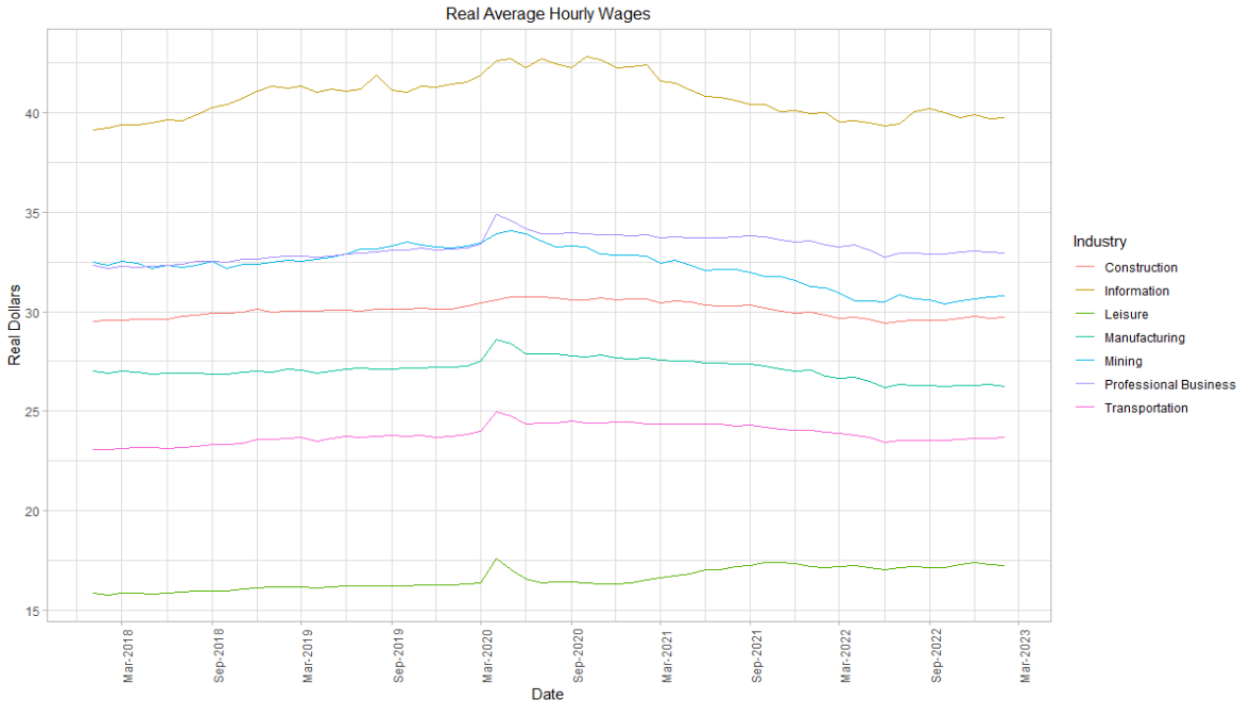
Figure 23 and Figure 24 show national overall average real wages, and national average real wages by industry. The real wages for the US have shown a continued downward trend. Although nominal wages are increasing slightly, the buying power of those wages have decreased significantly as the result of the near double-digit inflation. The construction sector and the manufacturing sector are showing slight upward trends in real wages. There is some concern that the US might be heading caught in an inflation-wage spiral – where overall inflation has upward pressure on wages, which, in turn, puts upward pressure on prices, which leads to more wage inflation. There is little evidence that the entire economy is caught in a wage-inflation web. Rather, there seems to be some wage inflation in a select number of industries. Most sectors are experiencing a decline in real wages.

Figure 23: Real Hourly Wages (Nationwide)



Source: Federal Reserve Economic Database (https://fred.stlouisfed.org)

Figure 24: Real Hourly Wages for Select Industries (Nationwide)



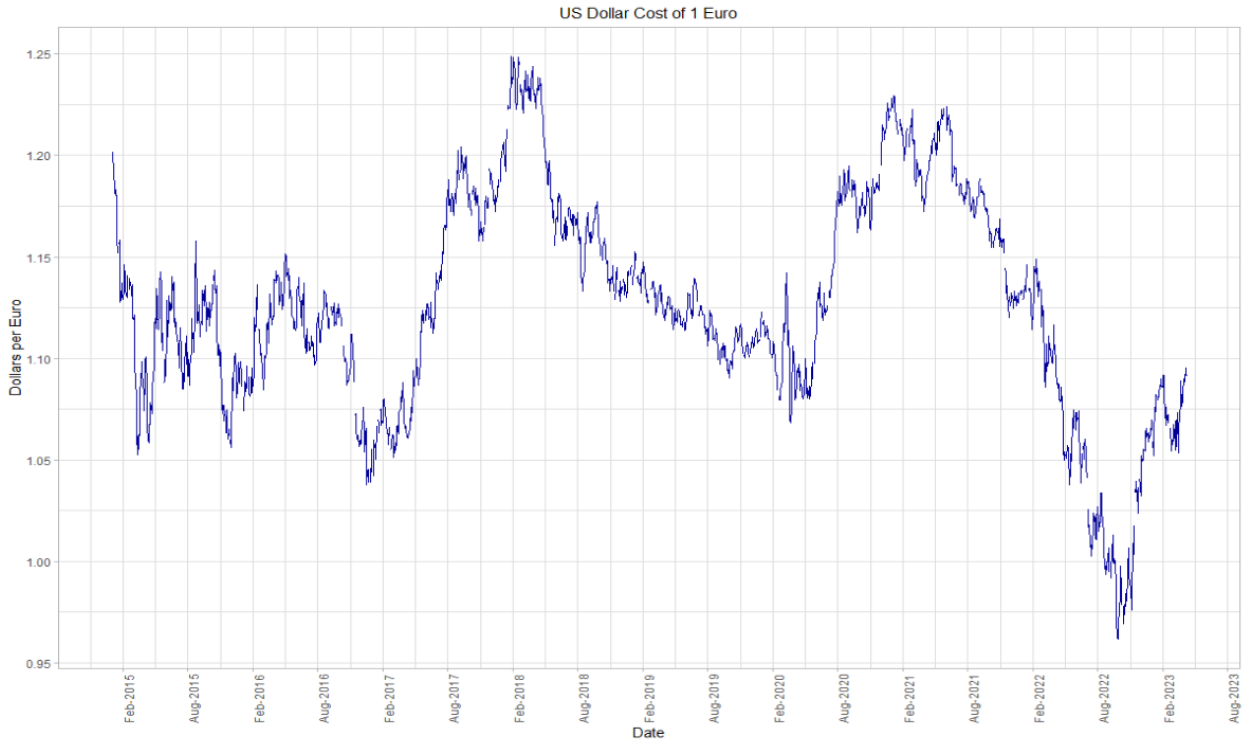
Source: Federal Reserve Economic Database (https://fred.stlouisfed.org)

Exchange Rates, Dollar-Euro Parity and Dollar-Pound Sterling Parity

Figure 25 and Figure 26 show the exchange rate between the dollar and the Euro and the dollar and the British Pound, respectively; the dollar is appreciating against both of those currencies. The political costs of changing prime ministers (following the turmoil of Prime Minster Boris Johnson), and the impact of the Russian-Ukraine conflict in Europe, has weakened the economies of the UK and of Europe, driving down the demand for Euros and Pounds relative to the dollar. Although the economic outlook of the US is not certain (and looks as if the US is either in a recession or headed towards one), the economic trends in the UK and Europe are no better. Although the appreciation of the dollar against these currencies may create opportunities for US foreign travel, the most likely impact will be in decreasing US exports to the UK and Europe.

Farmers are currently concerned about possible export bans of GMO corn to Mexico[12] and additional soft demand for US agricultural products that could create a depressed situation in the Midwest farming communities. We believe that as the Midwest goes, so goes the rest of the United States. A decrease in farming exports will result in a decrease in the prices of corn and other US crops, placing downward pressure on farm revenues and increasing the likelihood of farm loan default. This scenario plays into the prediction that the US is either in or headed towards an economic slowdown.

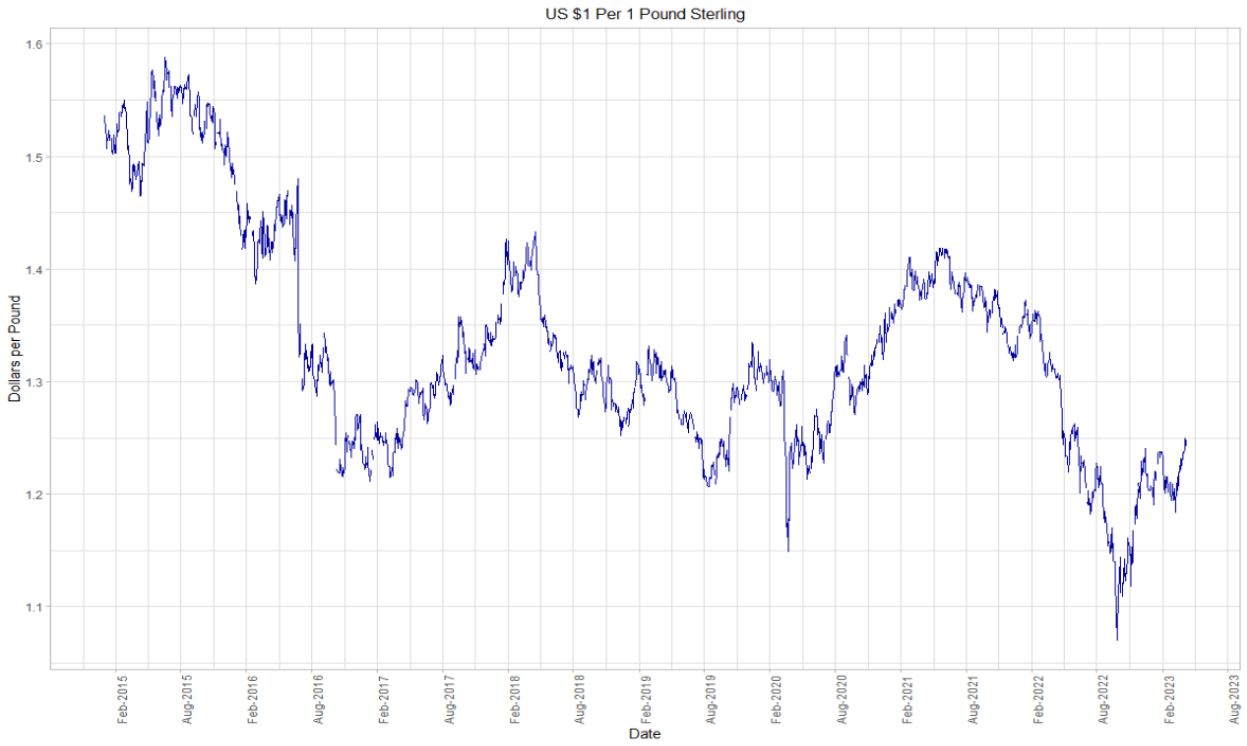
Figure 25: Euro / Dollar Spot Rate (Euros Per USD)



Source: Federal Reserve Economic Database (https://fred.stlouisfed.org)

[12] https://www.kcur.org/news/2021-10-20/the-u-s-agriculture-secretary-says-mexicos-gmo-ban-wont-hurt-corn-exports

Figure 26: British Pound Sterling / US Dollar Spot Rate (BPS per USD)



Source: Federal Reserve Economic Database (https://fred.stlouisfed.org)

Unemployment and Labor Force Participation

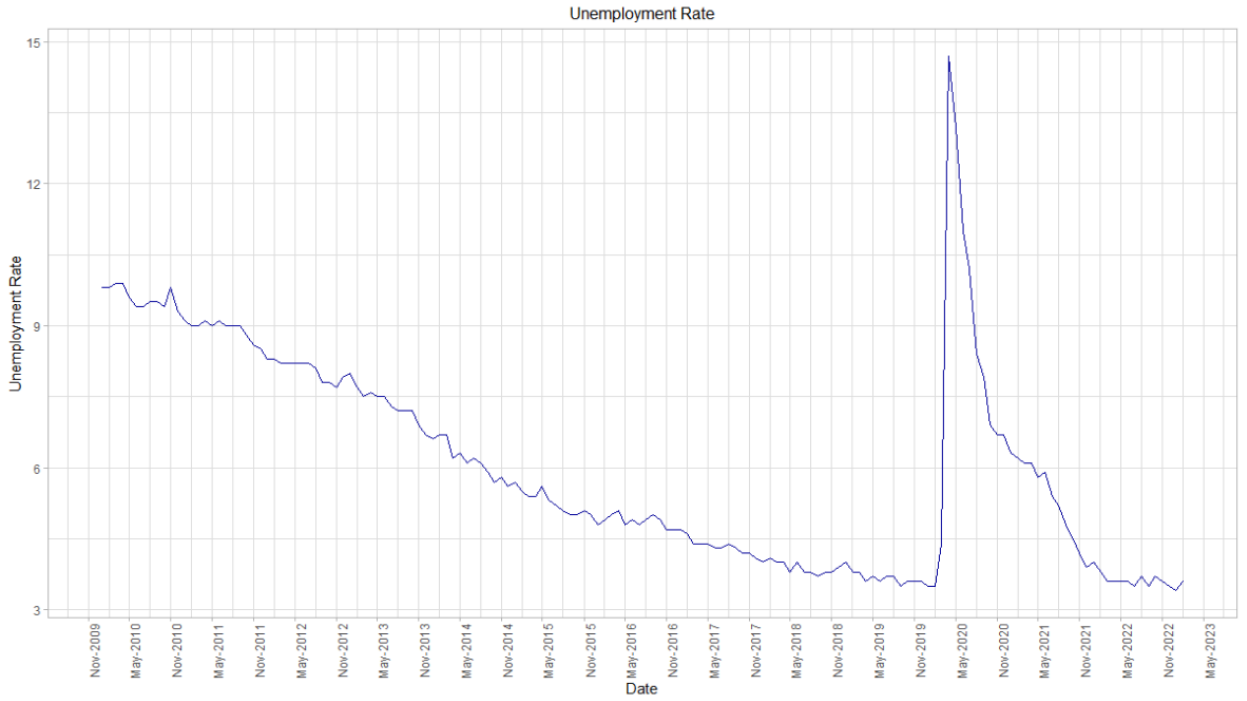
Although the current unemployment rate (3.6%) is nearly as low as the month before the start of the pandemic (3.5%, March 2020, per Figure 27), the employment situation is still unstable and is a continued cause for concern. The labor force participation rate (Figure 28) has not reached pre-pandemic levels. The labor force participation rate is ticking up a little bit, but not at the magnitude needed to fulfill the plethora of job vacancies. The differences in the labor force participation rate across genders and races shows that only black men and Hispanic men have surpassed their participation rates prior to the pandemic.

We do believe that, with the fear of the US slipping into a recession and the declines in the equities and crypto currency markets, ***we believe that the US will experience an increase in the labor force participation rate***. Recent stories of rescinded offers[13] and layoffs by Ford[14], Stanley Black & Decker[15], Peloton[16], and Goldman Sachs[17] are likely to push "potential" employees (those on the fence) back into the labor market. The labor market participants have continued to be stubborn; we anticipated that "former" labor market participants would have made their re-entrance into the market after the omicron variant. The concern for this market, however, is that labor market hold-outs will enter back into the market as the economy is falling into a recession. In this case, the labor demand will be falling

[13] https://www.efinancialcareers.com/news/2022/09/revolut-graduates, https://www.wsj.com/articles/the-surprise-in-a-faltering-economy-laid-off-workers-quickly-find-jobs-11661333405, and https://www.nytimes.com/2022/09/07/technology/recruiters-tech-layoffs.html
[14] https://www.wsj.com/articles/ford-confirms-layoffs-says-it-is-cutting-about-3-000-jobs-primarily-in-u-s-and-canada-11661180161
[15] https://www.wsj.com/articles/stanley-black-decker-cuts-about-1-000-finance-jobs-as-part-of-cost-savings-drive-11664568393
[16] https://www.wsj.com/articles/peloton-to-cut-another-500-jobs-in-last-bid-for-turnaround-11665011471
[17] https://www.wsj.com/articles/goldman-sachs-plans-to-cut-hundreds-of-jobs-11663002265

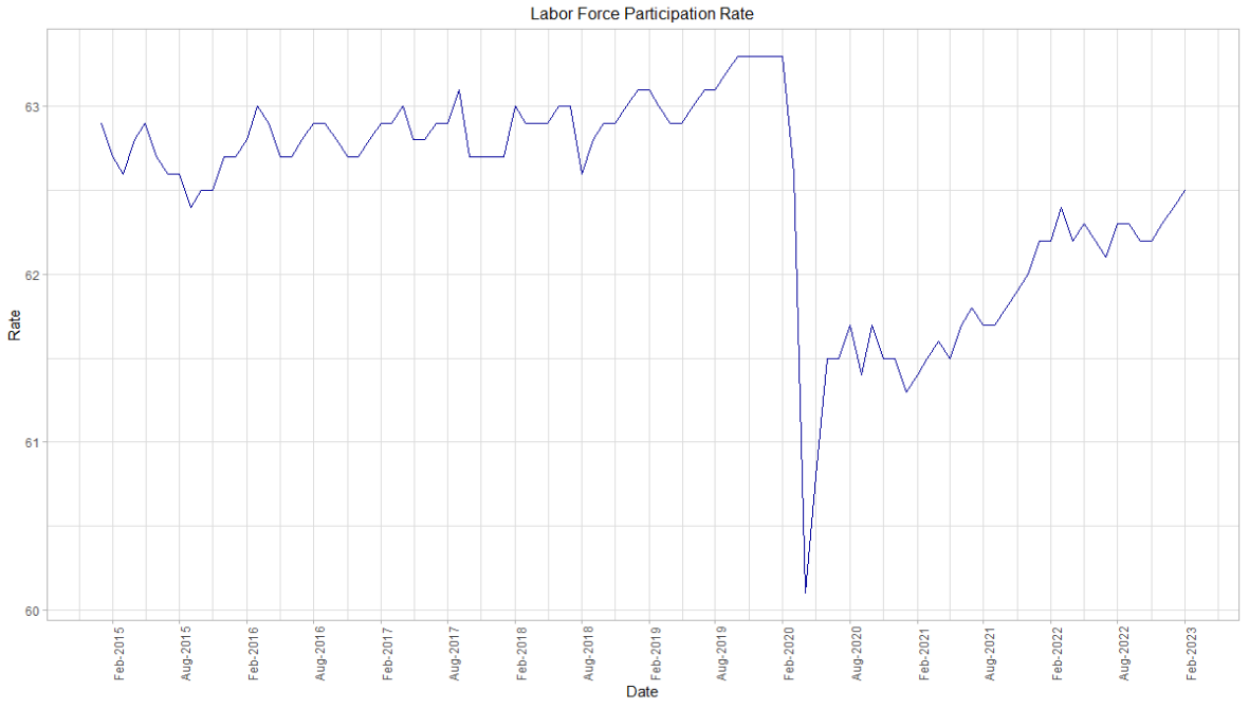
just as labor supply starts to uptick. This would not be a surprise given how asynchronous and out-of-step the labor market seems to be. (See Figure 30 and Figure 31.)

Figure 27: US National Unemployment Rate



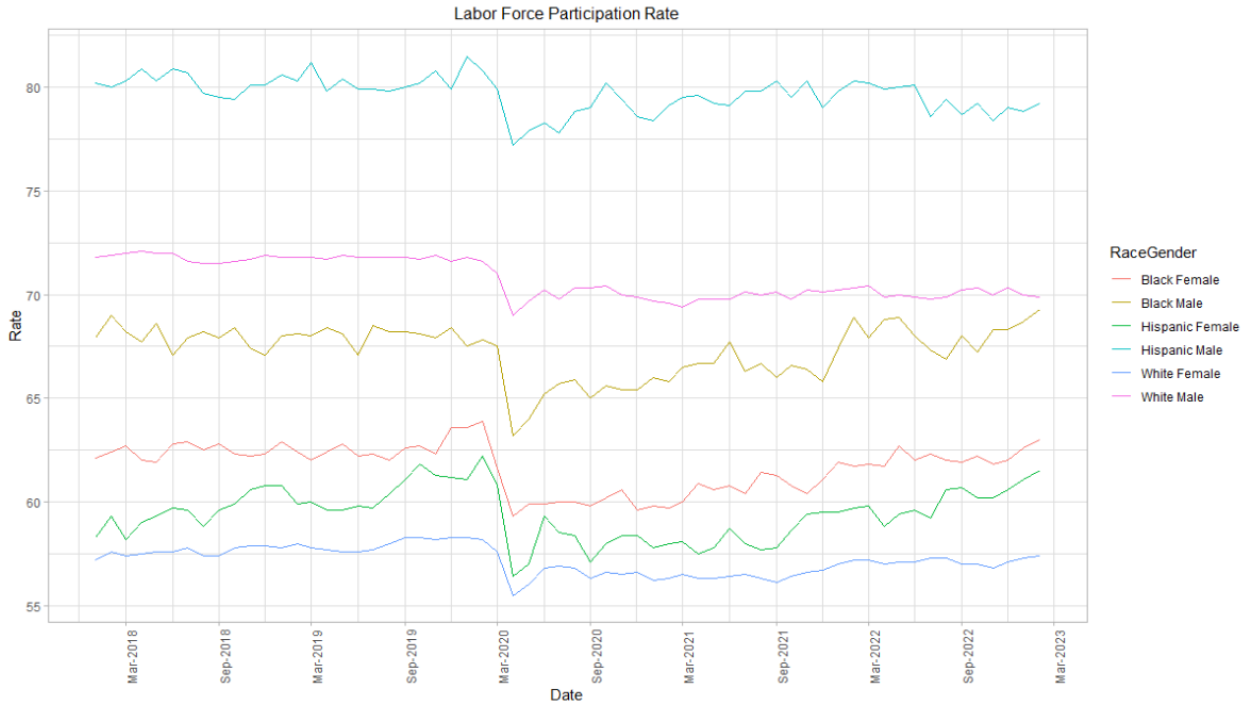
Source: Federal Reserve Economic Database (https://fred.stlouisfed.org)

Figure 28: US National Labor Force Participation Rate



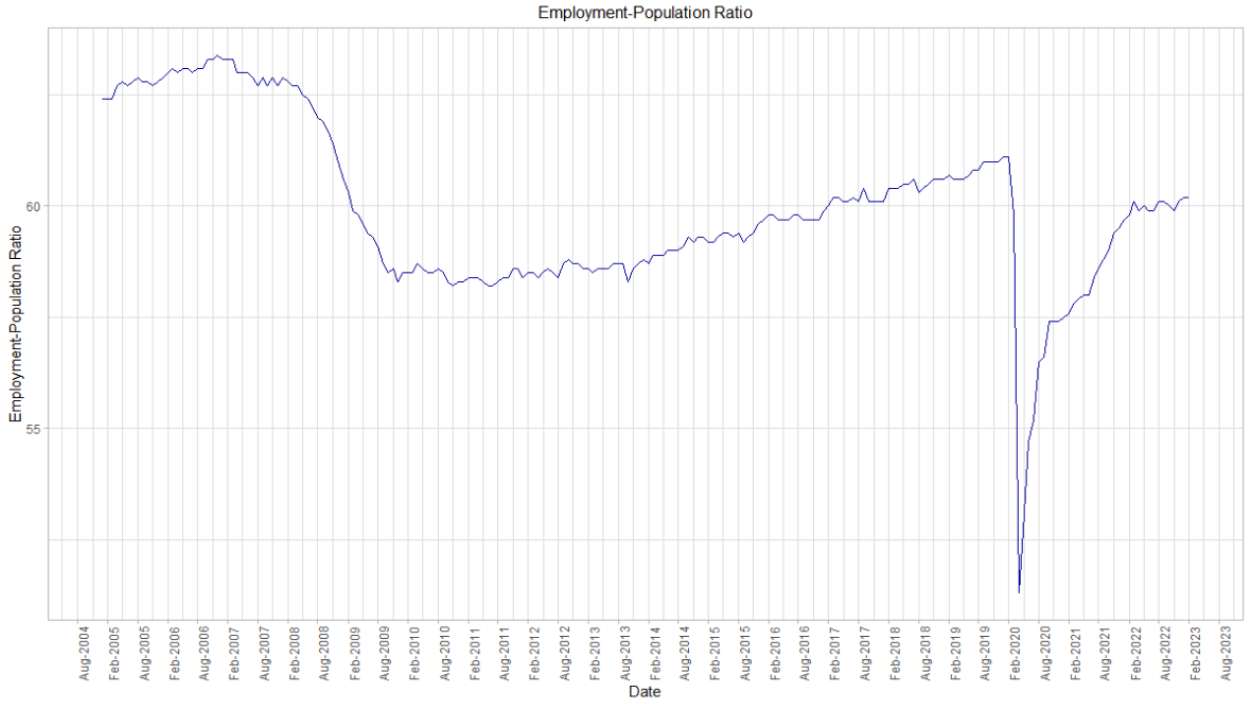
Source: Federal Reserve Economic Database (https://fred.stlouisfed.org)

Figure 29: US National Labor Force Participation Rate per Race & Gender



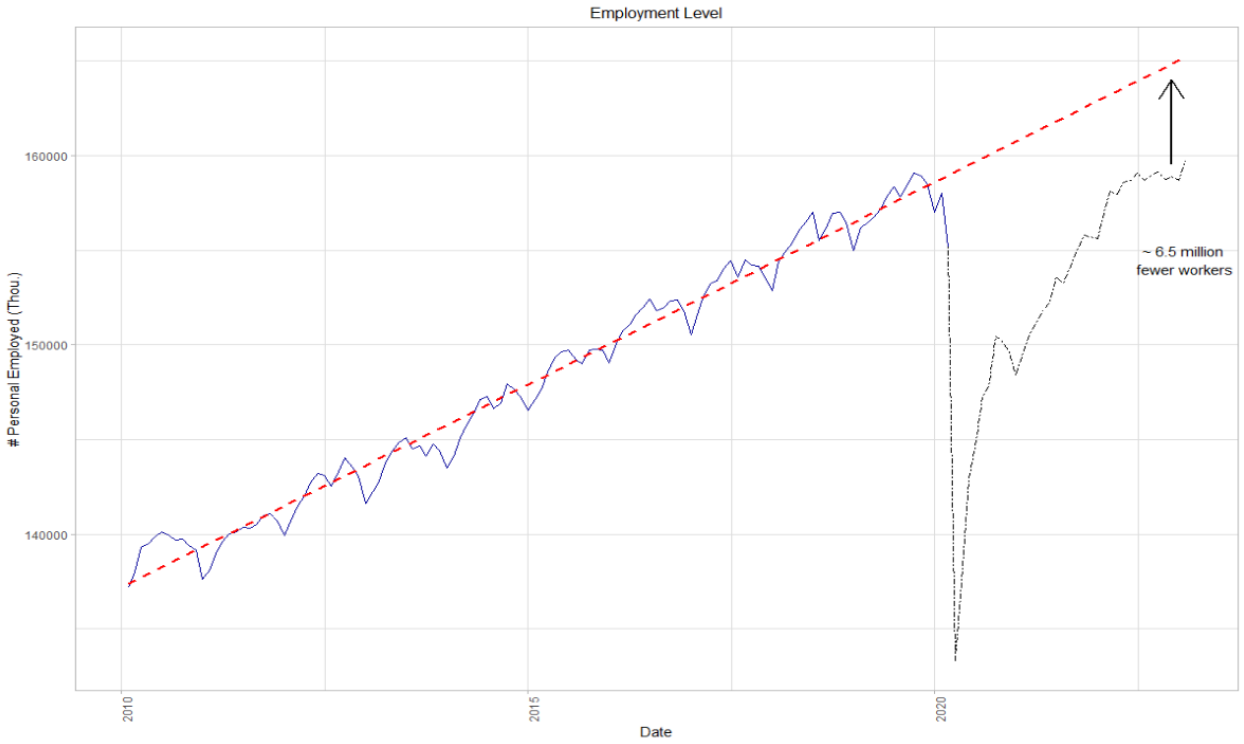
Source: Federal Reserve Economic Database (https://fred.stlouisfed.org)

Figure 30: US Employment to Population Ratio (%)



Source: Federal Reserve Economic Database (https://fred.stlouisfed.org)

Figure 31: Employment Level (Nationwide)



Source: Federal Reserve Economic Database (https://fred.stlouisfed.org

Disruptive ("Black Swan") Events

The past five years have seen several unusual events that had a substantial impact on the national and/or global events that warrant mentioning. We mention them from the perspective of considering whether any of these types of events could occur again in the near future, and planning for their potential impact on the economy and or business operations would seem prudent.

1. Biological Events: The world has seen a number of new "Influenza-Like Illnesses" (ILI), with the latest now directly affecting virtually every country on the global in a crippling fashion.

   A. SARS (2002 & 2004)
   B. "Swine flu" (H1N1, 2009)
   C. "Avian flu" (H5N1 in 1997; H7N9 in 2013; H5N6 in 2014; H5N8 in 2016)
   D. COVID-19 (2019-2022), with several different strains (most recently, "Omicron")

   While questions during the handling of the COVID-19 emergency have shone a light on the globe's ability to address a new pathogen under pressure, any answer is still a function of the contagiousness of the pathogen. Depending on how quickly a new pathogen spreads, along with its incubation period and symptoms, could mean the difference between survival and massive devastation.

2. Disinformation Campaigns: A staple of international conflicts (both military and otherwise), organized campaigns based on disinformation or propaganda have been around for hundreds of years. Most recently, the US has made allegations against foreign governments that there has been interference in federal elections (and caused social unrest) by using freely available social networks[18]. It is expected that the same types of propaganda that was made noteworthy in 2016 will continue to be seen in future elections at all levels of government, and as part of other key events.

3. Disruptive Malware and Ransomware: Malware has been an issue for computers for decades, dating back to the initial hypothesized versions of "worms" in US universities of the 1960s and 1970s (as "thought exercises"). More recently, however, sophisticated attacks on businesses has (literally) become a business for some entities, foreign and domestic. "Ransomware" is the latest version of malware that "… [locks and encrypts] a victim's computer or device data, then demand a ransom to restore access."[19] There is currently 1 attack every 11 seconds (during 2020, according to the FBI), with an average cost of about $4M per breach globally (as of YE 2019)[20]. And, just to add an interesting twist, ransomware is now even offered as a *service* in which a criminal may sell a *license* to a (software) ransomware variant to another criminal, who will then infect a system and demand a fee for the decryption key. As our society becomes more dependent on automated systems, disruptions to those systems will have an increasing impact on us.

4. Societal Unrest, including Domestic Social Changes and Terrorism: During 2020, we saw many social protests turn violent on both ends of the political spectrum. Without warning, these movements have caused rapid and unexpected upheavals in social climates, and upended

[18] See https://www.nytimes.com/2020/09/01/technology/facebook-russia-disinformation-election.html
[19] See https://us.norton.com/internetsecurity-malware-ransomware-5-dos-and-donts.html
[20] See https://security.berkeley.edu/faq/ransomware/ and https://securityintelligence.com/articles/6-ransomware-trends-2020/

assumptions on which financial decisions were made. As these questions have been explored socially and officially, the discussions have led to questions of how deep the disdain in the country remains on both sides of the political fence, and what societal and legislative impacts these investigations may carry.[21]

5. Unanticipated Changes in Leadership: President Biden is currently 80 years old (the oldest seated President of the United States). While he is now expected to run for President again in 2024[22], his age is a recurring topic of conversation, and it is entirely possible that a transition of leadership from him to (assumedly) Vice President Harris may be necessary before the next inauguration in 2024. It is not clear at this time what differences in policy may come to light between Mr. Biden and Ms. Harris if such a transition were to occur, or how effective Ms. Harris may be at leading domestically or internationally. It has been reported that Ms. Harris is a strong advocate of diversity[23] and wage protection[24], but we are most concerned about how she will be perceived on the international stage in negotiations with, e.g., Saudi Arabia, and countries in the Far East.

6. Supply Chain Disruptions: The recent blockage of the Suez Canal by the tanker Ever Given over a five-day period highlighted the fragility of certain key bottlenecks in distribution of many goods, including paper products, oil, and food. The Suez itself accounts for 10-15% of all goods[25]. Notice that the Suez, the Panama Canal, the Strait of Hormuz, and the Malacca Strait are the four most noteworthy trade chokepoints. If closed, the Panama Canal would impact 5% of global trade (and 60% of US imports and exports); closing the Strait of Hormuz would affect 25% of seaborne oil and a third of global liquified natural gas; and the Malacca Strait carries 40% of all global trade (including 16M barrels of oil per day globally).[26]

7. Cryptocurrencies: With the increasing visibility of distributed cryptocurrencies, several countries are currently investigating the benefits of implementing their own cryptocurrencies based on their own hard currencies. Over the past few years, several Caribbean countries have launched successful cryptocurrencies, including the Bahamas, Grenada, and St. Kitt's & Nevis[27]. Ecuador, Senegal, and China have canceled or withdrawn their currencies[28].

8. Global unrest: As we have now seen, Russia's invasion of the Ukraine has led to a dramatic impact on the energy and grain sectors globally. Though the west has not agreed to purchase Russian oil with a price cap, Russia is now refusing to sell its resources for anything other than a market price. The resulting rising energy prices can only drain the level of wealth of (primarily) Europe, and raise prices globally.

[21] See https://www.npr.org/2020/11/05/931829801/election-dispute-increases-risk-of-political-violence-analysts-warn , https://www.independent.co.uk/news/world/americas/us-election-2020/election-results-2020-riots-trump-biden-b1700559.html , and https://www.brookings.edu/blog/fixgov/2020/10/27/why-the-risk-of-election-violence-is-high/
[22] https://www.cnn.com/2023/02/16/politics/joe-biden-age-question/index.html
[23] See, e.g., https://www.huffpost.com/entry/kamala-harris-vice-president-nominee-dnc_n_5f36f56bc5b69fa9e2fb7862
[24] See, e.g., https://www.shrm.org/resourcesandtools/hr-topics/benefits/pages/where-kamala-harris-stands-on-workers-pay-and-benefits.aspx
[25] See https://www.businessinsider.com/toilet-paper-coffee-products-delayed-suez-canal-blockage-impact-2021-3
[26] See https://www.dw.com/en/suez-canal-blockage-4-of-the-biggest-trade-chokepoints/a-57020755
[27] https://www.atlanticcouncil.org/cbdctracker/
[28] Ibid.

Data Analysis

As part of the Dodd-Frank Act, larger banking institutions in the United States are required to use government specified variables, and approved proprietary processes, to determine if they are adequately prepared for unexpected "systemic failures". Some banking institutions are also incorporating portions or components of their forecasting processes to estimate future profitability; in order to do so, however, realistic forecasts (as opposed to extremes) are required.
While arguments could be made about the variables included in this study, as stated in Jiang, et al., "… a conclusion that can be made for … US data is that there is little to no improvement in forecast accuracy when the number of predictors is expanded beyond 20-40 variables."

Capitalytics provides the results of a rigorous analysis of every variable that is included in our quarterly macroeconomic study. These variables include the following[29]:

1. Real GDP growth
2. Nominal GDP growth
3. Real disposable income growth
4. Nominal disposable income growth
5. Unemployment rate
6. CPI inflation rate
7. 1-month Treasury yield
8. 3-month Treasury yield
9. 6-month Treasury yield
10. 1-year Treasury yield
11. 3-year Treasury yield
12. 5-year Treasury yield
13. 7-year Treasury yield
14. 10-year Treasury yield
15. 20-year Treasury yield
16. 30-year Treasury yield
17. BBB corporate yield
18. Mortgage rate
19. Prime rate
20. US Average Retail Gasoline Price ($/gal; all grades, all formulations)
21. S&P 500 Stock Price Index
22. Cost of Federal Funds (Primary Credit Rate)
23. Moody's AAA Rate
24. Moody's BAA Rate
25. Dow Jones Total Stock Market Index
26. House Price Index
27. Commercial Real Estate Price Index
28. Market Volatility Index (VIX)

[29] This study is motivated by the Federal Reserve Board's Dodd-Frank Act, which includes requirements to consider various international factors; however, those factors will not be discussed extensively in this particular report based on the target use and audience of this report.

Our procedure is as follows:

1. Data is collected per the information in Appendix A, "Data sources".
2. Correlations between variables are identified to determine which variables are may be considered as "dependent" (upon other variables, i.e., highly correlated with other variables as part of their nature).
3. Multiple forecast analyses are performed per the procedure in Section I of Appendix B for all variables, with the results of corresponding forecasts aggregated.
4. Regressions are performed per the procedure in Section III of Appendix B for all variables.
5. The rationale for these analyses, modifications, and the conclusions thereto are documented in the following section of this report, "Data Series Conclusions".

Correlations

Part of Capitalytics' analysis of macro-economic variables entails computing the correlation between variables, to establish the existence and level of interdependence of variables. In Appendix C of this document, we document the 173 pairs of variables that showed absolute correlation values greater than or equal to 0.6. As part of this portion of the study, Capitalytics identified the following sets of strong dependencies (correlations with magnitudes greater than 0.95) between variables that were subsequently validated as significant, long-term, recurring correlations as part of the nature of the variables; these pairings of variables are viewed as extremely significant based on the respective definitions of the variables and will be leveraged as discussed in Section I of Appendix B.

Table 14: Variable Dependencies

Regression (Dependent) Variable		**Independent Variable**[30]
1-month, and 3-year Treasury yield	**… depends on …**	1-year Treasury yield
6-month and 7-year Treasury yield		3-year Treasury yield*
20-year and 30-year Treasury yield, and Moody's AAA yield		7-year Treasury yield*
30-year Mortgage rate		3-year Treasury yield*

Due to the unexpected impact of the COVID pandemic, and the requirements to address the pandemic, the results of many of our quantitative algorithms will not match our reported expectations for what will occur over the next several months and/or years. We will note these deviations where they occur.

[30] It should be immediately apparent that some of the variables that are listed as "independent" are, in fact, dependent on other variables; these "independent" variables that actually have dependencies are noted by a trailing "*".

Real & Nominal GDP Growth, Real & Nominal Disposable Income Growth, and CPI Inflation Rate

Analysis

GDP is driven by several factors:

- Personal consumption;
- Retail sales;
- Government spending;
- Net trade; and
- Mortgage & interest rates.

Quarterly personal consumption growth peaked at a $1.3T Q/Q increase in 3Q2020, and has been gradually declining since then. Recently, it dropped from $682B to approximately half of that value between 2Q and 3Q2021 as it became more clear that the widespread immunization for COVID-19 was feasible. While it held at an increase of $350B Q/Q from mid-year of 2021 through mid-year of 2022, the rate of increase declined to $280B and then $220B Q/Q during the last two quarters of 2022.[31] Nominal consumer spending increased by 0.7% during October 2022, and then decreased by 0.2% and 0.1% in November and December 2022[32], likely due to the pending uncertainty in the jobs market balanced against inflation expectations[33].

Advance retail sales growth percentages have historically peaked in Q4 and waffled around the zero line during the remainder of the year, giving credence to sayings about "profits being made around 'the holidays'". 2022 held true to that saying, but with the weakest growth during a Q4 period since 2008; Q4 of 2008 showed 3.8% growth Q/Q; Q4 of 2022 showed 4.5% growth Q/Q; and Q4 of 2018 and 2020 having the next lowest intervening Q4 periods with 5.8% growth Q/Q[34]. This point seems to point to sluggish sales, again due to perceived uncertainty in the jobs market and inflation. The fact that the US has generally had 4Q growth rates of +/- 7% consistently since 2008 reinforces the strength of the economy, and how much it has been weakened during 2022.

US federal government expenditures have solidly increased by $130B Q/Q, going from $5.9T to $6.2T per quarter during 2022, after spiking at almost $9T during 2Q 2020, and $8.2T during 1Q 2021.[35] Federal, state, and local government combined expenditures went from $8.7T in 3Q2022 to almost $9.0T in 4Q2022, showing a 2.9% increase (Q/Q).[36]

The average of the monthly trade deficit rose to almost $94B during 1Q2022, then dropped to roughly $69B per month during both Q3 and Q4 2022.[37] Overall, the trade deficit increased in 2022 from $845B in 2021 to $948B in 2022, with the goods deficit increasing by $101.5B in 2022 to $1.2T, and the services

[31] https://fred.stlouisfed.org/series/PCE
[32] See https://www.bea.gov/news/2023/personal-income-and-outlays-january-2023
[33] See https://www.capitalytics.com/perception_reports for charting of consumer expectations for inflation per The University of Michigan Inflation Expectation Index.
[34] https://fred.stlouisfed.org/series/MARTSMPCSM44000USN
[35] https://fred.stlouisfed.org/series/FGEXPND
[36] See https://www.bea.gov/data/government/receipts-and-expenditures
[37] https://fred.stlouisfed.org/series/BOPGSTB and https://www.census.gov/foreign-trade/Press-Release/current_press_release/ft900.pdf

surplus decreasing by $1.6B in 2022 to $244B.[38] During 2022, average exports increased approximately 10% Y/Y and imports increased by 2% Y/Y.[39]

Inflation is currently the proverbial "pink elephant in the room". Consider the following factors:

- Significant energy & food price increases that have been driven by Russia's conflict in Ukraine[40];
- Supply chain issues that still exist due to both remnants of COVID-19 and the Russian invasion[41] (that impose upward pressure on prices generally, which, in turn, apply pressure on wages);
- Pent-up demand[42], and significant savings[43], in the US that have been gradually eroding over the past year;
- A record tight labor market in the US[44]; and
- Dramatic central bank interest rate increases[45] that have not slowed any of the world's largest economies.

While US inflation rates are no longer the 9% that were seen almost a year ago, we are still seeing +/- 6%, which is driven by aforementioned supply-demand mismatches, and service industries which are continuing to try to adapt to other changing forces in the market[46]. We note that both the U.S. and euro areas nominal wages have increased, but they have both been exceeded by the respective rates of inflation. As real wages have fallen, savings have generally eroded. On the opposing side, pre-existing debt loads (both personal and national debts) have been correspondingly cut in values.[47]

Given these factors, real GDP rose in the US by less than 0.7% during 4Q2022[48], which is inkeeping with the current global slowdown; global growth slowed in 2022 to 3.2%[49], due to a number of coinciding factors: Russia's war of aggression in Ukraine, now dragging on for over a year with no end in sight; financial instability; and global inflation (specifically, higher than expected energy and food prices – though both have been seen to moderate somewhat during 1Q2023) resulting from the continued economic recovery post-pandemic. As mentioned, inflation and weaknesses in the economic system[50] are key problems in the US economy. One key point that should notably and positively affect the US' GDP is the unplanned removal of China's strict "zero COVID" policies, potentially boosting production, shipping, and consumption globally and helping alleviate some inflation related to goods production.[51]

We continue to believe that inflation will be a significant issue through 2023. The fragility of the ongoing recovery is a key point of concern; we believe that it would be extremely easy to derail the

[38] https://www.bea.gov/news/blog/2023-02-07/2022-trade-gap-9481-billion
[39] https://www.census.gov/foreign-trade/Press-Release/current_press_release/ft900.pdf
[40] https://www.imf.org/-/media/Files/Publications/WP/2023/English/wpiea2023074-print-pdf.ashx, accessed from https://www.imf.org/en/Publications/WP/Issues/2023/03/24/Policy-Responses-to-High-Energy-and-Food-Prices-531343
[41] https://www.forbes.com/sites/chloedemrovsky/2023/01/18/supply-chain-and-ukraine-shaped-a-hectic-year--what-will-2023-bring/ and https://news.ufl.edu/2023/02/russia-ukraine-global-supply-chain/
[42] https://www.wsj.com/articles/godot-recession-federal-reserve-powell-d50ba71f
[43] https://www.federalreserve.gov/econres/notes/feds-notes/excess-savings-during-the-covid-19-pandemic-20221021.html and https://www.wsj.com/articles/once-flush-savings-accounts-are-starting-to-run-dry-11675691637
[44] https://apnews.com/article/jobless-claims-layoffs-unemployment-benefits-0e4fff203da34c5391fd1b81f8e3bd9b
[45] See https://fred.stlouisfed.org/series/FF and https://www.investing.com/central-banks/
[46] See https://fred.stlouisfed.org/series/CUSR0000SASLE for data, and https://www.teneo.com/us-economic-outlook-2023-a-soft-landing-or-deep-recession/ for commentary
[47] https://www.gisreportsonline.com/r/inflation-central-banks/
[48] https://fred.stlouisfed.org/series/gdpc1
[49] https://www.oecd.org/economic-outlook/march-2023
[50] See https://www.conference-board.org/topics/recession/Silicon-Valley-Bank-SVB-Collapse-Implications-for-Business, https://www.wsj.com/articles/ubs-offers-1-billion-to-take-over-credit-suisse-bfac51fa, and https://www.wsj.com/articles/federal-reserve-rolls-out-emergency-measures-to-prevent-banking-crisis-ba4d7f98
[51] Ibid.

recovery by the wrong key event occurring: unexpected wage pressures; continued/additional geopolitical conflict; additional regional bank failures (domestically or globally); or any of several of the events mentioned in our "Black Swan Events" section. At this point, we continue to believe that ***the global economy will remain in a state of flux through 2024***. ***We expect that annualized US inflation will average at least 5.5% through 2023, with a potential to drop to as low as 4% in a best case outcome in 2024,*** and ***real GDP growth rates during 2023 and 2024 will most likely come in at no more than 0.75% (Q/Q).***

Other Commentary

- "Americans' expectations for the near-term path of inflation ebbed to nearly a two-year low last month, which could take pressure off the Federal Reserve to raise rates amid fresh uncertainties created by turmoil in the U.S. banking system … the New York Fed's Survey of Consumer Expectations on Monday showed respondents said inflation would stand at 4.2% a year from now." (https://www.reuters.com/business/ny-fed-february-near-term-inflation-expectations-retreat-sharply-2023-03-13/; March 13, 2023)
- "In a best-case scenario, the U.S. will likely see a 'soft landing' with low/slow growth across 2023 before picking up in 2024. However, a downside scenario is a real possibility and could see the U.S. enter a prolonged recession lasting well into 2024, as is currently forecast for the UK and Germany." (https://www.teneo.com/us-economic-outlook-2023-a-soft-landing-or-deep-recession/; March 8, 2023)
- "Moody's Analytics baseline outlook calls for a recession-free 2023 in the U.S., though the pace of growth will slow demonstrably. Key to our forecast is the expectation that inflationary pressures continue to steadily moderate." (https://www.moodysanalytics.com/-/media/article/2023/weekly-market-outlook-the-2023-kickoff.pdf; Jan. 5, 2023)

Employment

Analysis

The FOMC has been steadily raising rates in an effort to slow the US economy, to be evidenced by expected increases in unemployment rates. It has only been recently that layoff announcements have begun to have the expected impact; in Figure 32, we see county-level unemployment rates which have started to increase across areas adjacent to the Canadian border, parts of the Ohio River valley, and the Deep South (notably in parts of Alabama and Louisiana). Further, looking at data from the Bureau of Labor Statistics, we see that the number of open positions seems to be on the decline[52]. However, we are still seeing extremely low unemployment nationally (see Figure 33), and the employment-to-population ratio is also at approximately the same level as over the past year (Figure 34).

[52] https://data.bls.gov/timeseries/JTS000000000000000JOL

Figure 32: US Unemployment Rate per County (January 2023 and March 2023, respectively)

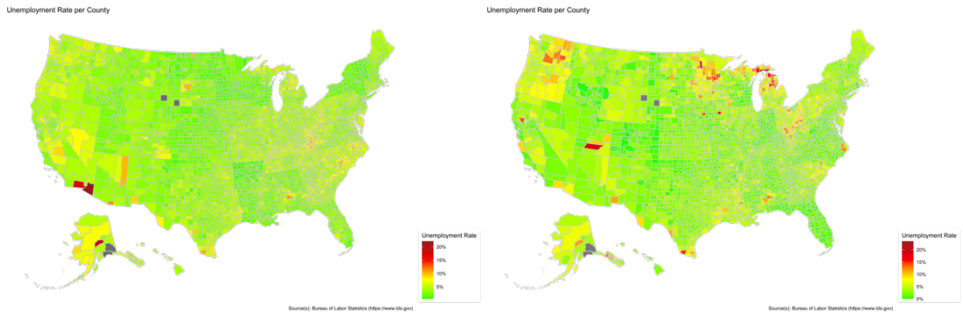


Figure 33: US Unemployment Rate

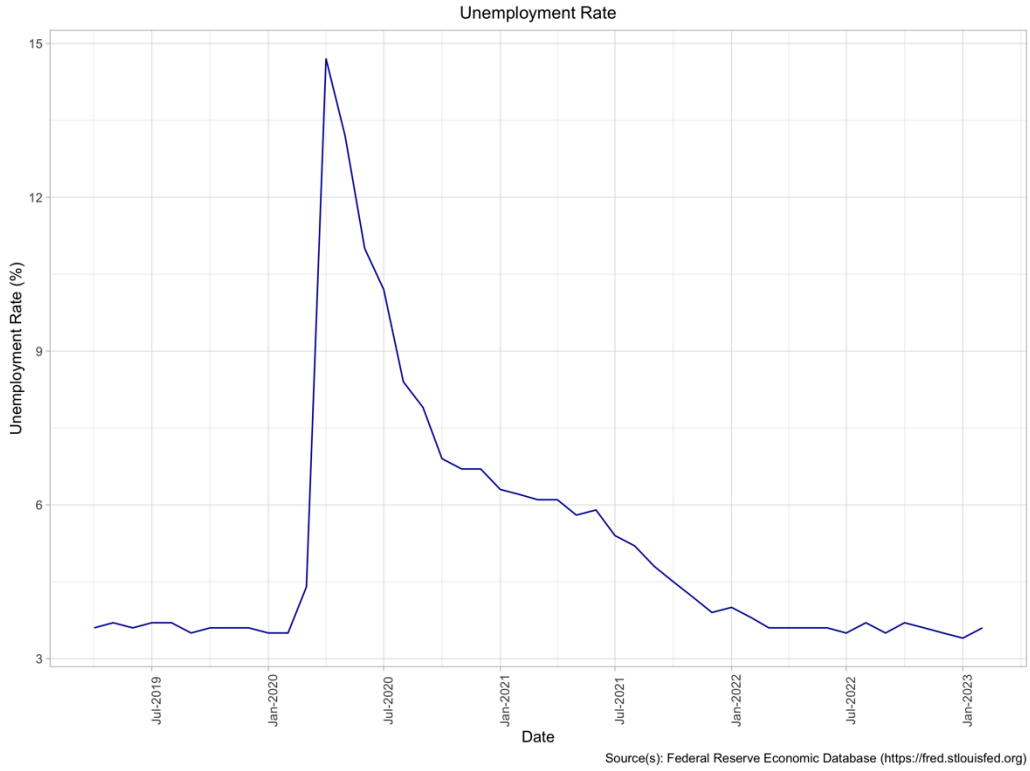
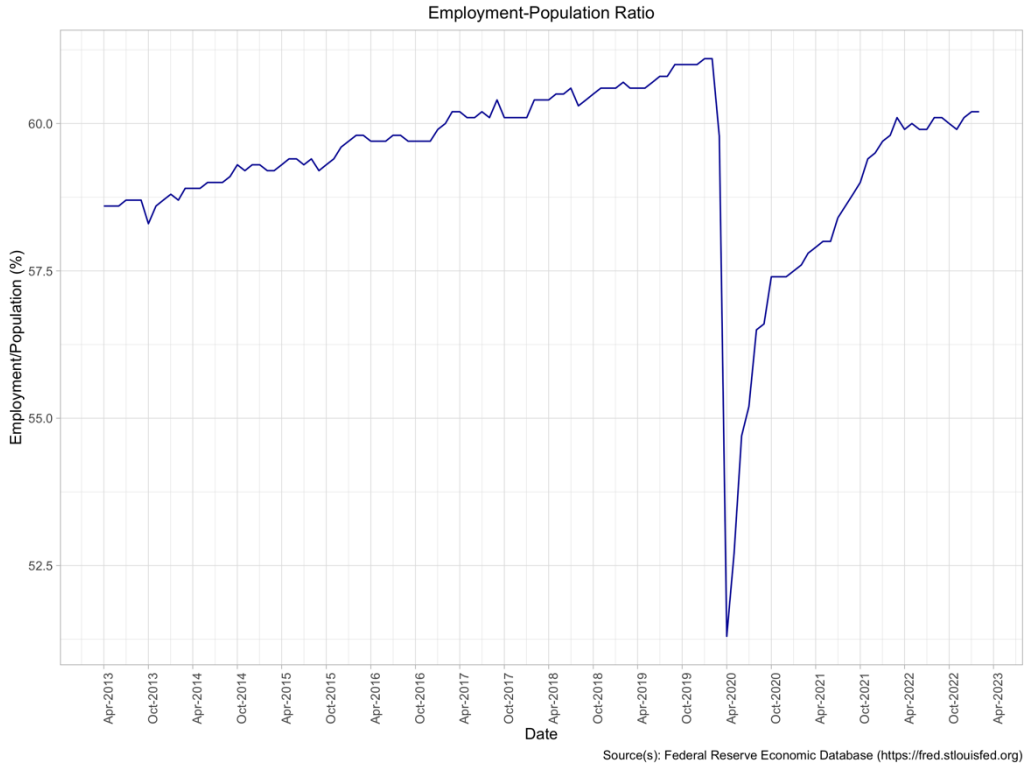


Figure 34: US Employment to Population Ratio (%)



Indeed, most nominal level metrics and employment rates have been relatively consistent; the issues that have caused notable pain in the nation have been the "pinch" of inflation, which drives real measures. Nominal measures take time to feel enough influence in order to eventually adjust salaries and payments, particularly with the churn of workers gradually slowing. (See Figure 35, Figure 36, and Figure 38.) However, buying power, while not necessarily easily felt on a day-to-day basis, can be calculated and noted in retrospect.

In Figure 37, we see a notable uptick in unemployment of young, less trained workers, with unemployment of other groups remaining relatively constant, leading us to believe that the change in the employment scenario seen in Figure 32 is due to the changes in employment in this demographic. Further, in Figure 39, we see that real wages have kept steady with the influence of inflation since mid 2022.

There have been notable reports of layoffs, particularly in the tech sector – that experienced extremely strong hiring during the COVID-19 pandemic. While layoffs have been prevalent overall,[53] the tech sector has been very aggressive about "right sizing" their respective labor forces, likely due to that previously mentioned hiring spree. Many speculate that tech companies are now trimming lower performers, with the added note that, while they have garnered substantially publicity in their layoffs, they have still only cut approximately 8% of the new hires made during the pandemic.[54]

[53] https://www.wsj.com/articles/the-companies-conducting-layoffs-in-2023-heres-the-list-11673288386
[54] https://news.crunchbase.com/layoffs/analysis-big-tech-pandemic-amzn-meta/

Figure 35: Unemployment Rate per US SE MSA

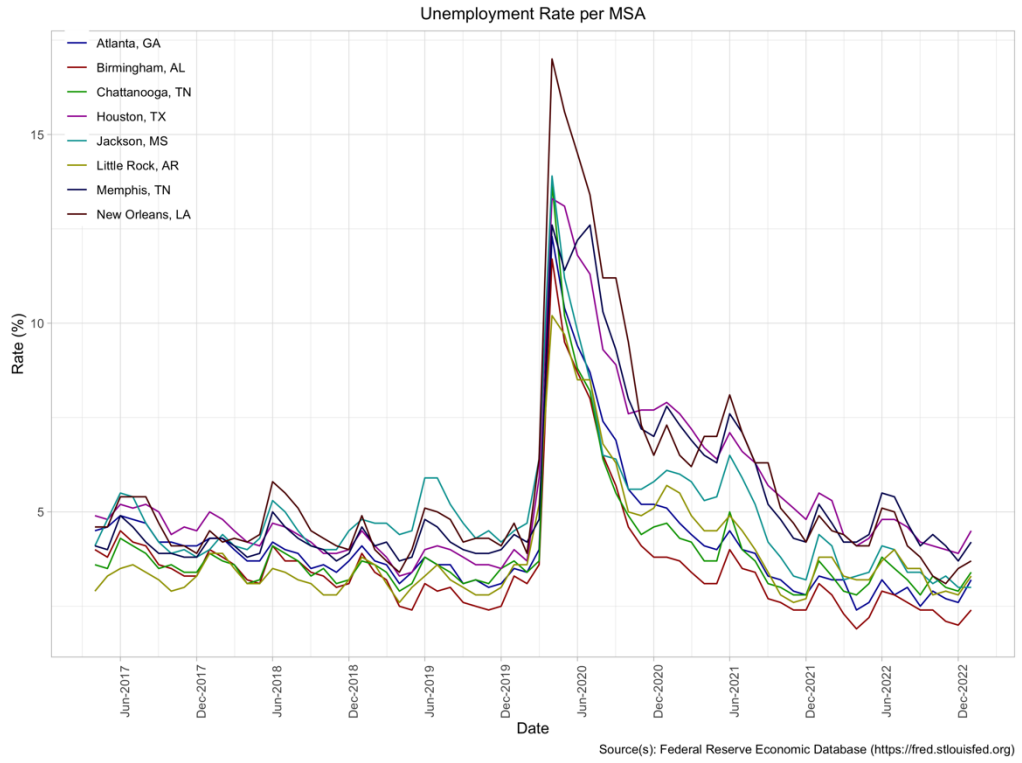


Figure 36: US Employment Level by Industry

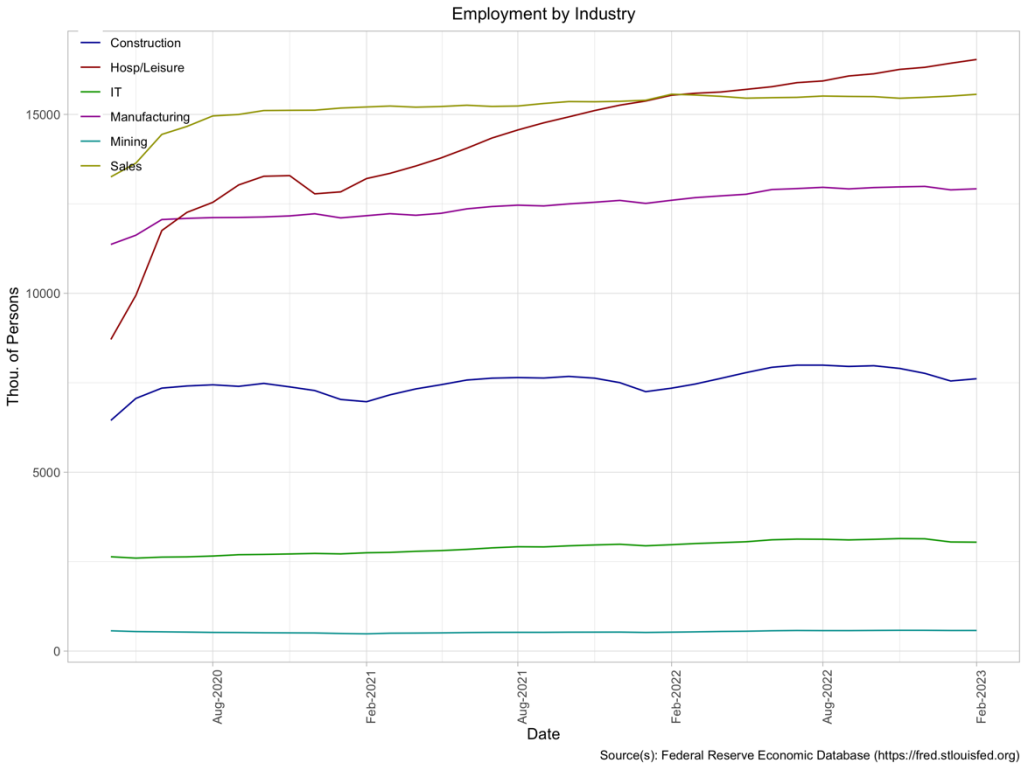


Figure 37: US Unemployment Rate by Education

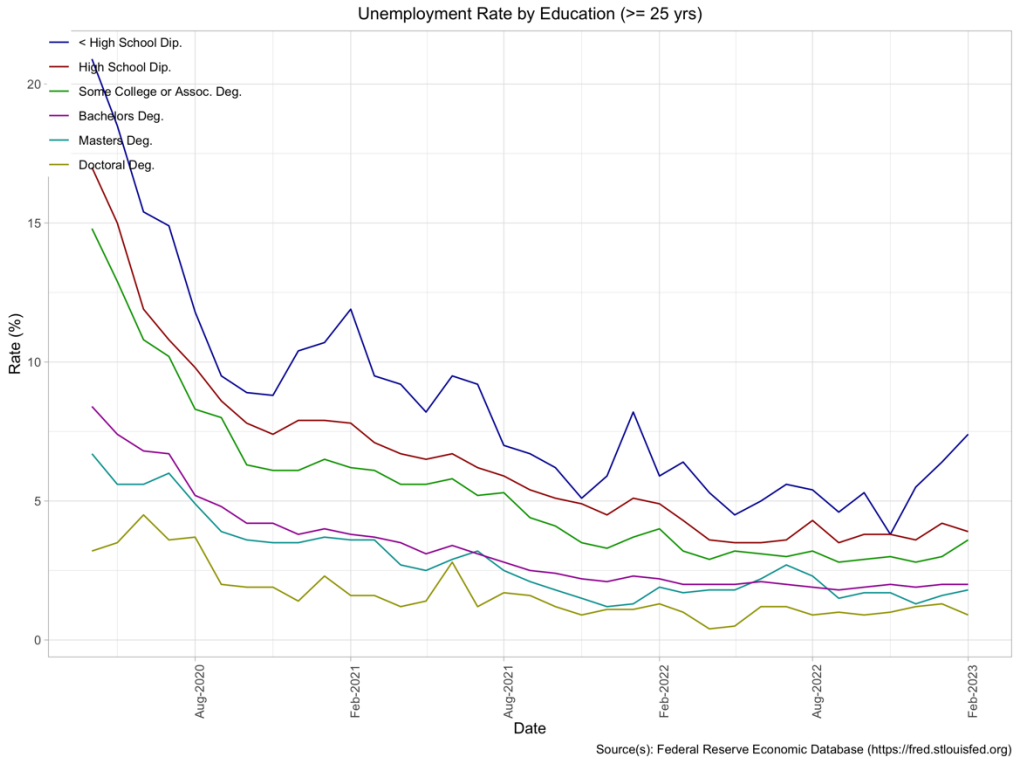


Figure 38: Hourly Wages per Industry

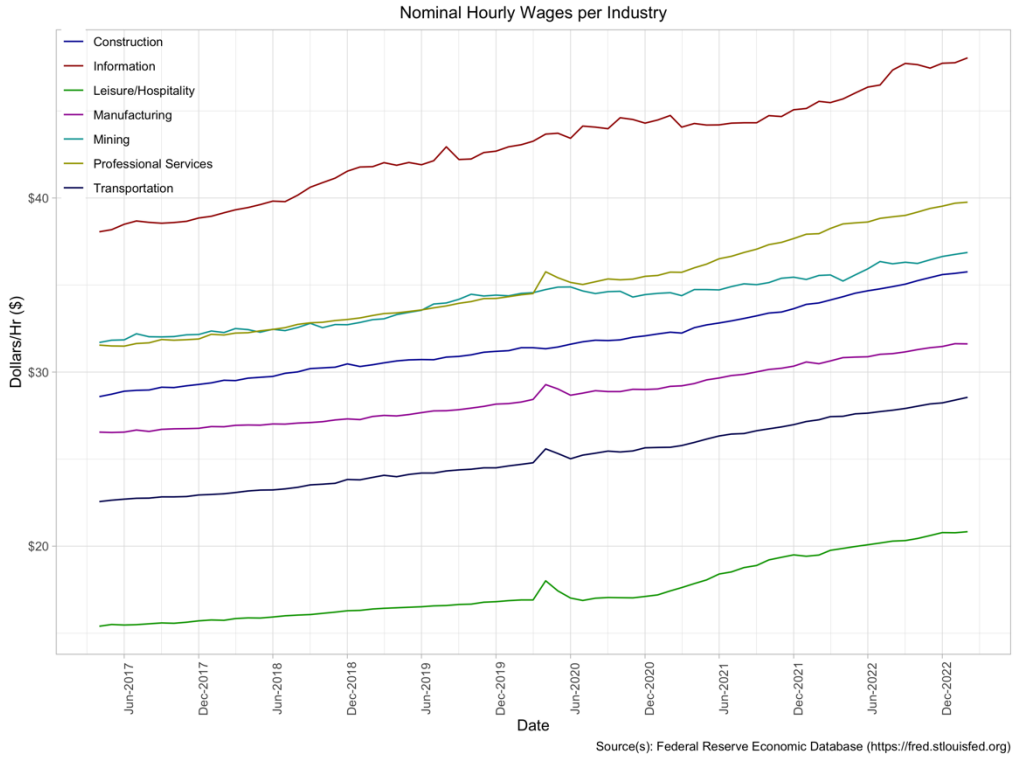
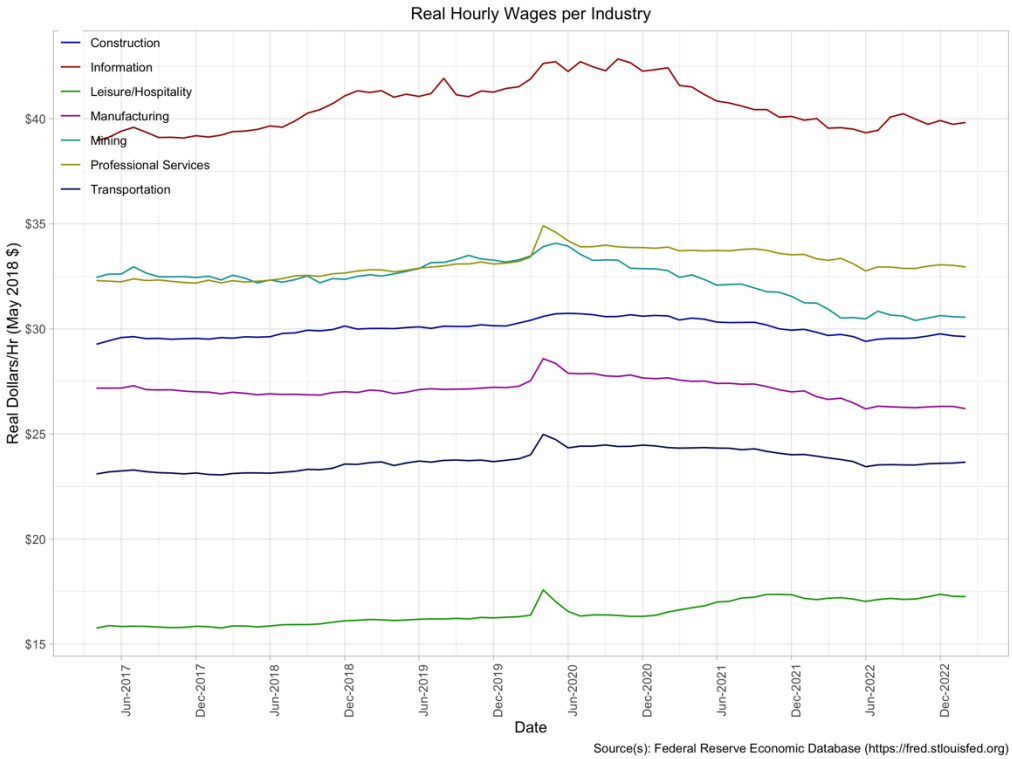


Figure 39: Real Hourly Wages per Industry



Other Commentary

- "According to estimates last week, central bankers expect the unemployment rate to rise to 4.5% this year, from its current 3.6% level. Doing so would require the loss of more than 540,000 jobs, according to an Atlanta Fed calculator. … Growth likely accelerated for the first three months of 2023, according to the Atlanta Fed's GDPNow tracker. That gauge shows GDP rising at a 3.2% pace." (https://www.cnbc.com/2023/03/30/jobless-claims-edge-up-to-198000-higher-than-expected-.html; March 30, 2023)
- " … [T]here are signs of a coming slowdown in hiring, and of increasing slack in the labor market. For example, the unemployment rate moved up to 3.6% from 3.4%. The number of newly unemployed people jumped, as did the number of workers being forced to work part-time instead of full-time. Employment in trucking and delivery services related to e-commerce declined, illustrating that the boom in goods sales is ending. Manufacturing industries are starting to cut back, though slowly. Hiring in the hospitality industry is still in recovery mode, which is why it has been strong recently but is unlikely to maintain that pace as the economy slows." (https://www.kiplinger.com/economic-forecasts/jobs; Mar 10, 2023)
- " 'This jobs report managed a neat trick: Good news for both workers and the Fed,' says Robert Frick, an economist at Navy Federal Credit Union. 'For workers, hiring continues to be robust, especially in industries that need people most: leisure and hospitality, retail, government and healthcare... That may blunt the Fed's ardor for raising rates much more, and so increase the odds of a soft landing.' " (https://www.forbes.com/sites/jonathanponciano/2023/03/10/labor-market-added-311000-jobs-in-february-but-unemployment-rate-unexpectedly-rose-to-36/?sh=58950f783374; Mar 10, 2023)

Federal Funds (Primary Credit) Rate

Analysis

When a depository institution has a shortfall and need for liquidity, it may borrow funds on a short-term basis from the Federal Reserve. The "discount rate" is the interest rate charged to commercial banks and other depository institutions on loans they receive from their regional Federal Reserve Bank's "discount window". The Federal Reserve Banks offer three discount window programs to depository institutions: Primary Credit, Secondary Credit, and Seasonal Credit, each with its own interest rate. Under the Primary Credit program, loans are extended for a very short term (usually overnight) to depository institutions in generally sound financial condition. (Secondary Credit & Seasonal Credit may be available to institutions that do not meet the "sound financial condition" criteria.) The discount rate charged for primary credit (the primary credit rate) is set above the usual level of short-term market interest rates.

Inter-bank loan rates will also track with the primary credit rate for overnight lending. The rate for inter-bank loans is generally driven by the target federal funds rate; the target federal funds rate is the target interest rate set by the Federal Open Market Committee (FOMC), and is intended as a guide for the rate at which commercial banks borrow and lend their excess reserves to each other on an overnight basis. The FOMC sets the target federal funds rate periodically based on key economic indicators that may show signs of inflation, recession, or other issues that can affect sustainable economic growth. The actual interest rate that a lending bank will charge is determined through negotiations between the two banks. The weighted average of interest rates across all transactions of this type is known as the effective federal funds rate.

The FOMC has raised the target federal funds rate nine times since their March 2022 meeting (see Figure 40 and Figure 41), most recently adding 25 bp to raise the rate to between 4.75% to 5.00% after their March 2023 meeting. Hawkish pundits had questioned whether the rate would be increased by 50 bp, but those plans were quashed as the issues at Silicon Valley Bank became known[55], implying the market's recognition that the economy is still likely running too hot for the FOMC's liking. As issues came to light at three significant regional banks, the FDIC, with the backing of the US Treasury, announced that all insured accountholders would be made whole as deposits were transferred between banks under the FDIC's guidance.

Opinions within the FOMC about future interest rates do not appear to have changed substantially between their meeting in December 2022 and March 2023. The average projected interest rates for the next few years appear essentially unchanged, along with the general distribution of rate expectations within the committee. The expectation is that rates will rise slightly (i.e., between 5.0% and 5.25%) between current day levels and YE 2023, dropping by 100 bp during 2024, and dropping between 75 and 100 more bp during 2025. Interestingly, there appears to be one unswayed vote on the FOMC that appears to believe that rates should remain substantially higher than the rest of the committee, unwilling to acknowledge any believe that rates should drop substantially from current or near future peak rates.

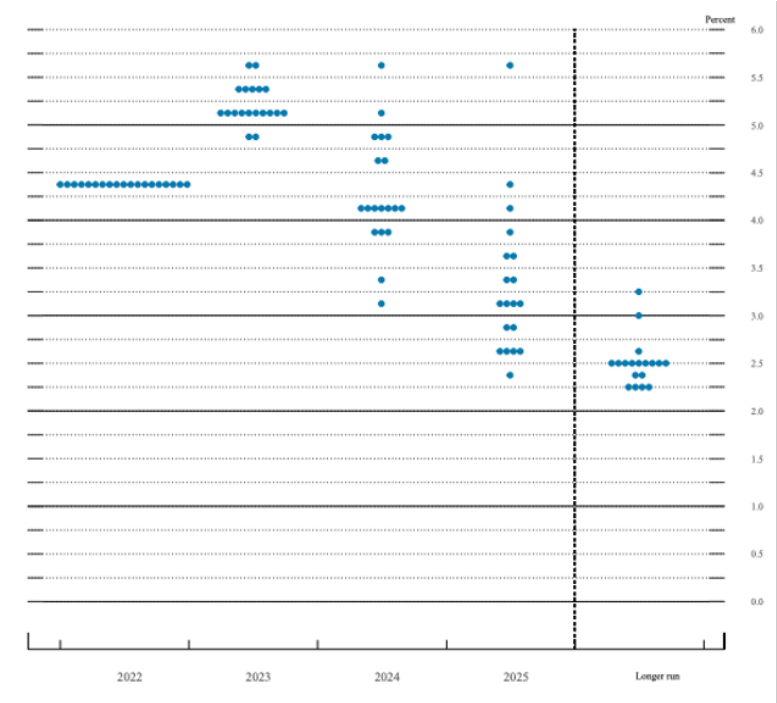
The opinion has some merit: while interest rates are markedly higher than they have been in recent times, there are still not close to the "historic" levels (of, e.g., the 1980s) that have been purported in

[55] https://www.cnbc.com/2023/03/10/just-like-that-market-pricing-swings-back-to-quarter-point-fed-rate-hike.html

the press reports. Unemployment is at a remarkably low level, somewhat due to the labor force remaining at a relatively low level (despite reports of some recently retired individuals returning to the labor force based on the strength of their retirement plans[56]). And, savings levels *and* rates are still higher than traditionally expected levels[57]. And, given that it has been almost 15 years since the last financial crisis (which was generally limited to US residents that were property owning), it isn't clear that Millennial wage-earners realize what to make of the current strategy of the FOMC and the US Treasury "throwing money" at their problems (thereby increasing the level of M3 to record highs, as shown in https://fred.stlouisfed.org/series/MABMM301USM189S).

So, while consumer expectations are for overall inflation to remain between 4% and 4.5% for the next year, they have at least released their expectations from being above 5.5% (see Figure 42). We are similarly hopeful of that goal being able to be reached, but cynically feel that the country may not get inflation to that level of control by mid-year 2024.

Figure 40: FOMC "Dot Plot" from December 2022 Board of Governors' Meeting

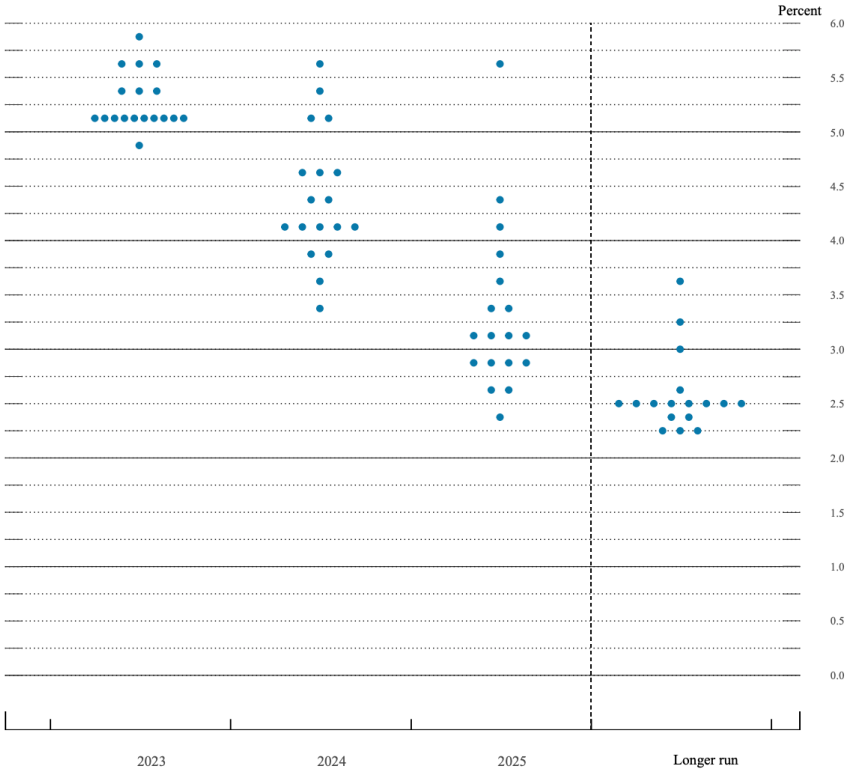


Source: https://www.federalreserve.gov/monetarypolicy/files/fomcprojtabl20221214.pdf

[56] https://www.cnbc.com/2023/02/22/1-in-6-retirees-are-considering-a-return-to-the-workforce.html, https://www.forbes.com/sites/chriscarosa/2023/03/15/why-people-return-to-work-after-retiring/?sh=1430dbea4eee, and https://www.shrm.org/resourcesandtools/hr-topics/talent-acquisition/pages/older-workers-unretiring-what-can-employers-do-welcome-back-retirees-boomerangs-mature-workers.aspx

[57] https://www.richmondfed.org/research/national_economy/macro_minute/2023/mm_03_07_23 and https://www.nerdwallet.com/article/finance/what-did-the-pandemic-change

Figure 41: FOMC "Dot Plot" from March 2023 Board of Governors' Meeting



Source: https://www.federalreserve.gov/monetarypolicy/files/fomcprojtabl20230322.pdf

Figure 42: US Consumer Inflation Expectations

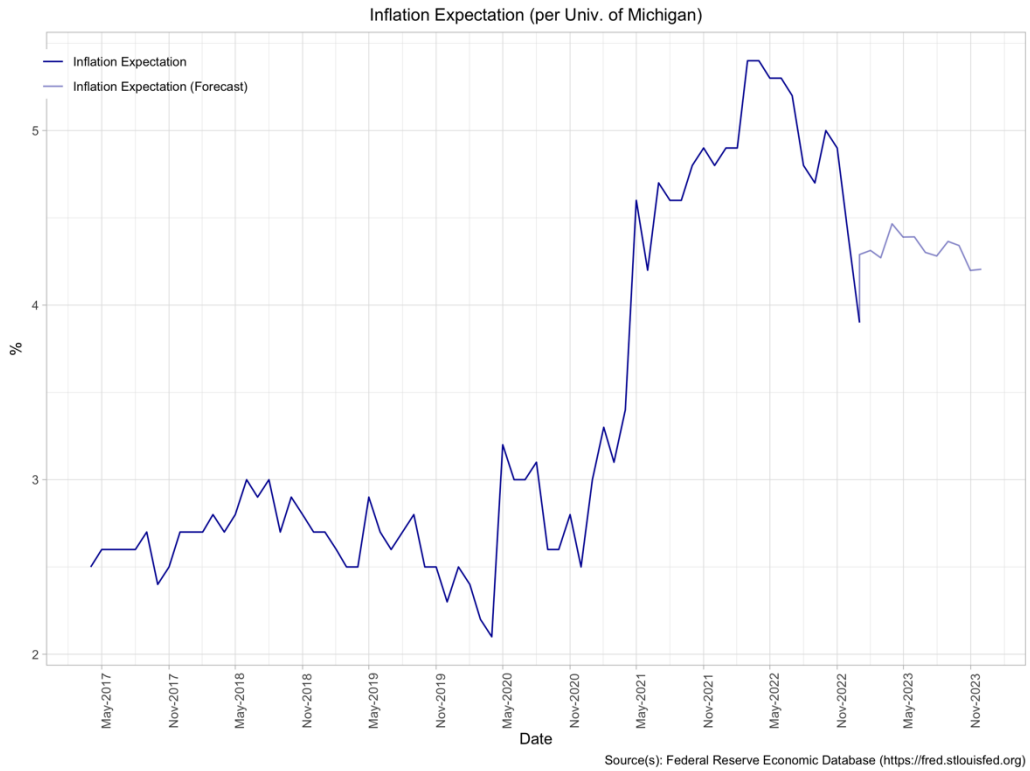
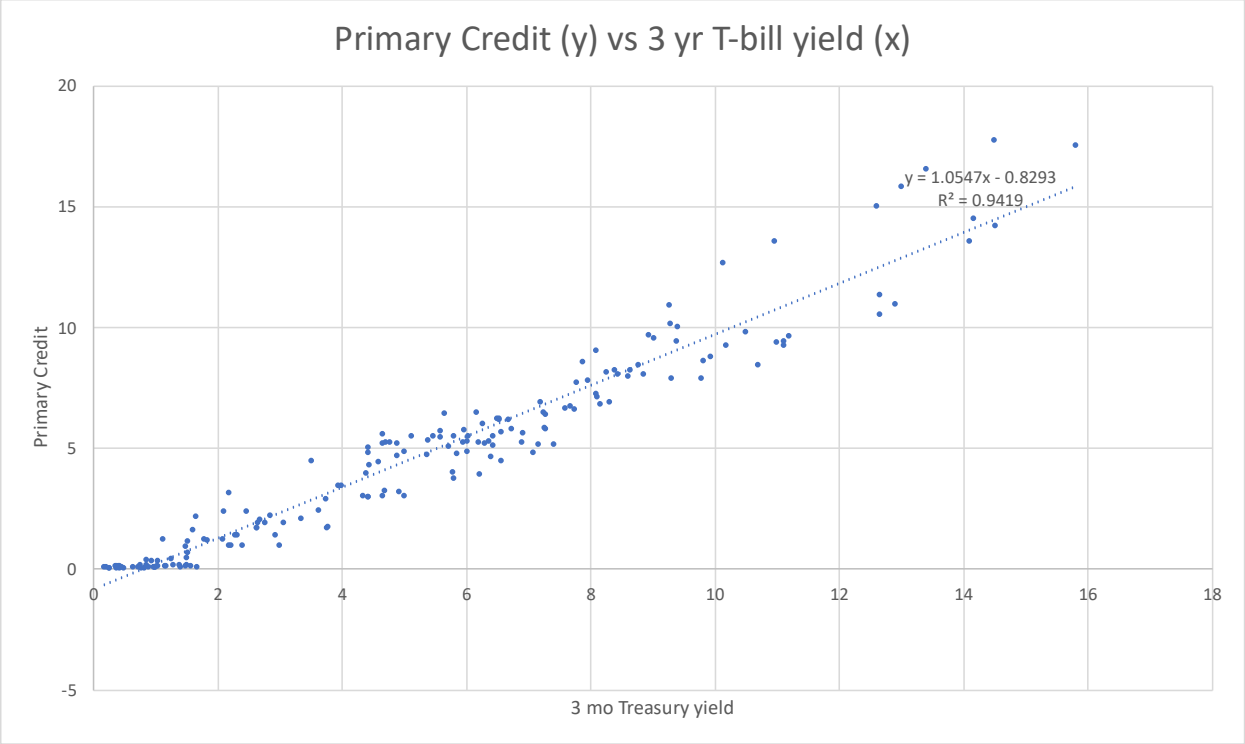


Figure 43: Primary Credit, as a function of 3-year Treasury yield



Source: Authors' calculation

Other Commentary

- "After spending last year raising interest rates …, Fed policymakers are taking a different approach in 2023: hiking interest rates at a slower and more deliberate pace. … After downshifting to quarter-point moves in February, the Fed was gearing up to raise interest rates by a larger half point in March as inflation remained more stubborn than expected. That, however, was before two major bank failures rocked financial markets, creating stability concerns and risks of knocking the economy off course. … Only one Fed official projects the Fed won't hike rates anymore this year, while the majority (10 officials) see just one more rate increase. Three project two more rate hikes, another three project an extra three rate hikes, while one policymaker sees four more rate hikes." (https://www.bankrate.com/banking/federal-reserve/how-much-will-fed-raise-rates-in-2023/; March 29, 2023)
- "The Fed kept the 'terminal rate,' or the rate at which its benchmark fed funds rate will peak, unchanged from the last estimate in December at 5.1%, equivalent to a target range of 5%-5.25%." (https://www.cnbc.com/2023/03/22/the-fed-projections-call-for-just-one-more-rate-hike-this-year.html; March 22, 2023)

Treasury Yields (1, 3, & 6-month; 1, 3, 5, 7, 10, 20, & 30-year series)

Analysis

The Federal Reserve initiated a strategy in March of 2020 to purchase $700B of debt and mortgage-backed securities. As a result, significant amounts of cash were injected into the US money supply to retard interest rates. Now that the crux of COVID-19 crisis has passed, this policy of quantitative easing has been traded for one of "quantitative tightening", during which the Treasury will attempt to sell its accrued investments and take money back out of the US money supply. This activity was originally expected to last from 2022 through 2025[58], but it is not clear how much capital has been injected into the economy during March 2023, given the unknown impact of the collapse of the FTX cybercurrency exchange and the collapse of three regional banks during this month.

The US Treasury yield curve is still exhibiting the increasingly pronounced inversion that has been seen for the past year (see Figure 44), with yields notably spiking as of this writing for 1-year maturities. Given this inversion, we interpret the markets as felt that a short-term recession was likely in the near future. This figure was taken after the announced failure of the FTX exchange and Silicon Valley Bank. ***We do not expect the yield curve shown in Figure 44 to change substantially for the next six- to nine-months.***

We expect that the short-term effects of the failures of FTX, SVB, and First Republic Bank have been successfully cauterized for now[59], meaning that the direct effects of these failures we believe to have been managed. We see a minimal risk of additional bank failures occurring, since the root causes of the known failures have been broadly publicized as a combination of poor management and sudden, unexpected illiquidity; we hope that the management teams of regional banks will receive the message of liquidity risk, and engage in appropriate swaps or execute comparable tactics.[60] ***Assuming that the markets continue to respond favorably to the responses by the Federal Reserve, FDIC, and Treasury, we are next concerned about a mild recession that the nation might already be experiencing (once events are studied by the NBER), along with the emergence of housing and commercial real-estate driven risks*** (which will be discussed later in this report). The recessionary forces that are currently at work will continue to drive short-term Treasury yields up (above mid-term yields), and mid-to long-term yields to moderate levels.

Figure 45 through Figure 50 illustrate the most significant correlations between Treasury yield rates.

Other Commentary

- "Here's a faulty thought process from 2008 that I see playing out all over again: 'Hey, these banks collapsed and the economy is holding up just fine!' But the datapoint is not how the economy is doing the first few weeks after such a seismic event (I literally saw big bank research assuring us that 'credit card spending was largely unaffected' in the days after SVB's collapse). The datapoint is *that the seismic event happened in the first place.*" (https://www.cnbc.com/2023/03/30/kelly-evans-we-are-so-not-out-of-the-woods.html; March 30, 2023)

[58] https://www.cbo.gov/publication/58457
[59] https://www.cnbc.com/2023/03/28/us-treasury-yields-investors-consider-economic-outlook.html
[60] https://www.cnbc.com/video/2023/03/27/advisors-capitals-chuck-lieberman-bank-crisis-to-run-its-course-quickly.html

- "Treasury yields are likely to fall this year, and we expect the 10-year Treasury yield to end 2023 around 3.25%." (https://www.nuveen.com/en-us/insights/investment-outlook/fixed-income-weekly-commentary; March 27, 2023)

Figure 44: Treasury Yield Curves based on maturity duration

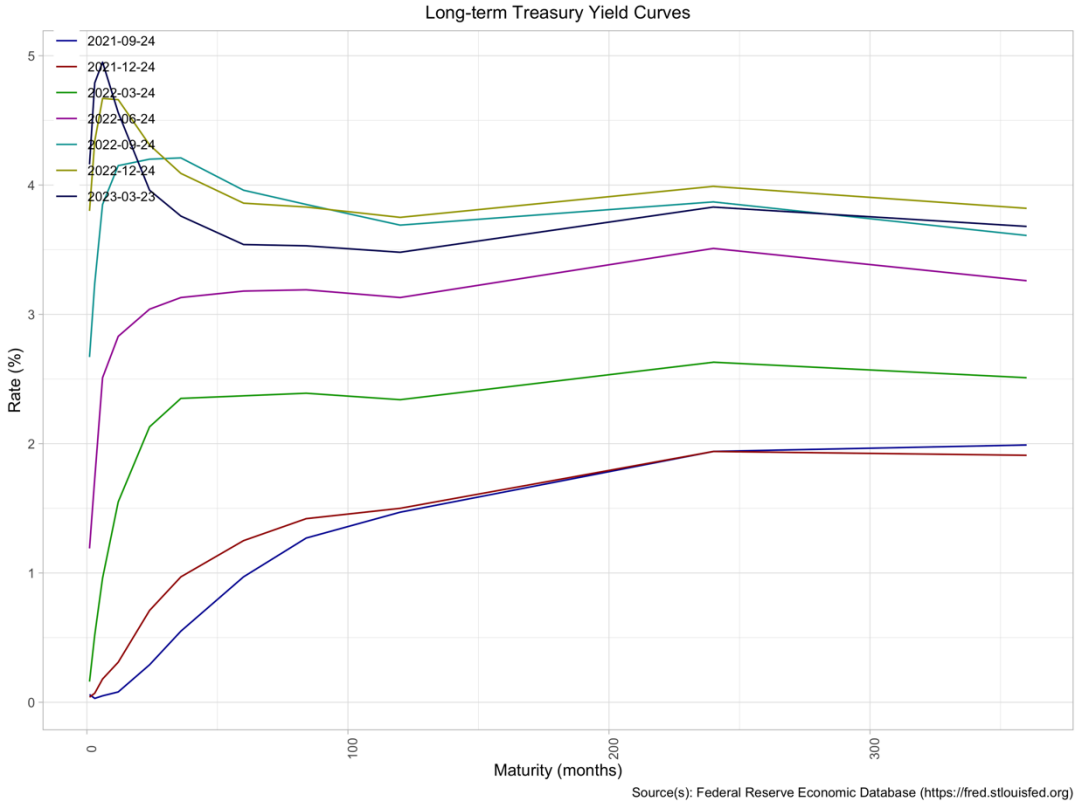
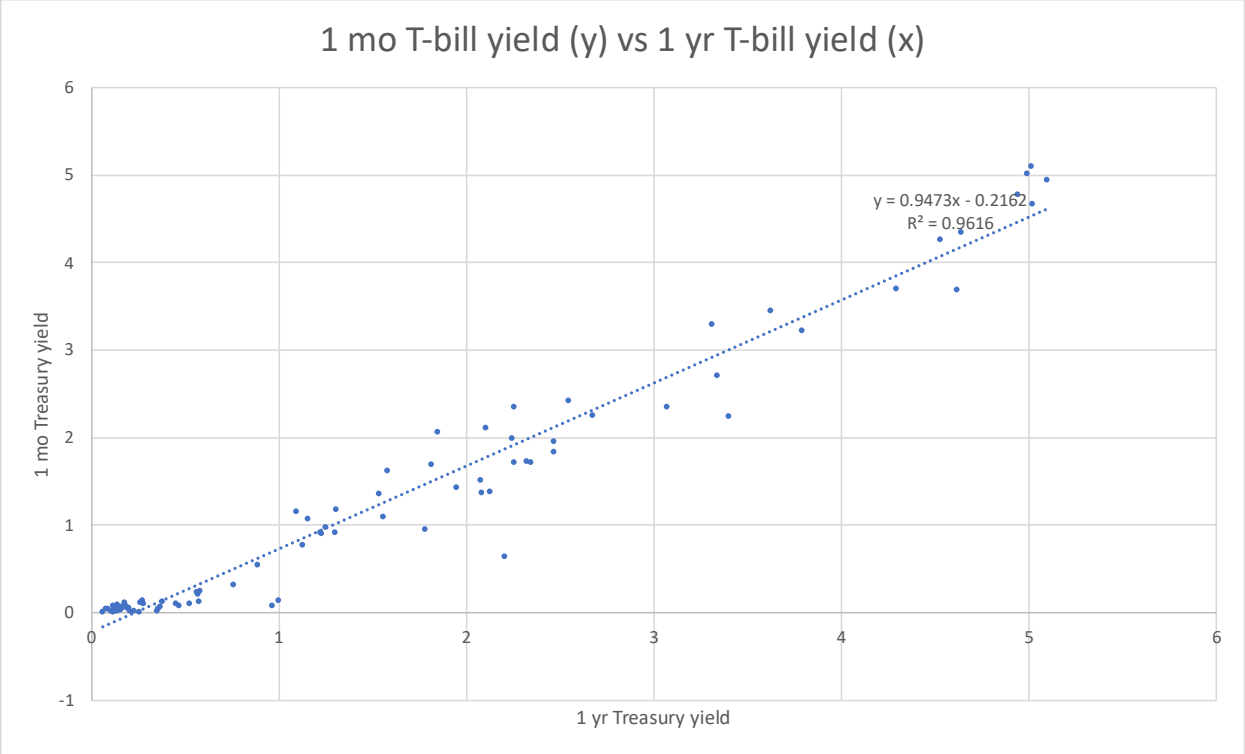
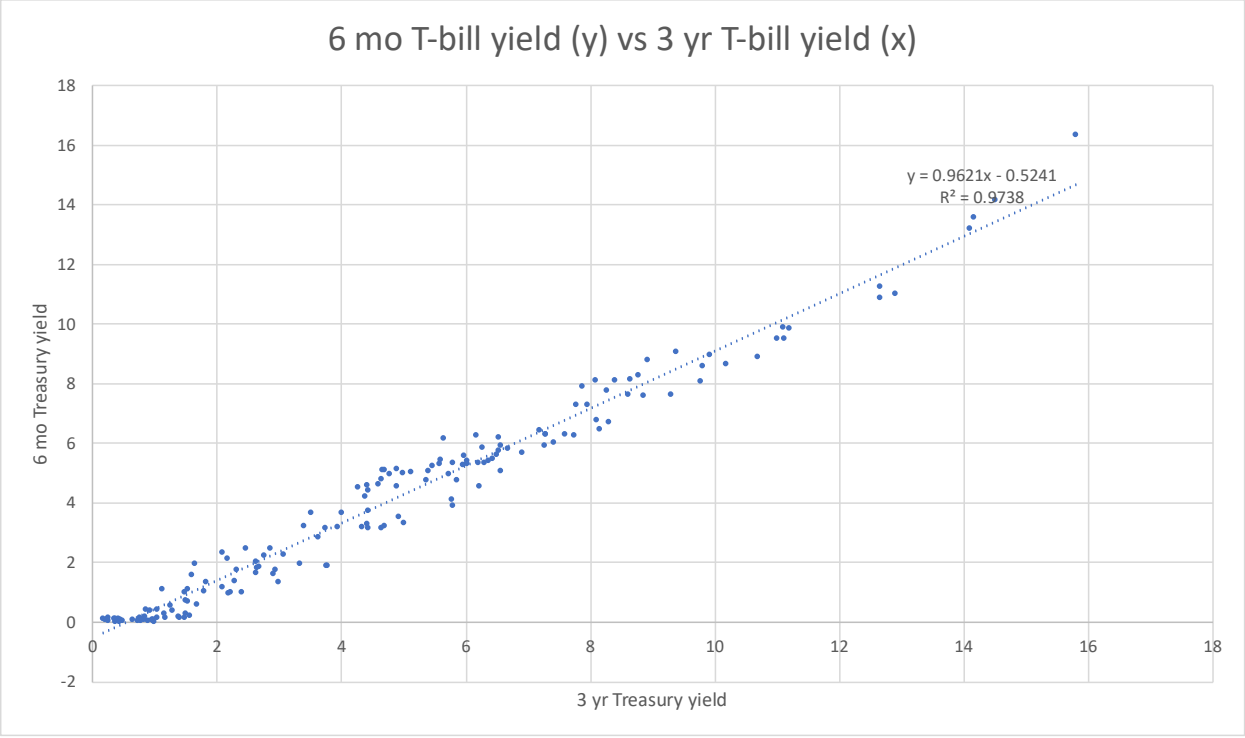


Figure 45: 1-month Treasury yield rates, as a function of 1-year Treasury yield rates



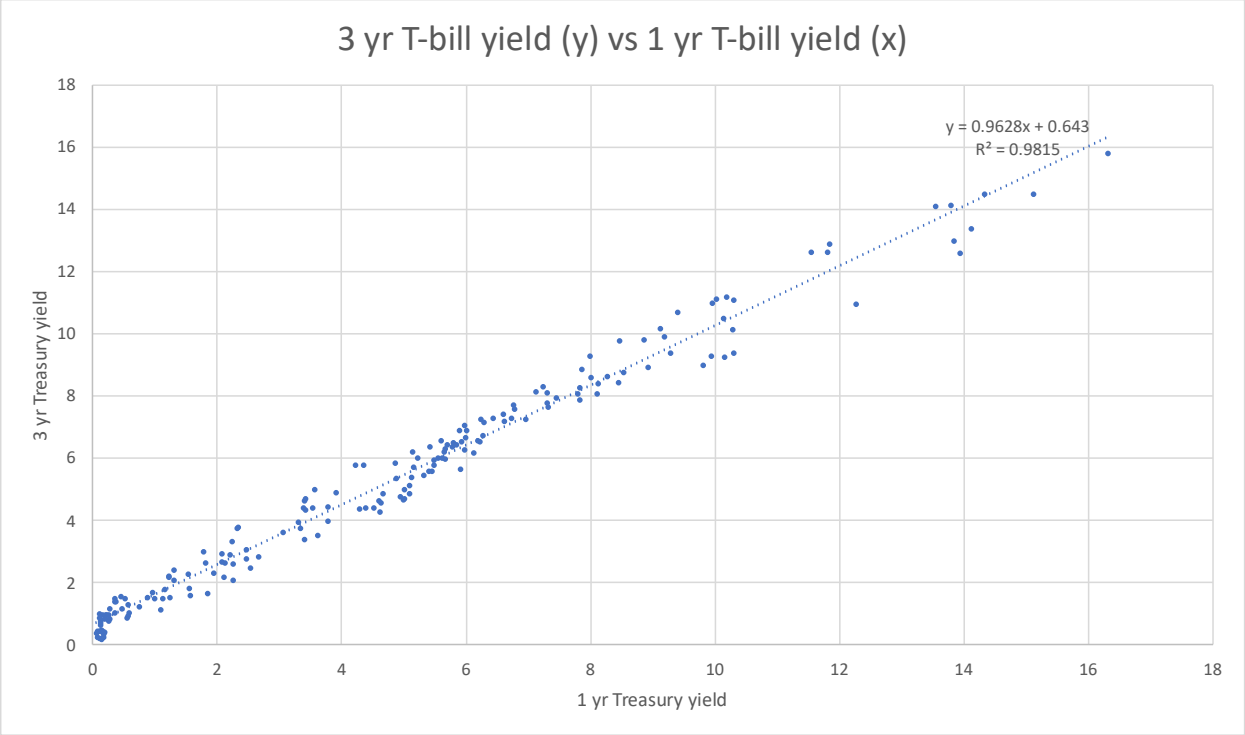
Source: Authors' calculation

Figure 46: 6-month Treasury yields, as a function of 3-year Treasury yields



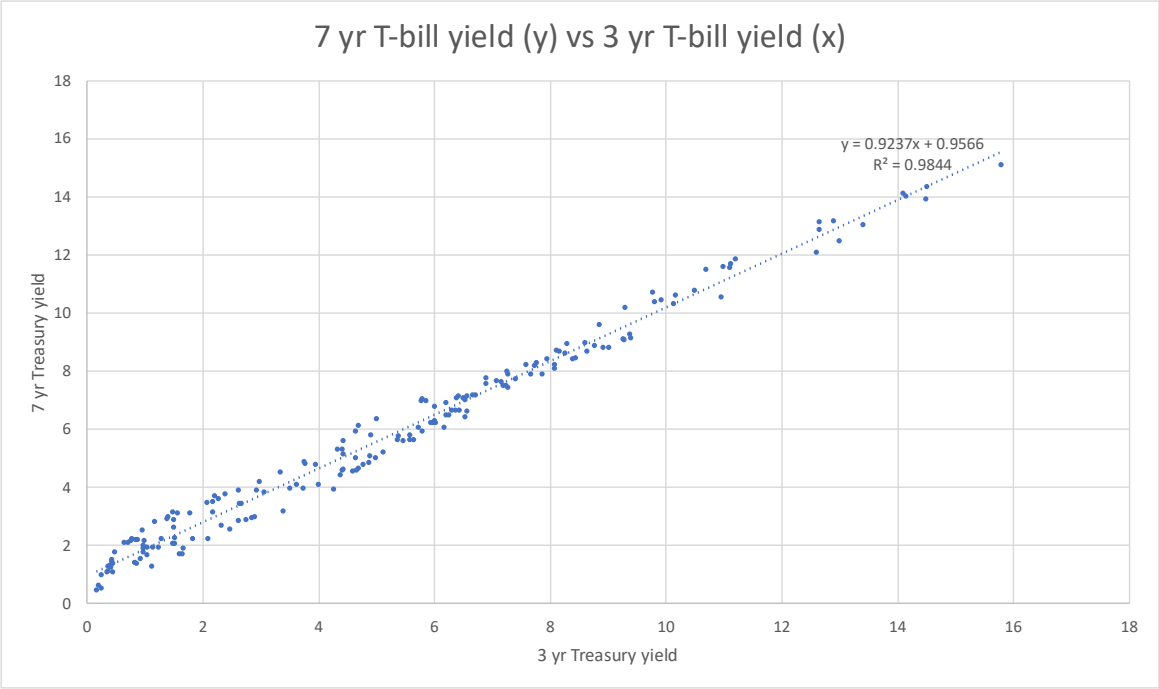
Source: Authors' calculation

Figure 47: 3-year Treasury yields, as a function of 1-year Treasury yields



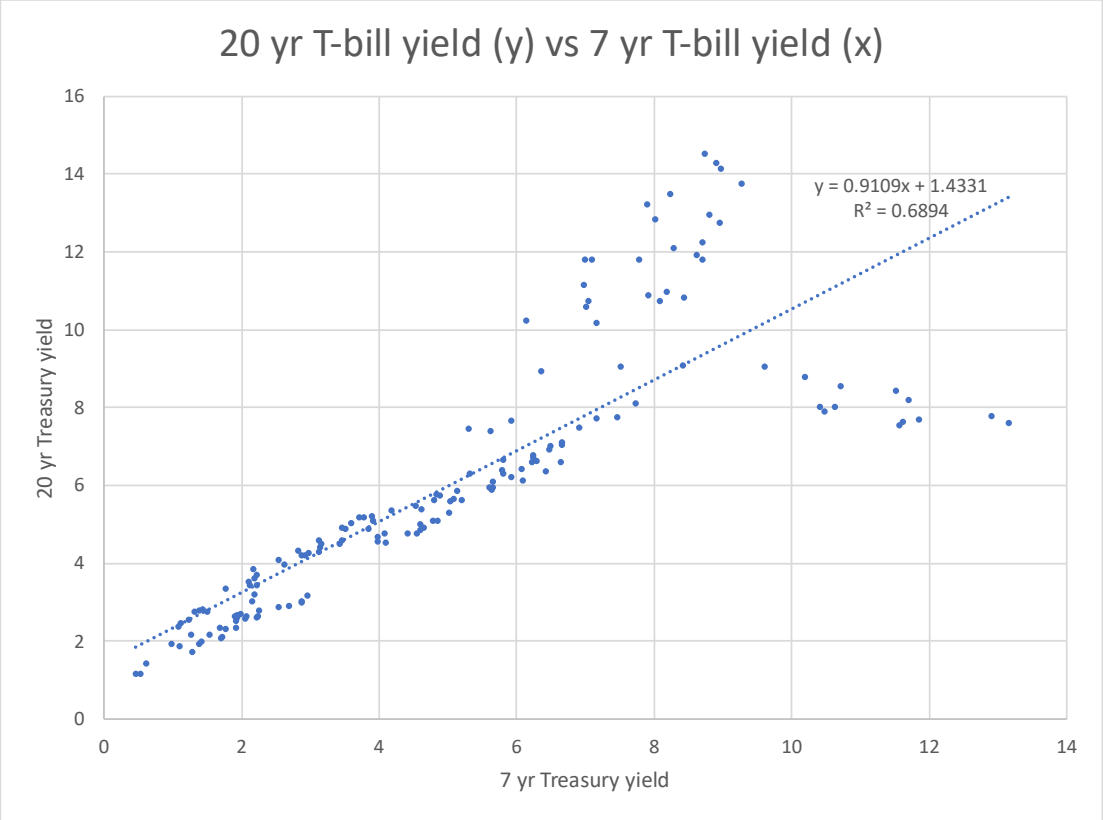
Source: Authors' calculation

Figure 48: 7-year Treasury yields, as a function of 3-year Treasury yields



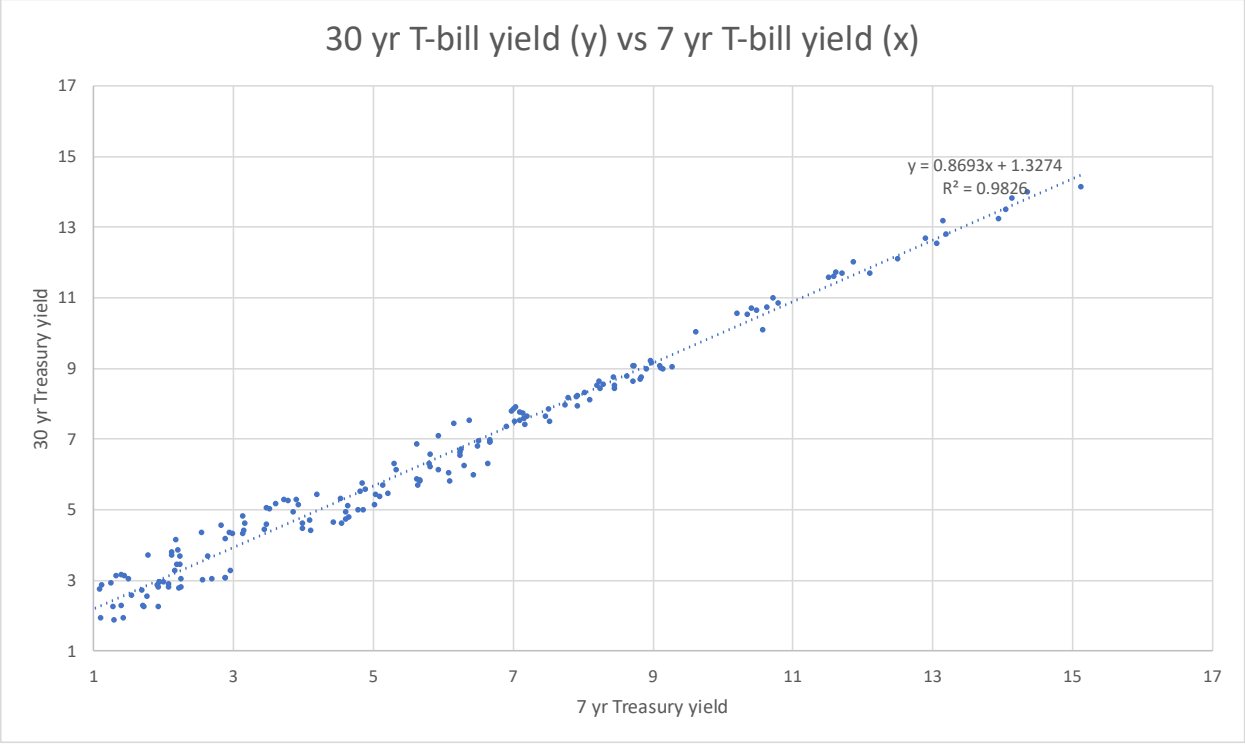
Source: Authors' calculation

Figure 49: 20-year Treasury yields, as a function of 7-year Treasury yields



Source: Authors' calculation

Figure 50: 30-year Treasury yields, as a function of 7-year Treasury yields



Source: Authors' calculation

30-year Mortgage Rate

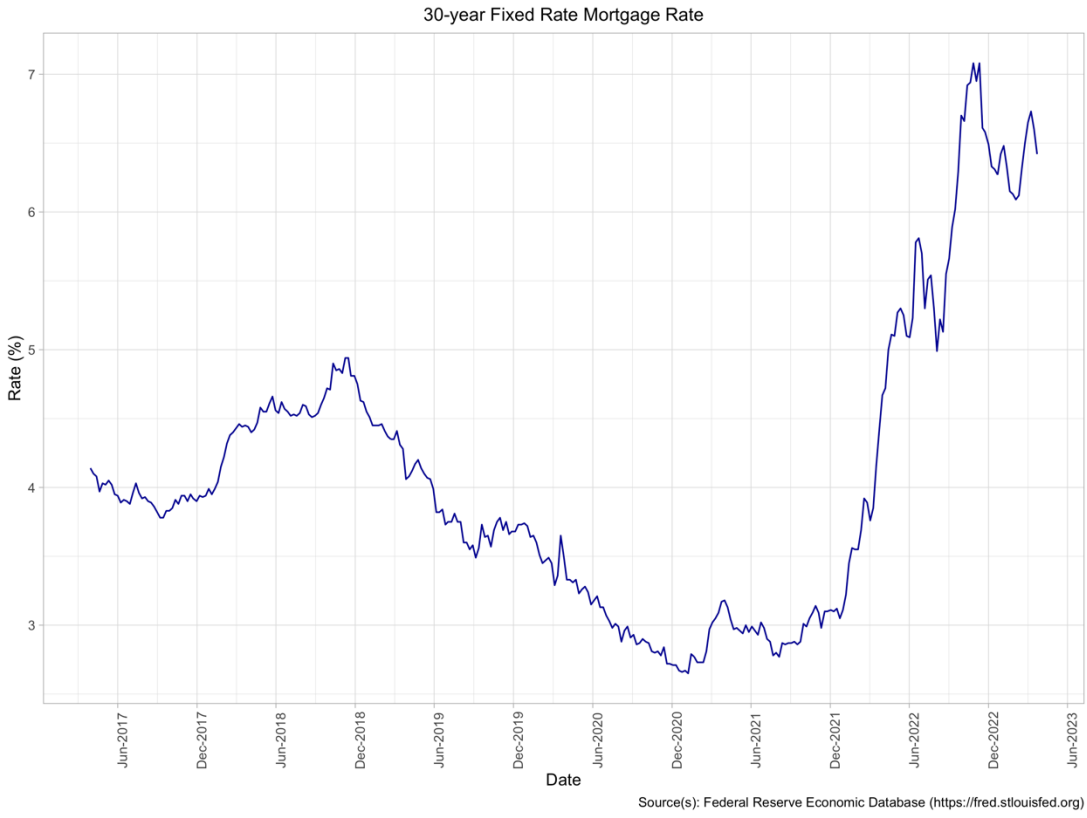
Analysis

Mortgage rates have been traditionally tightly correlated with mid-duration Treasury yields given the typical sources of funding and duration of held mortgages. We see the historical (30-year fixed-rate mortgage) rates in Figure 51, including the drop in mortgage rates leading up to and during the first year of the COVID-19 pandemic, rates' stabilization around 3% for about 21 months, followed by increases that (expectedly) tightly correlate with overnight lending rates.

Day-to-day, we expect to see interest rates driven by the demand for, and the profitability of, mortgage products. Interest rate increases are slowing more than we anticipated, with the FOMC telegraphing that they (ideally) want to only have one more 25 bp increase for overnight lending (implying that ***mortgage rates could be firmly entrenched above 7% during the summer peak selling season***). As rates retreat slightly during the fall, the questions of whether the FOMC has control of inflation and unemployment will become more significant. Bankers, as mortgage originators and (potentially) servicing agents, will be watching the Fed', as well as Freddie Mac and Fannie Mae, for signals of turbulence in the market.

We also expect the rigor with which bankers are scrutinizing mortgage applicants to continue. Given the fragility of the job market, underwriters will be looking for any chink in applicant's proverbial armor, with the process itself likely causing a small percentage of the market to abandon its goal.

Figure 51: US 30-year (fixed rate) mortgage rate



Other Commentary

- "The Fed signaled in a statement following the March meeting that 'some additional policy firming may be appropriate' to bring inflation to its target rate of 2%. Experts believe this suggests the Fed may be ready to push the pause button on tightening, especially in the wake of multiple high-profile bank failures. Additionally, inflation continues to cool, falling to 6.0% in February from 6.4% the previous month, according to the latest Consumer Price Index (CPI) report." (https://www.forbes.com/advisor/mortgages/mortgage-interest-rates-forecast/ ; March 31, 2003)
- "… [W]e expect mortgage rates to continue rising and so with food, energy and real estate prices remaining high, home ownership can feel extremely challenging at the moment. … As a result, many first-time buyers are backing out of the market altogether. For current homeowners, a recent survey from Redfin reveals that mortgage payments are now the highest they've ever been. The typical homeowner now pays $2,563 on mortgage payments 29% higher than they'd have paid in 2022. Not surprisingly the latest Home Purchase Sentiment report from Fannie Mae shows that both homebuyers and owners are feeling increasingly pessimistic about market conditions. Sentiment has lowered — due to worries about job security, rising rates and home sellers are concerned about a potential slump in home prices (which has yet to fully materialize)." (https://www.kiplinger.com/real-estate/mortgage-rates-and-payments-keep-rising; March 10, 2023)

Moody's AAA & BAA Rates; and the BofA BBB Corporate Yield

Analysis

AAA bond rates tend to track with mid-duration Treasury yields, with rates for bonds with lower grades tending to be higher (in conjunction with their risk ratings). On a quarterly basis, Moody's Seasoned AAA Corporate Bond yield was 4.81% in 4Q2022 and 4.52% in 1Q2023; Moody's BAA yields were 5.97% and 5.60%, respectively. These figures imply that the market viewed the potential for defaults as decreasing (slightly) for BAA bonds over AAA bonds as the difference in returns went from a +1.16% premium for BAA bonds (over AAA bonds in 4Q2022) to a +1.08% premium in 1Q2023. In contrast, the quarterly averages for the 1-year and 7-year Treasury yields were 4.61% and 3.93% in 4Q2022, and 4.76% and 3.74% (respectively) in 1Q2023. We present these numbers, and comparable numbers for the more familiar 10-year/2-year yield spread, in Table 2[61].

Table 2: Comparison between Moody's Bond Yields and Treasury Yields

Instrument	4Q2022	1Q2023	Δ
Moody's AAA Bonds	4.81%	4.52%	-0.29%
Moody's BAA Bonds	5.97%	5.60%	-0.37%
BAA-AAA Yield Spread	+1.16%	+1.08%	
1-year Treasury Yield	4.61%	4.76%	+0.16%
7-year Treasury Yield	3.93%	3.74%	-0.19%
2-year Treasury Yield	4.39%	4.34%	-0.05%
10-year Treasury Yield	3.83%	3.65%	-0.18%

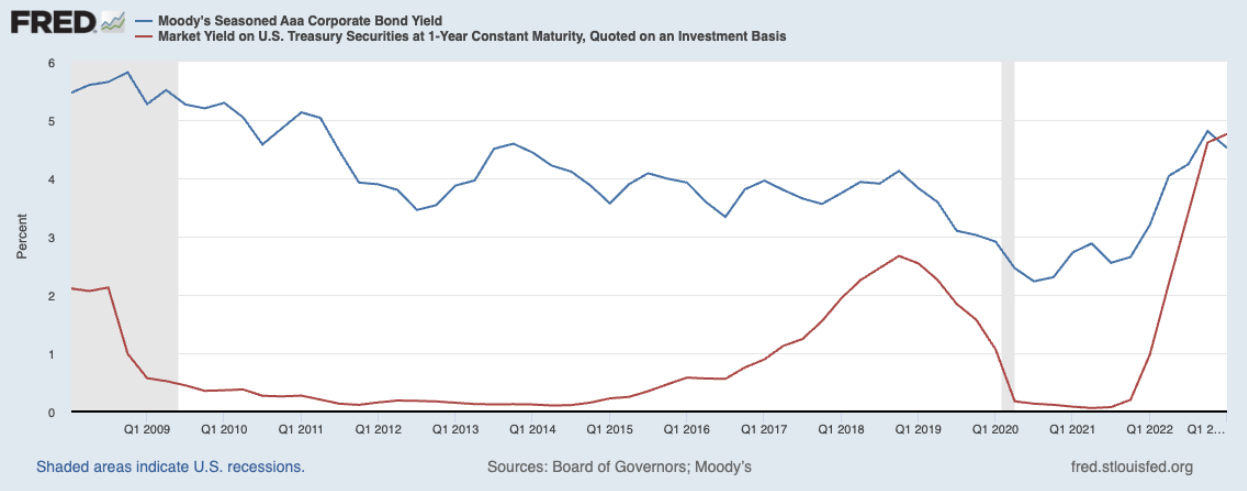
[61] See https://fred.stlouisfed.org/series/DGS10, https://fred.stlouisfed.org/series/DGS7, https://fred.stlouisfed.org/series/DGS2, https://fred.stlouisfed.org/series/DGS1, https://fred.stlouisfed.org/series/aaa, and https://fred.stlouisfed.org/series/baa

10 yr-2 yr Yield Spread	-0.56%	-0.69%	

There are a few interesting points in Table 2. First, as lending interest rates increase, the 1-year Treasury yield is coming extremely close to the AAA bond yields, despite the minimal additional amount of risk that is associated with that corporate bond over the US Treasury bill. Second, the 1-year Treasury yield has increased notably while the 2-year has decreased slightly between 4Q2022 and 1Q2023; the 7-year and 10-year Treasury yields have decreased comparably, which intuitively makes sense given how far out they are on the yield curve.

However, to put a sharp point on the situation, both grades of bonds have lost approximately 30 bp of yield while the 1-year Treasury yield has gained 16 bp of yield, and (given the 1Q2023 quarterly average figures) ***the AAA yield is 5 bp less than that of the 1-year Treasury yield (see Figure 52), a relationship that hasn't occurred since 3Q 1981***; at that time, the AAA yield and the 1-year Treasury yield jockeyed amongst each other for almost 3 years, presenting a unique opportunity to investors. Given the direction of inflation and the current regime of "Quantitative Tightening", ***we believe that this phenomena could repeat itself over the next 12 to 36 months***. The only thing that we can foresee buoying bond yields are actually default rates, which are reported as being on the rise due primarily to the Russia-Ukraine conflict causing an increased number of defaults in the recent months.[62]

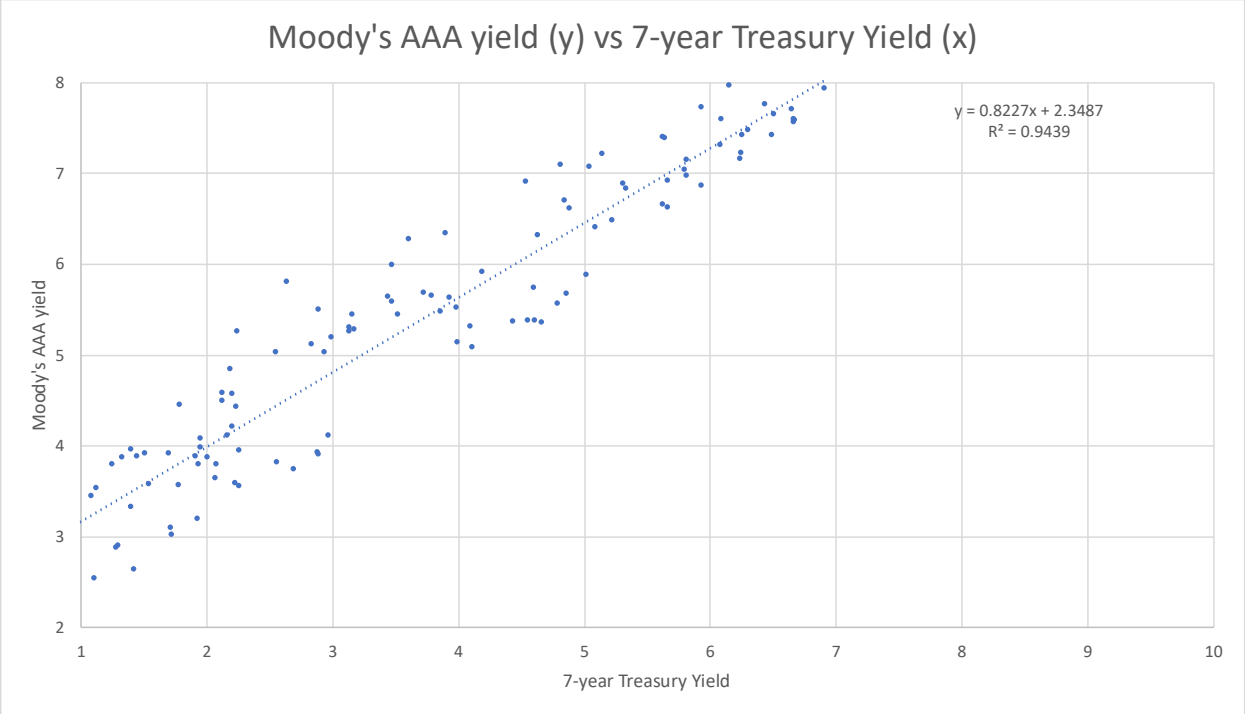
Figure 52: Moody's Seasoned AAA Corporate Bond Yield versus 1-Year Treasury Yield



See Figure 53 for how Moody's AAA yields have historically tracked with the 7-year Treasury yield.

[62] https://www.investmentexecutive.com/news/research-and-markets/corporate-defaults-set-to-rise-into-2024-moodys/

Figure 53: Moody's AAA-grade investment yields, as a function of 7-year Treasury yields



Source: Authors' calculation

Other Commentary

- "High yield corporates also gained, returning 0.35% for the week, though they lagged similar-duration Treasuries by -6 bps. Yields fell -5 bps, but spreads rose 7 bps to reach their widest levels in five months. Outflows continued, with -$902 million leaving high yield funds and $1.7 billion leaving loan funds. The loan asset class had a small negative return of -0.02%." (https://www.nuveen.com/en-us/insights/investment-outlook/fixed-income-weekly-commentary; March 23, 2023)

Prime Rate

Analysis

The Prime Rate is a benchmark rate that many banks use for setting consumer credit rates for creditworthy customers. It is generally based on the federal funds rate, and a spread (typically 3%) is dictated by banks as a matter of policy to specify lending rates for mortgages, small business loans, and personal loans[63]. The quarterly average of the Prime Rate is currently (as of this writing) 7.69%, and the daily value is currently 8.0%[64].

We do not expect the relationship between the federal funds rate and the Prime Rate to change in the near future. We do believe that it is possible that the FOMC could raise the federal funds rate as much

[63] https://www.investopedia.com/terms/p/primerate.asp
[64] https://fred.stlouisfed.org/series/DPRIME

as 50 bp during its next meeting in early May, but it seems more likely that the federal funds rate will be raised by no more than 25 bp, causing the Prime Rate to increase to 8.25%. ***We believe that it is possible that the Prime Rate could rise by as much as 100 bp from its current level by YE2023, with a 75 bp increase viewed as more plausible.***

US Average Retail Gasoline Price

Analysis

The US average retail gasoline price for regular unleaded gasoline is $3.51/gallon[65] at the time of this writing, about 16% less than it was one year ago. (See Figure 54 and Figure 55.) Further, retail gasoline is up about 6.1% in the past month, with prices the lowest in the Southeast US, and highest in the West[66].

EIA forecasts that oil prices will fall in 2023 and 2024, believing that Brent crude oil prices (currently $85/barrel, as of this writing[67]) will hit $83/barrel in 2023 and $78/barrel in 2024. Goldman-Sachs, on the other hand, estimates that prices will rise to $95/barrel by YE2023, a dramatic difference[68]. However, there are three factors that the EIA identifies as potentially impacting that forecast:

- Russia's oil production and ability to export petroleum products (now exporting directly to India and China by sea, counter to sanctions by the US & EU nations[69]),
- Several countries' ability to increase oil production, and
- China's loosening of COVID-related restrictions[70].

Again, given these factors and the energy inflation rate expected for the near term, ***we expect mean retail prices to remain between $3.40/gallon and $3.90/gallon through the Summer of 2023***.

To that point, Fox Business reports "A group of OPEC+ countries led by Saudi Arabia, Iraq, and the United Arab Emirates announced a surprise oil production cut on Sunday that will reduce the energy bloc's output by 1.15 million barrels per day from May through the end of this year. The latest cuts are in addition to the 2 million barrels per day output cuts OPEC+ announced in October."[71] The result of this has pundits speculating about a 5% immediate increase (during week of April 2, 2023)[72] and a long-term 15%-20% increase in retail gasoline prices.[73]

Other Commentary

- "OPEC appears concerned about oil demand taking a hit in the United States and other Western nations later this year, as higher interest rates weigh on economic growth and a possible banking crisis makes financial markets jittery. But for now, demand appears to be solid, so the reduced output is likely to push oil prices higher. We look for WTI to trade between $75 and $85 per barrel this spring, and possibly spike even higher if any further disruptions to supply hit the market." (https://www.kiplinger.com/economic-forecasts/energy; April 3, 2023)

[65] https://gasprices.aaa.com/
[66] https://gasprices.aaa.com/like-the-temperatures-gas-prices-start-to-rise/
[67] https://oilprice.com/
[68] https://www.cnbc.com/2023/04/03/oil-opec-just-made-the-feds-job-more-complicated-heres-what-they-did.html
[69] https://www.cnn.com/2023/04/02/business/opec-production-cuts/index.html
[70] https://www.eia.gov/outlooks/steo/report/BTL/2023/01-brentprice/article.php
[71] https://www.foxbusiness.com/markets/yellen-opec-production-cut-regrettable-not-positive-global-growth
[72] https://www.bbc.com/news/business-61188579 and https://www.cnn.com/2023/04/02/business/opec-production-cuts/index.html
[73] https://www.foxbusiness.com/economy/gas-prices-4-gallon-after-opec-production-cut

Figure 54: Crude Oil vs Retail Gasoline Prices

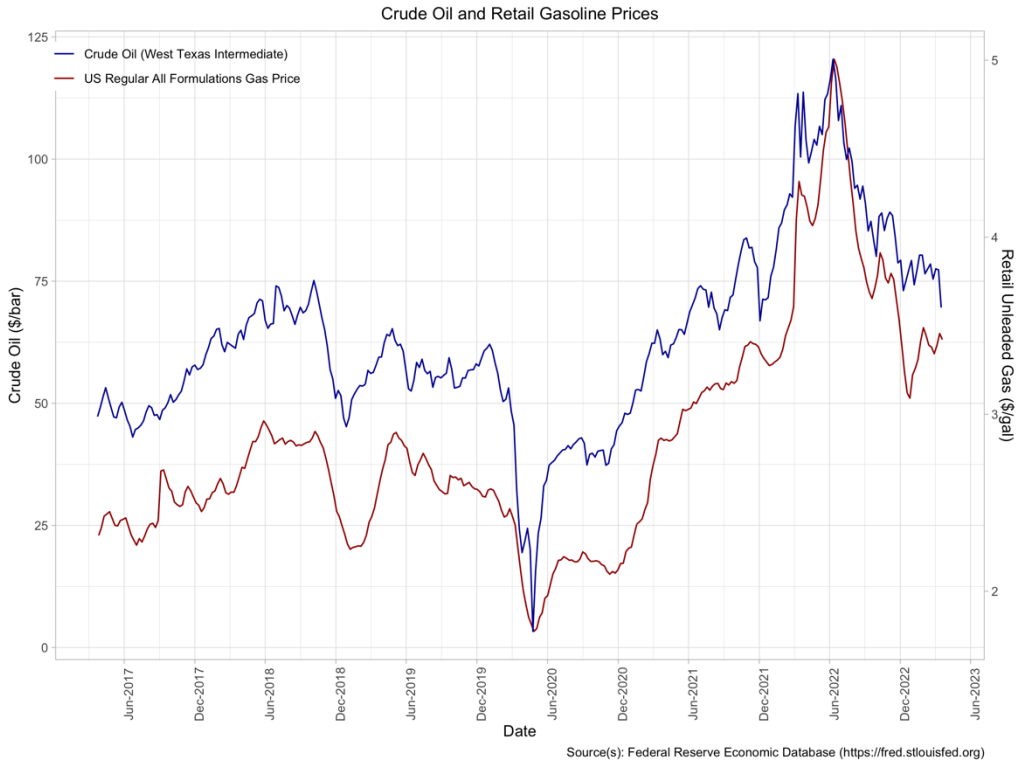
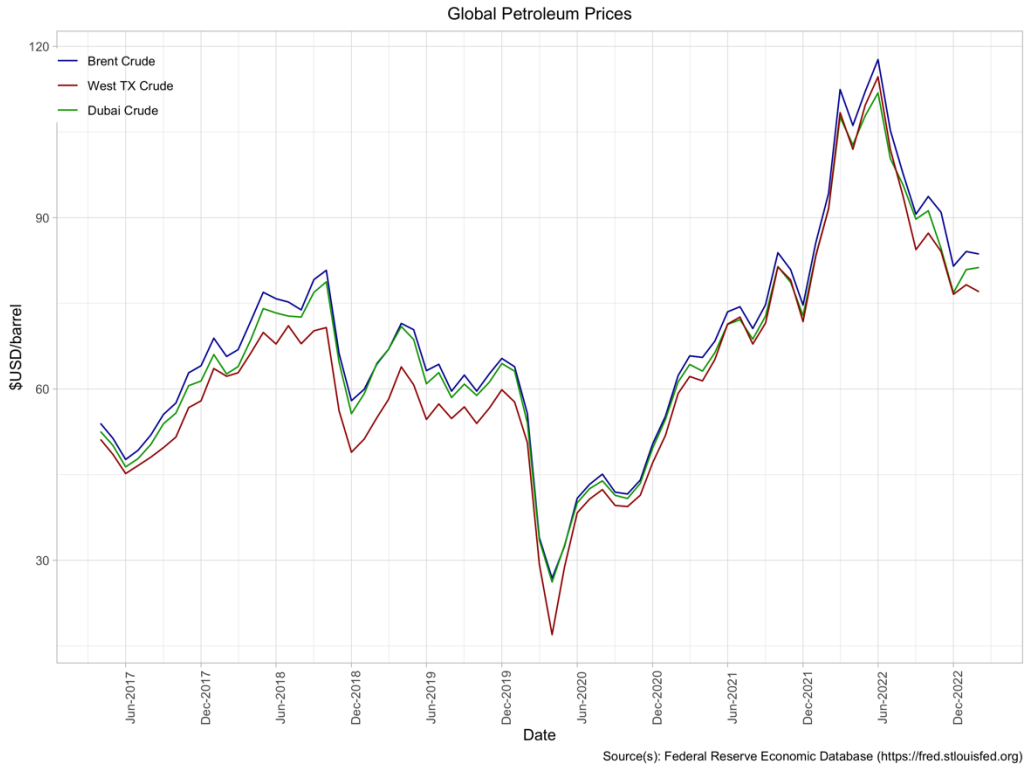


Figure 55: Global crude oil prices



- "Our forecast indicates that wholesale electricity prices fall in 2023. The decline in price reflects the forecast drop in natural gas prices from 2022 to 2023. Natural gas is the most-used fuel for power generation in the United States. In addition, increasing electricity generation from renewable sources contributes to lower power prices." (https://www.eia.gov/outlooks/steo/; March 7, 2023)
- "After a tumultuous year for gas prices, some relief may be on the way in 2023. The yearly national average price of gas in 2023 is forecast to drop nearly 50 cents per gallon from that of 2022 to $3.49, according to GasBuddy's 2023 Fuel Outlook released this past Friday. Continuing improvement in refinery capacity will help alleviate gasoline and diesel prices, though high levels of uncertainty remain amidst Russia's ongoing war on Ukraine and continuing economic concerns. A $4 national average remains possible ahead of and during the summer driving season." (https://www.wane.com/top-stories/what-does-the-future-hold-for-gas-prices-gasbuddy-releases-2023-forecast/; January 9, 2023)

House and Commercial Real Estate Price Indexes

Analysis

Residential Real Estate continues to be a significant burden to most households coming out of the COVID-19 pandemic. Per a report from the National Bureau of Economic Research, "… the shift to remote work explains over one half of the 23.8 percent national house price increase [since late

2019]".[74] Additionally, the authors state that, at the time of their work, each additional percentage point of workers that are working remotely causes a 0.93% increase of home prices. (Similarly, and based on different information sources, renters have seen significant increases in rent: the US nationwide median rent was $1,637 in February 2019, peaked at $2,053 in August 2022, and is now $1,937 in February 2023.[75])

Intuitively, the authors' conclusions are relevant, given that they contend that their analysis accounts for an increase in residential property prices of just over 15% due to the shift to remote work that the COVID-19 pandemic motivated.[76] Y/Y change in nationwide median home prices spiked in mid-2021, exceeding 25% in May 2021; for the first time in 11 years, Y/Y change in median home price was negative in February 2023.[77] This point is not entirely unexpected as the number of homes sold have consistently declined for each of the 12 months ending in January 2023;[78] coinciding with the FOMC's increases in federal funds rates which eventually impact US mortgage rates.

Since it seems that the FOMC is currently telegraphing that it is planning to raise rates no more than 50 bp during 2023, *ceteris paribus*, ***we expect for home sales to increase from current levels seasonally during 2Q and early-3Q and then retreat before YE2023***. Acceptance of current mortgage rates, and adjustments of price expectations, is progressing, and, while we think that home sales will be slightly retarded compared to pre-pandemic levels, prices will generally hold their ground or relent some (more) of the gains that have occurred over the past 36 months.

[74] See https://www.nber.org/system/files/working_papers/w30041/w30041.pdf
[75] Per https://www.rent.com/research/average-rent-price-report/
[76] Ibid.
[77] https://www.wsj.com/articles/home-prices-fell-in-february-for-first-time-in-11-years-73df0107
[78] https://www.wsj.com/articles/u-s-home-sales-fell-in-january-for-12th-straight-month-ef2a2e71

Figure 56: US Nationwide Housing Inventory

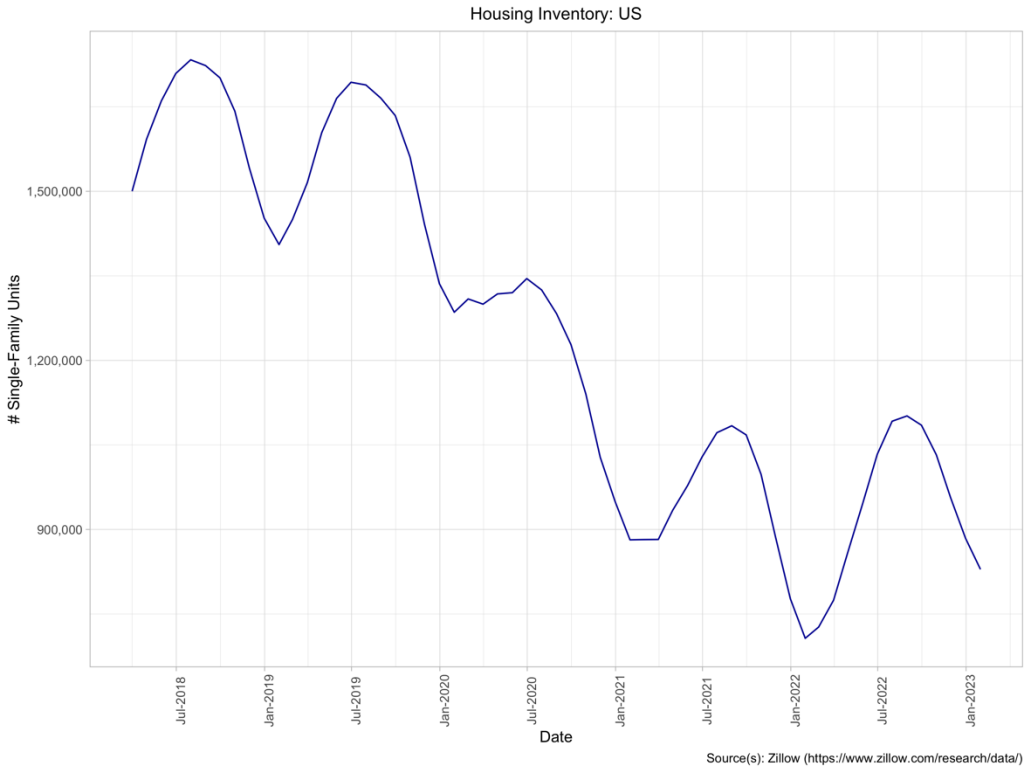


Figure 57: Y/Y % Change in Housing Inventory

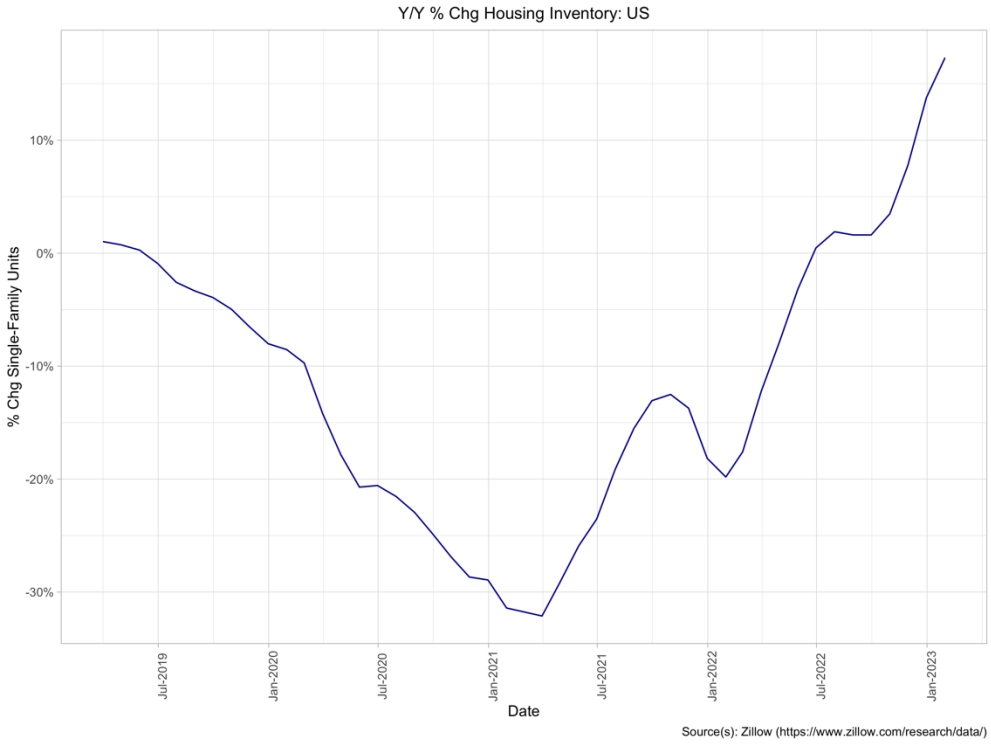
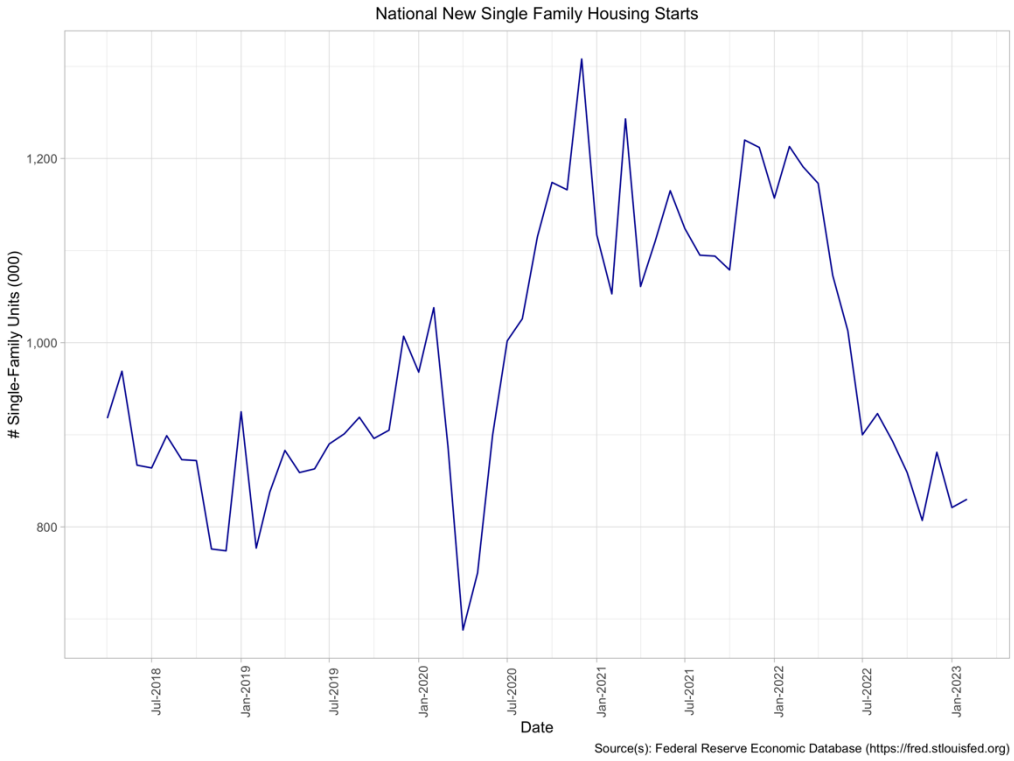


Figure 58: US Nationwide Housing Starts (thou.)



Commercial Real Estate is a simmering pot that is becoming an increasing concern. While many have speculated about repurposing the growing CRE portfolio in the US (including previous versions of this report), many large markets are experiencing notable decreases in office occupancy post-COVID. Nationwide, the National Association of Realtors reports that office space leases are down nearly 60% from 1Q 2019,[79] with smaller markets outperforming the country as a whole.[80] Austin, Atlanta, and Houston, as examples, are reported as having the worst vacancy rates last month, with each having over 20% of its corporate real estate unused.[81] According to Cushman & Wakefield, there are a total of 6.6B square feet of office space in the US (i.e., 330M ft^2 is 5% of US office space[82]), and more than 50% of office vacancies are located in only about 7% of office markets in the nation.[83]

Also according to Cushman & Wakefield, office vacancy is projected to rise before coming down slowly through 2030. At that rate, the office market would have a vacancy rate of 18% — mirroring where it is today — by the end of the decade, surpassing what is estimated to be a healthy vacancy rate of 13%.

Given that there is currently significantly more CRE available than is easily usable, it is worth noting there is another 400M ft^2 that are either being planned or under construction nationwide.[84] Add to these points that, per Goldman-Sachs, the banks that are approximately the same size as Silicon Valley

[79] https://www.newsnationnow.com/business/work-from-home-vacant-offices/
[80] https://www.nar.realtor/commercial/create/the-office
[81] https://www.newsnationnow.com/business/work-from-home-vacant-offices/
[82] https://www.costar.com/article/670443844/us-office-market-imbalance-could-mean-330-million-square-feet-of-opportunity
[83] Ibid.
[84] https://www.commercialedge.com/blog/national-office-report/

Bank (or smaller) are holding about 80% of all CRE loans today.[85] Given the glut in CRE that is seen as currently existing, and the decreased demand post-pandemic, one would be reasonable to think that rent prices per square foot would be declining, and, as a result, the value of the CRE property (collateral for the construction loans) would leave one concerned about the value of the CRE loans. Further, it seems quite plausible that the smaller banks that are holding the CRE loans are disproportionately leveraged in the commercial real estate market, and the syndication of notes across banks and inter-connectedness of the markets should be extremely concerning in the case that banks start to experience defaults, thereby tightening credit standards, which will cause owners to incur further losses & defaults.[86]

Other Commentary

- "Regional banks are a critical source of funding for commercial borrowers because national banks such as Wells Fargo and Bank of America are less likely to provide funds to the average commercial practitioner. But with the recent failures of regional lenders Silicon Valley Bank and Signature Bank, smaller lenders may consider commercial projects be too risky. These banks may even mark down the value of some commercial loans. [NAR Chief Economist Lawrence Yun] predicted that commercial lending will see a 'slight contraction' over the next year." (https://www.nar.realtor/magazine/real-estate-news/commercial/bank-failures-may-cause-commercial-lending-to-tighten; March 23, 2023)
- "CommercialEdge already expects that 2023 office transaction volumes will be at their lowest levels since the years following the Great Financial Crisis. The national vacancy rate currently sits at approx. 17%. Remote work and tech-focused layoffs have certain centers, such as Denver, Seattle, and San Francisco already sitting above 18%. This is before any further impacts make their way through the system, such as the fallout from SVB, and the rapid deployment of AI. … All I will say is that in a few short months, a lot of white-collar jobs have already been augmented to the point that smaller teams are likely warranted. At some point, this will flow through to an already pressured office sector." (https://www.forbes.com/sites/markledain/2023/03/19/the-larger-hidden-risk-to-the-market-after-svb/?sh=52e7b5f47302; March 19, 2023)
- "In the next year or so, [David Smith is the global head of occupier services for Cushman & Wakefield] said, office vacancy is projected to rise before coming down slowly through 2030. At that rate, the office market would have a vacancy rate of 18% — mirroring where it is today — by the end of the decade, surpassing what is estimated to be a healthy vacancy rate of 13%, Smith said. Those five percentage points into unhealthy vacancy territory represents about 330 million square feet of office space, Smith said." (https://www.costar.com/article/670443844/us-office-market-imbalance-could-mean-330-million-square-feet-of-opportunity; March 15, 2023)

[85] Further, over $500B of CRE debt is held by banks with assets of less than $1.3B over the last two years, and those banks' CRE originations went from $800B in 2012 to $2T in mid-2022.
[86] https://www.investing.com/analysis/commercial-real-estate-market-is-a-ticking-time-bomb-for-small-banks-200636853

Dow Jones Total Stock Market Index (end-of-quarter); S&P 500 (quarterly average); and the Market Volatility Index (VIX)

Analysis

The Dow Jones U.S. Total Market Index (DWCF) is a market-capitalization-weighted index that represents the top 95% of the U.S. stock market based on market capitalization. Per Table 3, stocks have rebounded slightly during 1Q2023.

Table 3: Approximate Quarterly Milestones for the Dow-Jones Total Market Index

Period	Index Range[87]	Trading Days	Avg points/day
2Q2022 (4/1/2022-6/30/2022)	45847.30 → 37976.52	63	-124.93
3Q2022 (7/1/2022-9/30/2022)	37976.52→ 36097.99	64	-29.4
4Q2022 (10/1/2022-12/31/2022)	36097.99 → 38520.60	61	39.7
1Q2023 (1/1/2023-3/31/2023)	38520.60 → 41136.55	62	42.2

We note in Table 4 that the Standard & Poor's 500 Index ("SP500") is an index of 500 very large, publicly traded companies in the U.S.

Table 4: Approximate Quarterly Milestones for the Standard and Poor's 500 ("SP500") Index

Period	Index Range[88]	Trading Days	Avg points/day
2Q2022 (4/1/2022-6/30/2022)	4530.41→ 3785.38	63	-11.82
3Q2022 (7/1/2022-9/30/2022)	3785.38 → 3585.62	64	-3.12
4Q2022 (10/1/2022-12/31/2022)	3585.62 → 3839.50	61	4.16
1Q2023 (1/1/2023-3/31/2023)	3839.50 → 4109.31	62	4.35

However, the notable point of this section is that of the VIX: it's quarterly average has gone from 27.4 in 2Q2022, to 24.8 in 3Q2022, to 25.0 in 4Q2022, to 20.7 in 1Q2023, and falling. The crux of these numbers is the perception of *decreasing* forward-looking market volatility. Generally speaking, with decreasing volatility, we should see increasing levels of the DWCF and the SP500.

The biggest headwind in the equities market at the time of this writing is what was alluded to in a previous section of this paper: the equity markets are not presenting the risk-weighted returns that (essentially risk-free) Treasury yields are offering. In other words, bonds are currently generating noteworthy returns as compared to the risk associated with the equity market. When the investment premium over a risk-free yield is too small in light of the risk of that investment's default, then it becomes increasing likely that yields must rise in order to maintain the market for the equity. S&P Global Ratings places the corporate default rate at 1.7% as of December 2022[89], and Moody's estimates that the default rate of corporate bonds is 2.8% overall for the year ending February 2023.[90]

[87] Index values found at https://www.marketwatch.com/investing/index/dwcf
[88] Index values found at https://www.marketwatch.com/investing/index/spx
[89] https://www.spglobal.com/ratings/en/research/articles/230216-default-transition-and-recovery-growing-strains-could-push-the-u-s-speculative-grade-corporate-default-rat-12640407
[90] See https://www.moodys.com/creditfoundations/Default-Trends-and-Rating-Transitions-05E002

Other Commentary

- "The demand for high-yield bonds has faltered since February due to a rise in U.S. Treasury yields, as strong economic activity bolstered expectations that inflation would remain sticky and the Federal Reserve would have to raise interest rates more to contain it." (https://www.reuters.com/markets/rates-bonds/investors-shun-high-yield-bonds-recession-banking-risks-2023-03-16/; March 16, 2023)
- "S&P Global Ratings forecasts that costlier financing from higher rates and weaker corporate earnings will increase the 12-month trailing default rate of non-investment-grade rated companies to 4% by December, up from a historically low 1.7% at the end of 2022. … BNP Paribas forecasts a default rate of 5% in 2023 that will persist through 2024 if interest rates stay elevated." (https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/fed-risks-more-defaults-if-interest-rates-go-higher-for-longer-74706361; March 14, 2023)
- "Terry Sandven, chief equity strategist at U.S. Bank Wealth Management in Minneapolis sees "significant headwinds for equities" including elevated inflation, the Fed's rating hiking cycle and decreasing earnings expectations for 2023 … [Sandven] said it is "difficult to envision equities trending meaningfully higher" but still he said "sentiment is becoming increasing constructive." (https://www.reuters.com/markets/us/sp-500-index-seen-climbing-5-by-end-2023-2023-02-22/; Feb. 22, 2023)

Regression Analyses

The following section document the linear regression coefficients found for each of the aforementioned variables, as a function of other variables (which are not significantly correlated with the control variable). With this report, we have also included the natural log and the square of all variables as experimental (dependent) variables; these variables are denoted by a "LN_" prefix and a "_2" suffix below (respectively).

To compare the effectiveness of these regressions, we calculate the percentage error between the forecasted value (based on the given regression, using the values from the immediately preceding quarter) and the actual value for the period between 1Q2013 and 4Q2022, inclusive.

Table 15: Regression Aggregate Errors for 1Q2013 through 4Q2022

Variable	Min Abs. Error	Average Error	Max Abs. Error
Real GDP Growth	19.64%	**	***
Nominal GDP Growth	33.02%	**	***
Real Disposable Income Growth	4.70%	-37.68%	552.00%
Nominal Disposable Income Growth	2.11%	0.96%	468.25%
Inflation	0.00%	-491.13%	***
Unemployment Rate	30.49%	-134.40%	310.70%
1-month Treasury Yield	2.58%	213.64%	***
3-month Treasury Yield	0.00%	55.18%	799.44%
6-month Treasury Yield	2.38%	88.44%	***
1-year Treasury Yield	1.37%	84.73%	918.42%
3-year Treasury Yield	28.69%	-96.03%	559.57%
5-year Treasury Yield	1.08%	10.55%	383.85%
7-year Treasury Yield	1.06%	25.36%	326.29%
10-year Treasury Yield	0.55%	-10.33%	198.09%
20-year Treasury Yield	0.69%	4.56%	57.12%
30-year Treasury Yield	0.48%	1.55%	41.12%
30-year Mortgage Rate	0.33%	-1.77%	22.16%
Moody's AAA Curve	0.41%	3.62%	29.17%
Moody's BAA Curve	2.16%	-28.82%	75.99%
BBB Corporate Yield	1.78%	-32.74%	81.21%
Prime Rate	0.06%	0.61%	33.46%
US Average Retail Gasoline Price	7.95%	386.85%	713.59%
Cost of Federal Funds	3.34%	16.96%	***
Dow Jones Total Stock Market Index	10.54%	20.76%	292.70%
S&P 500 Stock Price Index	56.09%	358.84%	***
Commercial Real Estate Price Index	0.01%	-5.54%	67.44%
Residential Home Price Index	0.14%	0.04%	44.62%
Market Volatility Index	9.46%	38.34%	140.12%

** The indicated value has a percentage error less than -1000%.
*** The indicated value has a percentage error greater than 1000%.

Real & Nominal GDP Growth, Real & Nominal Disposable Income Growth, and CPI Inflation Rate

REGRESSION FOR REAL GDP GROWTH

	Dependent variable (+/- SE):
	Real GDP growth
Constant	-140.894 (+/- 25.393)
	p = 0.00001***
Real disposable income growth	-6.839 (+/- 0.836)
	p = 0.00000***
Nominal disposable income growth	6.461 (+/- 0.793)
	p = 0.00000***
Unemployment Rate	-4.163 (+/- 0.642)
	p = 0.00000***
CPI Inflation Rate	-4.822 (+/- 0.670)
	p = 0.00000***
Market Volatility Index	-0.106 (+/- 0.037)
	p = 0.009***
10-year Treasury Yield	213.645 (+/- 27.907)
	p = 0.00000***
LN_10-year Treasury Yield	-212.331 (+/- 22.345)
	p = 0.000***
7-year Treasury Yield	-61.588 (+/- 8.337)
	p = 0.00000***
6-month Treasury Yield	-13.395 (+/- 2.000)
	p = 0.00000***
3-year Treasury Yield	59.290 (+/- 6.952)
	p = 0.000***
3-year Treasury Yield_2	-6.009 (+/- 0.641)
	p = 0.000***
3-month Treasury Yield_2	-2.188 (+/- 0.501)
	p = 0.0002***
10-year Treasury Yield_2	-24.474 (+/- 4.063)
	p = 0.00001***
20-year Treasury Yield_2	7.578 (+/- 1.057)
	p = 0.00000***
Observations	40
R^2	0.957
Adjusted R^2	0.933

Residual Std. Error	1.974 (df = 25)
F Statistic	39.941*** (df = 14; 25)
Note:	*p<0.1; **p<0.05; ***p<0.01

REGRESSION FOR NOMINAL GDP GROWTH

	Dependent variable (+/- SE):
	Nominal GDP growth
Constant	-215.408 (+/- 24.904)
	p = 0.00000***
US Fed Reserve O-N Loan Rate	61.982 (+/- 13.077)
	p = 0.0001***
Real disposable income growth	-8.818 (+/- 1.256)
	p = 0.00000***
Nominal disposable income growth	8.445 (+/- 1.191)
	p = 0.00000***
Unemployment Rate	-6.506 (+/- 1.025)
	p = 0.00001***
CPI Inflation Rate	-6.553 (+/- 1.000)
	p = 0.00001***
Prime Rate	6.905 (+/- 1.923)
	p = 0.002***
LN_30-year Treasury Yield	47.656 (+/- 8.034)
	p = 0.00001***
1-month Treasury Yield	-98.569 (+/- 15.722)
	p = 0.00001***
7-year Treasury Yield	-13.185 (+/- 3.230)
	p = 0.0005***
5-year Treasury Yield	186.191 (+/- 17.686)
	p = 0.000***
LN_5-year Treasury Yield	-146.855 (+/- 13.150)
	p = 0.000***
1-year Treasury Yield	62.745 (+/- 9.305)
	p = 0.00000***
LN_1-year Treasury Yield	-14.098 (+/- 2.642)
	p = 0.00003***
3-year Treasury Yield_2	-5.189 (+/- 1.247)
	p = 0.0005***
5-year Treasury Yield_2	-29.250 (+/- 3.167)
	p = 0.000***
10-year Treasury Yield_2	3.426 (+/- 0.806)
	p = 0.0004***
Market Volatility Index_2	-0.003 (+/- 0.0004)

	p = 0.00000***
Observations	40
R^2	0.966
Adjusted R^2	0.940
Residual Std. Error	2.115 (df = 22)
F Statistic	36.762*** (df = 17; 22)
Note:	*p<0.1; **p<0.05; ***p<0.01

REGRESSION FOR REAL DISPOSABLE INCOME GROWTH

	Dependent variable (+/- SE):
	Real disposable income growth
Constant	5.432 (+/- 1.882)
	p = 0.007***
Real GDP growth	-0.945 (+/- 0.238)
	p = 0.0004***
Observations	40
R^2	0.294
Adjusted R^2	0.275
Residual Std. Error	11.342 (df = 38)
F Statistic	15.798*** (df = 1; 38)
Note:	*p<0.1; **p<0.05; ***p<0.01

REGRESSION FOR NOMINAL DISPOSABLE INCOME GROWTH

	Dependent variable (+/- SE):
	Nominal disposable income growth
Constant	7.034 (+/- 1.929)
	p = 0.001***
Real GDP growth	-0.839 (+/- 0.244)
	p = 0.002***
Observations	40
R^2	0.238
Adjusted R^2	0.218
Residual Std. Error	11.630 (df = 38)
F Statistic	11.856*** (df = 1; 38)
Note:	*p<0.1; **p<0.05; ***p<0.01

REGRESSION FOR CPI INFLATION RATE

	Dependent variable (+/- SE):
	CPI Inflation Rate
Constant	24.092 (+/- 3.643)
	p = 0.00002***
US Fed Reserve O-N Loan Rate	-14.276 (+/- 2.956)
	p = 0.0004***
Real GDP growth	-1.568 (+/- 0.085)
	p = 0.000***
Nominal GDP growth	1.424 (+/- 0.078)
	p = 0.000***
Nominal disposable income growth	-0.025 (+/- 0.008)
	p = 0.007***
Unemployment Rate	-0.613 (+/- 0.179)
	p = 0.005***
Prime Rate	-4.056 (+/- 0.471)
	p = 0.00000***
Home Price Index	0.207 (+/- 0.022)
	p = 0.00000***
Commercial Real Estate Price Index	-0.148 (+/- 0.016)
	p = 0.00000***
US Avg Retail Gasoline Price ($-gal; all grades, all formulations)	1.253 (+/- 0.336)
	p = 0.003***
20-year Treasury Yield	24.320 (+/- 2.611)
	p = 0.00000***
LN_20-year Treasury Yield	-44.954 (+/- 4.044)
	p = 0.00000***
10-year Treasury Yield	13.211 (+/- 1.809)
	p = 0.00001***
LN_10-year Treasury Yield	-29.301 (+/- 3.670)
	p = 0.00001***
1-month Treasury Yield	29.251 (+/- 4.040)
	p = 0.00001***
LN_1-month Treasury Yield	1.478 (+/- 0.218)
	p = 0.00002***
7-year Treasury Yield	-11.856 (+/- 2.068)
	p = 0.0001***
5-year Treasury Yield	-11.629 (+/- 1.722)

	p = 0.00002***
LN_5-year Treasury Yield	19.895 (+/- 2.860)
	p = 0.00001***
6-month Treasury Yield	-47.171 (+/- 5.487)
	p = 0.00001***
3-year Treasury Yield	-13.884 (+/- 3.274)
	p = 0.001***
LN_3-year Treasury Yield	9.436 (+/- 1.778)
	p = 0.0002***
1-year Treasury Yield	43.638 (+/- 6.621)
	p = 0.00002***
LN_1-year Treasury Yield	-2.905 (+/- 0.817)
	p = 0.004***
1-year Treasury Yield_2	-9.789 (+/- 2.200)
	p = 0.001***
3-year Treasury Yield_2	3.906 (+/- 0.944)
	p = 0.002***
6-month Treasury Yield_2	6.705 (+/- 1.630)
	p = 0.002***
Observations	40
R^2	0.996
Adjusted R^2	0.989
Residual Std. Error	0.236 (df = 13)
F Statistic	136.943*** (df = 26; 13)
Note:	*p<0.1; **p<0.05; ***p<0.01

Unemployment Rate

REGRESSION FOR UNEMPLOYMENT RATE

	Dependent variable (+/- SE):
	Unemployment Rate
Constant	4.119 (+/- 0.415)
	p = 0.003***
SP500 Stock Price Index	-0.001 (+/- 0.00001)
	p = 0.00001***
US Fed Reserve O-N Loan Rate	-3.095 (+/- 0.071)
	p = 0.00003***
Moody's AAA Curve	1.127 (+/- 0.035)
	p = 0.0001***
Moody's BAA Curve	-1.019 (+/- 0.016)
	p = 0.00001***
Real GDP growth	-0.981 (+/- 0.006)
	p = 0.00000***
Nominal GDP growth	0.837 (+/- 0.006)
	p = 0.00000***
Real disposable income growth	-0.324 (+/- 0.009)
	p = 0.0001***
Nominal disposable income growth	0.289 (+/- 0.009)
	p = 0.0001***
CPI Inflation Rate	-0.837 (+/- 0.008)
	p = 0.00001***
30-year Mortgate Rate	0.667 (+/- 0.037)
	p = 0.0004***
Home Price Index	0.124 (+/- 0.001)
	p = 0.00001***
Commercial Real Estate Price Index	-0.069 (+/- 0.0005)
	p = 0.00000***
Market Volatility Index	0.021 (+/- 0.001)
	p = 0.00004***
30-year Treasury Yield	-4.645 (+/- 0.246)
	p = 0.0004***
20-year Treasury Yield	18.869 (+/- 0.315)
	p = 0.00002***
LN_20-year Treasury Yield	-30.015 (+/- 0.534)
	p = 0.00002***

LN_10-year Treasury Yield	-8.845 (+/- 0.055)
	p = 0.00000***
1-month Treasury Yield	11.885 (+/- 0.151)
	p = 0.00001***
7-year Treasury Yield	-21.856 (+/- 0.166)
	p = 0.00000***
LN_7-year Treasury Yield	14.440 (+/- 0.148)
	p = 0.00001***
3-month Treasury Yield	-4.400 (+/- 0.037)
	p = 0.00001***
5-year Treasury Yield	5.364 (+/- 0.057)
	p = 0.00001***
6-month Treasury Yield	-31.218 (+/- 0.184)
	p = 0.00000***
LN_6-month Treasury Yield	2.447 (+/- 0.023)
	p = 0.00001***
3-year Treasury Yield	3.803 (+/- 0.073)
	p = 0.00002***
1-year Treasury Yield	31.212 (+/- 0.148)
	p = 0.00000***
LN_1-year Treasury Yield	-5.690 (+/- 0.031)
	p = 0.00000***
1-year Treasury Yield_2	-5.346 (+/- 0.046)
	p = 0.00001***
6-month Treasury Yield_2	3.827 (+/- 0.037)
	p = 0.00001***
5-year Treasury Yield_2	-1.752 (+/- 0.014)
	p = 0.00001***
3-month Treasury Yield_2	1.011 (+/- 0.015)
	p = 0.00001***
7-year Treasury Yield_2	1.818 (+/- 0.022)
	p = 0.00001***
10-year Treasury Yield_2	0.969 (+/- 0.009)
	p = 0.00001***
20-year Treasury Yield_2	-0.928 (+/- 0.043)
	p = 0.0003***
30-year Treasury Yield_2	1.118 (+/- 0.050)
	p = 0.0002***
Market Volatility Index_2	-0.001 (+/- 0.00001)

	p = 0.00001***
Observations	40
R^2	1.000
Adjusted R^2	1.000
Residual Std. Error	0.005 (df = 3)
F Statistic	196,866.800*** (df = 36; 3)
Note:	*p<0.1; **p<0.05; ***p<0.01

Treasury Yields (1, 3, & 6-month; 1, 3, 5, 7, 10, 20, & 30-year series)

REGRESSION FOR 1-MONTH TREASURY YIELD

	Dependent variable (+/- SE):
	1-month Treasury Yield
Constant	3.805 (+/- 0.799)
	p = 0.00004***
Unemployment Rate	-0.241 (+/- 0.044)
	p = 0.00001***
10-year Treasury Yield	-3.088 (+/- 0.674)
	p = 0.0001***
7-year Treasury Yield_2	0.223 (+/- 0.023)
	p = 0.000***
10-year Treasury Yield_2	0.805 (+/- 0.168)
	p = 0.00003***
Observations	40
R^2	0.813
Adjusted R^2	0.791
Residual Std. Error	0.433 (df = 35)
F Statistic	38.006*** (df = 4; 35)
Note:	*p<0.1; **p<0.05; ***p<0.01

REGRESSION FOR 3-MONTH TREASURY YIELD

	Dependent variable (+/- SE):
	3-month Treasury Yield
Constant	4.141 (+/- 0.634)
	p = 0.00000***
Moody's BAA Curve	-0.476 (+/- 0.129)
	p = 0.001***
Unemployment Rate	-0.245 (+/- 0.045)
	p = 0.00001***
Observations	40
R^2	0.547
Adjusted R^2	0.523
Residual Std. Error	0.546 (df = 37)
F Statistic	22.343*** (df = 2; 37)
Note:	*p<0.1; **p<0.05; ***p<0.01

REGRESSION FOR 6-MONTH TREASURY YIELD

	Dependent variable (+/- SE):
	6-month Treasury Yield
Constant	-13.011 (+/- 1.586)
	p = 0.000***
Moody's BAA Curve	1.189 (+/- 0.150)
	p = 0.000***
BBB corporate yield	0.568 (+/- 0.171)
	p = 0.003***
Commercial Real Estate Price Index	0.025 (+/- 0.003)
	p = 0.000***
Observations	40
R^2	0.743
Adjusted R^2	0.722
Residual Std. Error	0.570 (df = 36)
F Statistic	34.698*** (df = 3; 36)
Note:	*p<0.1; **p<0.05; ***p<0.01

REGRESSION FOR 1-YEAR TREASURY YIELD

	Dependent variable (+/- SE):
	1-year Treasury Yield
Constant	-12.907 (+/- 1.539)
	p = 0.000***
Moody's BAA Curve	1.250 (+/- 0.145)
	p = 0.000***
BBB corporate yield	0.493 (+/- 0.166)
	p = 0.006***
Commercial Real Estate Price Index	0.025 (+/- 0.003)
	p = 0.000***
Observations	40
R^2	0.766
Adjusted R^2	0.746
Residual Std. Error	0.553 (df = 36)
F Statistic	39.212*** (df = 3; 36)
Note:	*p<0.1; **p<0.05; ***p<0.01

REGRESSION FOR 3-YEAR TREASURY YIELD

	Dependent variable (+/- SE):
	3-year Treasury Yield
Constant	-4.256 (+/- 0.897)
	p = 0.00004***
SP500 Stock Price Index	-0.002 (+/- 0.0003)
	p = 0.00005***
Home Price Index	0.051 (+/- 0.009)
	p = 0.00000***
Observations	40
R^2	0.517
Adjusted R^2	0.491
Residual Std. Error	0.683 (df = 37)
F Statistic	19.838*** (df = 2; 37)
Note:	*p<0.1; **p<0.05; ***p<0.01

REGRESSION FOR 5-YEAR TREASURY YIELD

	Dependent variable (+/- SE):
	5-year Treasury Yield
Constant	3.613 (+/- 0.344)
	p = 0.000***
Unemployment Rate	-0.196 (+/- 0.041)
	p = 0.00003***
US Avg Retail Gasoline Price ($-gal; all grades, all formulations)	-0.354 (+/- 0.127)
	p = 0.009***
Observations	40
R^2	0.594
Adjusted R^2	0.572
Residual Std. Error	0.439 (df = 37)
F Statistic	27.056*** (df = 2; 37)
Note:	*p<0.1; **p<0.05; ***p<0.01

REGRESSION FOR 7-YEAR TREASURY YIELD

	Dependent variable (+/- SE):
	7-year Treasury Yield
Constant	2.277 (+/- 0.133)
	p = 0.000***
LN_1-month Treasury Yield	0.214 (+/- 0.056)
	p = 0.0005***
Observations	40
R^2	0.279
Adjusted R^2	0.260
Residual Std. Error	0.630 (df = 38)
F Statistic	14.698*** (df = 1; 38)
Note:	*p<0.1; **p<0.05; ***p<0.01

REGRESSION FOR 10-YEAR TREASURY YIELD

	Dependent variable (+/- SE):
	10-year Treasury Yield
Constant	2.945 (+/- 0.367)
	p = 0.000***
SP500 Stock Price Index	-0.0004 (+/- 0.0001)
	p = 0.00000***
Unemployment Rate	-0.198 (+/- 0.039)
	p = 0.00002***
1-month Treasury Yield	1.495 (+/- 0.366)
	p = 0.0003***
LN_1-month Treasury Yield	-0.389 (+/- 0.104)
	p = 0.001***
1-month Treasury Yield_2	-0.301 (+/- 0.087)
	p = 0.002***
Observations	40
R^2	0.718
Adjusted R^2	0.676
Residual Std. Error	0.341 (df = 34)
F Statistic	17.305*** (df = 5; 34)
Note:	*p<0.1; **p<0.05; ***p<0.01

REGRESSION FOR 20-YEAR TREASURY YIELD

	Dependent variable (+/- SE):
	20-year Treasury Yield
Constant	3.233 (+/- 0.398)
	p = 0.000***
Prime Rate	-0.433 (+/- 0.069)
	p = 0.00000***
Dow Total Stock Market Index	-0.00003 (+/- 0.00001)
	p = 0.00001***
US Avg Retail Gasoline Price ($-gal; all grades, all formulations)	0.504 (+/- 0.081)
	p = 0.00000***
1-month Treasury Yield	0.495 (+/- 0.051)
	p = 0.000***
Observations	40
R^2	0.862
Adjusted R^2	0.846
Residual Std. Error	0.256 (df = 35)
F Statistic	54.588*** (df = 4; 35)
Note:	*p<0.1; **p<0.05; ***p<0.01

REGRESSION FOR 30-YEAR TREASURY YIELD

	Dependent variable (+/- SE):
	30-year Treasury Yield
Constant	3.950 (+/- 0.378)
	p = 0.000***
SP500 Stock Price Index	-0.0004 (+/- 0.00005)
	p = 0.000***
Prime Rate	-0.388 (+/- 0.067)
	p = 0.00001***
US Avg Retail Gasoline Price ($-gal; all grades, all formulations)	0.378 (+/- 0.075)
	p = 0.00002***
1-month Treasury Yield	0.357 (+/- 0.045)
	p = 0.000***
Observations	40
R^2	0.865
Adjusted R^2	0.850
Residual Std. Error	0.243 (df = 35)
F Statistic	56.143*** (df = 4; 35)
Note:	*p<0.1; **p<0.05; ***p<0.01

30-year Mortgage Rate

REGRESSION FOR 30-YEAR MORTGATE RATE

	Dependent variable (+/- SE):
	30-year Mortgate Rate
Constant	5.435 (+/- 0.289)
	p = 0.000***
Unemployment Rate	-0.128 (+/- 0.031)
	p = 0.0003***
Dow Total Stock Market Index	-0.00004 (+/- 0.00001)
	p = 0.00002***
Observations	40
R^2	0.481
Adjusted R^2	0.453
Residual Std. Error	0.369 (df = 37)
F Statistic	17.166*** (df = 2; 37)
Note:	*p<0.1; **p<0.05; ***p<0.01

Moody's AAA & BAA Rates

REGRESSION FOR MOODY'S AAA CURVE

	Dependent variable (+/- SE):
	Moody's AAA Curve
Constant	5.154 (+/- 0.429)
	p = 0.000***
SP500 Stock Price Index	-0.0004 (+/- 0.0001)
	p = 0.000***
Prime Rate	-0.364 (+/- 0.074)
	p = 0.00002***
US Avg Retail Gasoline Price ($-gal; all grades, all formulations)	0.295 (+/- 0.086)
	p = 0.002***
1-month Treasury Yield_2	0.123 (+/- 0.018)
	p = 0.00000***
Observations	40
R^2	0.834
Adjusted R^2	0.815
Residual Std. Error	0.277 (df = 35)
F Statistic	44.066*** (df = 4; 35)
Note:	*p<0.1; **p<0.05; ***p<0.01

REGRESSION FOR MOODY'S BAA CURVE

	Dependent variable (+/- SE):
	Moody's BAA Curve
Constant	5.468 (+/- 0.184)
	p = 0.000***
SP500 Stock Price Index	-0.001 (+/- 0.0001)
	p = 0.000***
LN_1-month Treasury Yield	-0.481 (+/- 0.108)
	p = 0.0001***
LN_6-month Treasury Yield	0.515 (+/- 0.134)
	p = 0.001***
1-year Treasury Yield_2	0.126 (+/- 0.018)
	p = 0.00000***
Observations	40
R^2	0.808
Adjusted R^2	0.786
Residual Std. Error	0.315 (df = 35)
F Statistic	36.757*** (df = 4; 35)
Note:	*p<0.1; **p<0.05; ***p<0.01

BBB Corporate Yield

REGRESSION FOR BBB CORPORATE YIELD

	Dependent variable (+/- SE):
	BBB corporate yield
Constant	5.021 (+/- 0.181)
	p = 0.000***
SP500 Stock Price Index	-0.001 (+/- 0.0001)
	p = 0.000***
US Fed Reserve O-N Loan Rate	0.424 (+/- 0.140)
	p = 0.005***
1-year Treasury Yield_2	-0.098 (+/- 0.032)
	p = 0.005***
3-month Treasury Yield_2	0.116 (+/- 0.038)
	p = 0.005***
Observations	40
R^2	0.792
Adjusted R^2	0.768
Residual Std. Error	0.326 (df = 35)
F Statistic	33.245*** (df = 4; 35)
Note:	*p<0.1; **p<0.05; ***p<0.01

Prime Rate

REGRESSION FOR PRIME RATE

	Dependent variable (+/- SE):
	Prime Rate
Constant	8.123 (+/- 0.759)
	p = 0.000***
Moody's AAA Curve	-2.732 (+/- 0.633)
	p = 0.0002***
Moody's BAA Curve	1.149 (+/- 0.296)
	p = 0.001***
Unemployment Rate	-0.161 (+/- 0.027)
	p = 0.00001***
BBB corporate yield	0.739 (+/- 0.100)
	p = 0.00000***
30-year Treasury Yield	-9.234 (+/- 2.213)
	p = 0.0003***
20-year Treasury Yield	7.505 (+/- 1.799)
	p = 0.0003***
20-year Treasury Yield_2	-0.949 (+/- 0.292)
	p = 0.003***
30-year Treasury Yield_2	1.417 (+/- 0.326)
	p = 0.0002***
Observations	40
R^2	0.902
Adjusted R^2	0.876
Residual Std. Error	0.259 (df = 31)
F Statistic	35.537*** (df = 8; 31)
Note:	*p<0.1; **p<0.05; ***p<0.01

US Average Retail Gasoline Price

REGRESSION FOR US AVG RETAIL GASOLINE PRICE (-GAL; ALL GRADES, ALL FORMULATIONS)

	Dependent variable (+/- SE):
	US Avg Retail Gasoline Price ($-gal; all grades, all formulations)
Constant	-28.440 (+/- 1.899)
	p = 0.00001***
US Fed Reserve O-N Loan Rate	4.371 (+/- 0.310)
	p = 0.00001***
Moody's AAA Curve	-0.423 (+/- 0.095)
	p = 0.004***
Real GDP growth	0.155 (+/- 0.022)
	p = 0.0003***
Nominal GDP growth	-0.137 (+/- 0.023)
	p = 0.001***
Real disposable income growth	-0.431 (+/- 0.059)
	p = 0.0002***
Nominal disposable income growth	0.418 (+/- 0.056)
	p = 0.0002***
CPI Inflation Rate	-0.209 (+/- 0.034)
	p = 0.0005***
BBB corporate yield	0.373 (+/- 0.041)
	p = 0.00004***
30-year Mortgate Rate	1.933 (+/- 0.124)
	p = 0.00001***
Prime Rate	0.832 (+/- 0.132)
	p = 0.0004***
Commercial Real Estate Price Index	0.033 (+/- 0.001)
	p = 0.00000***
20-year Treasury Yield	2.010 (+/- 0.326)
	p = 0.0005***
10-year Treasury Yield	-7.354 (+/- 0.361)
	p = 0.00000***
LN_10-year Treasury Yield	14.708 (+/- 0.591)
	p = 0.00000***
1-month Treasury Yield	-3.687 (+/- 0.497)
	p = 0.0002***
LN_1-month Treasury Yield	-0.544 (+/- 0.031)
	p = 0.00000***

7-year Treasury Yield	6.155 (+/- 0.854)
	p = 0.0002***
3-month Treasury Yield	-2.403 (+/- 0.129)
	p = 0.00000***
5-year Treasury Yield	8.160 (+/- 0.812)
	p = 0.00003***
LN_5-year Treasury Yield	-9.789 (+/- 0.633)
	p = 0.00001***
6-month Treasury Yield	6.310 (+/- 0.654)
	p = 0.00003***
3-year Treasury Yield	-0.858 (+/- 0.225)
	p = 0.007***
LN_3-year Treasury Yield	-2.063 (+/- 0.225)
	p = 0.00004***
1-year Treasury Yield	-5.192 (+/- 0.589)
	p = 0.00005***
1-year Treasury Yield_2	2.031 (+/- 0.216)
	p = 0.00004***
6-month Treasury Yield_2	-2.108 (+/- 0.178)
	p = 0.00001***
5-year Treasury Yield_2	-0.983 (+/- 0.114)
	p = 0.0001***
3-month Treasury Yield_2	0.686 (+/- 0.064)
	p = 0.00002***
7-year Treasury Yield_2	-0.776 (+/- 0.183)
	p = 0.004***
20-year Treasury Yield_2	-0.906 (+/- 0.072)
	p = 0.00001***
30-year Treasury Yield_2	0.388 (+/- 0.057)
	p = 0.0003***
Market Volatility Index_2	-0.0001 (+/- 0.00002)
	p = 0.0002***
Observations	40
R^2	1.000
Adjusted R^2	0.999
Residual Std. Error	0.021 (df = 7)
F Statistic	1,028.274*** (df = 32; 7)
Note:	*p<0.1; **p<0.05; ***p<0.01

US Federal Reserve Overnight Lending Rate

REGRESSION FOR US FED RESERVE O-N LOAN RATE

	Dependent variable (+/- SE):
	US Fed Reserve O-N Loan Rate
Constant	-7.760 (+/- 1.438)
	p = 0.00001***
Unemployment Rate	-0.145 (+/- 0.045)
	p = 0.003***
BBB corporate yield	0.673 (+/- 0.156)
	p = 0.0002***
Commercial Real Estate Price Index	0.018 (+/- 0.003)
	p = 0.00000***
LN_20-year Treasury Yield	2.433 (+/- 0.274)
	p = 0.000***
Observations	40
R^2	0.803
Adjusted R^2	0.781
Residual Std. Error	0.433 (df = 35)
F Statistic	35.748*** (df = 4; 35)
Note:	*p<0.1; **p<0.05; ***p<0.01

Dow Jones Total Stock Market Index (end-of-quarter) and S&P 500 (quarterly average)

REGRESSION FOR DOW TOTAL STOCK MARKET INDEX

	Dependent variable (+/- SE):
	Dow Total Stock Market Index
Constant	169,611.700 (+/- 16,939.780) p = 0.00000***
Nominal GDP growth	-190.922 (+/- 29.089) p = 0.00001***
Real disposable income growth	-56.873 (+/- 16.915) p = 0.004***
30-year Mortgate Rate	-15,551.500 (+/- 1,770.671) p = 0.00000***
Market Volatility Index	-102.222 (+/- 19.606) p = 0.0001***
US Avg Retail Gasoline Price ($-gal; all grades, all formulations)	3,716.268 (+/- 667.346) p = 0.00004***
20-year Treasury Yield	-165,863.700 (+/- 21,429.350) p = 0.00000***
LN_20-year Treasury Yield	190,139.400 (+/- 24,059.890) p = 0.00000***
10-year Treasury Yield	-22,339.090 (+/- 4,875.501) p = 0.0003***
1-month Treasury Yield	-33,003.780 (+/- 4,479.230) p = 0.00001***
7-year Treasury Yield	-15,996.670 (+/- 4,803.847) p = 0.004***
3-month Treasury Yield	4,943.851 (+/- 1,150.395) p = 0.0005***
5-year Treasury Yield	46,007.070 (+/- 10,272.360) p = 0.0004***
LN_5-year Treasury Yield	-20,715.130 (+/- 6,169.154) p = 0.004***
6-month Treasury Yield	38,988.740 (+/- 5,853.647) p = 0.00001***
3-year Treasury Yield	49,927.970 (+/- 7,407.362) p = 0.00001***
LN_3-year Treasury Yield	-11,916.020 (+/- 2,187.461) p = 0.00005***

1-year Treasury Yield	-26,376.850 (+/- 5,576.635)
	p = 0.0002***
3-year Treasury Yield_2	-5,966.773 (+/- 1,088.568)
	p = 0.00005***
5-year Treasury Yield_2	-8,136.812 (+/- 1,950.920)
	p = 0.001***
1-month Treasury Yield_2	4,038.312 (+/- 625.894)
	p = 0.00001***
10-year Treasury Yield_2	6,494.025 (+/- 1,115.684)
	p = 0.00003***
20-year Treasury Yield_2	17,583.970 (+/- 2,507.165)
	p = 0.00001***
Observations	40
R^2	0.997
Adjusted R^2	0.992
Residual Std. Error	760.481 (df = 17)
F Statistic	231.401*** (df = 22; 17)
Note:	*p<0.1; **p<0.05; ***p<0.01

REGRESSION FOR SP500 STOCK PRICE INDEX

	Dependent variable (+/- SE):
	SP500 Stock Price Index
Constant	8,430.789 (+/- 721.607)
	p = 0.000***
Real GDP growth	-15.826 (+/- 3.871)
	p = 0.0004***
Unemployment Rate	-185.360 (+/- 36.960)
	p = 0.00004***
LN_30-year Treasury Yield	-8,249.145 (+/- 1,155.285)
	p = 0.00000***
LN_20-year Treasury Yield	5,977.734 (+/- 1,163.057)
	p = 0.00003***
10-year Treasury Yield	-2,821.688 (+/- 601.997)
	p = 0.0001***
6-month Treasury Yield	-4,977.911 (+/- 1,036.434)
	p = 0.0001***
LN_6-month Treasury Yield	902.130 (+/- 277.240)
	p = 0.004***
LN_3-year Treasury Yield	638.139 (+/- 209.386)
	p = 0.006***
1-year Treasury Yield	5,611.960 (+/- 1,255.608)
	p = 0.0002***
LN_1-year Treasury Yield	-1,707.199 (+/- 393.115)
	p = 0.0002***
1-year Treasury Yield_2	-964.890 (+/- 295.057)
	p = 0.004***
6-month Treasury Yield_2	951.713 (+/- 268.702)
	p = 0.002***
10-year Treasury Yield_2	584.727 (+/- 149.810)
	p = 0.001***
Observations	40
R^2	0.981
Adjusted R^2	0.972
Residual Std. Error	153.747 (df = 26)
F Statistic	104.351*** (df = 13; 26)
Note:	*p<0.1; **p<0.05; ***p<0.01

House and Commercial Real Estate Price Indexes

REGRESSION FOR HOME PRICE INDEX

	Dependent variable (+/- SE):
	Home Price Index
Constant	37.325 (+/- 46.264)
	p = 0.429
US Fed Reserve O-N Loan Rate	141.696 (+/- 22.295)
	p = 0.00001***
Real GDP growth	-1.042 (+/- 0.178)
	p = 0.00001***
Unemployment Rate	-9.426 (+/- 1.448)
	p = 0.00001***
Market Volatility Index	1.171 (+/- 0.301)
	p = 0.001***
LN_Market Volatility Index	-38.302 (+/- 10.073)
	p = 0.001***
1-month Treasury Yield	-217.470 (+/- 24.830)
	p = 0.000***
7-year Treasury Yield	-47.427 (+/- 7.672)
	p = 0.00001***
5-year Treasury Yield	178.410 (+/- 28.935)
	p = 0.00001***
LN_5-year Treasury Yield	-181.444 (+/- 19.212)
	p = 0.000***
LN_6-month Treasury Yield	24.862 (+/- 7.235)
	p = 0.003***
3-year Treasury Yield	237.915 (+/- 24.813)
	p = 0.000***
LN_3-year Treasury Yield	-42.458 (+/- 11.967)
	p = 0.002***
LN_1-year Treasury Yield	-47.802 (+/- 10.851)
	p = 0.0003***
1-year Treasury Yield_2	27.454 (+/- 3.674)
	p = 0.00000***
3-year Treasury Yield_2	-44.602 (+/- 7.110)
	p = 0.00001***
5-year Treasury Yield_2	-20.019 (+/- 5.435)
	p = 0.002***

3-month Treasury Yield_2	7.511 (+/- 1.705) p = 0.0003***
Observations	40
R^2	0.990
Adjusted R^2	0.982
Residual Std. Error	4.575 (df = 22)
F Statistic	126.829*** (df = 17; 22)
Note:	*p<0.1; **p<0.05; ***p<0.01

REGRESSION FOR COMMERCIAL REAL ESTATE PRICE INDEX

	Dependent variable (+/- SE):
	Commercial Real Estate Price Index
Constant	-311.876 (+/- 115.593)
	p = 0.013**
US Fed Reserve O-N Loan Rate	182.352 (+/- 49.572)
	p = 0.002***
Real GDP growth	-0.868 (+/- 0.284)
	p = 0.006***
BBB corporate yield	-25.437 (+/- 7.310)
	p = 0.002***
Prime Rate	38.232 (+/- 9.260)
	p = 0.0004***
Market Volatility Index	0.619 (+/- 0.179)
	p = 0.002***
1-month Treasury Yield	-290.682 (+/- 52.489)
	p = 0.00001***
LN_1-month Treasury Yield	10.139 (+/- 3.291)
	p = 0.005***
5-year Treasury Yield	363.049 (+/- 60.350)
	p = 0.00001***
LN_5-year Treasury Yield	-256.659 (+/- 39.312)
	p = 0.00000***
3-year Treasury Yield	250.741 (+/- 59.935)
	p = 0.0004***
LN_3-year Treasury Yield	-88.613 (+/- 23.506)
	p = 0.001***
1-year Treasury Yield_2	39.615 (+/- 8.495)
	p = 0.0001***
3-year Treasury Yield_2	-61.955 (+/- 16.243)
	p = 0.001***
5-year Treasury Yield_2	-50.772 (+/- 11.891)
	p = 0.0003***
Observations	40
R^2	0.962
Adjusted R^2	0.941
Residual Std. Error	10.961 (df = 25)
F Statistic	45.456*** (df = 14; 25)

Note: *p<0.1; **p<0.05; ***p<0.01

Market Volatility Index

REGRESSION FOR MARKET VOLATILITY INDEX

	Dependent variable (+/- SE):
	Market Volatility Index
Constant	-159.599 (+/- 21.140)
	p = 0.00000***
Dow Total Stock Market Index	-0.005 (+/- 0.001)
	p = 0.000***
Home Price Index	1.666 (+/- 0.168)
	p = 0.000***
20-year Treasury Yield	23.290 (+/- 5.924)
	p = 0.0005***
7-year Treasury Yield	-27.568 (+/- 7.358)
	p = 0.001***
3-month Treasury Yield	-7.045 (+/- 2.348)
	p = 0.006***
6-month Treasury Yield	-70.452 (+/- 19.777)
	p = 0.002***
1-year Treasury Yield	63.841 (+/- 19.286)
	p = 0.003***
1-year Treasury Yield_2	-5.218 (+/- 1.580)
	p = 0.003***
1-month Treasury Yield_2	11.221 (+/- 2.260)
	p = 0.00003***
Observations	40
R^2	0.828
Adjusted R^2	0.776
Residual Std. Error	6.020 (df = 30)
F Statistic	16.016*** (df = 9; 30)
Note:	*p<0.1; **p<0.05; ***p<0.01

Appendix A: Data Sources

The following table lists the attributes provided by Capitalytics as part of its macro-economic forecast service. The sources for data that are defined by the document "2022 Stress Test Scenarios" (found at https://www.federalreserve.gov/newsevents/pressreleases/files/bcreg20220210a1.pdf) are listed. Please note that shaded attributes are not discussed within this report.

Table 16: Data Values and Referenced Sources

Attribute	Referenced Source[91]
Real GDP growth	Bureau of Economic Analysis (NIPA table 1.1.6, line 1)
Nominal GDP growth	Bureau of Economic Analysis (NIPA table 1.1.5, line 1)
Real disposable income growth	Bureau of Economic Analysis (NIPA table 2.1, line 27, and NIPA table 1.1.4, line 2)
Nominal disposable income growth	Bureau of Economic Analysis (NIPA table 2.1, line 27)
Unemployment rate	Bureau of Labor Statistics (series LNS14000000)
CPI inflation rate	Bureau of Labor Statistics (series CUSR0000SA0)
3-month Treasury yield	Quarterly average of 3-month Treasury bill secondary market rate on a discount basis, H.15 Release, Selected Interest Rates, Federal Reserve Board (series RIFSGFSM03_N.B)
5-year Treasury yield	Quarterly average of the yield on 5-year U.S. Treasury bonds, constructed for the FRB/U.S. model by Federal Reserve staff based on the Svensson smoothed term structure model; see Lars E. O. Svensson (1995), "Estimating Forward Interest Rates with the Extended Nelson-Siegel Method," Quarterly Review, no. 3, Sveriges Riksbank, pp. 13–26
10-year Treasury yield	Quarterly average of the yield on 10-year U.S. Treasury bonds, constructed for the FRB/U.S. model by Federal Reserve staff based on the Svensson smoothed term structure model; see Lars E. O. Svensson (1995), "Estimating Forward Interest Rates with the Extended Nelson-Siegel Method," Quarterly Review, no. 3, Sveriges Riksbank, pp. 13–26
BBB corporate yield	Ice Data Indices, LLC, ICE BofA BBB US Corporate Index Effective Yield [BAMLC0A4CBBBEY], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/BAMLC0A4CBBBEY[92]

[91] Per https://www.federalreserve.gov/newsevents/pressreleases/files/bcreg20190213a1.pdf

[92] Capitalytics does not have license to use the data referenced in https://www.federalreserve.gov/newsevents/pressreleases/files/bcreg20210212a1.pdf, specifically "Quarterly average of ICE BofAML U.S.

Mortgage rate	Quarterly average of weekly series for the interest rate of a conventional, conforming, 30-year fixed-rate mortgage, obtained from the Primary Mortgage Market Survey of the Federal Home Loan Mortgage Corporation.
Prime rate	Quarterly average of monthly series, H.15 Release, Selected Interest Rates, Federal Reserve Board (series RIFSPBLP_N.M).
Dow Jones Total Stock Market Index (end-of-qtr value)	Dow-Jones
House Price Index	Price Index for Owner-Occupied Real Estate, CoreLogic National, Z.1 Release (Financial Accounts of the United States), Federal Reserve Board (series FL075035243.Q divided by 1000)[93].
Commercial Real Estate Price Index	Commercial Real Estate Price Index, Z.1 Release (Financial Accounts of the United States), Federal Reserve Board (series FL075035503.Q divided by 1000)[94].
Market Volatility Index (VIX)	VIX converted to quarterly frequency using the maximum close-of-day value in any quarter, Chicago Board Options Exchange.
Euro Area Real GDP Growth	Percent change in real gross domestic product at an annualized rate, staff calculations based on Statistical Office of the European Communities via Haver, extended back using ECB Area Wide Model dataset (ECB Working Paper series no. 42).
Euro Area Inflation	Percent change in the quarterly average of the harmonized index of consumer prices 16 Federal Reserve Supervisory Scenarios at an annualized rate, staff calculations based on Statistical Office of the European Communities via Haver.
Euro Area Bilateral Dollar Exchange Rate (USD/Euro)	End-of-quarter rates from the H.10 Release, Foreign Exchange Rates, Federal Reserve Board.
Developing Asia Real GDP Growth	Percent change in real gross domestic product at an annualized rate, staff calculations based on Bank of Korea via Haver; Chinese National Bureau of Statistics via CEIC; Indian Central Statistical Organization via CEIC; Census and Statistics Department of Hong Kong via CEIC; and Taiwan Directorate-General of Budget, Accounting, and Statistics via CEIC.
Developing Asia Inflation	Percent change in the quarterly average of the consumer price index, or local equivalent, at an annualized rate, staff calculations based on Chinese National Bureau of Statistics via CEIC; Indian Ministry of Statistics and Programme

Corporate 7-10 Year Yield-to-Maturity Index, ICE Data Indices, LLC, used with permission. (C4A4 series.)", but we use the referenced series as a proxy.

93 Capitalytics accesses this series from the data provided at https://www.quandl.com/data/FED/FL075035243_Q-Interest-rates-and-price-indexes-owner-occupied-real-estate-CoreLogic-national-SA-Quarterly-Levels-NSA

94 Capitalytics accesses this series from the data provided by https://www.quandl.com/data/FED/FL075035503_Q-Interest-rates-and-price-indexes-commercial-real-estate-price-index-Quarterly-Levels-NSA

	Implementation via Haver; Labour Bureau of India via CEIC; National Statistical Office of Korea via CEIC; Census and Statistic Department of Hong Kong via CEIC; and Taiwan Directorate General of Budget, Accounting, and Statistics via CEIC.
Developing Asia bilateral dollar exchange rate (F/USD, index)	End-of-quarter rates from the H.10 Release, Foreign Exchange Rates, Federal Reserve Board.
Japan Real GDP Growth	Percent change in gross domestic product at an annualized rate, Cabinet Office via Haver.
Japan Inflation	Percent change in the quarterly average of the consumer price index at an annualized rate, staff calculations based on Ministry of Internal Affairs and Communications via Haver.
Japan Bilateral Dollar Exchange Rate (Yen/USD)	End-of-quarter rates from the H.10 Release, Foreign Exchange Rates, Federal Reserve Board.
UK Real GDP Growth	Percent change in gross domestic product at an annualized rate, Office for National Statistics via Haver.
UK Inflation	Percent change in the quarterly average of the consumer price index at an annualized rate, staff calculations based on Office for National Statistics via Haver.
UK Bilateral Dollar Exchange Rate (USD/Pound)	End-of-quarter rates from the H.10 Release, Foreign Exchange Rates, Federal Reserve Board.

The above dataset from the Federal Reserve can be downloaded manually or automatically. Manual downloads are available at https://www.federalreserve.gov/supervisionreg/files/2023-Table_1A_Historic_Domestic.csv and https://www.federalreserve.gov/supervisionreg/files/2023-Table_1B_Historic_International.csv (shown below, as of March 2023) by clicking the links marked "2023 Historical Domestic (CSV)" and "2023 Historical International (CSV)"[95].

Since the CCAR dataset is only released annually (through 1Q2023 as of this writing), and Capitalytics provides quarterly updates to its forecasts, the CCAR dataset is supplemented by the data sources

[95] Again, due to the requirements of this client, international data elements are not being discussed in this document.

shown below on a quarterly basis. All datasets discussed herein are supplemented with data through (including) 1Q2023.

Table 17: Supplementary Data Sources for Data Attributes

Attribute	Supplementary Data Source
Real GDP growth	Bureau of Economic Analysis (NIPA table 1.1.6, line 1)
Nominal GDP growth	Bureau of Economic Analysis (NIPA table 1.1.5, line 1)
Real disposable income growth	Bureau of Economic Analysis (NIPA table 2.1, line 27, and NIPA table 1.1.4, line 2)
Nominal disposable income growth	Bureau of Economic Analysis (NIPA table 2.1, line 27)
Unemployment rate	Bureau of Labor Statistics (series LNS14000000)
CPI inflation rate	Bureau of Labor Statistics (series CUSR0000SA0)
3-month Treasury yield	Quarterly average of 3-month Treasury bill secondary market rate on a discount basis, H.15 Release
5-year Treasury yield	Federal Reserve Economic Research website (https://fred.stlouisfed.org/series/GS5), with "Quarterly" frequency and "Average" aggregation method
10-year Treasury yield	Federal Reserve Economic Research website (https://fred.stlouisfed.org/series/GS10), with "Quarterly" frequency and "Average" aggregation method
BBB corporate yield	Federal Reserve Economic Research website (https://fred.stlouisfed.org/series/BAMLC0A4CBBBEY), with "Quarterly" frequency and "Average" aggregation method
Mortgage rate	Federal Reserve Economic Research website (https://fred.stlouisfed.org/series/MORTGAGE30US), with "Quarterly" frequency and "Average" aggregation method
Prime rate	Federal Reserve Economic Research website (https://fred.stlouisfed.org/series/MPRIME), with "Quarterly" frequency and "Average" aggregation method
Dow Jones Total Stock Market Index (end-of-qtr value)	Dow-Jones as provided by the Wall Street Journal (https://quotes.wsj.com/index/DWCF/advanced-chart)
House Price Index	https://data.nasdaq.com/data/FED/FL075035243_Q-interest-rates-and-price-indexes-owneroccupied-real-estate-corelogic-national-sa-quarterly-levels-nsa
Commercial Real Estate Price Index	https://data.nasdaq.com/data/FED/FL075035503_Q-interest-rates-and-price-indexes-commercial-real-estate-price-index-quarterly-levels-nsa
Market Volatility Index (VIX)	Federal Reserve Economic Research website (https://fred.stlouisfed.org/series/VIXCLS), with "Quarterly" frequency and "Average" aggregation method

Euro Area Real GDP Growth	Quarterly series for "European Union GDP Annual Growth Rate" per tradingeconomics.com
Euro Area Inflation	Quarterly average of monthly series for "European Union Inflation Rate" per tradingeconomics.com
Euro Area Bilateral Dollar Exchange Rate (USD/Euro)	End-of-quarter rates from the H.10 Release, Foreign Exchange Rates, Federal Reserve Board.
Developing Asia Real GDP Growth	The nominal GDP-weighted aggregate of the Real GDP growth for China, India, South Korea, Hong Kong Special Administrative Region, and Taiwan per OECD
Developing Asia Inflation	The nominal GDP-weighted aggregate of the inflation rate for China, India, South Korea, Hong Kong Special Administrative Region, and Taiwan per OECD
Developing Asia bilateral dollar exchange rate (F/USD, index)	End-of-quarter rates from the H.10 Release, Foreign Exchange Rates, Federal Reserve Board.
Japan Real GDP Growth	Quarterly average of monthly series for "Japan GDP Growth Rate" per tradingeconomics.com
Japan Inflation	Quarterly average of monthly series for "Japan Inflation Rate" per tradingeconomics.com
Japan Bilateral Dollar Exchange Rate (Yen/USD)	End-of-quarter rates from the H.10 Release, Foreign Exchange Rates, Federal Reserve Board.
UK Real GDP Growth	Quarterly average of monthly series for "United Kingdom GDP Growth Rate" per tradingeconomics.com
UK Inflation	Quarterly average of monthly series for "United Kingdom Inflation Rate" per tradingeconomics.com
UK Bilateral Dollar Exchange Rate (USD/Pound)	End-of-quarter rates from the H.10 Release, Foreign Exchange Rates, Federal Reserve Board.

While all data that is required for the Annual Stress Tests is available from at https://www.federalreserve.gov/supervisionreg/files/2022-table_1a_historic_domestic.csv and https://www.federalreserve.gov/supervisionreg/files/2022-table_1b_historic_international.csv, Capitalytics provides 13 additional metrics per the information in the following table. These values are available from the point at which they are collected (which varies from metric to metric) through (and including) 1Q2022.

Table 17: Supplementary Data Attributes and Sources

Attribute	Capitalytics' Source
1-month Treasury yield	https://fred.stlouisfed.org/series/dgs1mo
6-month Treasury yield	https://fred.stlouisfed.org/series/dgs6mo
1-year Treasury yield	https://fred.stlouisfed.org/series/dgs1
3-year Treasury yield	https://fred.stlouisfed.org/series/dgs3
7-year Treasury yield	https://fred.stlouisfed.org/series/dgs7
20-year Treasury yield	https://fred.stlouisfed.org/series/dgs20

30-year Treasury yield	https://fred.stlouisfed.org/series/dgs30
US Average Retail Gasoline Price ($/gal; all grades, all formulations)	https://fred.stlouisfed.org/series/gasallm
S&P 500 Stock Price Index	https://fred.stlouisfed.org/series/sp500
Primary Credit	https://fred.stlouisfed.org/series/FEDFUNDS
Moody's AAA Rate	https://fred.stlouisfed.org/series/aaa
Moody's BAA Rate	https://fred.stlouisfed.org/series/baa
Dow Jones Total Industrial Average	https://fred.stlouisfed.org/series/djia

Appendix B: Methodologies

Capitalytics uses non-structured macroeconomic forecasting techniques in order to prepare its clients for what trends and relationships drive certain metrics, and what values those metrics may take on in the coming months.

Section I: General Forecasting Methodology

Generally, the most effective overall forecasting techniques have been found to be a hybridization of multiple other techniques. Capitalytics uses several forecasting schemes, and aggregates the results, as part of its analysis methodology. This section describes the process that is executed for generating these results.

For each metric, four distinct forecasts are produced.

1. The first forecast uses the full quarterly history of the metric as an input to an additive exponential smoothing representation. The process that is executed is that provided by R's[96] "forecast" package[97]; specifically, the "ets" function (see p.39 of https://cran.r-project.org/web/packages/forecast/forecast.pdf)[98] is designed to automatically determine the best fitting representation out of the "Generic 'ETS' Methodology" (discussed later in this section), including optimal parameters thereto, given a sequence of values. In our work, we have restricted our study to only "additive" forms (i.e., we set "`additive.only=TRUE`" in our calls), and our optimization criteria is set to the mean of absolute residuals (i.e., "`opt.crit=mae`"). Therefore, calls to generate our estimates through this procedure look something like the following command, where "s" is an appropriately populated array, vector, time series, or similar object.

```
> m<–ets(s, model='ZZZ', opt.crit=c('mae'), additive.only=TRUE)
```

   The results of this call are shown above each dataset, including the representation type returned (as described later this section), the initial values that are used by the software, the optimal smoothing parameters estimated, and the *n+1*st forecasted value given the first *n* values of the metric's sequence (the "fitted" values)[99], and the determined parameters. While fitting forecasts to previous values,

   - "forecast error" is defined as being actual values less forecasted values,
   - "% error" is defined as forecast error divided by actual value, and

[96] As of this writing, v.4.1.2 of the "R" language is available at https://cran.r-project.org/.

[97] As of this writing, v.8.16 of the forecast package is available at https://CRAN.R-project.org/package=forecast.

[98] It should be noted that Microsoft's Excel software includes a FORECAST.ETS function which is documented as potentially producing comparable results; however, we have not been able to re-create its output independently, and, given the documentation, flexibility, and source availability of the R packages, Capitalytics has decided that it is a preferable option at this time.

[99] While this procedure does generate fitted values for intermediate samples within a sequence -- and allow for generating a forecasted set of samples to extend a sequence – according to the identified parameter set, it does not directly provide for determining the optimal parameter set of a sub-sequence. Capitalytics is currently codifying the process herein so that we may prescribe a "most likely" long term representation for each forecast, and determine the likely effects of errors in the forecasts by estimating the "recent term" values of dy/dx_i (where y is the metric being estimated and x_i is each of the parameters within the representation) and then compensating for recent quantified errors. We can also consider how "finite" a window to account for in building a set of parameters; these representations are theoretically using all history in building a forecast, but the values for alpha, beta, etc. implicitly give an indication of how much history of a metric is truly impacting a specific value.

- "score" is defined as mean absolute forecast error over an appropriate range (generally the duration of the collected past values, less the first two to four years of collected values)[100].

2. The second forecast uses the differences between successive quarterly values in order to forecast the future quarterly differences. It should be noted that these sequences are (obviously) one data-point shorter than those in the preceding procedure. These values are forecasted using the same procedure as described in the first section, with forecasted values for the actual metric being built using the last known value for the metric and forecasts of incremental changes to the metric provided.

   An edited example for loading the SP500 end-of quarter values, and the differences between successive quarterly values, is shown below.

```
> sp<-c(130.659129, 1250.520109, 998.4076848, 812.047, 799.5264066, 927.5045326,
1041.372826, … )
> sp_ts<-ts(sp,freq=4,end=c(2017,4))
> sp_ts
   Qtr1      Qtr2      Qtr3      Qtr4
2008           130.6591 1250.5201  998.4077
2009  812.0470  799.5264  927.5045 1041.3728
…

> m<-ets(sp_ts,model='ZZZ',opt.crit=c('mae'),additive.only=TRUE)
> dsp_ts<-diff(sp_ts)
> dsp_ts
    Qtr1        Qtr2        Qtr3        Qtr4
2008                    1119.860980 -252.112424
2009 -186.360685  -12.520593  127.978126  113.868293
…

> m<-ets(dsp_ts,model='ZZZ',opt.crit=c('mae'),additive.only=TRUE
```

3. The third forecast uses the sequence of numbers from the second forecast, but partitions the dataset based on the quarter in which they are incurred. Assuming that the differences between quarters are associated with the ending points of each quarter (i.e., the difference between third and fourth quarter values are associated with a date of December 31st), four sequences of numbers are now created, with annual forecasts now being produced for each sequence using the same procedures as previously outlined. The final sequence appropriately interleaves the forecasted data-points.

4. The fourth forecast builds three sequences of values based the history of the metric to an observed point:

   - the slope of the "best fitting" line (based on minimizing the total absolute error) using the immediately preceding 2 years of values[101];
   - the same slope using the immediately preceding 4 years of values; and,
   - the same slope using the immediately preceding 8 years of values.

   While two years of data would provide for a relatively responsive change in aggregate values to be reflected given a change in the economic conditions, eight years of data (a not unreasonable

[100] It bears noting that a lower value for the "score" indicates better accuracy of an algorithm.
[101] The value for this slope is calculated using Microsoft Excel's SLOPE function, with the first argument being the appropriate number of preceding values for the metric, and the second argument being the same number of corresponding "end-of-quarter" dates.

estimate for an "economic cycle") would allow for a much more slowly moving change in average window for a counterbalance.
Using these datasets independently, we are able to use our previous procedure to generate forecasts for each slope, and then average the results on a quarterly basis. Multiplying the average slope by the duration of the following quarter (in days) provides an estimate for the change in the metric's value during that following quarter, just as in our second forecast. Obviously, this technique requires at least eight years of data to pass before being able to produce any data. However, in order to err on the side of conservatism, we generally allow a sequence to "mature" for two to four years before believing that its initial transience has become less significant and its results are trustworthy. If a dataset does not have enough data to complete one of these analyses, the analysis is dropped. In other words, if the metric does not have +/-11 years of data available, the 8-year slopes cannot be reliably calculated, and the average slope is only based on the 2- & 4-year slopes[102].

5. In some cases, we may find variables with extremely tight cross-connections that can be justified as part of their nature (treasury bill yield rates, for example, with a magnitude or correlation greater than ~0.95). In these cases, we are able to additionally enhance our forecast by building a forecast that expresses one variable (the "dependent" variable, *y(t)*) in terms of another (the "independent" variable, *x(t)*) with a coefficient of determination (R^2), such that

$$y(t) = m(t) * x(t) + b(t) .$$

Notice that the "slope" and "intercept" terms in this expression are time varying expressions that are re-evaluated with each data-point, not simply constants.

By averaging the results of these distinct forecasts in order to provide an aggregate forecast, the error for which can be characterized and measured, Capitalytics aims to provide a robust dataset that can be used for future business decisions.
It was stated earlier that Capitalytics uses each metric's complete history in order to generate a matching representation and forecast. It should be recognized that we also perform the same analyses for periods starting no more than 100, 80, 60, and 40 quarters prior to the forecasted period. However, we have found the results of all of these analyses are more reactionary and less coherent than that already presented within this report.

Section II: Exponentially Smoothed State Space Representations & Generic "ETS" Methodology

Exponential smoothing was proposed in the late 1950s (Brown 1959, Holt 1957 and Winters 1960 are key pioneering works) and has motivated some of the most successful forecasting methods. Forecasts produced using exponential smoothing methods are weighted averages of past observations, with the weights decaying exponentially as the observations get older. In other words, the more recent the observation the higher the associated weight. (See the following equation for one example of this type of equation which requires $0 \le \alpha \le 1$, and estimates future values of $\hat{y}$ given a history of values denoted as y_t. The ε_{T+1} term denotes an error term, the *residual*, which determines the value of the forecasting function.) This framework generates reliable forecasts quickly and for a wide spectrum of time series.

$$\hat{y}_{T+1|T} = \alpha y_T + \alpha(1-\alpha)y_{T-1} + \alpha(1-\alpha)^2 y_{T-2} + \cdots + \varepsilon_{T+1}$$

[102] See the SP500 metric's analysis.

In this study, the relevance of quarterly samples more than 3 years old is eliminated by setting the number of terms in this type of expression to no more than 13.
The challenge with these forecasting techniques is to estimate the value of α such that some criteria is optimized, e.g., minimizing the sum of squared errors (SSE), across all values of a set of historical values.
There are other forms of exponential smoothing methods that may account for any combination of forecasting *levels* (as in the Theta method), *trends* (for which a metric may, for instance, be growing or lessening according to a linear or higher order function), and *seasonality* (for which a metric may have engrained "cycles" on, e.g., a monthly, quarterly, or annual basis).

By considering variations in the combination of the trend and seasonal components, fifteen exponential smoothing methods are possible. Each method is labelled by a pair of letters (T,S) defining the type of 'Trend' and 'Seasonal' components. For example, (A,M) is the method with an additive trend and multiplicative seasonality; (M,N) is the method with multiplicative trend and no seasonality; and so on. Per Section 7.6 of Hyndman & Athanasopoulos, some of these methods are well known per the following table.

Table 18: Mathematical Methods Associated with Trend & Seasonal Components

Trend & Seasonal Components	Method
(N,N)	simple exponential smoothing
(A,N)	Holts linear method
(M,N)	Exponential trend method
(A_d,N)	additive damped trend method
(M_d,N)	multiplicative damped trend method
(A,A)	additive Holt-Winters method
(A,M)	multiplicative Holt-Winters method
(A_d,M)	Holt-Winters damped method

Additionally, the following table (again from Section 7.6 of Hyndman & Athanasopoulos) gives the recursive formulae for applying all possible fifteen exponential smoothing methods. Each cell includes the forecast equation for generating h-step-ahead forecasts and the smoothing equations for applying the method. By recursively applying the appropriate expressions to generate consecutive forecasts, this framework can be an extremely powerful tool.

Section III: Regression Construction

Capitalytics also generates a regression to estimate future values of the variables that we track in terms of current-day values. By using R's "lm" function, we estimate the next quarter's values for each variable in terms of the preceding set of variables' values. These regressions are built using the immediately preceding 57 sets of variables' values.
Each output variable is considered in turn as the response variable, with all other variables as possibilities for the control (independent) variables *excluding* any variables that have an 80% correlation with the response variable. Successive linear regressions are built; if any of the control variables' p-values exceed 5%, or if the model's p-value exceeds 5% and the number of considered control variables is greater than one, the most offensive control variable is dropped, and the regression is re-run.

Trend	Seasonal		
	N	**A**	**M**
N	$\hat{y}_{t+h\|t} = \ell_t$ $\ell_t = \alpha y_t + (1-\alpha)\ell_{t-1}$	$\hat{y}_{t+h\|t} = \ell_t + s_{t-m+h_m^+}$ $\ell_t = \alpha(y_t - s_{t-m}) + (1-\alpha)\ell_{t-1}$ $s_t = \gamma(y_t - \ell_{t-1}) + (1-\gamma)s_{t-m}$	$\hat{y}_{t+h\|t} = \ell_t s_{t-m+h_m^+}$ $\ell_t = \alpha(y_t / s_{t-m}) + (1-\alpha)\ell_{t-1}$ $s_t = \gamma(y_t / \ell_{t-1}) + (1-\gamma)s_{t-m}$
A	$\hat{y}_{t+h\|t} = \ell_t + hb_t$ $\ell_t = \alpha y_t + (1-\alpha)(\ell_{t-1} + b_{t-1})$ $b_t = \beta^*(\ell_t - \ell_{t-1}) + (1-\beta^*)b_{t-1}$	$\hat{y}_{t+h\|t} = \ell_t + hb_t + s_{t-m+h_m^+}$ $\ell_t = \alpha(y_t - s_{t-m}) + (1-\alpha)(\ell_{t-1} + b_{t-1})$ $b_t = \beta^*(\ell_t - \ell_{t-1}) + (1-\beta^*)b_{t-1}$ $s_t = \gamma(y_t - \ell_{t-1} - b_{t-1}) + (1-\gamma)s_{t-m}$	$\hat{y}_{t+h\|t} = (\ell_t + hb_t)s_{t-m+h_m^+}$ $\ell_t = \alpha(y_t / s_{t-m}) + (1-\alpha)(\ell_{t-1} + b_{t-1})$ $b_t = \beta^*(\ell_t - \ell_{t-1}) + (1-\beta^*)b_{t-1}$ $s_t = \gamma(y_t / (\ell_{t-1} + b_{t-1})) + (1-\gamma)s_{t-m}$
A_d	$\hat{y}_{t+h\|t} = \ell_t + \phi_h b_t$ $\ell_t = \alpha y_t + (1-\alpha)(\ell_{t-1} + \phi b_{t-1})$ $b_t = \beta^*(\ell_t - \ell_{t-1}) + (1-\beta^*)\phi b_{t-1}$	$\hat{y}_{t+h\|t} = \ell_t + \phi_h b_t + s_{t-m+h_m^+}$ $\ell_t = \alpha(y_t - s_{t-m}) + (1-\alpha)(\ell_{t-1} + \phi b_{t-1})$ $b_t = \beta^*(\ell_t - \ell_{t-1}) + (1-\beta^*)\phi b_{t-1}$ $s_t = \gamma(y_t - \ell_{t-1} - \phi b_{t-1}) + (1-\gamma)s_{t-m}$	$\hat{y}_{t+h\|t} = (\ell_t + \phi_h b_t)s_{t-m+h_m^+}$ $\ell_t = \alpha(y_t / s_{t-m}) + (1-\alpha)(\ell_{t-1} + \phi b_{t-1})$ $b_t = \beta^*(\ell_t - \ell_{t-1}) + (1-\beta^*)\phi b_{t-1}$ $s_t = \gamma(y_t / (\ell_{t-1} + \phi b_{t-1})) + (1-\gamma)s_{t-m}$
M	$\hat{y}_{t+h\|t} = \ell_t b_t^h$ $\ell_t = \alpha y_t + (1-\alpha)\ell_{t-1}b_{t-1}$ $b_t = \beta^*(\ell_t / \ell_{t-1}) + (1-\beta^*)b_{t-1}$	$\hat{y}_{t+h\|t} = \ell_t b_t^h + s_{t-m+h_m^+}$ $\ell_t = \alpha(y_t - s_{t-m}) + (1-\alpha)\ell_{t-1}b_{t-1}$ $b_t = \beta^*(\ell_t / \ell_{t-1}) + (1-\beta^*)b_{t-1}$ $s_t = \gamma(y_t - \ell_{t-1}b_{t-1}) + (1-\gamma)s_{t-m}$	$\hat{y}_{t+h\|t} = \ell_t b_t^h s_{t-m+h_m^+}$ $\ell_t = \alpha(y_t / s_{t-m}) + (1-\alpha)\ell_{t-1}b_{t-1}$ $b_t = \beta^*(\ell_t / \ell_{t-1}) + (1-\beta^*)b_{t-1}$ $s_t = \gamma(y_t / (\ell_{t-1}b_{t-1})) + (1-\gamma)s_{t-m}$
M_d	$\hat{y}_{t+h\|t} = \ell_t b_t^{\phi_h}$ $\ell_t = \alpha y_t + (1-\alpha)\ell_{t-1}b_{t-1}^{\phi}$ $b_t = \beta^*(\ell_t / \ell_{t-1}) + (1-\beta^*)b_{t-1}^{\phi}$	$\hat{y}_{t+h\|t} = \ell_t b_t^{\phi_h} + s_{t-m+h_m^+}$ $\ell_t = \alpha(y_t - s_{t-m}) + (1-\alpha)\ell_{t-1}b_{t-1}^{\phi}$ $b_t = \beta^*(\ell_t / \ell_{t-1}) + (1-\beta^*)b_{t-1}^{\phi}$ $s_t = \gamma(y_t - \ell_{t-1}b_{t-1}^{\phi}) + (1-\gamma)s_{t-m}$	$\hat{y}_{t+h\|t} = \ell_t b_t^{\phi_h} s_{t-m+h_m^+}$ $\ell_t = \alpha(y_t / s_{t-m}) + (1-\alpha)\ell_{t-1}b_{t-1}^{\phi}$ $b_t = \beta^*(\ell_t / \ell_{t-1}) + (1-\beta^*)b_{t-1}^{\phi}$ $s_t = \gamma(y_t / (\ell_{t-1}b_{t-1}^{\phi})) + (1-\gamma)s_{t-m}$

Appendix C: Variable Correlations

The following table shows the correlation factors between all of the listed variables for which the absolute value of the correlation is greater than 0.6, indicating a noteworthy degree of correlation. As is discussed in Appendix B of this report, (absolute) correlations greater than 0.95 warrant further investigation as the relationship between variables may be useful for our research.

Table 5: Correlation Factors found as of 1Q2022

Variable 1	Variable 2	Correlation
S&P 500 Stock Price Index	**Dow Jones Total Stock Market Index**	**0.9673**
S&P 500 Stock Price Index	**Residential Home Price Index**	**0.952516**
S&P 500 Stock Price Index	**Commerical Real Estate Index**	**0.957203**
Cost of Federal Funds	Moody's AAA Curve	0.80879
Cost of Federal Funds	Moody's BAA Curve	0.751723
Cost of Federal Funds	BBB Corporate Yield	0.758739
Cost of Federal Funds	30-year Mortgage Rate	0.866869
Cost of Federal Funds	**Prime Rate**	**0.988167**
Cost of Federal Funds	US Average Retail Gasoline Price	-0.609532
Cost of Federal Funds	30-year Treasury Yield	0.79383
Cost of Federal Funds	20-year Treasury Yield	0.796029
Cost of Federal Funds	10-year Treasury Yield	0.850769
Cost of Federal Funds	**1-month Treasury Yield**	**0.993229**
Cost of Federal Funds	7-year Treasury Yield	0.896388
Cost of Federal Funds	**3-month Treasury Yield**	**0.98871**
Cost of Federal Funds	5-year Treasury Yield	0.916761
Cost of Federal Funds	**6-month Treasury Yield**	**0.992494**
Cost of Federal Funds	**3-year Treasury Yield**	**0.954874**
Cost of Federal Funds	**1-year Treasury Yield**	**0.985402**
Moody's AAA Curve	**Moody's BAA Curve**	**0.979283**
Moody's AAA Curve	BBB Corporate Yield	0.949025
Moody's AAA Curve	**30-year Mortgage Rate**	**0.981556**
Moody's AAA Curve	Prime Rate	0.795128
Moody's AAA Curve	Dow Jones Total Stock Market Index	-0.80925
Moody's AAA Curve	Residential Home Price Index	-0.840042
Moody's AAA Curve	Commerical Real Estate Index	-0.861798
Moody's AAA Curve	US Average Retail Gasoline Price	-0.720687
Moody's AAA Curve	**30-year Treasury Yield**	**0.985246**
Moody's AAA Curve	**20-year Treasury Yield**	**0.984055**
Moody's AAA Curve	**10-year Treasury Yield**	**0.98358**
Moody's AAA Curve	**7-year Treasury Yield**	**0.965837**
Moody's AAA Curve	3-month Treasury Yield	0.815967
Moody's AAA Curve	5-year Treasury Yield	0.946344
Moody's AAA Curve	6-month Treasury Yield	0.814429
Moody's AAA Curve	3-year Treasury Yield	0.900764
Moody's AAA Curve	1-year Treasury Yield	0.830556
Moody's BAA Curve	**BBB Corporate Yield**	**0.983099**
Moody's BAA Curve	**30-year Mortgage Rate**	**0.953448**
Moody's BAA Curve	Prime Rate	0.736022
Moody's BAA Curve	Dow Jones Total Stock Market Index	-0.826734
Moody's BAA Curve	Residential Home Price Index	-0.825415
Moody's BAA Curve	Commerical Real Estate Index	-0.834617
Moody's BAA Curve	US Average Retail Gasoline Price	-0.682723
Moody's BAA Curve	30-year Treasury Yield	0.94894
Moody's BAA Curve	20-year Treasury Yield	0.933507
Moody's BAA Curve	10-year Treasury Yield	0.946464
Moody's BAA Curve	7-year Treasury Yield	0.918242
Moody's BAA Curve	3-month Treasury Yield	0.755092
Moody's BAA Curve	5-year Treasury Yield	0.895201
Moody's BAA Curve	6-month Treasury Yield	0.756362

Moody's BAA Curve	3-year Treasury Yield	0.845227
Moody's BAA Curve	1-year Treasury Yield	0.772727
Real GDP Growth Rate	**Nominal GDP Growth Rate**	**0.976561**
Real Disposable Income Growth Rate	**Nominal Disposable Income Growth Rate**	**0.975253**
BBB Corporate Yield	30-year Mortgage Rate	0.942279
BBB Corporate Yield	Prime Rate	0.754648
BBB Corporate Yield	Dow Jones Total Stock Market Index	-0.792638
BBB Corporate Yield	Residential Home Price Index	-0.783142
BBB Corporate Yield	Commerical Real Estate Index	-0.772778
BBB Corporate Yield	US Average Retail Gasoline Price	-0.645279
BBB Corporate Yield	30-year Treasury Yield	0.906911
BBB Corporate Yield	20-year Treasury Yield	0.882769
BBB Corporate Yield	10-year Treasury Yield	0.927126
BBB Corporate Yield	7-year Treasury Yield	0.896684
BBB Corporate Yield	3-month Treasury Yield	0.771174
BBB Corporate Yield	5-year Treasury Yield	0.887026
BBB Corporate Yield	6-month Treasury Yield	0.760818
BBB Corporate Yield	3-year Treasury Yield	0.837792
BBB Corporate Yield	1-year Treasury Yield	0.775033
30-year Mortgage Rate	Prime Rate	0.860336
30-year Mortgage Rate	Dow Jones Total Stock Market Index	-0.757154
30-year Mortgage Rate	Residential Home Price Index	-0.775462
30-year Mortgage Rate	Commerical Real Estate Index	-0.798568
30-year Mortgage Rate	US Average Retail Gasoline Price	-0.712338
30-year Mortgage Rate	**30-year Treasury Yield**	**0.972204**
30-year Mortgage Rate	**20-year Treasury Yield**	**0.975677**
30-year Mortgage Rate	**10-year Treasury Yield**	**0.992644**
30-year Mortgage Rate	1-month Treasury Yield	0.645498
30-year Mortgage Rate	**7-year Treasury Yield**	**0.984476**
30-year Mortgage Rate	3-month Treasury Yield	0.883528
30-year Mortgage Rate	**5-year Treasury Yield**	**0.980899**
30-year Mortgage Rate	6-month Treasury Yield	0.875417
30-year Mortgage Rate	3-year Treasury Yield	0.946144
30-year Mortgage Rate	1-year Treasury Yield	0.890495
Prime Rate	US Average Retail Gasoline Price	-0.619619
Prime Rate	30-year Treasury Yield	0.77646
Prime Rate	20-year Treasury Yield	0.788098
Prime Rate	10-year Treasury Yield	0.845154
Prime Rate	**1-month Treasury Yield**	**0.954863**
Prime Rate	7-year Treasury Yield	0.879145
Prime Rate	**3-month Treasury Yield**	**0.992016**
Prime Rate	5-year Treasury Yield	0.910447
Prime Rate	**6-month Treasury Yield**	**0.975896**
Prime Rate	3-year Treasury Yield	0.937512
Prime Rate	**1-year Treasury Yield**	**0.968471**
Dow Jones Total Stock Market Index	Residential Home Price Index	0.903668
Dow Jones Total Stock Market Index	Commerical Real Estate Index	0.919699
Dow Jones Total Stock Market Index	30-year Treasury Yield	-0.80731
Dow Jones Total Stock Market Index	20-year Treasury Yield	-0.752391
Dow Jones Total Stock Market Index	10-year Treasury Yield	-0.77036
Dow Jones Total Stock Market Index	7-year Treasury Yield	-0.697007
Dow Jones Total Stock Market Index	5-year Treasury Yield	-0.675709
Residential Home Price Index	**Commerical Real Estate Index**	**0.970289**
Residential Home Price Index	US Average Retail Gasoline Price	0.692639
Residential Home Price Index	30-year Treasury Yield	-0.831978
Residential Home Price Index	20-year Treasury Yield	-0.767835
Residential Home Price Index	10-year Treasury Yield	-0.797149
Residential Home Price Index	7-year Treasury Yield	-0.738901
Residential Home Price Index	5-year Treasury Yield	-0.718343
Residential Home Price Index	3-year Treasury Yield	-0.635991
Commerical Real Estate Index	US Average Retail Gasoline Price	0.707583
Commerical Real Estate Index	30-year Treasury Yield	-0.867505
Commerical Real Estate Index	20-year Treasury Yield	-0.837477

Commerical Real Estate Index	10-year Treasury Yield	-0.826532
Commerical Real Estate Index	7-year Treasury Yield	-0.771044
Commerical Real Estate Index	5-year Treasury Yield	-0.745041
Commerical Real Estate Index	3-year Treasury Yield	-0.664031
US Average Retail Gasoline Price	30-year Treasury Yield	-0.707181
US Average Retail Gasoline Price	20-year Treasury Yield	-0.701372
US Average Retail Gasoline Price	10-year Treasury Yield	-0.728203
US Average Retail Gasoline Price	7-year Treasury Yield	-0.718056
US Average Retail Gasoline Price	3-month Treasury Yield	-0.635713
US Average Retail Gasoline Price	5-year Treasury Yield	-0.725249
US Average Retail Gasoline Price	6-month Treasury Yield	-0.605401
US Average Retail Gasoline Price	3-year Treasury Yield	-0.679623
US Average Retail Gasoline Price	1-year Treasury Yield	-0.620168
30-year Treasury Yield	**20-year Treasury Yield**	**0.995718**
30-year Treasury Yield	**10-year Treasury Yield**	**0.98573**
30-year Treasury Yield	**7-year Treasury Yield**	**0.968049**
30-year Treasury Yield	3-month Treasury Yield	0.80576
30-year Treasury Yield	5-year Treasury Yield	0.945538
30-year Treasury Yield	6-month Treasury Yield	0.803747
30-year Treasury Yield	3-year Treasury Yield	0.896912
30-year Treasury Yield	1-year Treasury Yield	0.821843
20-year Treasury Yield	**10-year Treasury Yield**	**0.988692**
20-year Treasury Yield	**7-year Treasury Yield**	**0.972003**
20-year Treasury Yield	3-month Treasury Yield	0.803221
20-year Treasury Yield	5-year Treasury Yield	0.945557
20-year Treasury Yield	6-month Treasury Yield	0.808354
20-year Treasury Yield	3-year Treasury Yield	0.899305
20-year Treasury Yield	1-year Treasury Yield	0.830051
10-year Treasury Yield	1-month Treasury Yield	0.621741
10-year Treasury Yield	**7-year Treasury Yield**	**0.988709**
10-year Treasury Yield	3-month Treasury Yield	0.870384
10-year Treasury Yield	**5-year Treasury Yield**	**0.981276**
10-year Treasury Yield	6-month Treasury Yield	0.860696
10-year Treasury Yield	3-year Treasury Yield	0.940692
10-year Treasury Yield	1-year Treasury Yield	0.877318
1-month Treasury Yield	7-year Treasury Yield	0.765438
1-month Treasury Yield	**3-month Treasury Yield**	**0.965033**
1-month Treasury Yield	5-year Treasury Yield	0.814158
1-month Treasury Yield	**6-month Treasury Yield**	**0.990822**
1-month Treasury Yield	3-year Treasury Yield	0.921358
1-month Treasury Yield	**1-year Treasury Yield**	**0.980592**
7-year Treasury Yield	3-month Treasury Yield	0.905988
7-year Treasury Yield	**5-year Treasury Yield**	**0.993704**
7-year Treasury Yield	6-month Treasury Yield	0.91205
7-year Treasury Yield	**3-year Treasury Yield**	**0.976506**
7-year Treasury Yield	1-year Treasury Yield	0.927287
3-month Treasury Yield	5-year Treasury Yield	0.935454
3-month Treasury Yield	**6-month Treasury Yield**	**0.986676**
3-month Treasury Yield	**3-year Treasury Yield**	**0.960493**
3-month Treasury Yield	**1-year Treasury Yield**	**0.982708**
5-year Treasury Yield	6-month Treasury Yield	0.930582
5-year Treasury Yield	**3-year Treasury Yield**	**0.985**
5-year Treasury Yield	1-year Treasury Yield	0.944361
6-month Treasury Yield	**3-year Treasury Yield**	**0.973054**
6-month Treasury Yield	**1-year Treasury Yield**	**0.997954**
3-year Treasury Yield	**1-year Treasury Yield**	**0.983369**
S&P 500 Stock Price Index	**Dow Jones Total Stock Market Index**	**0.9673**
S&P 500 Stock Price Index	**Residential Home Price Index**	**0.952516**
S&P 500 Stock Price Index	**Commerical Real Estate Index**	**0.957203**
Cost of Federal Funds	Moody's AAA Curve	0.80879

Appendix D: Mortgage Delinquencies

The following tables, Table 6 through Table 10, present the delinquency rates of mortgages held by Freddie Mac for May 2022 in several southeastern states, broken down by MSA. As we have provided this information for many previous reports, but the information does not appear pertinent to the main portion of the paper, we have included it here for continuity and general interest.

Table 6: Percentage of Freddie Mac Mortgages by Status (Current, 30 dpd and 30+ dpd) as of December 2022: Alabama & SMSAs

MSA	# Units	Total	Current	30-59 dpd	60-89 dpd	90-119 dpd	120+ dpd	% 30dpd	% >30 dpd	% >= 30 dpd
Anniston-Oxford, AL	1 unit	1407	1390	10	0	0	7	0.71%	0.50%	1.21%
	2 units	3	3	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	7	7	0	0	0	0	0.00%	0.00%	0.00%
Auburn-Opelika, AL	1 unit	5424	5373	26	7	1	17	0.48%	0.46%	0.94%
	2 units	36	36	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	1	1	0	0	0	0	0.00%	0.00%	0.00%
Birmingham-Hoover, AL	1 unit	35772	35363	197	37	21	154	0.55%	0.59%	1.14%
	2 units	30	30	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	18	18	0	0	0	0	0.00%	0.00%	0.00%
Columbus, GA-AL	1 unit	419	412	3	3	0	1	0.72%	0.96%	1.67%
	2 units	5	5	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	0	0	0	0	0	0	0.00%	0.00%	0.00%
Daphne-Fairhope-Foley, AL	1 unit	9536	9451	46	9	6	24	0.48%	0.41%	0.89%
	2 units	18	18	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	4	4	0	0	0	0	0.00%	0.00%	0.00%
Decatur, AL	1 unit	2593	2562	20	2	0	9	0.77%	0.42%	1.20%
	2 units	6	6	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	12	12	0	0	0	0	0.00%	0.00%	0.00%
Dothan, AL	1 unit	2440	2410	12	2	1	15	0.49%	0.74%	1.23%
	2 units	1	1	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	2	2	0	0	0	0	0.00%	0.00%	0.00%
Florence-Muscle Shoals, AL	1 unit	3116	3060	32	1	3	20	1.03%	0.77%	1.80%
	2 units	3	3	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	1	1	0	0	0	0	0.00%	0.00%	0.00%
Gadsden, AL	1 unit	1470	1445	10	1	1	13	0.68%	1.02%	1.70%
	2 units	2	2	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	1	1	0	0	0	0	0.00%	0.00%	0.00%
Huntsville, AL	1 unit	16558	16410	83	10	8	47	0.50%	0.39%	0.89%
	2 units	25	25	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	58	58	0	0	0	0	0.00%	0.00%	0.00%
Mobile, AL	1 unit	6713	6625	36	6	4	42	0.54%	0.78%	1.31%
	2 units	16	16	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	6	6	0	0	0	0	0.00%	0.00%	0.00%
Montgomery, AL	1 unit	7125	7038	35	7	0	45	0.49%	0.73%	1.22%

	2 units	25	25	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	11	11	0	0	0	0	0.00%	0.00%	0.00%
Tuscaloosa, AL	1 unit	5928	5847	48	3	3	27	0.81%	0.56%	1.37%
	2 units	4	4	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	2	2	0	0	0	0	0.00%	0.00%	0.00%
Outside all MSAs	1 unit	12622	12390	113	21	10	88	0.90%	0.94%	1.84%
	2 units	45	45	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	11	11	0	0	0	0	0.00%	0.00%	0.00%

Source: STACR Freddie Mac, as of 23 Dec 2022

Table 7: Percentage of Freddie Mac Mortgages by Status (Current, 30 dpd and 30+ dpd) as of December 2022: Florida & SMSAs

MSA	# Units	Total	Current	30-59 dpd	60-89 dpd	90-119 dpd	120+ dpd	% 30dpd	% >30 dpd	% >= 30 dpd
Cape Coral-Fort Myers, FL	1 unit	31879	31241	169	103	162	204	0.53%	1.47%	2.00%
	2 units	437	420	7	1	2	7	1.60%	2.29%	3.89%
	3+ units	48	44	1	1	1	1	2.08%	6.25%	8.33%
Crestview-Fort Walton Beach-Destin, FL	1 unit	8654	8576	45	10	1	22	0.52%	0.38%	0.90%
	2 units	20	20	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	19	19	0	0	0	0	0.00%	0.00%	0.00%
Deltona-Daytona Beach-Ormond Beach, FL	1 unit	22518	22225	131	33	26	103	0.58%	0.72%	1.30%
	2 units	203	202	0	0	1	0	0.00%	0.49%	0.49%
	3+ units	56	55	0	0	0	1	0.00%	1.79%	1.79%
Gainesville, FL	1 unit	7057	6995	29	8	4	21	0.41%	0.47%	0.88%
	2 units	28	28	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	16	16	0	0	0	0	0.00%	0.00%	0.00%
Homosassa Springs, FL	1 unit	3795	3750	22	5	2	16	0.58%	0.61%	1.19%
	2 units	33	33	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	4	4	0	0	0	0	0.00%	0.00%	0.00%
Jacksonville, FL	1 unit	48577	48137	203	51	32	154	0.42%	0.49%	0.91%
	2 units	211	210	0	0	0	1	0.00%	0.47%	0.47%
	3+ units	129	129	0	0	0	0	0.00%	0.00%	0.00%
Lakeland-Winter Haven, FL	1 unit	18542	18303	100	26	34	79	0.54%	0.75%	1.29%
	2 units	119	119	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	53	53	0	0	0	0	0.00%	0.00%	0.00%
Miami-Fort Lauderdale-Pompano Beach, FL	1 unit	160247	157857	1007	284	166	933	0.63%	0.86%	1.49%
	2 units	1395	1376	9	1	3	6	0.65%	0.72%	1.36%
	3+ units	617	611	3	0	0	3	0.49%	0.49%	0.97%
Naples-Marco Island, FL	1 unit	14932	14781	55	16	15	65	0.37%	0.64%	1.01%
	2 units	54	52	2	0	0	0	3.70%	0.00%	3.70%
	3+ units	18	17	0	0	1	0	0.00%	5.56%	5.56%
North Port-Sarasota-Bradenton, FL	1 unit	37348	36921	147	75	47	158	0.39%	0.75%	1.14%
	2 units	208	208	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	33	33	0	0	0	0	0.00%	0.00%	0.00%
Ocala, FL	1 unit	9191	9078	58	12	7	36	0.63%	0.60%	1.23%

	2 units	28	28	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	24	24	0	0	0	0	0.00%	0.00%	0.00%
Orlando-Kissimmee-Sanford, FL	1 unit	87051	85926	449	152	100	424	0.52%	0.78%	1.29%
	2 units	362	360	0	0	0	2	0.00%	0.55%	0.55%
	3+ units	99	97	1	1	0	0	1.01%	1.01%	2.02%
Palm Bay-Melbourne-Titusville, FL	1 unit	22340	22083	118	39	13	87	0.53%	0.62%	1.15%
	2 units	68	68	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	30	28	1	0	0	1	3.33%	3.33%	6.67%
Panama City, FL	1 unit	5179	5107	40	8	5	19	0.77%	0.62%	1.39%
	2 units	49	49	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	16	16	0	0	0	0	0.00%	0.00%	0.00%
Pensacola-Ferry Pass-Brent, FL	1 unit	11580	11428	67	19	11	55	0.58%	0.73%	1.31%
	2 units	84	84	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	46	46	0	0	0	0	0.00%	0.00%	0.00%
Port St. Lucie, FL	1 unit	18865	18641	101	35	12	76	0.54%	0.65%	1.19%
	2 units	75	74	0	0	0	1	0.00%	1.33%	1.33%
	3+ units	17	17	0	0	0	0	0.00%	0.00%	0.00%
Punta Gorda, FL	1 unit	8724	8550	40	24	39	71	0.46%	1.54%	1.99%
	2 units	37	36	1	0	0	0	2.70%	0.00%	2.70%
	3+ units	7	7	0	0	0	0	0.00%	0.00%	0.00%
Sebastian-Vero Beach, FL	1 unit	6532	6462	22	3	7	38	0.34%	0.74%	1.07%
	2 units	16	15	0	0	0	1	0.00%	6.25%	6.25%
	3+ units	10	10	0	0	0	0	0.00%	0.00%	0.00%
Sebring-Avon Park, FL	1 unit	2212	2181	19	3	6	3	0.86%	0.54%	1.40%
	2 units	23	23	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	6	6	0	0	0	0	0.00%	0.00%	0.00%
Tallahassee, FL	1 unit	10032	9931	52	11	6	32	0.52%	0.49%	1.01%
	2 units	59	59	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	40	40	0	0	0	0	0.00%	0.00%	0.00%
Tampa-St. Petersburg-Clearwater, FL	1 unit	108113	106927	521	137	108	420	0.48%	0.62%	1.10%
	2 units	588	584	2	0	0	2	0.34%	0.34%	0.68%
	3+ units	301	300	0	0	1	0	0.00%	0.33%	0.33%
The Villages, FL	1 unit	3102	3092	3	1	1	5	0.10%	0.23%	0.32%
	2 units	1	1	0	0	0	0	0.00%	0.00%	0.00%

	3+ units	0	0	0	0	0	0	0.00%	0.00%	0.00%
Outside all MSAs	1 unit	10539	10369	77	15	17	61	0.73%	0.88%	1.61%
	2 units	352	343	6	0	0	3	1.71%	0.85%	2.56%
	3+ units	60	58	1	0	0	1	1.67%	1.67%	3.33%

Source: STACR Freddie Mac, as of 23 Dec 2022

Table 8: Percentage of Freddie Mac Mortgages by Status (Current, 30 dpd and 30+ dpd) as of December 2022: Louisiana & SMSAs

MSA	# Units	Total	Current	30-59 dpd	60-89 dpd	90-119 dpd	120+ dpd	% 30dpd	% >30 dpd	% >= 30 dpd
Alexandria, LA	1 unit	1839	1809	13	6	0	11	0.71%	0.92%	1.63%
	2 units	1	1	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	0	0	0	0	0	0	0.00%	0.00%	0.00%
Baton Rouge, LA	1 unit	23697	23331	145	53	18	150	0.61%	0.93%	1.54%
	2 units	62	61	0	0	0	1	0.00%	1.61%	1.61%
	3+ units	68	68	0	0	0	0	0.00%	0.00%	0.00%
Hammond, LA	1 unit	2410	2369	18	9	2	12	0.75%	0.95%	1.70%
	2 units	13	13	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	10	10	0	0	0	0	0.00%	0.00%	0.00%
Houma-Thibodaux, LA	1 unit	3674	3597	29	10	8	30	0.79%	1.31%	2.10%
	2 units	5	2	2	0	0	1	40.00%	20.00%	60.00%
	3+ units	5	4	1	0	0	0	20.00%	0.00%	20.00%
Lafayette, LA	1 unit	9829	9625	70	21	8	105	0.71%	1.36%	2.08%
	2 units	12	12	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	33	31	2	0	0	0	6.06%	0.00%	6.06%
Lake Charles, LA	1 unit	3955	3878	31	13	4	29	0.78%	1.16%	1.95%
	2 units	15	15	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	7	7	0	0	0	0	0.00%	0.00%	0.00%
Monroe, LA	1 unit	2876	2813	24	8	4	27	0.83%	1.36%	2.19%
	2 units	2	2	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	0	0	0	0	0	0	0.00%	0.00%	0.00%
New Orleans-Metairie, LA	1 unit	31237	30695	197	71	35	239	0.63%	1.10%	1.74%
	2 units	1677	1661	10	0	1	5	0.60%	0.36%	0.95%
	3+ units	407	396	1	1	0	9	0.25%	2.46%	2.70%
Shreveport-Bossier City, LA	1 unit	7607	7457	73	16	6	55	0.96%	1.01%	1.97%
	2 units	5	5	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	9	9	0	0	0	0	0.00%	0.00%	0.00%
Outside all MSAs	1 unit	6184	6027	73	7	10	67	1.18%	1.36%	2.54%
	2 units	470	461	0	0	0	9	0.00%	1.92%	1.92%
	3+ units	96	95	1	0	0	0	1.04%	0.00%	1.04%

Source: STACR Freddie Mac, as of 23 Dec 2022

Table 9: Percentage of Freddie Mac Mortgages by Status (Current, 30 dpd and 30+ dpd) as of December 2022: Mississippi & SMSAs

MSA	# Units	Total	Current	30-59 dpd	60-89 dpd	90-119 dpd	120+ dpd	% 30dpd	% >30 dpd	% >= 30 dpd
Gulfport-Biloxi, MS	1 unit	4940	4879	28	6	7	20	0.57%	0.67%	1.24%
	2 units	37	37	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	14	14	0	0	0	0	0.00%	0.00%	0.00%
Hattiesburg, MS	1 unit	2389	2355	16	4	0	14	0.67%	0.75%	1.42%
	2 units	4	4	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	2	2	0	0	0	0	0.00%	0.00%	0.00%
Jackson, MS	1 unit	9265	9125	52	18	7	63	0.56%	0.95%	1.51%
	2 units	12	12	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	4	4	0	0	0	0	0.00%	0.00%	0.00%
Memphis, TN-MS-AR	1 unit	6005	5926	39	13	4	23	0.65%	0.67%	1.32%
	2 units	2	2	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	0	0	0	0	0	0	0.00%	0.00%	0.00%
Outside all MSAs	1 unit	11310	11090	89	25	9	97	0.79%	1.16%	1.95%
	2 units	16	16	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	3	3	0	0	0	0	0.00%	0.00%	0.00%

Source: STACR Freddie Mac, as of 23 Dec 2022

Table 10: Percentage of Freddie Mac Mortgages by Status (Current, 30 dpd and 30 + dpd) as of December 2022: Texas & SMSAs

MSA	# Units	Total	Current	30-59 dpd	60-89 dpd	90-119 dpd	120+ dpd	% 30dpd	% >30 dpd	% >= 30 dpd
Abilene, TX	1 unit	3883	3825	29	5	2	22	0.75%	0.75%	1.49%
	2 units	20	20	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	2	2	0	0	0	0	0.00%	0.00%	0.00%
Amarillo, TX	1 unit	4546	4476	26	10	6	28	0.57%	0.97%	1.54%
	2 units	15	15	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	5	5	0	0	0	0	0.00%	0.00%	0.00%
Austin-Round Rock-Georgetown, TX	1 unit	99910	99119	364	97	40	290	0.36%	0.43%	0.79%
	2 units	1139	1136	2	0	0	1	0.18%	0.09%	0.26%
	3+ units	237	232	2	0	0	3	0.84%	1.27%	2.11%
Beaumont-Port Arthur, TX	1 unit	5659	5533	58	20	5	43	1.03%	1.20%	2.23%
	2 units	4	4	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	9	9	0	0	0	0	0.00%	0.00%	0.00%
Brownsville-Harlingen, TX	1 unit	2827	2765	28	8	5	21	0.99%	1.20%	2.19%
	2 units	36	36	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	33	33	0	0	0	0	0.00%	0.00%	0.00%
College Station-Bryan, TX	1 unit	6957	6901	37	2	0	17	0.53%	0.27%	0.81%
	2 units	106	106	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	68	68	0	0	0	0	0.00%	0.00%	0.00%
Corpus Christi, TX	1 unit	7241	7130	41	18	4	48	0.57%	0.97%	1.53%
	2 units	17	17	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	18	18	0	0	0	0	0.00%	0.00%	0.00%
Dallas-Fort Worth-Arlington, TX	1 unit	271369	268571	1334	338	179	947	0.49%	0.54%	1.03%
	2 units	879	872	4	0	0	3	0.46%	0.34%	0.80%
	3+ units	238	237	1	0	0	0	0.42%	0.00%	0.42%
El Paso, TX	1 unit	6627	6508	59	16	3	41	0.89%	0.91%	1.80%
	2 units	74	73	0	0	1	0	0.00%	1.35%	1.35%
	3+ units	32	32	0	0	0	0	0.00%	0.00%	0.00%
Houston-The Woodlands-Sugar Land, TX	1 unit	195538	192797	1161	317	196	1067	0.59%	0.81%	1.40%
	2 units	349	346	1	0	0	2	0.29%	0.57%	0.86%
	3+ units	294	287	4	0	0	3	1.36%	1.02%	2.38%
Killeen-Temple, TX	1 unit	6766	6674	48	10	6	28	0.71%	0.65%	1.36%

	2 units	225	225	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	189	187	0	0	0	2	0.00%	1.06%	1.06%
Laredo, TX	1 unit	1885	1852	19	6	0	8	1.01%	0.74%	1.75%
	2 units	4	3	1	0	0	0	25.00%	0.00%	25.00%
	3+ units	11	11	0	0	0	0	0.00%	0.00%	0.00%
Longview, TX	1 unit	2903	2850	23	4	3	23	0.79%	1.03%	1.83%
	2 units	17	17	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	2	2	0	0	0	0	0.00%	0.00%	0.00%
Lubbock, TX	1 unit	8417	8330	45	15	1	26	0.54%	0.50%	1.03%
	2 units	124	124	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	19	19	0	0	0	0	0.00%	0.00%	0.00%
McAllen-Edinburg-Mission, TX	1 unit	4454	4339	50	14	11	40	1.12%	1.46%	2.58%
	2 units	17	17	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	208	207	0	0	0	1	0.00%	0.48%	0.48%
Midland, TX	1 unit	6158	6056	42	10	5	45	0.68%	0.97%	1.66%
	2 units	15	15	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	2	2	0	0	0	0	0.00%	0.00%	0.00%
Odessa, TX	1 unit	2326	2266	23	8	2	27	0.99%	1.59%	2.58%
	2 units	5	5	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	0	0	0	0	0	0	0.00%	0.00%	0.00%
San Angelo, TX	1 unit	2575	2529	23	7	4	12	0.89%	0.89%	1.79%
	2 units	7	7	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	3	3	0	0	0	0	0.00%	0.00%	0.00%
San Antonio-New Braunfels, TX	1 unit	56805	56129	339	83	34	220	0.60%	0.59%	1.19%
	2 units	418	414	3	0	0	1	0.72%	0.24%	0.96%
	3+ units	222	221	1	0	0	0	0.45%	0.00%	0.45%
Sherman-Denison, TX	1 unit	4519	4453	36	9	5	16	0.80%	0.66%	1.46%
	2 units	40	40	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	1	1	0	0	0	0	0.00%	0.00%	0.00%
Texarkana, TX-AR	1 unit	1236	1210	7	4	1	14	0.57%	1.54%	2.10%
	2 units	6	6	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	4	4	0	0	0	0	0.00%	0.00%	0.00%
Tyler, TX	1 unit	4758	4697	34	2	2	23	0.72%	0.57%	1.28%
	2 units	13	13	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	1	1	0	0	0	0	0.00%	0.00%	0.00%
Victoria, TX	1 unit	1182	1160	9	5	1	7	0.76%	1.10%	1.86%

	2 units	5	5	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	0	0	0	0	0	0	0.00%	0.00%	0.00%
Waco, TX	1 unit	5144	5077	39	6	4	18	0.76%	0.54%	1.30%
	2 units	53	53	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	2	2	0	0	0	0	0.00%	0.00%	0.00%
Wichita Falls, TX	1 unit	1577	1553	7	3	1	13	0.44%	1.08%	1.52%
	2 units	7	7	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	3	3	0	0	0	0	0.00%	0.00%	0.00%
Outside all MSAs	1 unit	36528	35901	298	70	48	211	0.82%	0.90%	1.72%
	2 units	480	478	0	0	0	2	0.00%	0.42%	0.42%
	3+ units	64	64	0	0	0	0	0.00%	0.00%	0.00%

Data: STACR Freddie Mac, as of 23 Dec 2022

References

Fiorucci, Jose A., Tiago R. Pellegrini, Francisco Louzada, Fotios Petropoulos, Anne B. Koehler, "Models for optimising the theta method and their relationship to state space models", In International Journal of Forecasting, Volume 32, Issue 4, 2016, Pages 1151-1161, ISSN 0169-2070, https://doi.org/10.1016/j.ijforecast.2016.02.005. (http://www.sciencedirect.com/science/article/pii/S0169207016300243)

De Livera, Alysha M. "Automatic forecasting with a modified exponential smoothing state space framework." Monash Econometrics and Business Statistics Working Papers 10, no. 10 (2010).

De Livera, Alysha M., Rob J Hyndman, Ralph D Snyder, "Forecasting time series with complex seasonal patterns using exponential smoothing", Journal of the American Statistical Association, Volume 106, Number 496, pp 1513-1527, (2011)

Hyndman, R.J. and Athanasopoulos, G, Forecasting: principles and practice. OTexts: Melbourne, Australia. http://otexts.org/fpp/. Accessed on December 23, 2017 (2013)

Hyndman, Rob J., Baki Billah, "Unmasking the Theta method", In International Journal of Forecasting, Volume 19, Issue 2, 2003, Pages 287-290, ISSN 0169-2070, https://doi.org/10.1016/S0169-2070(01)00143-1. (http://www.sciencedirect.com/science/article/pii/S0169207001001431)

Jiang, Bin, George Athanasopoulos, Rob J Hyndman, Anastasios Panagiotelis, Farshid Vahid, "Macroeconomic forecasting for Australia using a large number of predictors", Unpublished working paper, http://business.monash.edu/econometrics-and-business-statistics/research/publications/ebs/wp02-17.pdf. Accessed on December 27, 2017 (2017)

