Macroeconomic Forecasts, 1Q2022
Domestic Metrics

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Summary

The economic condition of the United States seems to be at a new crossroads every week. A look back at the last few outbreak "bumps" suggest that we should expect a very troubling 2022. The current "Omicron" variant appears to be much easier to transmit and, although the death rate appears to be lower, the numbers do not ultimately work in our favor (a lower percentage of hospitalizations and/or deaths of a much larger number still translates into many more deaths and hospitalizations). The mis-match in the labor market (including a record number of persons quitting their jobs[1]), the 7% annual rate of inflation, the lack of momentum in additional fiscal policies, and our forecast of a slew of business failures points to, at best, very little economic growth for 2022 and, at worst, another economic recession coming into its own by YE2022.

[1] https://www.bls.gov/news.release/jolts.t04.htm

State of Affairs

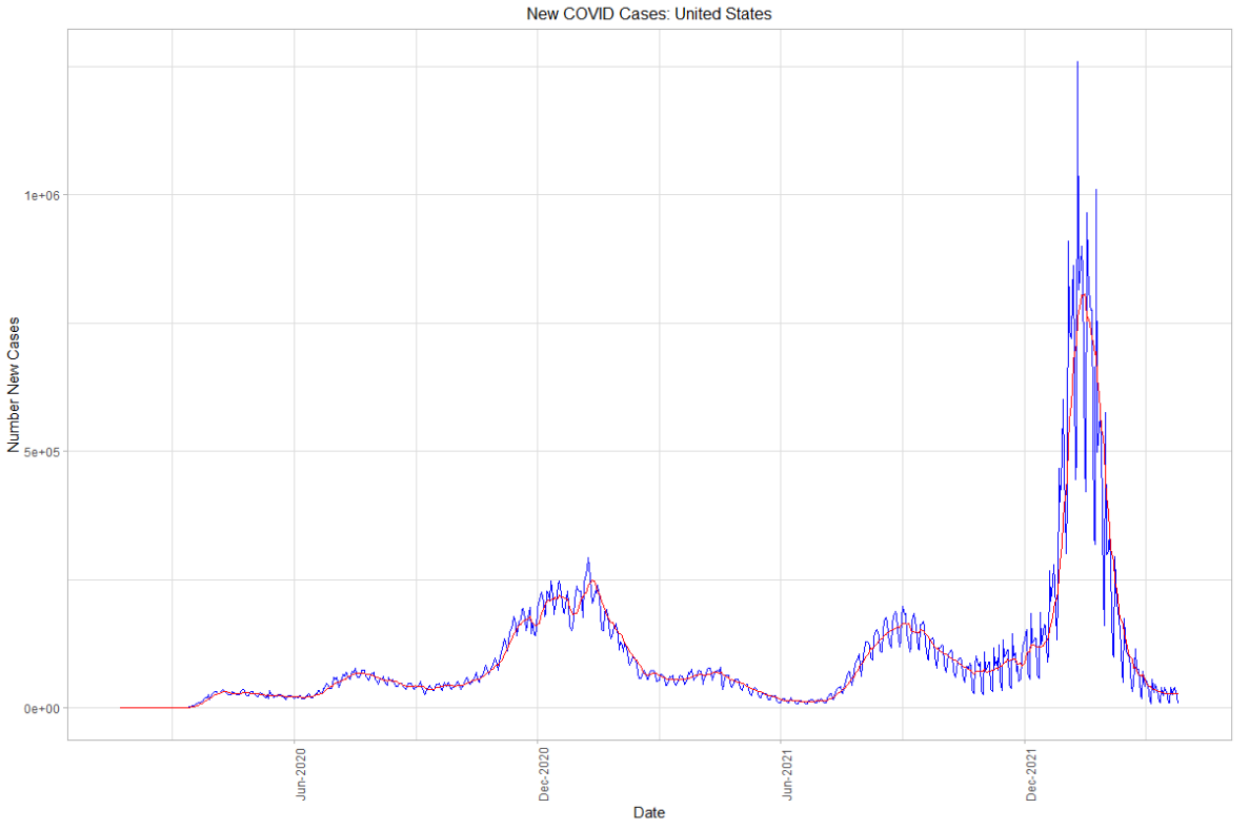
The economy might be summed up in two ideas:

1. COVID restrictions and protective protocols are waning, and
2. Inflation is becoming more prevalent.

The trend of the economy has been tied to COVID-19 for the last two years. With a significant decrease in the number of new infections and the weakening of protective measures – particularly masking and social distancing – the linkage between COVID-19 and the economy is starting to separate. The inflationary trends that started with consumer disposable goods at the onset of the pandemic (toilet paper and hand sanitizer) -- and moved to lumber and housing prices after the first year -- has become a nationwide issue, impacting housing and rental costs, food, and energy. The Federal Reserve will try to enact policy that reduces inflationary pressures without repeating a "Volker Recession[2]".

Covid Trends

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

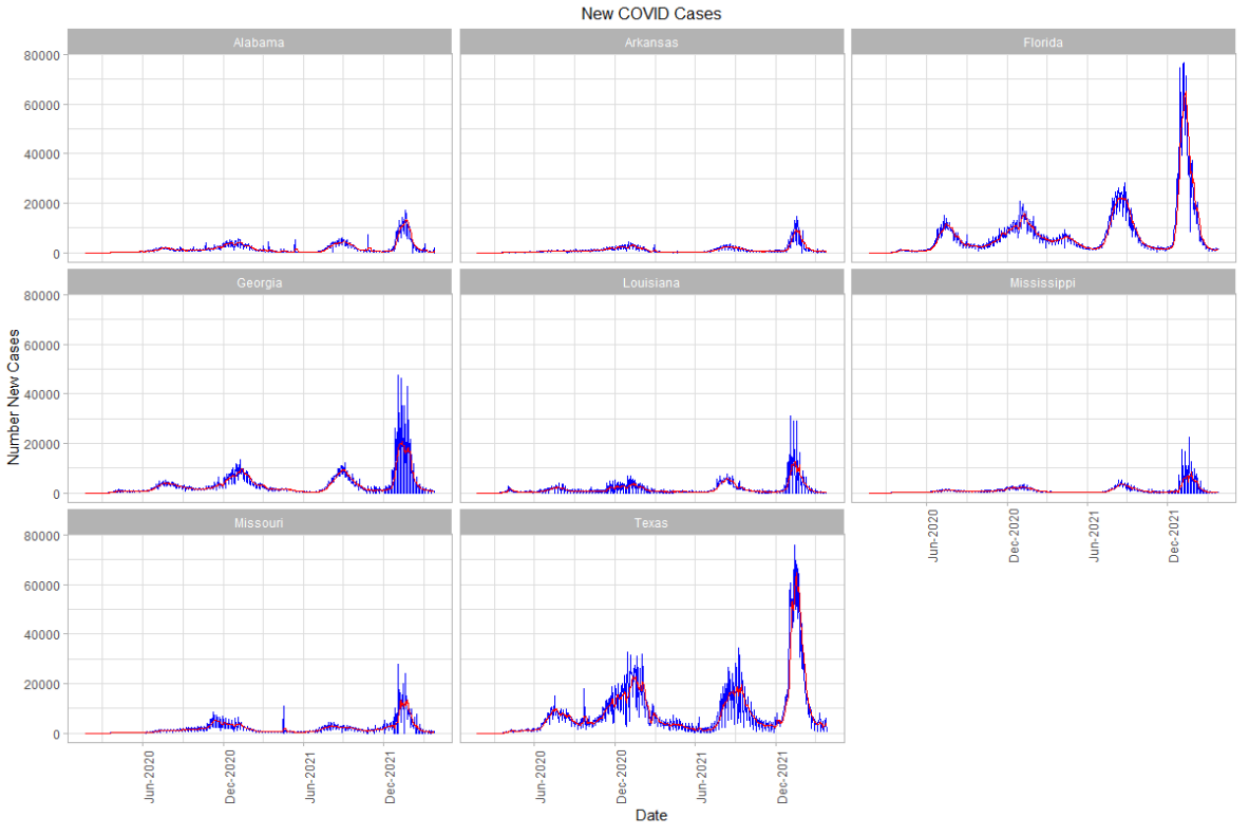


Source: Centers for Disease Control & Prevention (https://www.cdc.org): https://covid.cdc.gov/covid-data-tracker

[2] https://www.federalreservehistory.org/essays/recession-of-1981-82

As we can see from Figure 1 and Figure 2, the country is experiencing a downward trend in new COVID cases. Although Florida and Texas saw record-breaking spikes in new cases during the winter months, these states have returned to pre-Omicron levels of new cases.

Figure 2: Daily and Weekly Average Number of new COVID Cases for Select States



Source: Centers for Disease Control & Prevention (https://www.cdc.org)

Unfortunately, the decrease in cases has not created an urgency to return to the labor market. The labor force participation rate for the country remains substantially below the pre-pandemic rate. Although this doesn't appear to be impacting the ability for the economy to grow, the prolonged mismatch between firms and workers may have lasting effects.

Current Economic Climate

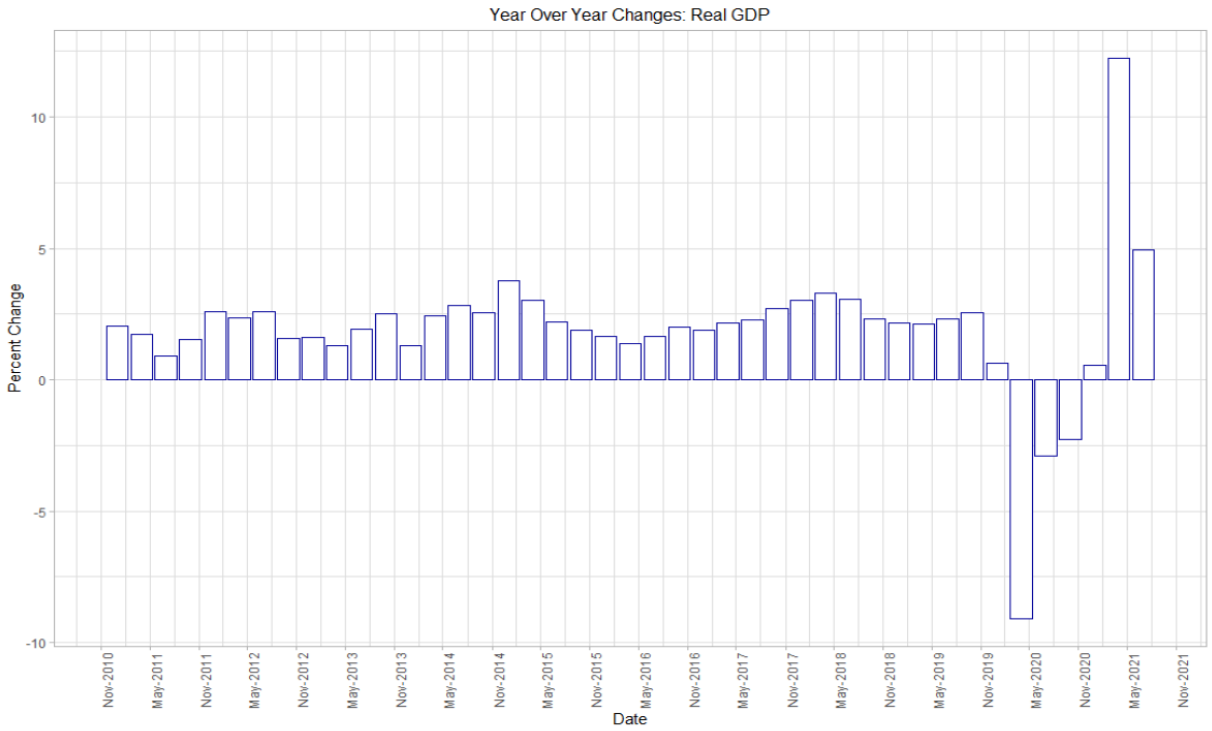
The current state of the economy and the movement of the economy in the last two quarters should be described as steady (even "robust") economic growth with significant inflationary pressures.

Real GDP has been growing consistently over the last two quarters. The year-over-year growth of real GDP was approximately 12% from 1Q2020 to 1Q2021, and 5% for 2Q2020 to 2Q2021. (See Figure 3.) ***We anticipate the year-over-year growth for 4Q2021 and 1Q2022 will be close to 5% growth***.

We see in Figure 4 that quarter-over-quarter growth of inflation-adjusted real GDP was just above 0.5% for 2Q2021 to 3Q2021. Although we do not have first-quarter GDP estimates for 1Q2022, we anticipate that the economy is continuing to grow at a quarterly rate of 1.5% and an annual rate of between 4.5 –

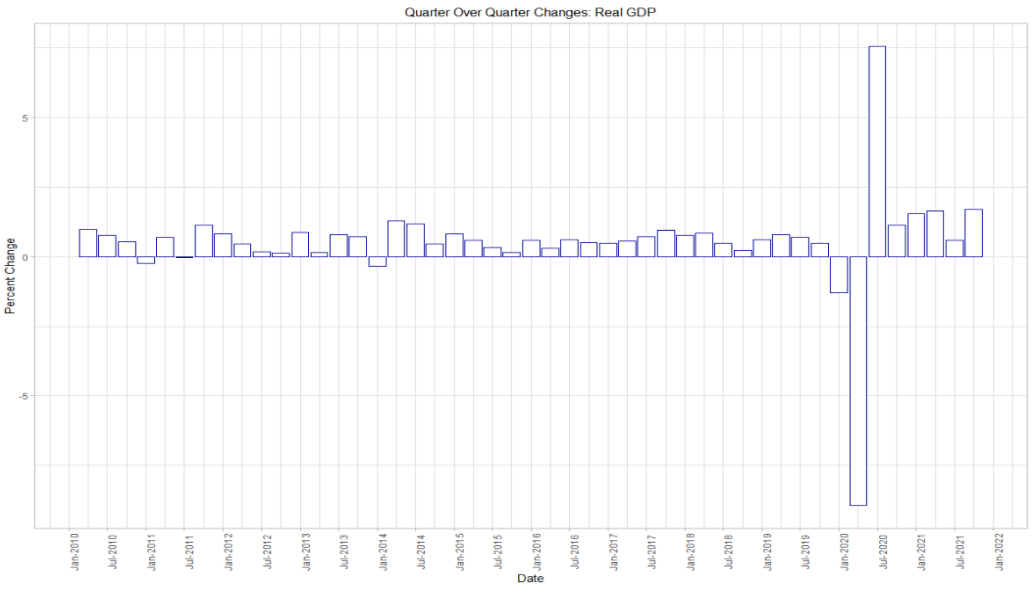
6%. There is a very real possibility that the US economy is in a growth-recession – a trend where the economy is experiencing growth in real GDP while suffering from the consequences of under-performance or falling real wages. The continued upward pressure in prices and decrease of real wages (see next two sections) adds support to this hypothesis.

Figure 3: Y/Y Percent Change in Real GDP



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

Figure 4: Q/Q Percent Change in Real GDP



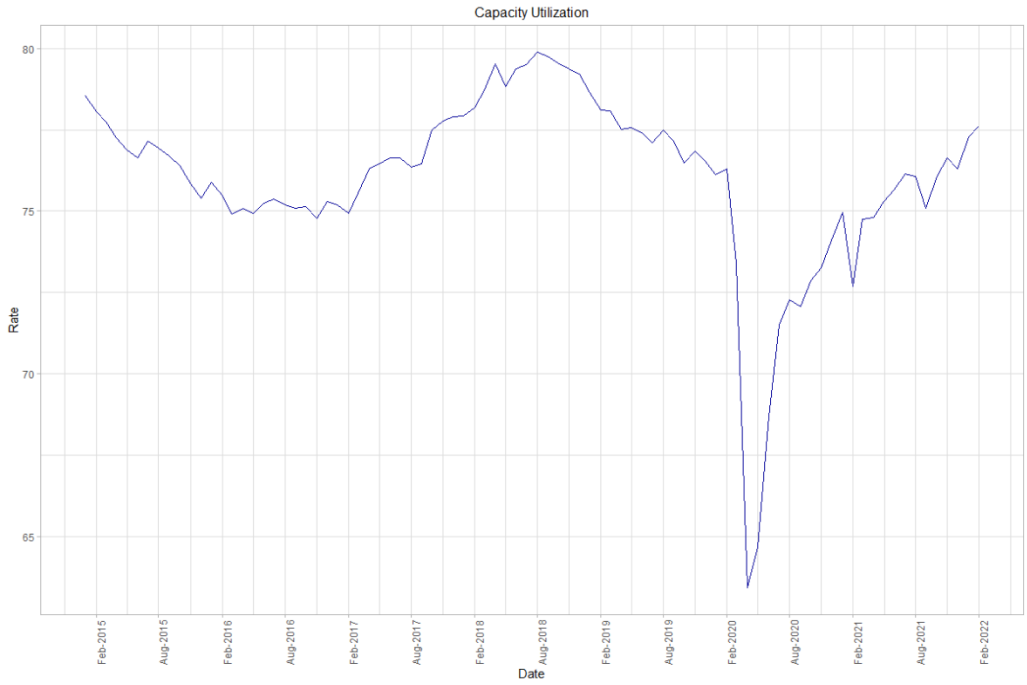
Source: Federal Reserve Economic Database (https://fred.stlouisfed.org)

It is fairly typical to see strong growth coming out of a deep recession; percentage changes in GDP growth can be large after real GDP falls into a trough. The continued growth of the economy – ranging from 3% to 6% annually – suggests that the economy is working well. Other indicators, such as capacity utilization (Figure 5) and industrial production (Figure 6) both show strong gains since the March 2020 recession. Capacity utilization is now higher than it was prior to the start of the pandemic, suggesting that the capital at factories and facilities is being used at a higher rate than we saw at the start of 2020. This conclusion is consistent with the GDP growth highlighted in the previous figures. The trend of real GDP, capacity utilization, and industrial production all point to strong growth. The catch, however, is that the economy is also experiencing inflation rates topping 7% annually.

Inflation (Including Energy Prices) & Monetary Policy

As we have written many times, inflation is, historically, a monetary phenomenon, driven by expansionary monetary policy and quantitative easing. The easy money policies that the US experienced between 2020 and the start of 2022 have contributed to near record inflation.
The current level of annual (year-over-year) inflation is 7.9% (as of February 2022), a level unseen since the early 1980s. (See Figure 7.) The Federal Reserve Bank announced a 25 bp increase in the Federal Funds target rate in mid-March[3], 2022, and ***will likely make three to four 25 bp to 50 bp adjustments to the Federal Funds target rate and the discount rate during 2022***. It is important to note that the Federal Reserve will likely make at least one 50 bp increase in the next 9 months. ***The total upward adjustments to the Federal Funds target rate will be between 125 bp to 150 bp during 2022.***

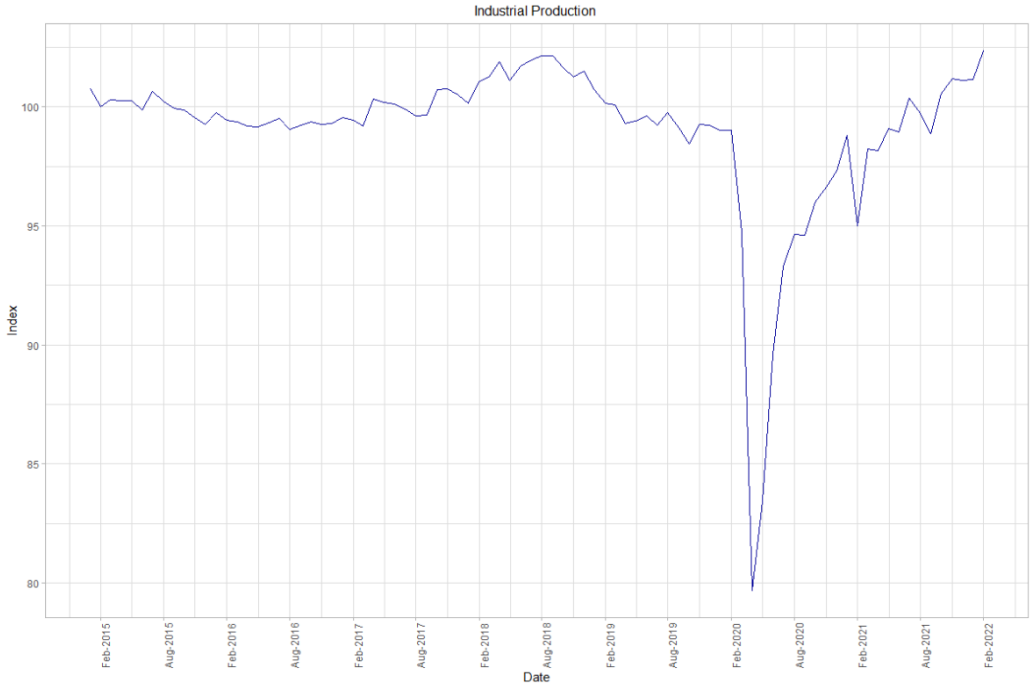
Figure 5: Capacity Utilization



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

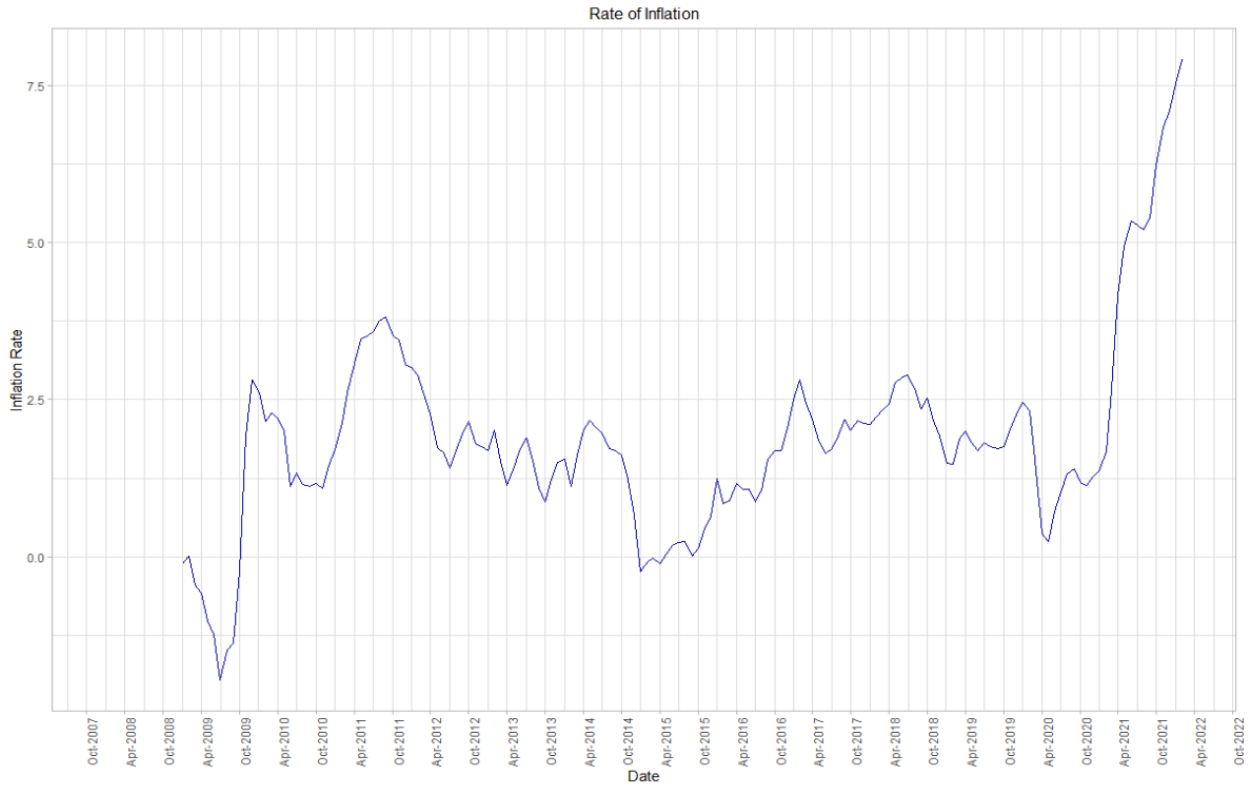
[33] https://www.wsj.com/articles/fed-raises-interest-rates-for-first-time-since-2018-11647453603

Figure 6: Industrial Production Index



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

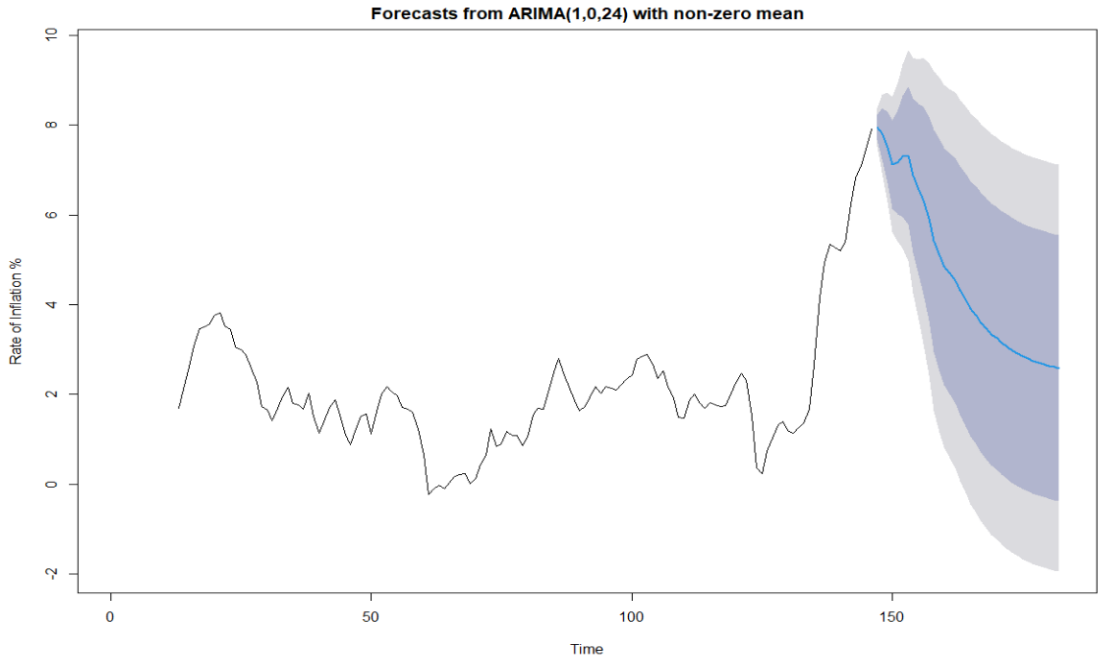
Figure 7: US Inflation Rate (Year-over-Year Changes in CPI)



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

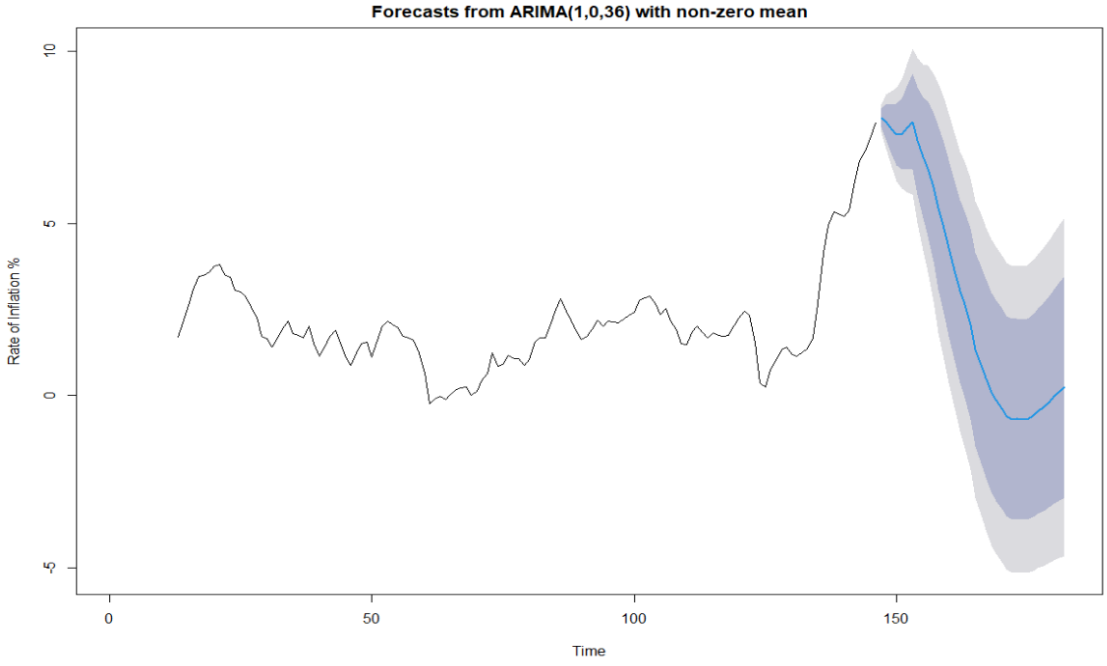
Our forecasting models, shown below, still suggest moderate inflation through most of 2022; ***we estimate inflation rates between 5% and 6% during most of 2022, and then solidifying between 3% and 4% for 2023***.

Figure 8: 24-month ARIMA Model for US Inflation



Source: Authors' calculations based on CPI

Figure 9: 36-month ARIMA Model for US Inflation

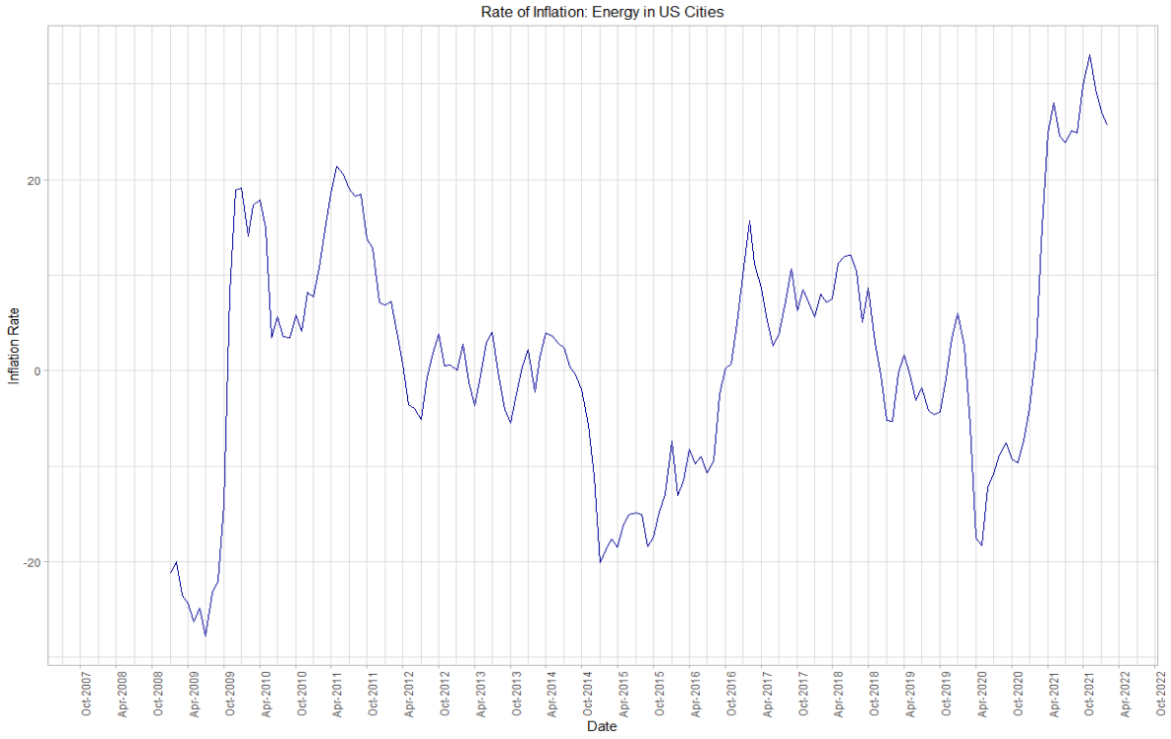


Source: Authors' calculations based on CPI

We have previously shown more confidence in our 36-month ARIMA model. However, since the Fed' is making it clear that it is taking the threat of inflation seriously, and is positioning itself for a series of contractionary policy moves, we are favoring our 24-month ARIMA model (per Figure 8). The difference in forecasts for these two models is the aggressiveness of the Fed's policy and the long-run implications of the Fed's adjustments. The 36-month ARIMA suggests that the economy will return to 2% inflation more quickly (than the 24-month model) and fall into a deflationary zone. (ref. Figure 9) In contrast, we believe that the near-term future will be better estimated by our 24-month ARIMA, which suggests dramatic movements occurring sooner and potentially followed by smaller, more frequent adjustments.

Figure 10 shows inflation based on energy prices in US cities. The 25 – 30% increase in energy prices hits consumers' wallets particularly hard in cities that have both large footprints and less access to public transportation[4]. The decrease in gas and energy prices early in the pandemic acted, in some ways, as an additional, albeit temporary, tax break. However, with the increase in demand for gasoline corresponding to the increase in driving miles and airline travel miles, energy prices have seen a sharp increase.

Figure 10: Inflation for Energy Products, in US Urban Areas



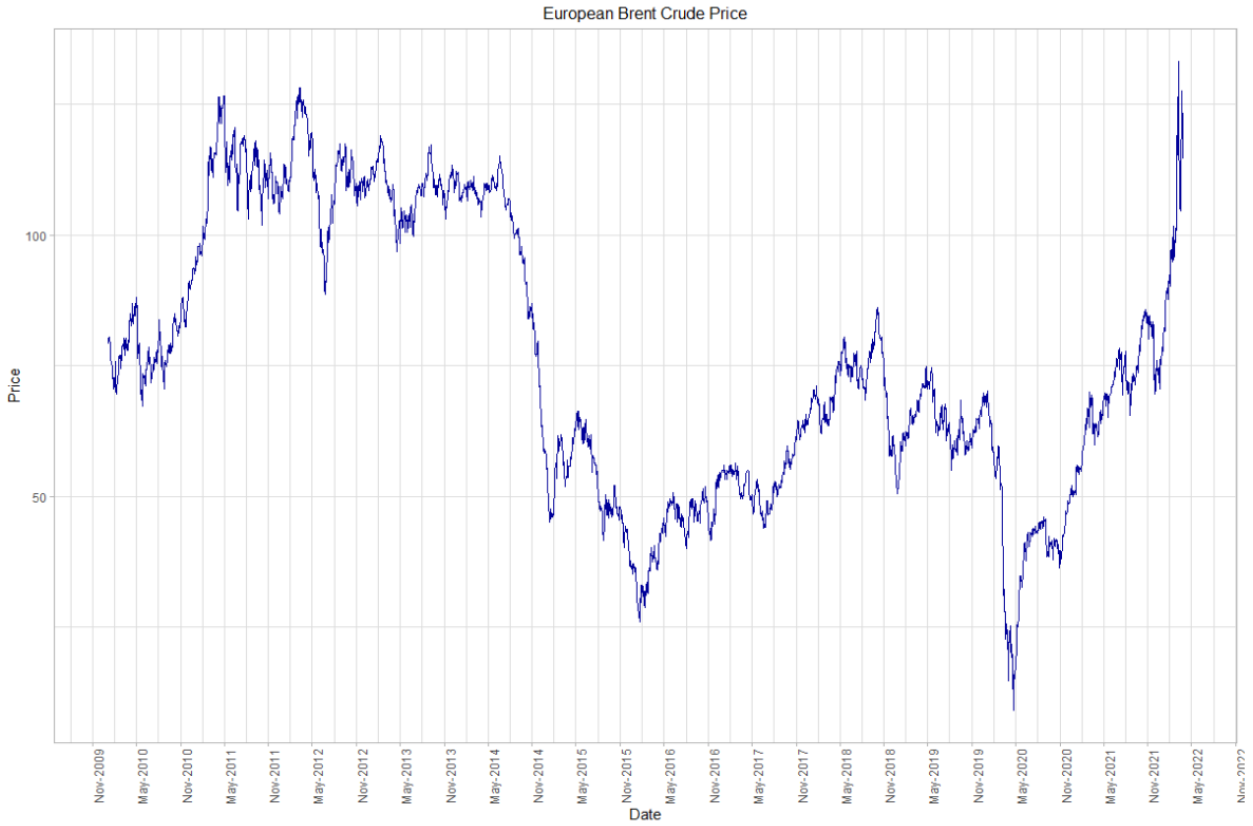
Source: Federal Reserve Economic Database (https://fred.stlouisfed.org)

The stance of Russia before the invasion of Ukraine (and then the subsequent invasion on March 24, 2022) increased consumer's fears about availability of energy. We saw a sharp increase in oil futures at the start of March and then again in mid-March after Russia's invasion. Although Russian oil comprises a small amount of the US total consumption (approximately 8% of total oil consumption[5]), the expectation

[4] https://www.wsj.com/articles/soaring-energy-prices-raise-concerns-about-u-s-inflation-economy-11633870800
[5] https://www.nbcnews.com/news/us-news/data-how-much-american-oil-comes-russia-n1291369

of continued decrease in oil exports from Russia created an anxiety in the market and upward pressure in prices. The lack of an exit plan from Russia (e.g., a clear path to a cease-fire, or firm position for peaceful negotiation with Russia) adds to the continued upward pressure in oil prices. As a point of reference, the price of Brent Crude recently topped $135 per barrel[6] (see Figure 11).

Figure 11: Brent Crude Prices

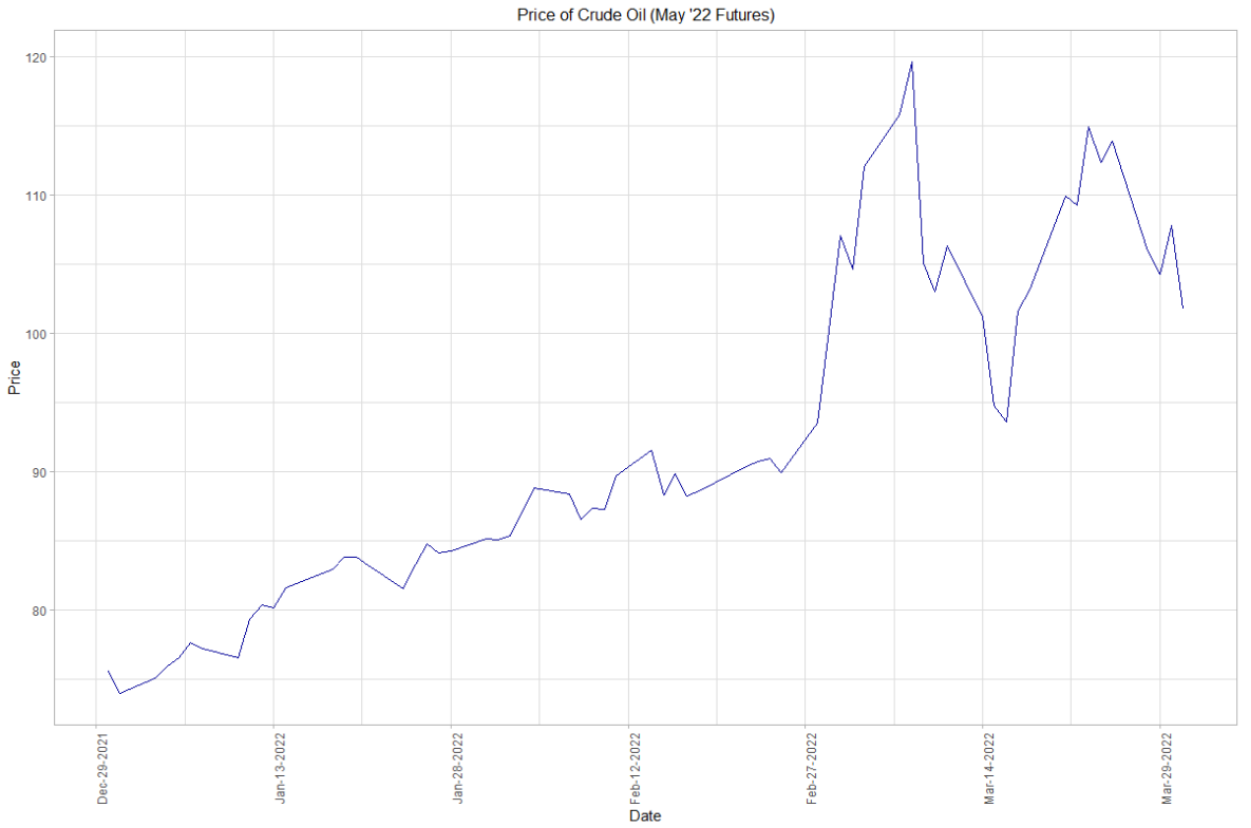


Source: Federal Reserve Economic Database (https://fred.stlouisfed.org)

The Biden administration has recently floated the idea of releasing 180 million barrels of oil from the US oil Strategic Petroleum Reserves (SPR)[7] to combat the increased demand and decreased global supply. It is not clear if this release will have a lasting impact. One of the issues relating to the market for oil (and, subsequently the market for gasoline) is that consumer demand may increase due to changes in expectations regarding the future price or future availability of oil. If (when) consumers feel "hopeless" or "anxious" about the future gas prices, they tend to "panic-buy"[8] gasoline, driving up prices even more. It possible (or even intended) that the release of oil from the SPR will act as a calming tonic, decreasing consumer's concerns and decreasing demand, rather than significantly increasing the oil supply. The invasion of Ukraine has pushed crude futures over $100 per barrel as of this writing; energy-related inflation is anticipated as continuing to run high through the Spring and into the Summer of 2022.

[6] https://www.cnbc.com/2022/03/06/us-crude-oil-jumps-to-125-a-barrel-a-13-year-high-on-possible-western-ban-of-russian-oil.html
[7] https://www.cnbc.com/2022/03/31/us-to-release-1-million-barrels-of-oil-per-day-from-reserves-to-help-cut-gas-prices.html
[8] https://www.cbsnews.com/news/gas-prices-colonial-pipeline-shutdown-panic-buying-hoarding-long-lines-outages/

Figure 12: Crude Oil Futures (May 2022)



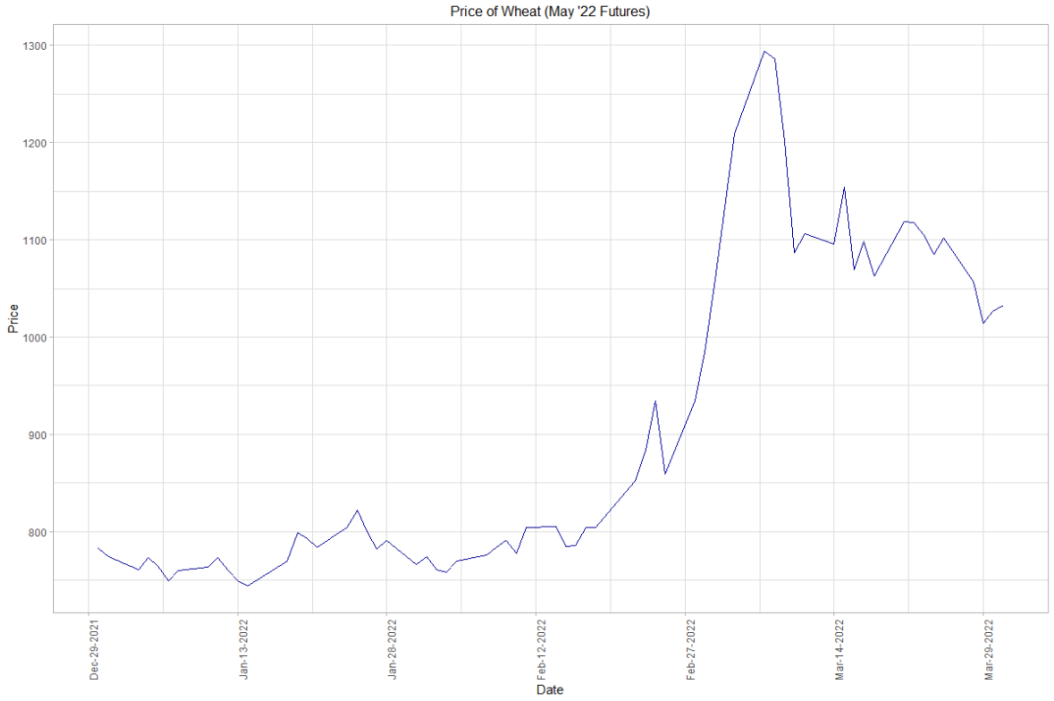
Source: https://www.barchart.com/futures/quotes/CLK22/price-history/historical

Because of the challenges we are facing with supply-chains and the conflict in Ukraine, we are also seeing price increases in food commodities. Figure 13 shows the trending future's price of May 2022 wheat. The decrease in exports out of Ukraine (the "bread basket" of Europe) is cutting supplies down and pushing up prices. The lack of Ukrainian exports may provide an additional market for US wheat farmers. The increase in exports from the US to Europe have increased (as of this writing) wheat prices domestically by almost 30% since YE2021, down from a peak of 40%. In short, the conflict in Ukraine has put additional pressures on wheat supplies that are leading to higher wheat prices domestically.

Wheat prices are not the only concern. Egg prices are also increasing (see Figure 14) . The culprit responsible for the upward swing in egg prices is a bird flu has killed more than 17 million birds[9]. The increase in food prices will hit domestic consumers directly, with prices currently 2.5x of YE2021 prices, with the added stresses of the products that use eggs and/or grains being affected (e.g., bakery goods, proteins, animal feed, etc.), and the inflationary impact on these commodities in addition to the effects of the bird flu.

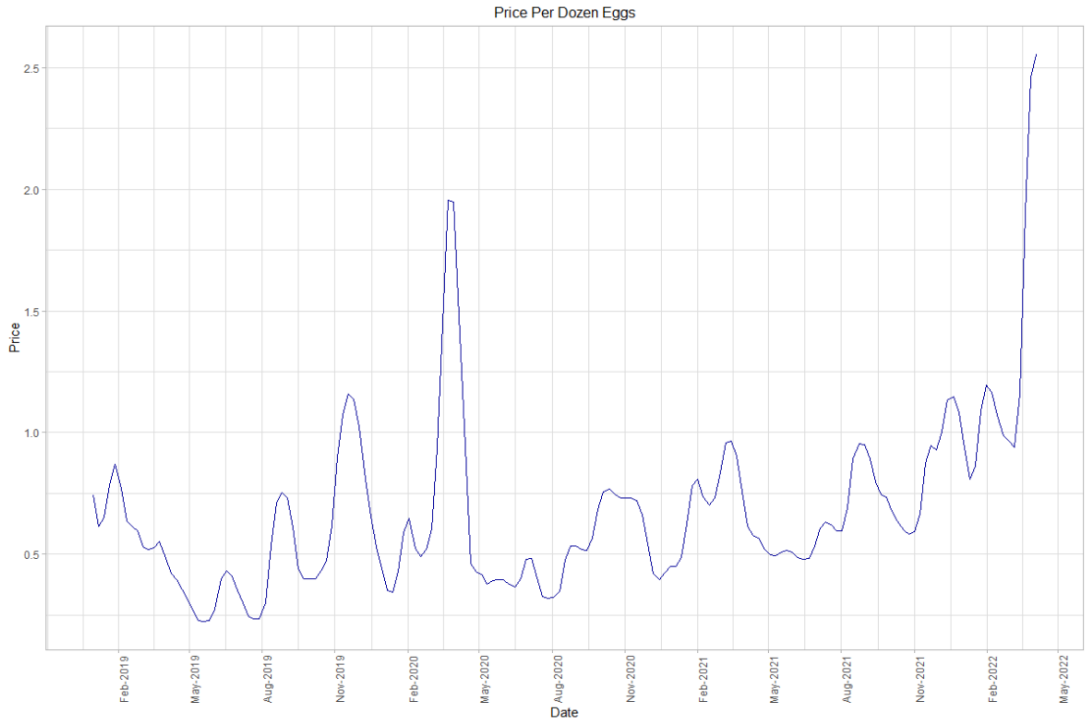
[9] https://www.cbsnews.com/news/covid-pandemic-burnout-americans-quit-jobs/

Figure 13: Futures Price of Wheat



Source: https://www.barchart.com/futures/quotes/ZWK22/price-history/historical

Figure 14: Price of One Dozen Eggs (in Shells)

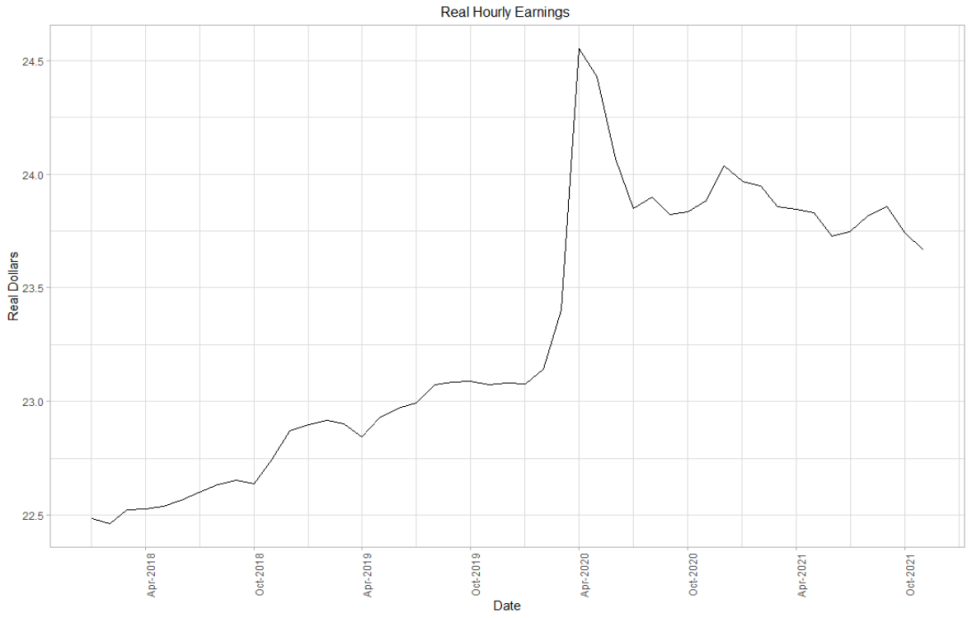


Source: https://www.urnerbarry.com/history/4850

Inflations & Real Wages

Although nominal wages have been increasing, real earnings have decreased during the last quarter of 2021. Real wages for workers in manufacturing, construction, information & technology services, transportation, and mining are below real wages prior to the pandemic. Real wages for professional services and hospitality & leisure are slightly higher than in March 2020, but lower than the peak that occurred in April and May 2020. Combining these points with our previous discussion regarding inflation, leads us to the fact that the current increase in inflation will likely connect with consumers more concretely than unemployment due to the day-to-day impact of changing prices throughout the marketplace. We believe that the increase in inflation, and the decrease in real wages, are the primary forces driving down consumer confidence. (See Figure 15, Figure 16, and Figure 17.)

Figure 15: Real Hourly Wages (Nationwide)

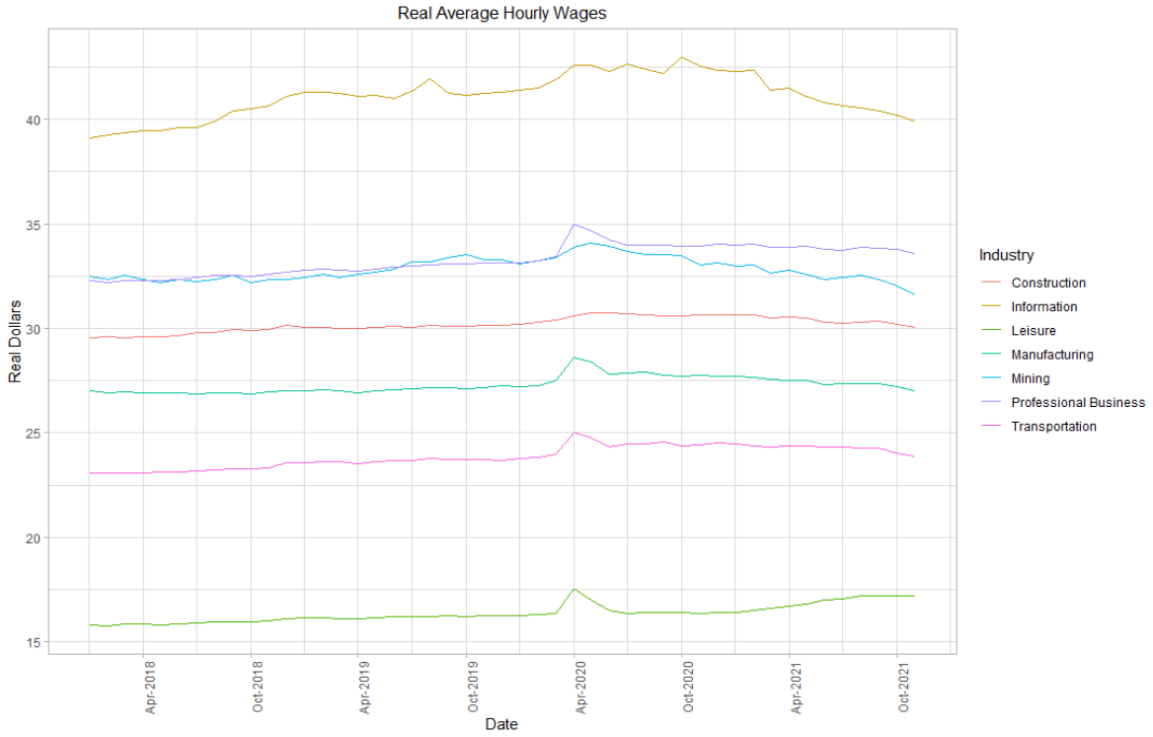


Source: Federal Reserve Economic Database (https://fred.stlouisfed.org)

Per Figure 17, consumers' one-year expectations of inflation (6%) is about 1.5 times what they were during Summer 2021 (4.5%) and approximately 2 times higher than they were prior to the pandemic (2.5-3%). The three-year expectations on inflation are substantially lower than the one-year expectations, suggesting that consumers are fearful of short-term inflation but less so of long-term inflation. The concern with rising consumer expectations of inflation is that, while deflationary expectations can decrease consumers' engagement with the market, high inflationary expectations can increase engagement in the market. With current supply-chains strained and an overall low supply of goods in the market, an increase in consumer demand (consistent with long-run inflationary trends) will likely have the impact of pushing up prices (i.e., creating the problem that consumers are anticipating, or, colloquially, a "self-fulfilling prophecy"[10]).

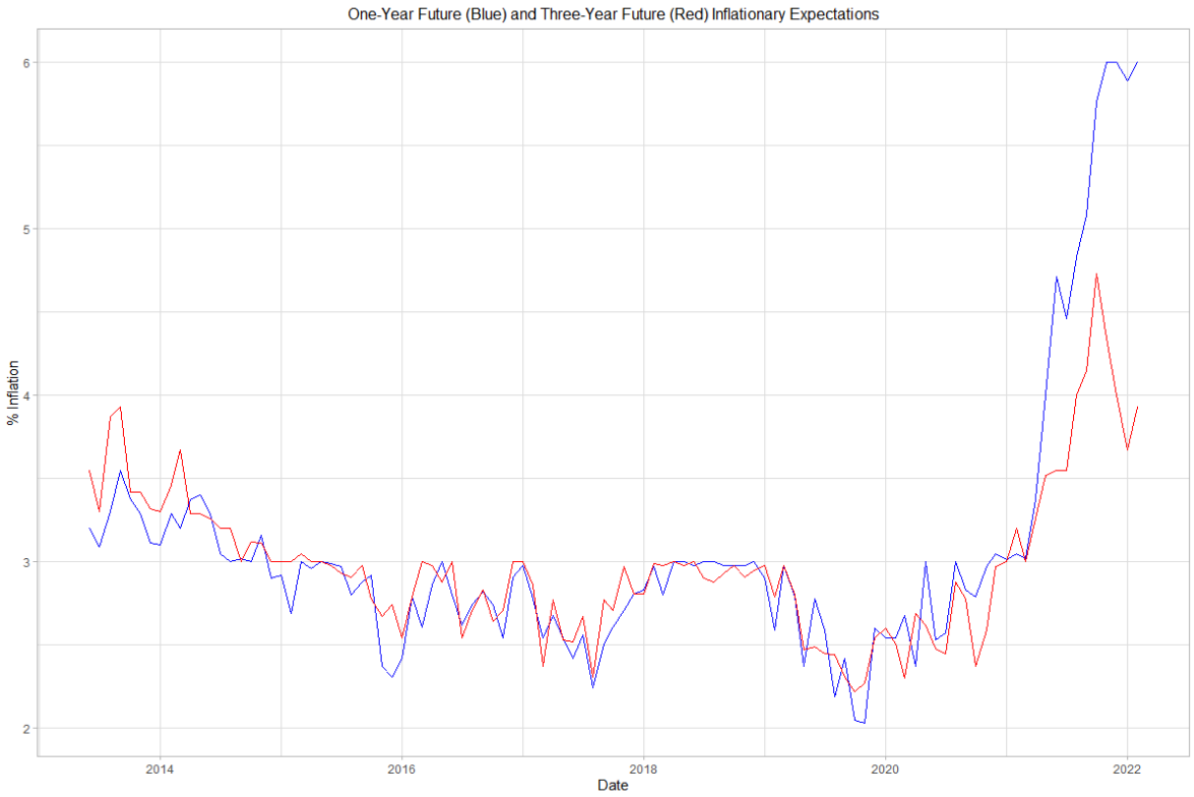
[10] https://www.wsj.com/articles/inflation-expectations-federal-reserve-interest-rates-11639352911

Figure 16: Real Hourly Wages for Select Industries (Nationwide)



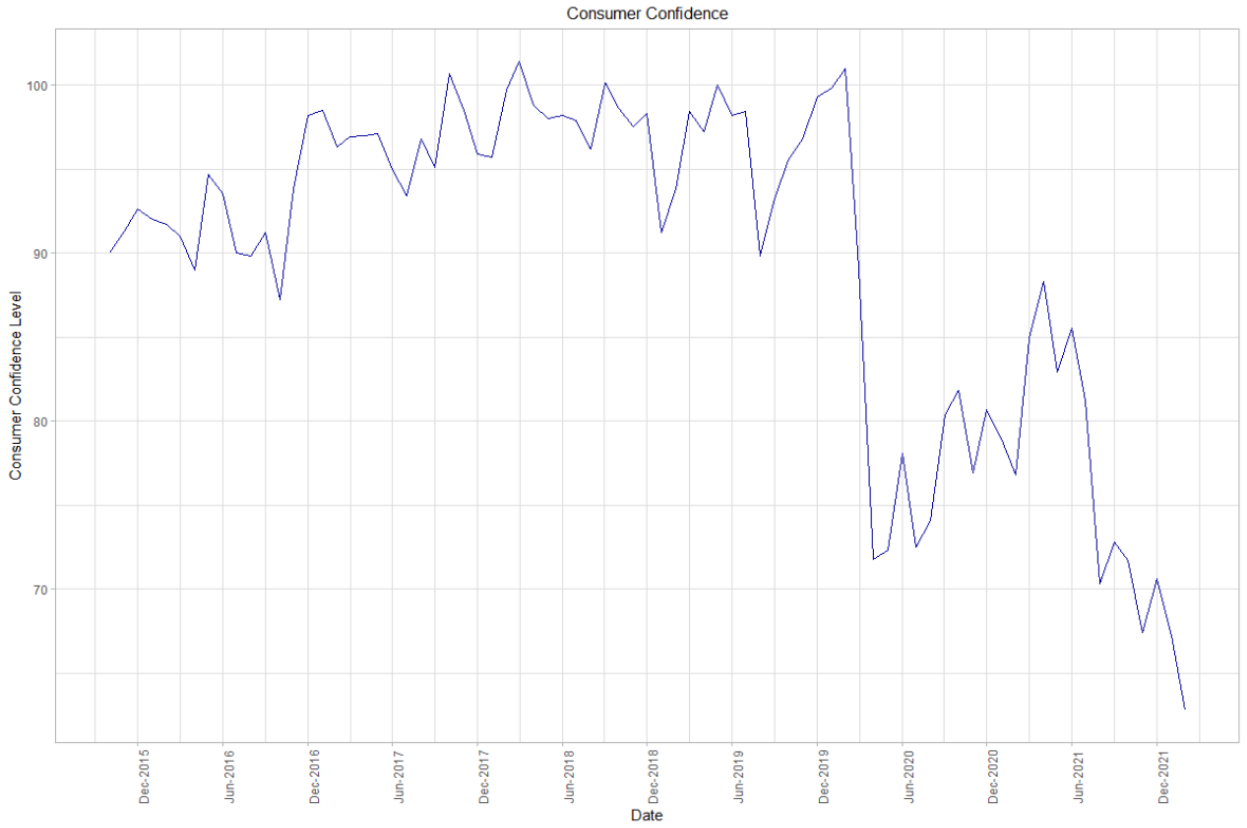
Source: Federal Reserve Economic Database (https://fred.stlouisfed.org)

Figure 17: Consumer Inflationary Expectations



Source: https://www.newyorkfed.org/microeconomics/sce#/inflexp-1

Figure 18: Consumer Confidence



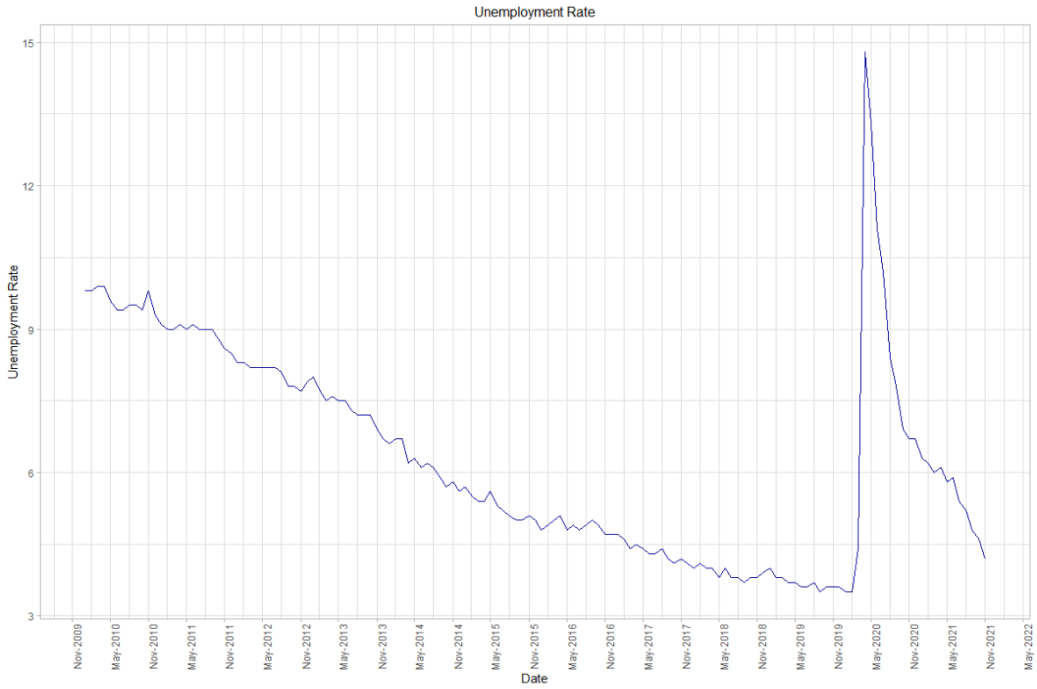
Source: Federal Reserve Economic Database (https://fred.stlouisfed.org)

The higher expectations of inflation and the falling real-wages are contributing to the pessimistic feeling surrounding the economy. The consumer confidence has fallen dramatically starting at the onset of the pandemic. Confidence started returning to pre-pandemic levels in the Spring 2021, but has fallen consistently since the Summer 2021. There is little evidence that consumers are feeling optimistic or that there will be a turnaround in consumer confidence. The drop in confidence can be problematic if consumers stop spending or working as a result of depressed feelings in the market. Depressed spending (based on depressed feelings) could contribute to another economic downturn and economic recession.

Labor Force Participation

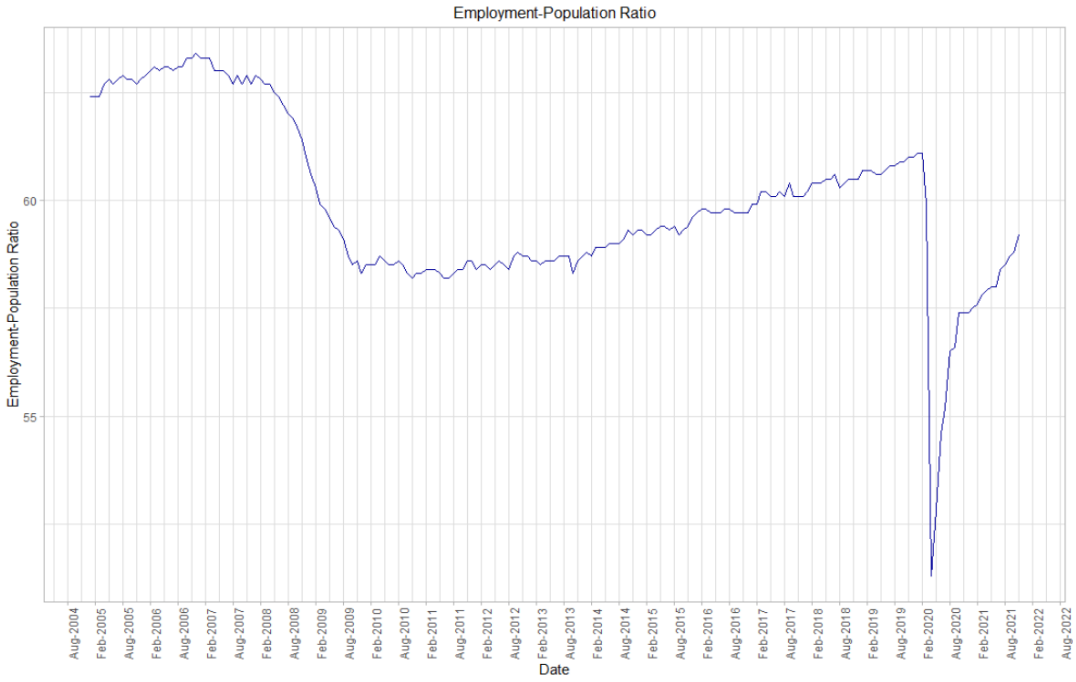
The second force that is pushing against economic gains is the employment gap and the lagging participation in the workforce (see Figure 19 through Figure 22). Per Figure 20, the employment-to-population ratio was approximately 62% prior to the recession. Although the ratio of persons in the labor market to the population has made significant gains since the end of the recession (May 2020), the economy is still experiencing a gap of nearly 300 basis points relative to the start of the recession and could be as large as 500 basis points relative to where the employment-population ratio would be counter-factual to the pandemic.

Figure 19: Unemployment Rate (Nationwide)



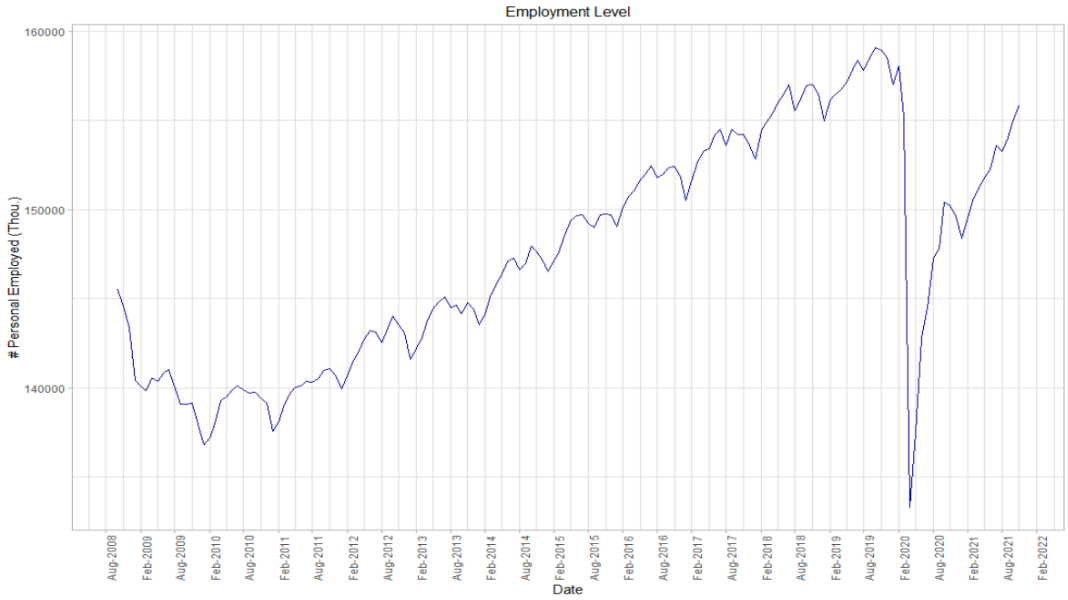
Source: Federal Reserve Economic Database (https://fred.stlouisfed.org)

Figure 20: Employment to Population Ratio (Nationwide)



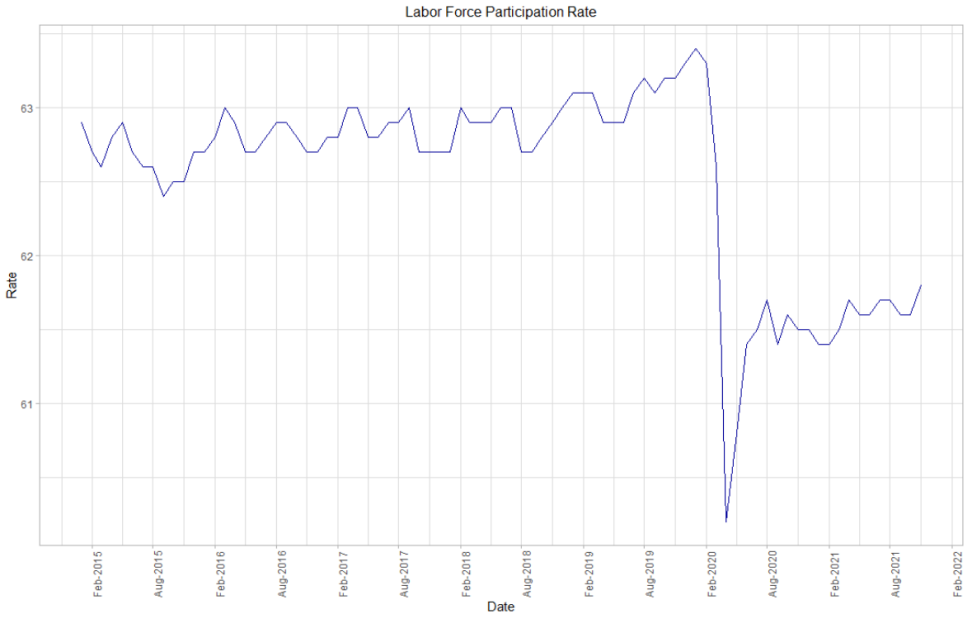
Source: Federal Reserve Economic Database (https://fred.stlouisfed.org)

Figure 21: Employment Level (Nationwide)



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

Figure 22: Labor Force Participation Rate (Nationwide)



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

"So, What's the Score?"

Unfortunately, the residual effects of COVID, in conjunction with the Russian invasion of Ukraine, and current policies from the Democratic White House and Congress are leaving us in a quandary to definitively forecast the direction that the economy will take. Consider the following conflicting factors:

↑ Unemployment: At extremely low levels, and stable
↑ Wages: High and rising, but gains are being consumed by inflation
↑ Industrial Production & Capacity Utilization: High, and rising

± Interest Rates: At record low levels, but expected to rise 1-2% this year, and 3-4% in 2 years
± Supply Chains: Brittle distribution, potentially affected by Russia-Ukraine conflict, with strong demand and capital available

↓ Inflation: At record high levels, volatile, *potentially* slowly falling
↓ Labor Force Participation: Almost to pre-pandemic levels, and slowly rising
↓ Employment-Population Ratio: Low, but slowly rising

? Consumer Confidence: Low, and volatile
? Consumer Inflation Expectations: High in the short term, and slightly lower in the longer term

Many of these factors are not things that can be easily and directly controlled: inflation is driven by the amount of liquidity in the economy, and supply-demand factors. Labor force, unemployment, and the employment-population ratio are driven by the indirect collective perception of the population. Interest rates are driven by the FOMC at the behest of unemployment and inflation. Wages, production, and utilization are also functions of supply and demand.

The open issues of consumer confidence and expectations are noted due to the fact that the economy may actually turn on these items. As we previously discussed, depending on consumers' expectations, the economy could turn towards either stagflation or inflation, or recovery. If market demands contract quickly due to waning consumer confidence, stagflation could occur; increasing demand would fuel inflation. If supply increases quickly (possibly due to the global recovery from COVID), then we could potentially see recovery or (in the extreme) deflation. Finally, if demand and supply increase appropriately, possibly motivated by government actions and incentives, we will hopefully experience an economic recovery.

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 (2019-2021), 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[11]. 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."[12] 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)[13]. 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

[11] See https://www.nytimes.com/2020/09/01/technology/facebook-russia-disinformation-election.html
[12] See https://us.norton.com/internetsecurity-malware-ransomware-5-dos-and-donts.html
[13] 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.[14]

5. Unanticipated Changes in Leadership: President Biden is currently 78 years old, 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[15] and wage protection[16], 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 (March 2021) 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[17]. 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).[18]

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[19]. Ecuador, Senegal, and China have canceled or withdrawn their currencies[20].

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. Domestically, gasoline has risen to its highest recorded levels, and is expected to continue in that direction. The impact of rising energy prices can only drain the level of wealth held by lower quantiles of the population, which happen to be those least likely to be able to leverage the technology that made much of the "remote work" phenomena of the COVID-era possible, at a time that household savings are already being tested.

[14] 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/
[15] See, e.g., https://www.huffpost.com/entry/kamala-harris-vice-president-nominee-dnc_n_5f36f56bc5b69fa9e2fb7862
[16] See, e.g., https://www.shrm.org/resourcesandtools/hr-topics/benefits/pages/where-kamala-harris-stands-on-workers-pay-and-benefits.aspx
[17] See https://www.businessinsider.com/toilet-paper-coffee-products-delayed-suez-canal-blockage-impact-2021-3
[18] See https://www.dw.com/en/suez-canal-blockage-4-of-the-biggest-trade-chokepoints/a-57020755
[19] https://www.atlanticcouncil.org/cbdctracker/
[20] 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[21]:

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)

[21] 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, in order to establish the existence and level of interdependence of variables.
In Appendix C of this document, we document the 170 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**[22]
Real GDP Growth		Nominal GDP Growth
Real Disposable Income Growth		Nominal Disposable Income Growth
Prime rate	**… depends on …**	3-month Treasury yield
10-year Treasury yield		5-year Treasury yield
30-year Mortgage rate		5-year Treasury yield*
US Residential Home Price Index		Commercial Real Estate Price index

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.

[22] 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

Ordinarily, GDP is driven by several factors:

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

Real GDP was 2.3% during 3Q2021, and then rose to 7.0% during 4Q2021[23]. As mentioned, labor force participation and supply chain durability continue to be key issues facing the economy. While white-collar workers have generally been able to continue with "business as usual", and public masking mandates are generally being dropped, the US still has yet to either increase its labor force participation rate to pre-pandemic levels (63.4% in Feb 2020, versus 62.3% in Feb 2022)[24], or manage the churn caused by the 11.26M current job openings.[25] There was a noteworthy jump in labor force participation level by 1.4M people at YE2021, but the country has only had 425,000 new people (on average) re-enter the workforce in each of the last 18 months.[26] As small businesses become more desperate to compete, while also encountering increasing operational costs, labor becomes the lynch-pin in continuing to drive the economy.

Tied to the limitations of US businesses, Q/Q personal spending increased by 2.3% in 4Q2021 by roughly $370B to $16.3T (Q/Q; i.e., +12.9% Y/Y)[27]. ***We expect for this trend to continue to some degree (possibly dropping as low as 1.5% to 1.75% per quarter) for the near future***. We have previously discussed the "inflationary hangover" that has been the result of the monetary policies of the past 18 to 24 months being modified. While there is still a significant amount of wealth that has been saved by consumers, interest rate increases that are expected from the FOMC, and price increases that are projected across several sectors, will likely cause consumers to pull back on unnecessary purchases for much of the rest of the year.

We expect ***government spending will continue to increase*** through 2022. At the time of this writing the US House of Representatives has endorsed a $1.5T spending package that includes over $700B of military aid. However, subsidies for states to address future pandemics were not included in this package, and is reported as being a point of contention between politicians.[28]

The US' net trade deficit increased to an average of over $76B during 4Q2021, and by over 9.0% to almost $90B during November 2021, December 2021, and January 2022[29]. As the globe continues to recover from the Omicron strain of COVID, with no (significant) successor strain currently in sight, ***we still believe that US exports will grow faster than imports during much of 2022***, resulting in a

[23] https://www.bea.gov/data/gdp/gross-domestic-product
[24] https://fred.stlouisfed.org/series/CIVPART
[25] https://www.bls.gov/jlt/
[26] https://fred.stlouisfed.org/series/CIVPART
[27] https://fred.stlouisfed.org/series/PCE
[28] https://www.politico.com/news/2022/03/09/congress-government-funding-package-00014322
[29] https://fred.stlouisfed.org/series/BOPGSTB and https://www.census.gov/foreign-trade/Press-Release/current_press_release/ft900.pdf

temporary decrease of the quarterly net trade deficit. However, the impact of the Russian invasion of Ukraine on domestic revenue is the wild card in predicting what will occur in the near future[30]. Vladimir Putin has been clear that he is determined to re-effect the Ukraine as a demilitarized neutral (non-threatening) nation[31,32]. Several experts believe that Russia will be successful in the near-term fall of Ukraine (expecting the collapse at some point by the end of 2Q2022)[33] despite reports of a dissenting military, and sanctions from the US and NATO[34]. The near-term concern is how long the conflict will last, given that it is causing immediate effects on the price of oil and natural gas, and secondary effects on grain, meat, and grocery prices. Long-term, questions remain about Putin's longevity on the world stage, his level of determination in re-acquiring the Ukraine, and if he has plans for expanding Russia's realm of influence further than simply the Ukraine.

As a result of the invasion, the price of a barrel of crude oil peaked out at over 65% higher than at YE2021, with it at over 40% higher than YE2021 at the time of this writing.[35] The average national retail gasoline price is up almost 25% in one month, and 50% in a year.[36] Natural gas prices are up by almost 25% since YE2021.[37] With (Y/Y) inflation close to 8% in February 2021, experts are expecting housing costs increasing by 4.7% during 2022, and food prices are up over 1% across the U.S. currently, and expected to rise by 3%-4% for the year.[38] Given that wallets were already expected to be squeezed due to post-COVID inflation during 2022, the projected pain to the US consumer due to the "Russian lock-out" from the world economy seems even worse. Further, as economic sanctions take hold over the Russian economy, their ability to pay premiums on the bond debts will become increasingly limited, eventually resulting in defaults that will likely end up being written off losses for bond holders. We expect that these will be the most significant implications unless the West becomes directly involved in the conflict, an outcome that – frankly – will almost surely have a catastrophic outcome.

At this point, we continue to believe that ***the global economy will remain in a state of flux (at least) through 2024***. ***We expect that annualized inflation will be at least 5% through 2022, and at least 4% through 2023,*** and ***real GDP growth rates during 2022 will most likely come in at no more than 0.75% (Q/Q).***

Other Commentary

- "The surge in gasoline prices this month will boost March inflation to near 10% when the figures are released next month. The inflation rate will likely remain high for th rest of the year, ending at 6.5% or so in December. Russia's war in Ukraine will keep gasoline prices elevated for much of the year. Even if the war ends, a Western embargo on Russian energy will likely continue for quite a while. Food prices are also likely to see a jump in next month's report, as wheat prices have surged 35%, given that Ukraine is a major producer." (https://www.kiplinger.com/economic-forecasts/inflation; March 10, 2022)

[30] https://www.washingtonpost.com/opinions/2022/02/21/ukraine-invasion-putin-goals-what-expect/
[31] https://www.reuters.com/world/europe/putin-tells-macron-russia-will-achieve-its-goals-ukraine-2022-03-03/
[32] See https://www.cbsnews.com/news/russia-ukraine-putins-objectives-ukraine-intelligence-matters/ and https://www.pbs.org/newshour/show/soviet-reunification-conquering-ukraine-invasion-highlights-putins-long-held-goals
[33] https://www.cnbc.com/video/2022/02/24/we-should-assume-within-90-days-putin-will-have-ukraine-says-retired-gen-barry-mccaffrey.html? and https://www.npr.org/2022/03/08/1085155440/cia-director-putin-is-angry-and-frustrated-likely-to-double-down
[34] https://www.bloomberg.com/news/articles/2022-02-24/u-k-hits-russia-with-more-sanctions-here-are-the-details
[35] https://www.marketwatch.com/investing/future/crude%20oil%20-%20electronic
[36] See https://gasprices.aaa.com/
[37] https://tradingeconomics.com/commodity/natural-gas
[38] https://www.cnbc.com/2022/03/10/cpi-inflation-february-2022-.html ; https://www.reuters.com/business/us-consumer-prices-accelerate-february-weekly-jobless-claims-rise-2022-03-10/ ; and https://www.deseret.com/2022/3/8/22967331/grocery-prices-rising-inflation-2022

- "A surge in oil prices, given new momentum by the U.S. embargo on Russian energy, has raised concerns that sustained inflation and lower economic growth could collide, which could lead to a 1970s stagflationary era." (seehttps://www.wsj.com/articles/global-stocks-markets-dow-update-03-09-2022-11646814910; March 9, 2022)

Employment

Analysis

We have previously discussed the evolution of the employment and unemployment situation in the US: as COVID took hold in 2020, many businesses retrenched and either laid-off staff, or had staff leave in order to explore new options. (See Table 1 and Figure 23.) During the COVID pandemic, over 5M new businesses were opened, resulting in an inordinate number of new job openings. Businesses that experienced a "net loss" of employees were compelled to increase wages, which translated into a cyclic phenomenon within markets that has driven wages up significantly.

Table 1: US Population, Employment-Population ratio, Labor Force Level, and Unemployment Rate % during COVID-19

Date	Population (Adult Civ. Noninst.)	Employment-Population ratio	Labor Force Level	US Unemployment %
Feb 2020	259.6M	61.2%	164.6M	3.5%
April 2020	259.9M	51.3%	156.3M	14.7%
Aug 2020	260.6M	56.5%	160.7M	8.4%
Feb 2021	260.9M	57.6%	160.3M	6.2%
Aug 2021	261.6M	58.5%	161.5M	5.2%
Feb 2022	263.3M	59.9%	164.0M	3.8%

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

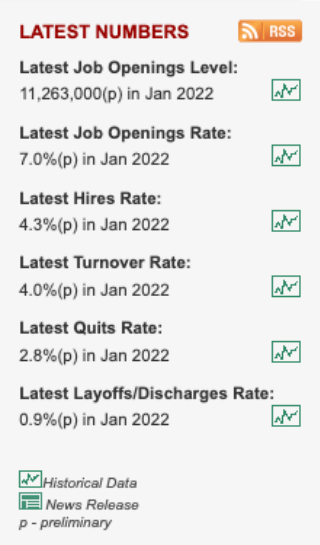
In a previous analysis, we stated that we expect 25%-35% of these businesses to fail by YE2022. ***We still expect that the vast majority of these businesses will cease operations over the next three to five years (by YE2026), with their entrepreneur founders returning to the workforce as employees once economic conditions stabilize***. However, consider the following quote:

> "Recent surveys, including one this week from the National Federation of Independent Business, show a record level of smaller companies are raising prices to cope with surging costs."[39]

The point that is being made is that the increasing prices of operating small businesses, price increases that are the result of the "Great Resignation" and the Russia-Ukraine conflict, will likely result in exacerbating the flexibility of the average entrepreneur and shortening their runway (or their tolerance for the lifestyle). Given the extremely low unemployment rates that are currently pervasive within the post-COVID US (see Figure 24), it would not be surprising for a substantial percentage of the small businesses that were formed during the COVID pandemic to be dissolved during 2Q2022 and 3Q2022. We are specific to that period due to the child care needs of the summer & fall that can be foreseen by struggling entrepreneurs that are likely reaching out to clients and looking for ways to be brought into an organization gracefully.

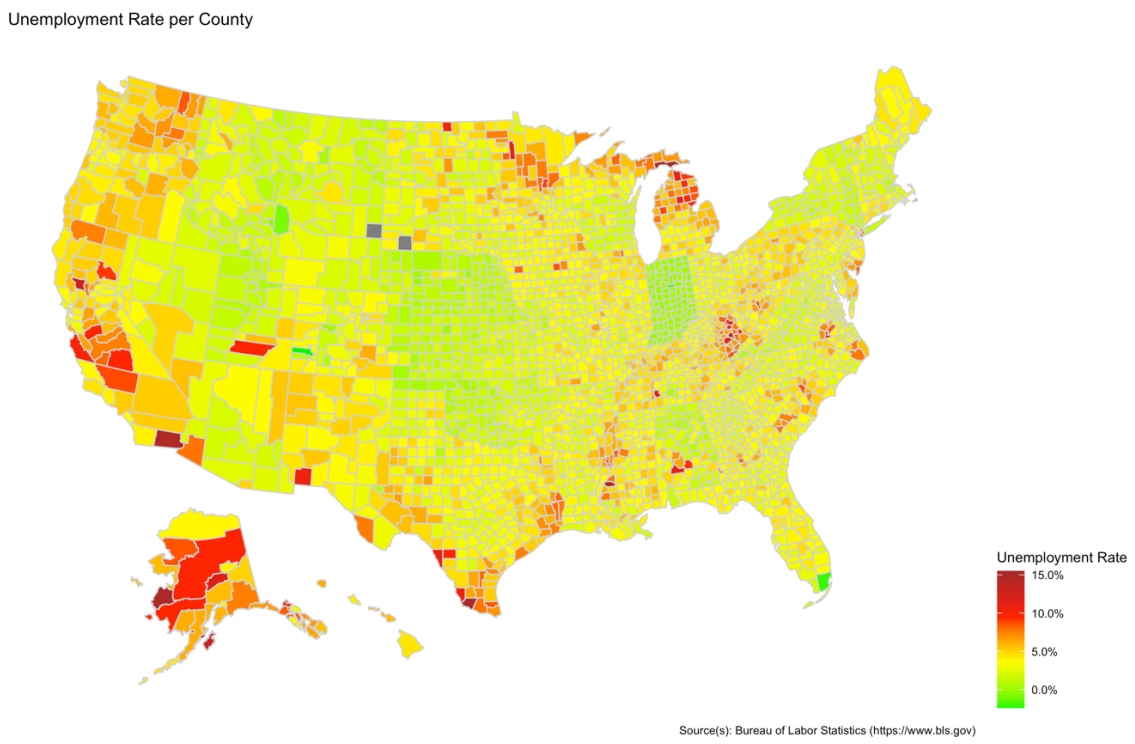
[39] https://www.cnbc.com/2022/03/10/cpi-inflation-february-2022-.html

Figure 23: US Job Openings, Hires, and Turnover Rates



Source: Bureau of Labor Statistics (https://www.bls.gov/jlt/)

Figure 24: US Unemployment Rate per County



Other Commentary

- "More than 300,000 people joined the workforce, and the ranks of those reporting being unable to work because of Covid-19 fell by 1.8 million. Wage growth cooled, a sign that a nationwide labor shortage might be easing as employers fill lower-wage positions that had long been dormant." (https://www.wsj.com/articles/february-jobs-report-unemployment-rate-2022-11646343310; March 4, 2022)
- "The Federal Reserve is watching the jobs numbers closely. Monetary policymakers widely view the economy as near full employment, adding pressure to prices that have soared amid supply shortages and demand surges related to the pandemic. … Traders continued to fully price in a 25 basis point rate hike at the March Fed meeting, and see a strong possibility of five more such increases through the end of the year, according to CME Group data." (See https://www.cnbc.com/2022/03/04/jobs-report-february-2022.html; March 4, 2022)
- "Expect the unemployment rate to keep falling to 3.2% by the end of the year. … The worker shortage is also pushing up wages, especially for production workers, whose pay is up 6.7% from a year ago. For all workers, wages are up 5.1%" (Per https://www.kiplinger.com/economic-forecasts/jobs; Mar. 4, 2022)

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.

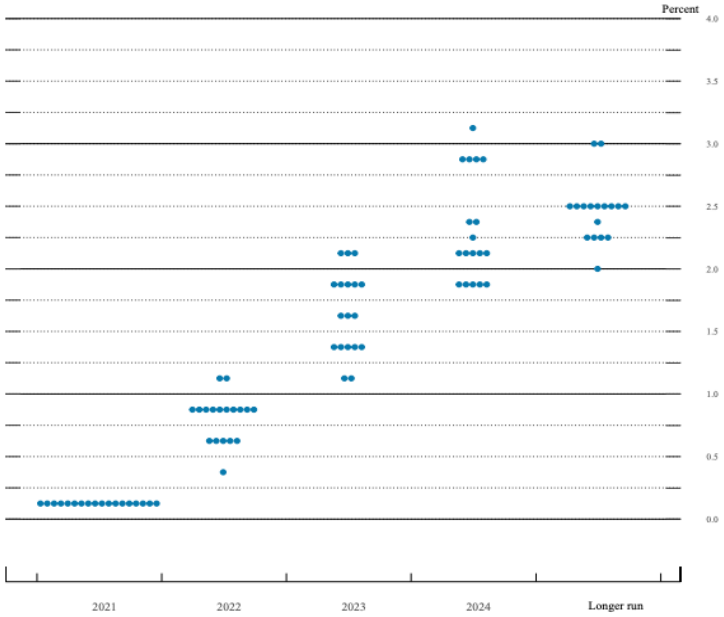
For the past 18 months or so, this rate has been "effectively zero". Current thinking is that increases in the overnight lending rate will be pushed forward at several points during 2022. The change in position of the FOMC is shown below in Figure 25 and Figure 26; therein, we see the attitude in December was that there was a possibility of two or three rate increases during 2022. However, we would like the highlight the question of how dramatic food and energy prices may affect the FOMC's attitude. Even though the Biden administration is publicly opposed to prices spiking, going so far as to call for the release of emergency reserves with international partners[40], we point out that the "law of unintended consequences" is still alive and well in 2022.

The FOMC has finally announced that it would raise interest rates as part of its March 2022 meeting.[41] Whereas we previously were suggesting two or three interest rate increases during 2022, many analysts are publicly suggesting 5 or 6 quarter point bumps. ***We believe that there will be four separate***

[40] https://www.bloomberg.com/news/articles/2022-02-24/u-k-hits-russia-with-more-sanctions-here-are-the-details
[41] https://www.federalreserve.gov/newsevents/pressreleases/monetary20220316a.htm

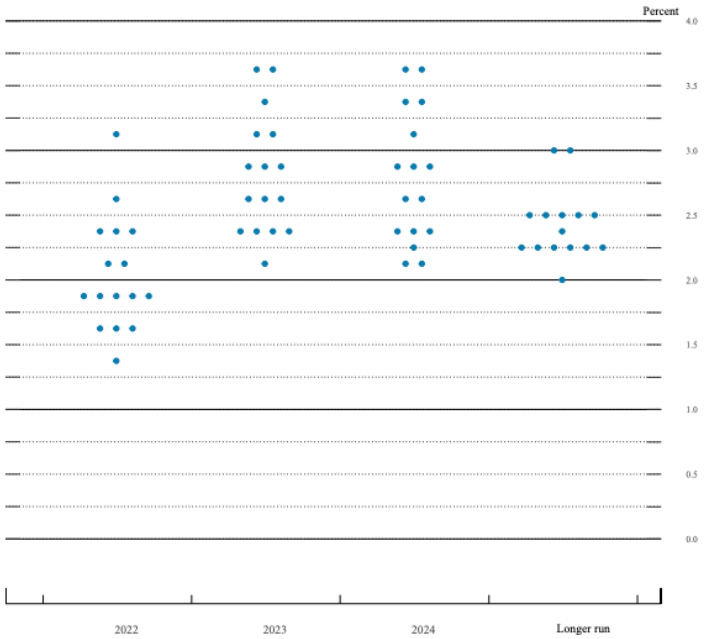
increases, though they will be for more than 25 bp each, in order to combat the inflation that is expected for 2022 and 2023. Total increases will be around 150 bp for 2022.

Figure 25: FOMC "Dot Plot" from December 2021 Board of Governors' Meeting



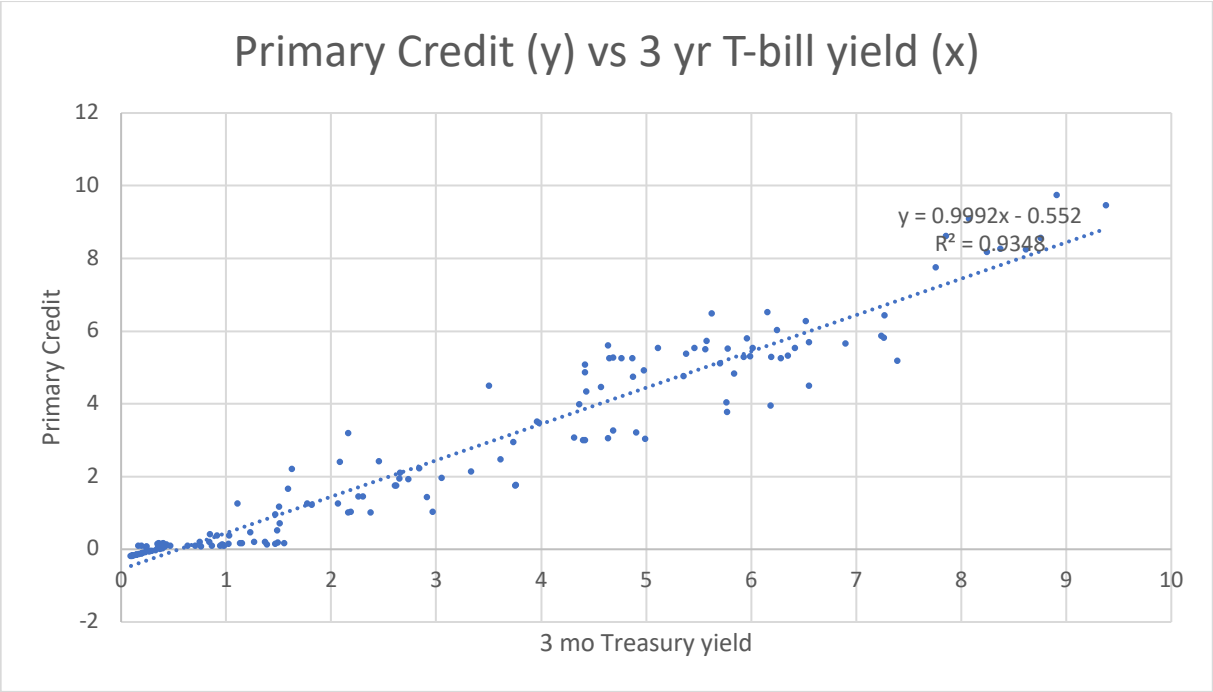
Source: https://www.federalreserve.gov/monetarypolicy/files/fomcprojtabl20211215.pdf

Figure 26: FOMC "Dot Plot" from March 2022 Board of Governors' Meeting



Source: https://www.federalreserve.gov/monetarypolicy/files/fomcprojtabl20220316.pdf

The following chart shows the relationship that has existed historically between the Federal Funds rate and the 3-year T-bill yield.



Source: Authors' calculation

Other Commentary

- "In an effort to fight inflation, the Federal Reserve will likely raise short-term interest rates by a quarter of a percentage point at its next meeting on March 16. The fed will also likely be raising rates a quarter-point at each of its subsequent six meetings through the end of the year." (https://www.kiplinger.com/economic-forecasts/inflation; March 10, 2021)

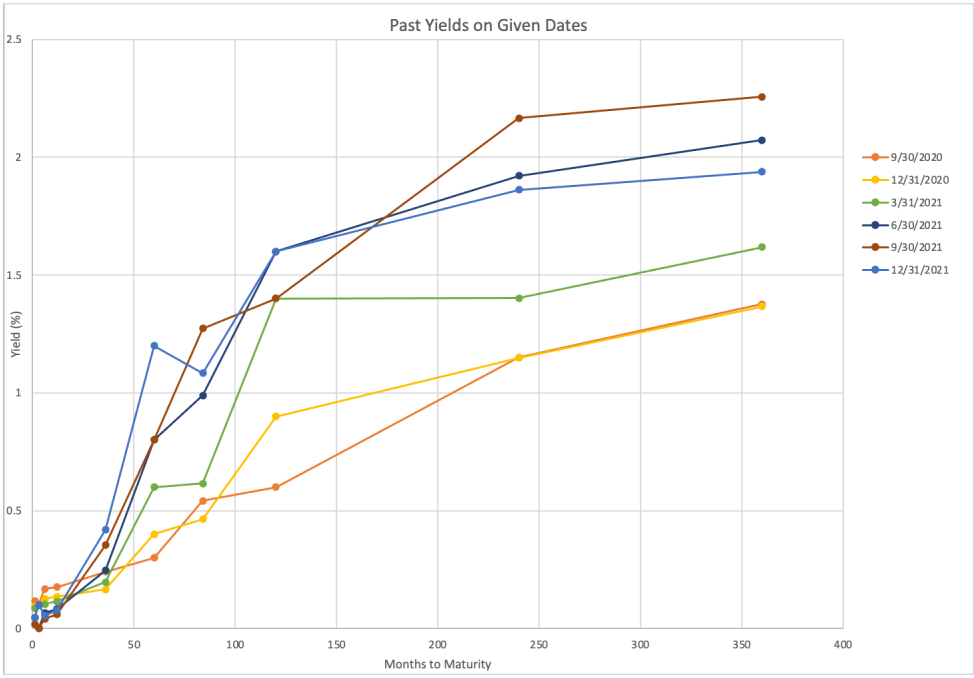
Treasury Yields (1, 3, & 6-month; 1, 3, 5, 7, 10, 20, & 30-year series)

Analysis

Figure 27 shows how the yield curve for T-bill's has evolved over the past two years. By mid-2020 the FOMC had slashed overnight lending rates, turning short-term yields to zero. Longer term yields were driven based on expectations of the housing market, and trading equities. At the end of 2020, general civil unrest, concerns about evictions, and the possibility of a vaccine for COVID were dominating the thoughts of traders, with the result being a slight buoying of rates on the whole. Through 2021, rates appear to have peaked mid-year, as concerns about the Fed' pulling back on its supplements to the market, and inflation eroding returns became evident. Now, in early 2022, we are seeing returns that are completely wiped out by current inflation rates. Since we expect inflation to remain well above 4% for 2022, it isn't likely that the prices of bonds (other than those with "inflation protection") will remain "above water" for some time.

We have previously described our interpretation of the steep slope of the yield curve as the expression by investors that (a) the strength of the overall US economy is improving with the distribution of the COVID-19 vaccines, and (b) they expect that the economy will experience inflation due to (1) global supply chain issues (both in raw materials & transportation), and (2) domestic labor issues. However, we are now concerned (a) whether Mr. Powell and the FOMC will be able to control the record-breaking inflation that the nation is currently experiencing, and (b) the effects of the Russian invasion into Eastern Europe. While we would have agreed with others on rising rates which were touted into February 2022, we now believe that ***the yield curve will drop in the coming weeks based on global instability, providing lower yields, and flattening as a function of the time to maturity***. The intermittent inversion of the yield curve recently[42,43], along with the projected flattening of the yield curve, matches with the expectation of a coming recession[44].

Figure 27: Treasury Yield Curves based on maturity duration



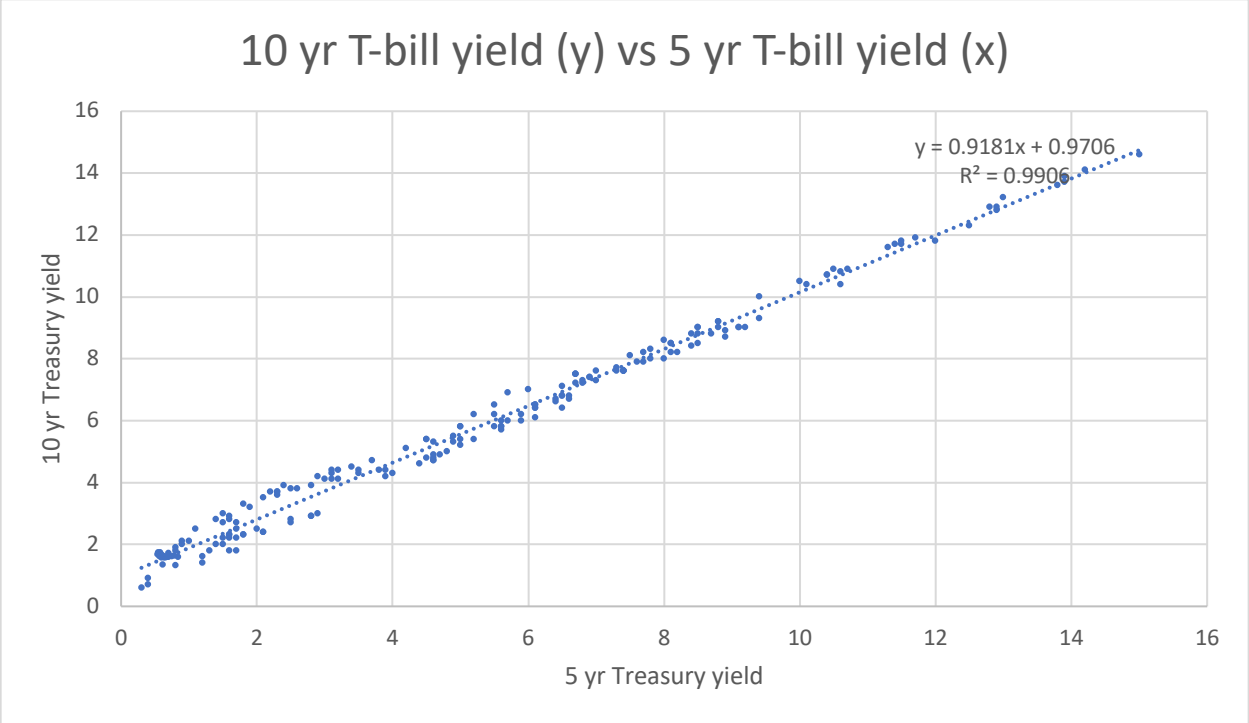
Source: US Treasury

Other Commentary

- "Expect the Treasury 10-year yield to rise to 2.3% by the end of 2022. The rise in the 10-year rate will also push up mortgage rates, …" (see https://www.kiplinger.com/economic-forecasts/interest-rates; Mar. 11, 2022)
- "As a lifelong Patriots fan, I subscribe to the *do your job* mantra. In a portfolio, every asset class has a job to do. For bonds, it's to provide stability and income. And historically, it has done a good job. According to data from Schwab, since 1981, the Bloomberg Barclay's U.S. Aggregate index has only ended a year with a negative total return four times. This year, all major bond

[42] https://www.cnbc.com/2022/03/31/2-year-treasury-yield-tops-10-year-rate-a-yield-curve-inversion-that-could-signal-a-recession.html
[43] https://www.bloomberg.com/news/articles/2022-03-29/u-s-yield-curve-inverts-from-two-to-10-years-in-recession-sign
[44] https://www.wsj.com/articles/flattening-yield-curve-stirs-recession-debate-11647913959

indices are in the red." (https://www.forbes.com/sites/kristinmckenna/2022/02/14/why-is-the-bond-market-down/; Feb. 14, 2022)



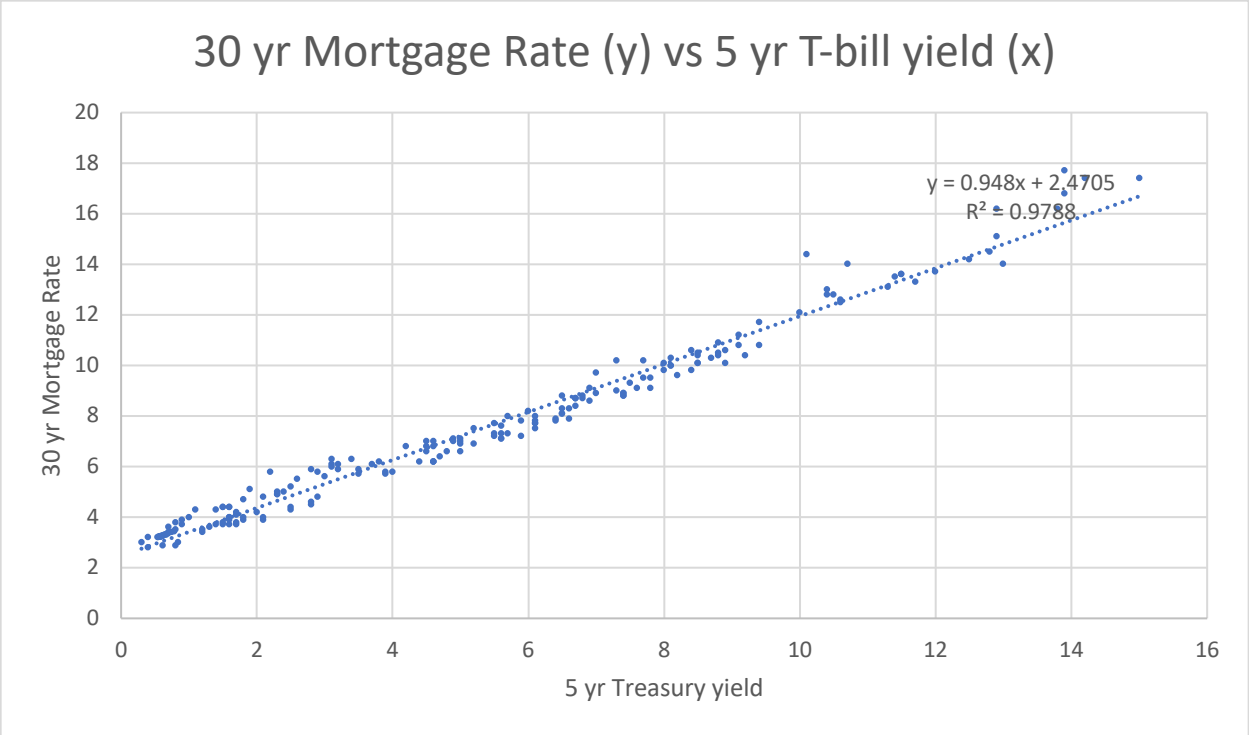
Source: Authors' calculation

30-year Mortgage Rate

Analysis

30-year fixed rate mortgages have been driven by mid-range (i.e., 7- to 10-year) treasury note yields, which are, in turn, affected by overnight lending rates. Mortgage rates have been hovering around 3% for over a year due to the FOMC holding overnight lending rates to "near zero". However, as the FOMC has prepared to raise overnight lending rates, so have banks started to raise mortgage rates.

Chairman Powell has indicated that multiple 25 bp rate increases are all but a certainty during 2022 and 2023. (The only currently foreseeable event that might mitigate that outcome would be if a new biological crisis, i.e., yet another new COVID variant, emerges in the interim.) We would expect that these rate increases (which we expect to accumulate to at least 100-150 bp during 2022) would directly affect mortgages, meaning that mortgage rates would almost immediately reflect quantum increases along with overnight lending rates. As a result, ***we could easily envision mortgage rates as high as 4.5% to 5.0% by YE2022, and above 6.0% by YE2023.***



Source: Authors' calculation

Other Commentary

- "The rise in the 10-year rate will also push up mortgage rates, from the current average of 3.9% for 30-year fixed-rate loans, to 4.3% by the end of 2022. 15-year fixed-rate mortgages will rise from 3.2% to 3.6%." (https://www.kiplinger.com/economic-forecasts/interest-rates; Mar. 11, 2022)

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

Analysis

Moody's AAA bond rates tend to track in conjunction with mid-duration T-bill yields. Moody's BAA rates tend to be higher yield (corresponding to higher risk), and more volatile, than AAA rates. Both were also dependent on consumer/investor confidence in the organizations that were reflected in the securities. The Moody's indices both show a noteworthy inverse correlation with the BBB Corporate Yield and the 30-year Mortgage Rate.

Capitalytics' quantitative models see AAA rates slightly declining over the next several years (through 2024) from 2.76% in 1Q2022 to 2.67% by the end of 2023. We do not believe that this is a likely outcome, instead believing that BAA yields will continue to track with AAA yields, with approximately 25 to 35 bp additional return to compensate for the risk associated with the BAA instruments. We anticipate that AAA yields will hover around 2.75% between YE2021 and YE2023, with (again) BAA yields slightly higher. BBB yields will remain about 50 bp lower than AAA yields.

Other Commentary

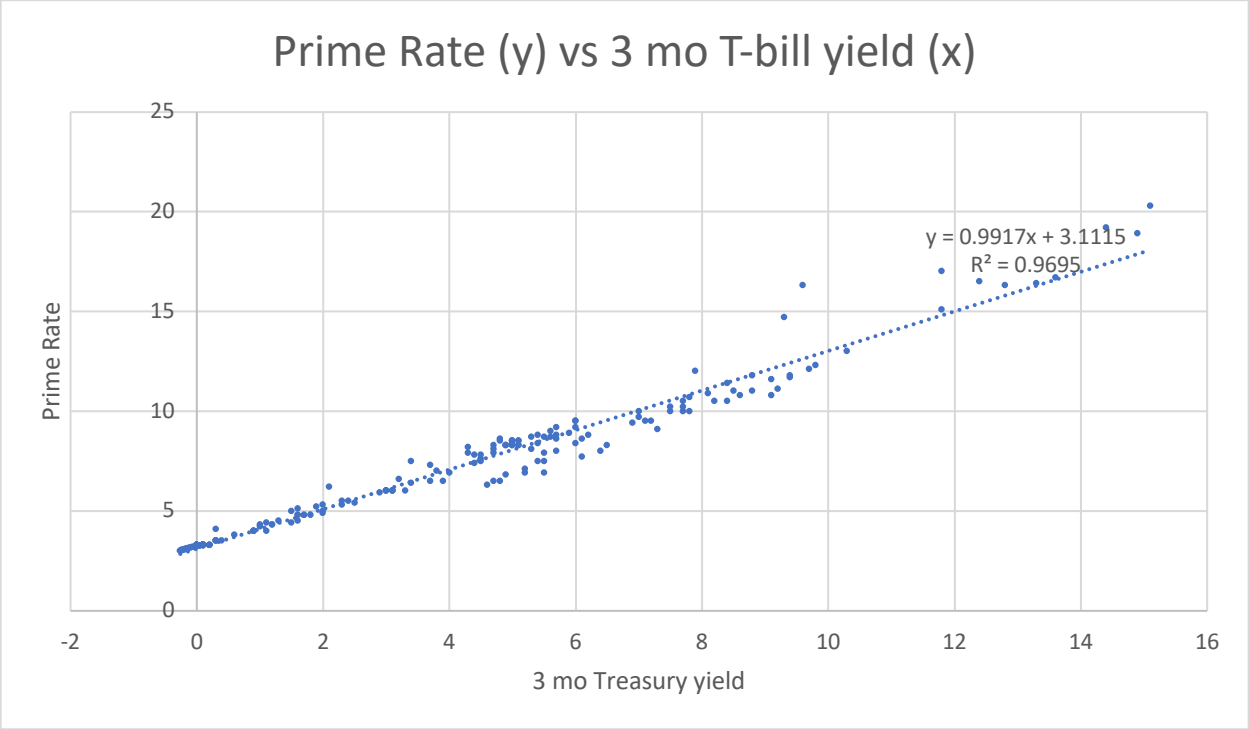
- "Corporate high-yield bond rates have started on a rising trend given the likelihood of tighter Fed policy. CCC-rated bond yields are at 10.0%, up two percentage points from the beginning of the year. AAA bonds are yielding 2.9% and BBB bonds, 3.8%." (https://www.kiplinger.com/economic-forecasts/interest-rates; Mar. 11, 2022)

Prime Rate

Analysis

The Prime Rate has historically been very tightly coupled to very short-term Treasury Bills (specifically, very short-term yields). Capitalytics' models anticipate that trend continuing, and the Prime Rate remaining very close its current level of 3.25%, with modifications based on overnight rate increases. In other words, as the FOMC increases overnight lending rates, the Prime Rate will be comparably affected. As such, ***we feel that it is likely that the Prime Rate will peak close to 5.0% by YE2022, and it could cross 5.5% by YE2023.***

The accompanying chart shows the tight relationship that has existed historically between the Prime Rate and the 3-month T-bill yield.



Source: Authors' calculation

US Average Retail Gasoline Price

Analysis

Gasoline prices during a significant war in Eastern Europe over the past month have caused prices to rocket to unprecedented levels. While West Texas crude (WTI) is selling for $99/barrel at the time of this writing[45], this is roughly a 25% contraction from its high point. Even though the US only imports 8% of its petroleum from Russia (which is now unwelcome in much of the world due to US-induced sanctions), and the Biden administration has pitched supplementing oil supplies with daily rations that equate to 30-35% of the nation's demand[46] from the US Strategic Petroleum Reserve[47], in conjunction with other countries and oil companies doing the same.

The US average retail gasoline price for regular unleaded gasoline is $4.215/gallon[48] as of this writing. This price is within a few pennies of the price of the same as of a week ago, but shows a $0.50 increase from one month ago (just after the Russian invasion began), and a 46.6% increase over prices one year ago. Prices peaked on or around March 11.

Prices will remain close to, or higher than, their current levels as long as sanctions remain in place against trade of products with Russia. While many marketing messages have emerged recently regarding "energy independence" and "green technology", none of these options will have a substantial effect on near-term retail prices. Instead, the accurate communication of the country's actual dependency upon Russian oil (and the acceptance of that message) will be the main approach that will actually reduce the current "run" on gasoline, and cause its price to drop.

Finally, President Biden has received substantial criticism on his position of domestic drilling and the management of new oil pipeline licenses as a result of the current situation. We do not expect his position to change due to the current situation, since (again) these actions are (a) part of the dogma of the President's party; and (b) will not generate any rapid relief for consumers.

Other Commentary

- "Already, higher oil prices are pushing up the cost of U.S. gasoline, which hit a record, unadjusted for inflation, last week. One rule of thumb holds that a $10-per-barrel rise in the price of oil increases overall U.S. inflation by 0.4 to 0.5 percentage points. That means inflation is likely to rise in coming months." (https://www.wsj.com/articles/ukraine-war-oil-gas-prices-inflation-federal-reserve-11647268257; March 14, 2021)
- "We expect the Brent price will average $117/b in March, $116/b in 2Q22, and $102/b in the second half of 2022 (2H22). We expect the average price to fall to $89/b in 2023. However, this price forecast is highly uncertain. Actual price outcomes will be dependent on the degree to which existing sanctions imposed on Russia, any potential future sanctions, and independent corporate actions affect Russia's oil production or the sale of Russia's oil in the global market. In addition, the degree to which other oil producers respond to current oil prices, as well as the

[45] https://oilprice.com/oil-price-charts/
[46] https://www.eia.gov/dnav/pet/pet_cons_wpsup_k_w.htm
[47] https://www.cnn.com/2022/03/30/politics/strategic-petroleum-reserve-release-oil-joe-biden/index.html
[48] https://gasprices.aaa.com/

effects macroeconomic developments might have on global oil demand, will be important for oil price formation in the coming months." (https://www.eia.gov/outlooks/steo/; March 8, 2021)

House and Commercial Real Estate Price Indexes

Analysis

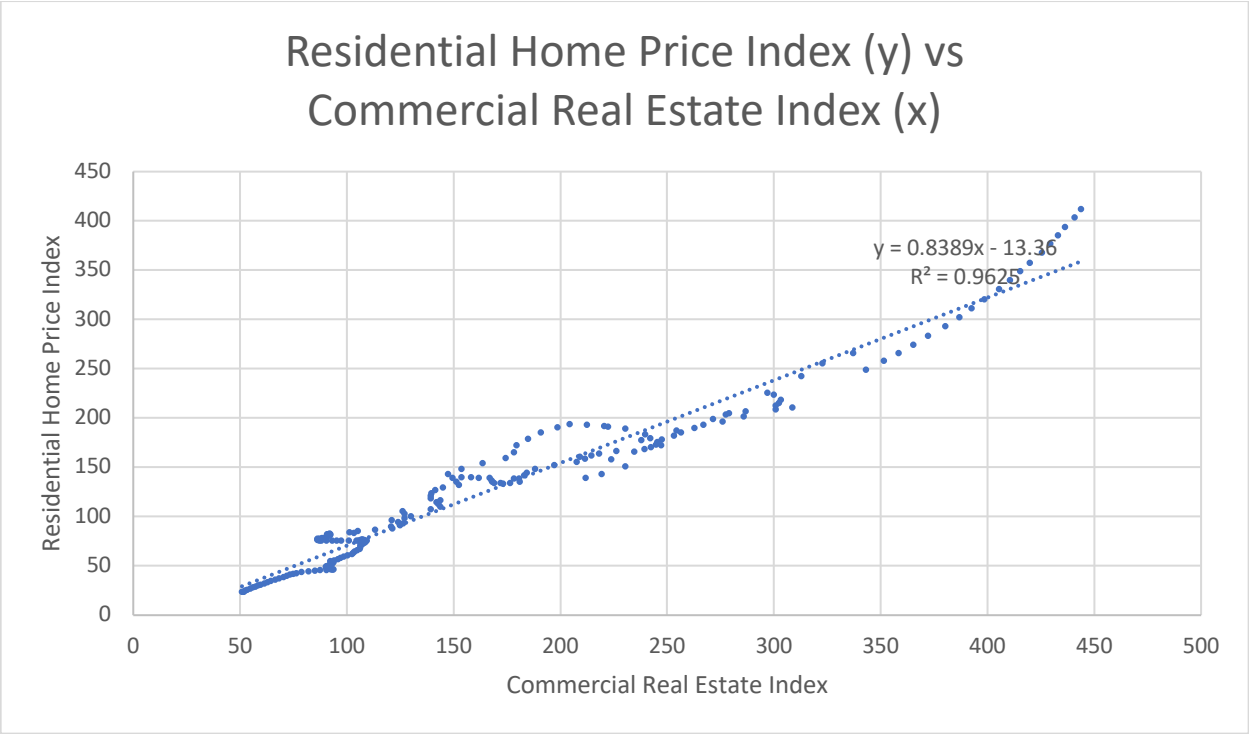
The residential real estate market has skyrocketed for a multitude of reasons over the past 24 months; record low interest rates, questions about job satisfaction, and a desire to be much more self-sufficient within one's home (or transitioning from a rented property to an owned property) has fueled demand for upwardly accessible single-family-homes; in many markets, inventory has been all but exhausted. Since COVID vaccinations have become available, new home construction during 4Q2021 and 1Q2022 has increased over the past summer and fall, with almost 3.5M homes' construction started since YE2021.[49]

Now that interest rates are rising, we would like to think that home price increases and sales would moderate. As first-time home buyers' budgets are typically stringent, and lenders may be flexible to a point, we don't expect lending standards to change appreciably from 2019. We also believe that the market for residential properties is finite amongst the potential buyers, and see that 17.1M homes have been sold in the US between 2019 and 2021, with over 6.1M occurring in 2021 (the most since 2006)[50]. ***Many have called for acknowledgement of a potential "housing bubble"[51],*** and we tend to agree that many markets are currently overpriced, and deals are being closed based on emotion. In the coming months, as buyers realize how much less their dollars will buy them with increasing rates, ***we expect sales to slow significantly, compelling sellers to lower prices in order to meet qualified buyers.*** The problem that we expect to then occur will be the sellers who won't be able to sell properties for the loans that are currently held (e.g., novice "flippers", investors, and remorseful buyers that purchased early in the COVID crisis).

Regarding commercial real estate, as has been the refrain for several months, while distribution, storage, and residential real estate has recovered to varying degrees, class-A, class-B, etc. office space is still in a quagmire. While tenants may be anchored to pre-existing leases, as those leases run out, many are not being renewed. Occupancy of space (i.e., actual *use* by a paying tenant) is the indicator of value being extracted that a property owner must measure in order to have a sense that the investment is generating value for all parties. While leasing rates have not capitulated as some speculated 12-18 months ago, a substantial amount of property is sitting dormant given that "work-from-home" is such a strong cost-effective option for many employees and companies.[52] Given the situation, tenants are able to compact their needs; be flexible with the purposes for space; and negotiate with landlords for better terms, amenities, etc. in order to attract employees back into office space where desired. Pre-COVID vacancy rates are about 10%, while rates in 2020 & 2021 were approximately 15-16%.[53]

[49] See, e.g., https://tradingeconomics.com/united-states/building-permits
[50] See https://www.statista.com/statistics/226144/us-existing-home-sales/
[51] https://www.dallasfed.org/research/economics/2022/0329
[52] https://www.cbsnews.com/news/housing-bubble-2022-federal-reserve-warning/
[53] https://www.statista.com/statistics/194054/us-office-vacancy-rate-forecasts-from-2010/ and https://www.commercialedge.com/blog/national-office-report/

The accompanying chart shows the correlation between the residential and commercial real estate indexes.



Source: Authors' calculation

Other Commentary

- "But real house prices can diverge from market fundamentals when there is widespread belief that today's robust price increases will continue. If many buyers share this belief, purchases arising from a "fear of missing out" can drive up prices and heighten expectations of strong house-price gains." (https://www.dallasfed.org/research/economics/2022/0329; March 29, 2022)

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 2, we have seen solid growth during 2Q2021 and 4Q2021, with 3Q2021 only hindered by September's losses, which erased the gains of July and August 2021. (Note that the index gained an average of 46 points per session during July and August.). On the other hand, 1Q2022 has been a disappointment with a loss of almost 3,000 points, actually recovering almost 3,000 points from a near-low point since Russia's invasion of Ukraine.

Table 2: Approximate Quarterly Milestones for the Dow-Jones Total Market Index

Period	Index Range[54]	Trading Days	Avg points/day
2Q2021 (4/1/2021-6/30/2021)	41602.65 → 44904.32	63	52.4
3Q2021 (7/1/2021-9/30/2021)	44904.32 → 44705.79	65	-3.1
4Q2021 (10/1/2021-12/31/2021)	44705.79 → 48634.31	61	64.4
1Q2021 (1/1/2022-3/31/2021)	48634.31 → 45847.30	63	-44.2

We note in Table 3 that the Standard & Poor's 500 Index ("SP500") is an index of 500 very large, publicly traded companies in the U.S. This index's measures are very similar to that of the DWCF, though on a different scale. Looking at the past year, the story for the S&P500 is very similar to that of the D-J Total Market Index: a fairly strong market for 2Q2021 through 4Q2021 (except for September), and then a weak 6-week period followed by recovery.

Table 3: Approximate Quarterly Milestones for the Standard and Poor's 500 ("SP500") Index

Period	Index Range[55]	Trading Days	Avg points/day
2Q2021 (4/1/2021-6/30/2021)	3972.89 → 4297.50	63	5.15
3Q2021 (7/1/2021-9/30/2021)	4297.50 → 4307.54	65	0.15
4Q2021 (10/1/2021-12/31/2021)	4307.54 → 4766.18	61	7.52
1Q2021 (1/1/2022-3/31/2021)	4766.18 → 4530.41	63	-3.74

The VIX has risen from 19.3 in 4Q2021, to 25.4 in 1Q2022. This rise is not surprising given the conflict in Eastern Europe and its impact on grain and petroleum supplies as we've previously discussed. COVID seems to be diminishing as a factor of instability in the markets as long as its severity and the message around its implications are carefully managed. Oil supplies have been supplemented in the US and other European countries through releases of reserves[56], and communication via press channels.

The current administration appears to be seeing diminishing confidence, and it's worth considering the possibility of President Biden will not serve his entire term in office; this point will likely move the VIX' needle, and hamper the other indexes. An unscheduled change in US leadership could potentially cause traders to pull back given the uncertainties around the Vice President that we have previously discussed. Similarly, a substantive change in geopolitical policies (for handling Middle East or Far East countries, or Russia with potential implications for US-China relations) could be enough to give pause to US markets, and affect the VIX. We believe that there is a slim possibility of this outcome, but it merits mention here.

Other Commentary

- "Stocks closed higher as investors welcomed the Fed's messages. The S&P 500 rose 1.63%, reversing earlier declines and ending the day near a record. The Dow Jones Industrial Average added 383.25 points, or 1.08%. The Nasdaq Composite Index surged 2.15%. Treasury yields rose as well." (See https://www.wsj.com/articles/fed-officials-project-three-rate-rises-next-year-and-accelerate-wind-down-of-stimulus-11639594785; Dec. 15, 2021)

[54] Index values found at https://www.marketwatch.com/investing/index/dwcf
[55] Index values found at https://www.marketwatch.com/investing/index/spx
[56] https://www.wsj.com/articles/western-nations-allies-to-release-oil-from-reserves-11648826913

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 4Q2011 and 3Q2021, inclusive.

Table 15: Regression Aggregate Errors for 4Q2011 through 3Q2021

Variable	Min Abs. Error	Average Error	Max Abs. Error
Real GDP Growth	77.47%	**	***
Nominal GDP Growth	12.26%	**	***
Real Disposable Income Growth	19.59%	***	***
Nominal Disposable Income Growth	0.35%	-13.30%	720.81%
Inflation	0.00%	**	***
Unemployment Rate	355.33%	***	***
1-month Treasury Yield	0.13%	7.47%	231.78%
3-month Treasury Yield	0.00%	59.00%	***
6-month Treasury Yield	0.13%	6.90%	112.95%
1-year Treasury Yield	1.98%	247.40%	***
3-year Treasury Yield	***	***	***
5-year Treasury Yield	747.95%	***	***
7-year Treasury Yield	1.36%	9.54%	137.92%
10-year Treasury Yield	28.13%	154.02%	601.40%
20-year Treasury Yield	0.34%	-4.12%	198.90%
30-year Treasury Yield	2.02%	81.83%	165.37%
30-year Mortgage Rate	243.55%	561.88%	775.47%
Moody's AAA Curve	0.96%	-21.16%	64.17%
Moody's BAA Curve	0.08%	0.38%	27.13%
BBB Corporate Yield	0.30%	4.55%	36.59%
Prime Rate	0.64%	-39.22%	69.52%
US Average Retail Gasoline Price	***	**	***
Cost of Federal Funds	9.21%	866.49%	***
Dow Jones Total Stock Market Index	2.02%	-335.78%	822.47%
S&P 500 Stock Price Index	0.00%	**	***
Commercial Real Estate Price Index	59.49%	259.62%	527.75%
Residential Home Price Index	28.32%	191.72%	366.68%
Market Volatility Index	944.44%	**	***

** 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	109.703 (+/- 15.513)
	p = 0.00000***
US Fed Reserve O-N Loan Rate	22.966 (+/- 2.539)
	p = 0.000***
Real disposable income growth	-1.082 (+/- 0.270)
	p = 0.001***
Nominal disposable income growth	1.092 (+/- 0.267)
	p = 0.001***
Unemployment Rate	-9.578 (+/- 0.618)
	p = 0.000***
BBB corporate yield	9.108 (+/- 1.820)
	p = 0.0001***
Home Price Index	-0.319 (+/- 0.028)
	p = 0.000***
10-year Treasury Yield	142.985 (+/- 19.685)
	p = 0.00000***
LN_10-year Treasury Yield	-315.295 (+/- 28.175)
	p = 0.000***
1-month Treasury Yield	-13.375 (+/- 2.555)
	p = 0.00004***
7-year Treasury Yield	-234.941 (+/- 29.695)
	p = 0.00000***
LN_7-year Treasury Yield	394.018 (+/- 38.151)
	p = 0.000***
LN_5-year Treasury Yield	-143.960 (+/- 13.333)
	p = 0.000***
3-year Treasury Yield	93.094 (+/- 13.890)
	p = 0.00001***
LN_1-year Treasury Yield	-14.641 (+/- 1.623)
	p = 0.000***
3-year Treasury Yield_2	-25.021 (+/- 3.386)
	p = 0.00000***
5-year Treasury Yield_2	22.793 (+/- 3.548)
	p = 0.00001***

20-year Treasury Yield_2	10.621 (+/- 2.378)
	p = 0.0003***
30-year Treasury Yield_2	-7.924 (+/- 1.913)
	p = 0.0005***
Observations	40
R^2	0.978
Adjusted R^2	0.959
Residual Std. Error	1.550 (df = 21)
F Statistic	51.493*** (df = 18; 21)
Note:	*p<0.1; **p<0.5; ***p<0.01

REGRESSION FOR NOMINAL GDP GROWTH

	Dependent variable (+/- SE):
	Nominal GDP growth
Constant	88.659 (+/- 12.906)
	p = 0.00000***
US Fed Reserve O-N Loan Rate	14.070 (+/- 2.988)
	p = 0.0001***
Real disposable income growth	-2.632 (+/- 0.450)
	p = 0.00001***
Nominal disposable income growth	2.536 (+/- 0.451)
	p = 0.00001***
Unemployment Rate	-5.784 (+/- 0.797)
	p = 0.00000***
Home Price Index	-0.297 (+/- 0.046)
	p = 0.00000***
LN_10-year Treasury Yield	-120.462 (+/- 21.577)
	p = 0.00001***
LN_7-year Treasury Yield	161.876 (+/- 34.070)
	p = 0.0001***
LN_5-year Treasury Yield	-83.571 (+/- 16.582)
	p = 0.00003***
LN_1-year Treasury Yield	-6.115 (+/- 2.019)
	p = 0.006***
3-year Treasury Yield_2	-6.744 (+/- 2.132)
	p = 0.004***
5-year Treasury Yield_2	8.013 (+/- 2.123)
	p = 0.001***
Observations	40
R^2	0.891
Adjusted R^2	0.848
Residual Std. Error	3.355 (df = 28)
F Statistic	20.837*** (df = 11; 28)
Note:	*p<0.1; **p<0.5; ***p<0.01

REGRESSION FOR REAL DISPOSABLE INCOME GROWTH

	Dependent variable (+/- SE):
	Real disposable income growth
Constant	137.446 (+/- 44.383)
	p = 0.004***
Unemployment Rate	9.288 (+/- 1.961)
	p = 0.00004***
20-year Treasury Yield	-157.212 (+/- 41.933)
	p = 0.001***
LN_10-year Treasury Yield	143.424 (+/- 32.106)
	p = 0.0001***
20-year Treasury Yield_2	16.572 (+/- 6.021)
	p = 0.010***
Observations	40
R^2	0.416
Adjusted R^2	0.350
Residual Std. Error	10.743 (df = 35)
F Statistic	6.242*** (df = 4; 35)
Note:	*p<0.1; **p<0.5; ***p<0.01

REGRESSION FOR NOMINAL DISPOSABLE INCOME GROWTH

	Dependent variable (+/- SE):
	Nominal disposable income growth
Constant	-4.800 (+/- 6.413)
	p = 0.459
Unemployment Rate	1.721 (+/- 1.065)
	p = 0.115
Observations	40
R^2	0.064
Adjusted R^2	0.040
Residual Std. Error	12.886 (df = 38)
F Statistic	2.610 (df = 1; 38)
Note:	*p<0.1; **p<0.5; ***p<0.01

REGRESSION FOR CPI INFLATION RATE

	Dependent variable (+/- SE):
	CPI Inflation Rate
Constant	1.345 (+/- 4.336)
	p = 0.760
Moody's AAA Curve	-1.835 (+/- 0.641)
	p = 0.010***
Real disposable income growth	-1.215 (+/- 0.034)
	p = 0.000***
Nominal disposable income growth	1.155 (+/- 0.034)
	p = 0.000***
Unemployment Rate	0.430 (+/- 0.060)
	p = 0.00000***
30-year Mortgate Rate	2.133 (+/- 0.517)
	p = 0.0005***
Prime Rate	-6.930 (+/- 1.330)
	p = 0.00004***
Commercial Real Estate Price Index	0.030 (+/- 0.004)
	p = 0.00000***
30-year Treasury Yield	-5.746 (+/- 1.119)
	p = 0.00005***
LN_30-year Treasury Yield	40.895 (+/- 4.165)
	p = 0.000***
LN_20-year Treasury Yield	-23.233 (+/- 2.478)
	p = 0.000***
1-month Treasury Yield	19.402 (+/- 2.210)
	p = 0.00000***
7-year Treasury Yield	4.981 (+/- 1.371)
	p = 0.002***
3-month Treasury Yield	-10.361 (+/- 1.472)
	p = 0.00000***
5-year Treasury Yield	-4.950 (+/- 1.119)
	p = 0.0003***
6-month Treasury Yield	-10.511 (+/- 2.766)
	p = 0.002***
1-year Treasury Yield	14.426 (+/- 2.324)
	p = 0.00001***
LN_1-year Treasury Yield	-1.431 (+/- 0.361)

	p = 0.001***
1-year Treasury Yield_2	-1.616 (+/- 0.261)
	p = 0.00001***
Observations	40
R^2	0.996
Adjusted R^2	0.992
Residual Std. Error	0.200 (df = 21)
F Statistic	275.245*** (df = 18; 21)
Note:	*p<0.1; **p<0.5; ***p<0.01

Unemployment Rate

REGRESSION FOR UNEMPLOYMENT RATE

	Dependent variable (+/- SE):
	Unemployment Rate
Constant	12.636 (+/- 3.260)
	p = 0.002***
SP500 Stock Price Index	-0.001 (+/- 0.0002)
	p = 0.0002***
US Fed Reserve O-N Loan Rate	4.321 (+/- 0.360)
	p = 0.00000***
Moody's AAA Curve	3.837 (+/- 0.515)
	p = 0.00001***
Moody's BAA Curve	0.877 (+/- 0.229)
	p = 0.003***
Real GDP growth	-0.294 (+/- 0.053)
	p = 0.0001***
Nominal GDP growth	0.268 (+/- 0.052)
	p = 0.0002***
Real disposable income growth	0.987 (+/- 0.072)
	p = 0.000***
Nominal disposable income growth	-0.931 (+/- 0.068)
	p = 0.000***
CPI Inflation Rate	0.679 (+/- 0.065)
	p = 0.00000***
30-year Mortgate Rate	-3.814 (+/- 0.385)
	p = 0.00000***
Prime Rate	4.160 (+/- 0.918)
	p = 0.001***
Dow Total Stock Market Index	0.0001 (+/- 0.00003)
	p = 0.0004***
Commercial Real Estate Price Index	-0.061 (+/- 0.005)
	p = 0.00000***
LN_Market Volatility Index	0.470 (+/- 0.150)
	p = 0.008***
US Avg Retail Gasoline Price ($-gal; all grades, all formulations)	0.521 (+/- 0.112)
	p = 0.0005***
30-year Treasury Yield	12.655 (+/- 1.126)
	p = 0.00000***

LN_30-year Treasury Yield	-65.417 (+/- 3.470)
	p = 0.000***
LN_20-year Treasury Yield	24.678 (+/- 2.220)
	p = 0.00000***
10-year Treasury Yield	-5.933 (+/- 0.816)
	p = 0.00001***
1-month Treasury Yield	-8.604 (+/- 1.477)
	p = 0.0001***
LN_7-year Treasury Yield	4.492 (+/- 1.211)
	p = 0.003***
3-month Treasury Yield	5.292 (+/- 1.210)
	p = 0.001***
5-year Treasury Yield	3.205 (+/- 0.560)
	p = 0.0001***
LN_3-year Treasury Yield	-1.577 (+/- 0.420)
	p = 0.003***
1-year Treasury Yield	-3.847 (+/- 0.557)
	p = 0.00002***
Market Volatility Index_2	0.0004 (+/- 0.0001)
	p = 0.0003***
Observations	40
R^2	0.999
Adjusted R^2	0.997
Residual Std. Error	0.113 (df = 13)
F Statistic	440.520*** (df = 26; 13)
Note:	*p<0.1; **p<0.5; ***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	-1.602 (+/- 0.131)
	p = 0.000***
Prime Rate	0.490 (+/- 0.040)
	p = 0.000***
3-month Treasury Yield	0.429 (+/- 0.037)
	p = 0.000***
3-month Treasury Yield_2	0.053 (+/- 0.008)
	p = 0.00000***
Market Volatility Index_2	0.00001 (+/- 0.00000)
	p = 0.002***
Observations	40
R^2	0.999
Adjusted R^2	0.999
Residual Std. Error	0.019 (df = 35)
F Statistic	16,011.330*** (df = 4; 35)
Note:	*p<0.1; **p<0.5; ***p<0.01

REGRESSION FOR 3-MONTH TREASURY YIELD

	Dependent variable (+/- SE):
	3-month Treasury Yield
Constant	-0.028 (+/- 0.021)
	p = 0.196
Real disposable income growth	-0.028 (+/- 0.007)
	p = 0.0004***
Nominal disposable income growth	0.028 (+/- 0.007)
	p = 0.0004***
CPI Inflation Rate	-0.020 (+/- 0.006)
	p = 0.004***
20-year Treasury Yield	0.051 (+/- 0.016)
	p = 0.003***
1-month Treasury Yield	0.476 (+/- 0.044)
	p = 0.000***
7-year Treasury Yield	-0.085 (+/- 0.019)
	p = 0.0002***
6-month Treasury Yield	0.541 (+/- 0.047)
	p = 0.000***
Observations	40
R^2	0.999
Adjusted R^2	0.999
Residual Std. Error	0.024 (df = 32)
F Statistic	6,235.387*** (df = 7; 32)
Note:	*p<0.1; **p<0.5; ***p<0.01

REGRESSION FOR 6-MONTH TREASURY YIELD

	Dependent variable (+/- SE):
	6-month Treasury Yield
Constant	-0.165 (+/- 0.057)
	p = 0.007***
Moody's BAA Curve	0.098 (+/- 0.019)
	p = 0.00002***
Real disposable income growth	0.025 (+/- 0.009)
	p = 0.010***
Nominal disposable income growth	-0.024 (+/- 0.009)
	p = 0.009***
CPI Inflation Rate	0.025 (+/- 0.008)
	p = 0.004***
30-year Treasury Yield	-0.112 (+/- 0.020)
	p = 0.00001***
3-month Treasury Yield	1.040 (+/- 0.027)
	p = 0.000***
5-year Treasury Yield_2	0.050 (+/- 0.005)
	p = 0.000***
3-month Treasury Yield_2	-0.053 (+/- 0.011)
	p = 0.0001***
Observations	40
R^2	0.999
Adjusted R^2	0.999
Residual Std. Error	0.029 (df = 31)
F Statistic	3,890.892*** (df = 8; 31)
Note:	*p<0.1; **p<0.5; ***p<0.01

REGRESSION FOR 1-YEAR TREASURY YIELD

	Dependent variable (+/- SE):
	1-year Treasury Yield
Constant	5.874 (+/- 1.040)
	p = 0.00001***
Moody's BAA Curve	0.100 (+/- 0.026)
	p = 0.001***
Unemployment Rate	-0.050 (+/- 0.011)
	p = 0.00005***
Prime Rate	-0.887 (+/- 0.205)
	p = 0.0002***
Market Volatility Index	0.092 (+/- 0.030)
	p = 0.005***
LN_Market Volatility Index	-1.546 (+/- 0.488)
	p = 0.004***
3-month Treasury Yield	1.777 (+/- 0.190)
	p = 0.000***
Market Volatility Index_2	-0.001 (+/- 0.0002)
	p = 0.006***
Observations	40
R^2	0.990
Adjusted R^2	0.988
Residual Std. Error	0.092 (df = 32)
F Statistic	449.063*** (df = 7; 32)
Note:	*p<0.1; **p<0.5; ***p<0.01

REGRESSION FOR 3-YEAR TREASURY YIELD

	Dependent variable (+/- SE):
	3-year Treasury Yield
Constant	-13.231 (+/- 3.146)
	p = 0.0002***
Real GDP growth	-0.016 (+/- 0.003)
	p = 0.00005***
Unemployment Rate	-0.251 (+/- 0.026)
	p = 0.000***
Prime Rate	-0.961 (+/- 0.316)
	p = 0.005***
30-year Treasury Yield	23.992 (+/- 3.588)
	p = 0.00000***
LN_30-year Treasury Yield	-30.323 (+/- 4.459)
	p = 0.00000***
3-month Treasury Yield	1.357 (+/- 0.297)
	p = 0.0001***
30-year Treasury Yield_2	-2.210 (+/- 0.347)
	p = 0.00000***
Observations	40
R^2	0.968
Adjusted R^2	0.961
Residual Std. Error	0.147 (df = 32)
F Statistic	139.134*** (df = 7; 32)
Note:	*p<0.1; **p<0.5; ***p<0.01

REGRESSION FOR 5-YEAR TREASURY YIELD

	Dependent variable (+/- SE):
	5-year Treasury Yield
Constant	-10.124 (+/- 2.950)
	p = 0.002***
Real GDP growth	-0.016 (+/- 0.003)
	p = 0.00004***
Unemployment Rate	-0.236 (+/- 0.027)
	p = 0.000***
30-year Treasury Yield	15.763 (+/- 3.987)
	p = 0.0005***
LN_30-year Treasury Yield	-20.900 (+/- 4.915)
	p = 0.0002***
1-month Treasury Yield	-1.168 (+/- 0.285)
	p = 0.0003***
LN_1-month Treasury Yield	-0.164 (+/- 0.037)
	p = 0.0002***
6-month Treasury Yield	1.720 (+/- 0.326)
	p = 0.00001***
30-year Treasury Yield_2	-1.338 (+/- 0.386)
	p = 0.002***
Observations	40
R^2	0.968
Adjusted R^2	0.960
Residual Std. Error	0.134 (df = 31)
F Statistic	119.105*** (df = 8; 31)
Note:	*p<0.1; **p<0.5; ***p<0.01

REGRESSION FOR 7-YEAR TREASURY YIELD

	Dependent variable (+/- SE):
	7-year Treasury Yield
Constant	3.926 (+/- 0.350)
	p = 0.000***
SP500 Stock Price Index	-0.0003 (+/- 0.0001)
	p = 0.001***
Unemployment Rate	-0.248 (+/- 0.037)
	p = 0.00000***
Observations	40
R^2	0.556
Adjusted R^2	0.532
Residual Std. Error	0.426 (df = 37)
F Statistic	23.197*** (df = 2; 37)
Note:	*p<0.1; **p<0.5; ***p<0.01

REGRESSION FOR 10-YEAR TREASURY YIELD

	Dependent variable (+/- SE):
	10-year Treasury Yield
Constant	-0.288 (+/- 0.115)
	p = 0.018**
US Fed Reserve O-N Loan Rate	0.631 (+/- 0.072)
	p = 0.000***
Real GDP growth	-0.007 (+/- 0.002)
	p = 0.002***
Unemployment Rate	-0.118 (+/- 0.012)
	p = 0.000***
30-year Treasury Yield	1.868 (+/- 0.194)
	p = 0.000***
LN_30-year Treasury Yield	-2.731 (+/- 0.487)
	p = 0.00001***
LN_1-month Treasury Yield	-0.139 (+/- 0.020)
	p = 0.00000***
1-month Treasury Yield_2	-0.099 (+/- 0.021)
	p = 0.00004***
Market Volatility Index_2	0.0001 (+/- 0.00002)
	p = 0.003***
Observations	40
R^2	0.987
Adjusted R^2	0.984
Residual Std. Error	0.077 (df = 31)
F Statistic	294.384*** (df = 8; 31)
Note:	*p<0.1; **p<0.5; ***p<0.01

REGRESSION FOR 20-YEAR TREASURY YIELD

	Dependent variable (+/- SE):
	20-year Treasury Yield
Constant	2.679 (+/- 0.405)
	p = 0.00000***
SP500 Stock Price Index	-0.0004 (+/- 0.0001)
	p = 0.00000***
Unemployment Rate	-0.135 (+/- 0.031)
	p = 0.0002***
US Avg Retail Gasoline Price ($-gal; all grades, all formulations)	0.351 (+/- 0.105)
	p = 0.003***
LN_1-month Treasury Yield	-0.160 (+/- 0.056)
	p = 0.008***
3-month Treasury Yield_2	1.520 (+/- 0.388)
	p = 0.0005***
1-month Treasury Yield_2	-1.344 (+/- 0.371)
	p = 0.001***
Observations	40
R^2	0.778
Adjusted R^2	0.737
Residual Std. Error	0.292 (df = 33)
F Statistic	19.229*** (df = 6; 33)
Note:	*p<0.1; **p<0.5; ***p<0.01

REGRESSION FOR 30-YEAR TREASURY YIELD

	Dependent variable (+/- SE):
	30-year Treasury Yield
Constant	-0.350 (+/- 0.143)
	p = 0.021**
30-year Mortgate Rate	0.432 (+/- 0.069)
	p = 0.00000***
LN_10-year Treasury Yield	2.650 (+/- 0.211)
	p = 0.000***
5-year Treasury Yield	1.626 (+/- 0.349)
	p = 0.0001***
LN_5-year Treasury Yield	-3.212 (+/- 0.532)
	p = 0.00000***
3-year Treasury Yield	-1.739 (+/- 0.341)
	p = 0.00002***
LN_3-year Treasury Yield	1.340 (+/- 0.272)
	p = 0.00003***
1-year Treasury Yield	0.308 (+/- 0.099)
	p = 0.004***
Observations	40
R^2	0.991
Adjusted R^2	0.988
Residual Std. Error	0.064 (df = 32)
F Statistic	477.071*** (df = 7; 32)
Note:	*p<0.1; **p<0.5; ***p<0.01

30-year Mortgage Rate

REGRESSION FOR 30-YEAR MORTGATE RATE

	Dependent variable (+/- SE):
	30-year Mortgate Rate
Constant	-9.097 (+/- 2.300)
	p = 0.0004***
Real GDP growth	-0.011 (+/- 0.003)
	p = 0.002***
Unemployment Rate	-0.103 (+/- 0.023)
	p = 0.0001***
30-year Treasury Yield	16.438 (+/- 3.088)
	p = 0.00001***
LN_30-year Treasury Yield	-21.059 (+/- 3.853)
	p = 0.00001***
1-month Treasury Yield	0.149 (+/- 0.041)
	p = 0.002***
30-year Treasury Yield_2	-1.396 (+/- 0.298)
	p = 0.00005***
Observations	40
R^2	0.939
Adjusted R^2	0.928
Residual Std. Error	0.133 (df = 33)
F Statistic	85.264*** (df = 6; 33)
Note:	*p<0.1; **p<0.5; ***p<0.01

Moody's AAA & BAA Rates

REGRESSION FOR MOODY'S AAA CURVE

	Dependent variable (+/- SE):
	Moody's AAA Curve
Constant	5.887 (+/- 0.282)
	p = 0.000***
SP500 Stock Price Index	-0.001 (+/- 0.0001)
	p = 0.000***
Unemployment Rate	-0.140 (+/- 0.030)
	p = 0.00005***
Observations	40
R^2	0.693
Adjusted R^2	0.676
Residual Std. Error	0.344 (df = 37)
F Statistic	41.697*** (df = 2; 37)
Note:	*p<0.1; **p<0.5; ***p<0.01

REGRESSION FOR MOODY'S BAA CURVE

	Dependent variable (+/- SE):
	Moody's BAA Curve
Constant	2.798 (+/- 0.392)
	p = 0.00000***
Real disposable income growth	0.116 (+/- 0.038)
	p = 0.005***
Nominal disposable income growth	-0.113 (+/- 0.038)
	p = 0.006***
US Avg Retail Gasoline Price ($-gal; all grades, all formulations)	0.644 (+/- 0.137)
	p = 0.00005***
LN_1-month Treasury Yield	-0.803 (+/- 0.181)
	p = 0.0001***
LN_6-month Treasury Yield	1.102 (+/- 0.229)
	p = 0.00004***
Observations	40
R^2	0.641
Adjusted R^2	0.588
Residual Std. Error	0.406 (df = 34)
F Statistic	12.124*** (df = 5; 34)
Note:	*p<0.1; **p<0.5; ***p<0.01

BBB Corporate Yield

REGRESSION FOR BBB CORPORATE YIELD

	Dependent variable (+/- SE):
	BBB corporate yield
Constant	1.725 (+/- 0.668)
	p = 0.015**
SP500 Stock Price Index	-0.0003 (+/- 0.0001)
	p = 0.00002***
LN_Market Volatility Index	0.399 (+/- 0.127)
	p = 0.004***
US Avg Retail Gasoline Price ($-gal; all grades, all formulations)	-0.287 (+/- 0.088)
	p = 0.003***
30-year Treasury Yield	0.861 (+/- 0.118)
	p = 0.00000***
3-month Treasury Yield_2	0.108 (+/- 0.027)
	p = 0.0003***
Observations	40
R^2	0.884
Adjusted R^2	0.867
Residual Std. Error	0.247 (df = 34)
F Statistic	51.736*** (df = 5; 34)
Note:	*p<0.1; **p<0.5; ***p<0.01

Prime Rate

REGRESSION FOR PRIME RATE

	Dependent variable (+/- SE):
	Prime Rate
Constant	2.223 (+/- 0.243)
	p = 0.000***
Real GDP growth	-0.003 (+/- 0.001)
	p = 0.006***
Real disposable income growth	-0.068 (+/- 0.012)
	p = 0.00002***
Nominal disposable income growth	0.064 (+/- 0.011)
	p = 0.00002***
CPI Inflation Rate	-0.051 (+/- 0.009)
	p = 0.00002***
BBB corporate yield	0.078 (+/- 0.019)
	p = 0.001***
Dow Total Stock Market Index	-0.00001 (+/- 0.00000)
	p = 0.003***
Home Price Index	0.004 (+/- 0.001)
	p = 0.00004***
LN_Market Volatility Index	-0.090 (+/- 0.015)
	p = 0.00001***
LN_30-year Treasury Yield	1.334 (+/- 0.242)
	p = 0.00002***
20-year Treasury Yield	-0.718 (+/- 0.110)
	p = 0.00001***
1-month Treasury Yield	1.590 (+/- 0.084)
	p = 0.000***
LN_1-month Treasury Yield	-0.079 (+/- 0.013)
	p = 0.00001***
7-year Treasury Yield	0.747 (+/- 0.128)
	p = 0.00001***
LN_7-year Treasury Yield	-0.542 (+/- 0.130)
	p = 0.0005***
3-year Treasury Yield	-0.454 (+/- 0.078)
	p = 0.00001***
1-year Treasury Yield_2	0.100 (+/- 0.031)
	p = 0.004***

6-month Treasury Yield_2	-0.246 (+/- 0.044) p = 0.00002***
Observations	40
R^2	1.000
Adjusted R^2	0.999
Residual Std. Error	0.018 (df = 22)
F Statistic	3,759.660*** (df = 17; 22)
Note:	*p<0.1; **p<0.5; ***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	-13.191 (+/- 0.275)
	p = 0.00002***
SP500 Stock Price Index	0.002 (+/- 0.00001)
	p = 0.00000***
US Fed Reserve O-N Loan Rate	-2.390 (+/- 0.056)
	p = 0.00003***
Moody's AAA Curve	-4.362 (+/- 0.060)
	p = 0.00001***
Moody's BAA Curve	-1.113 (+/- 0.036)
	p = 0.0001***
Real GDP growth	0.393 (+/- 0.007)
	p = 0.00002***
Nominal GDP growth	-0.380 (+/- 0.007)
	p = 0.00002***
Real disposable income growth	-1.653 (+/- 0.021)
	p = 0.00001***
Nominal disposable income growth	1.578 (+/- 0.020)
	p = 0.00001***
Unemployment Rate	0.809 (+/- 0.011)
	p = 0.00001***
CPI Inflation Rate	-1.101 (+/- 0.016)
	p = 0.00001***
BBB corporate yield	0.854 (+/- 0.028)
	p = 0.0001***
30-year Mortgate Rate	4.907 (+/- 0.060)
	p = 0.00001***
Prime Rate	-5.811 (+/- 0.087)
	p = 0.00001***
Home Price Index	-0.092 (+/- 0.001)
	p = 0.00001***
Commercial Real Estate Price Index	0.106 (+/- 0.001)
	p = 0.00001***
LN_Market Volatility Index	-0.538 (+/- 0.014)
	p = 0.00005***

30-year Treasury Yield	-40.257 (+/- 0.673)
	p = 0.00002***
LN_30-year Treasury Yield	137.494 (+/- 2.032)
	p = 0.00001***
20-year Treasury Yield	23.120 (+/- 0.512)
	p = 0.00003***
LN_20-year Treasury Yield	-65.578 (+/- 1.152)
	p = 0.00002***
10-year Treasury Yield	6.804 (+/- 0.279)
	p = 0.0002***
LN_10-year Treasury Yield	-9.974 (+/- 0.272)
	p = 0.00005***
1-month Treasury Yield	13.888 (+/- 0.194)
	p = 0.00001***
7-year Treasury Yield	-5.846 (+/- 0.092)
	p = 0.00001***
3-month Treasury Yield	-7.903 (+/- 0.121)
	p = 0.00001***
LN_5-year Treasury Yield	-12.119 (+/- 0.250)
	p = 0.00002***
6-month Treasury Yield	-16.425 (+/- 0.340)
	p = 0.00002***
LN_6-month Treasury Yield	1.949 (+/- 0.035)
	p = 0.00002***
3-year Treasury Yield	-7.312 (+/- 0.192)
	p = 0.00004***
LN_3-year Treasury Yield	13.245 (+/- 0.208)
	p = 0.00001***
1-year Treasury Yield	24.015 (+/- 0.486)
	p = 0.00002***
LN_1-year Treasury Yield	-5.595 (+/- 0.076)
	p = 0.00001***
1-year Treasury Yield_2	-2.086 (+/- 0.056)
	p = 0.00005***
3-year Treasury Yield_2	0.651 (+/- 0.019)
	p = 0.0001***
3-month Treasury Yield_2	1.054 (+/- 0.046)
	p = 0.0002***
10-year Treasury Yield_2	0.310 (+/- 0.049)

	p = 0.009***
Observations	40
R^2	1.000
Adjusted R^2	1.000
Residual Std. Error	0.003 (df = 3)
F Statistic	28,115.800*** (df = 36; 3)
Note:	*p<0.1; **p<0.5; ***p<0.01

Cost of Federal Funds (Primary Credit Rate)

REGRESSION FOR US FED RESERVE O-N LOAN RATE

	Dependent variable (+/- SE):
	US Fed Reserve O-N Loan Rate
Constant	2.070 (+/- 0.908)
	p = 0.031**
Dow Total Stock Market Index	-0.00004 (+/- 0.00001)
	p = 0.0004***
Home Price Index	0.011 (+/- 0.003)
	p = 0.002***
Market Volatility Index	0.111 (+/- 0.026)
	p = 0.0002***
LN_Market Volatility Index	-1.798 (+/- 0.421)
	p = 0.0002***
LN_10-year Treasury Yield	0.740 (+/- 0.204)
	p = 0.002***
3-month Treasury Yield	0.760 (+/- 0.031)
	p = 0.000***
5-year Treasury Yield	0.594 (+/- 0.104)
	p = 0.00001***
LN_5-year Treasury Yield	-0.784 (+/- 0.168)
	p = 0.0001***
30-year Treasury Yield_2	-0.052 (+/- 0.014)
	p = 0.001***
Market Volatility Index_2	-0.001 (+/- 0.0002)
	p = 0.00002***
Observations	40
R^2	0.993
Adjusted R^2	0.991
Residual Std. Error	0.073 (df = 29)
F Statistic	437.121*** (df = 10; 29)
Note:	*p<0.1; **p<0.5; ***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	5,317.678 (+/- 11,223.760)
	p = 0.641
US Fed Reserve O-N Loan Rate	13,213.820 (+/- 4,210.345)
	p = 0.005***
Real GDP growth	-413.151 (+/- 72.665)
	p = 0.00002***
Real disposable income growth	-3,315.387 (+/- 606.844)
	p = 0.00003***
Nominal disposable income growth	3,142.989 (+/- 570.256)
	p = 0.00002***
Unemployment Rate	-1,931.950 (+/- 469.348)
	p = 0.0005***
CPI Inflation Rate	-1,497.789 (+/- 507.893)
	p = 0.008***
Market Volatility Index	353.606 (+/- 96.540)
	p = 0.002***
LN_10-year Treasury Yield	-77,759.830 (+/- 7,293.791)
	p = 0.000***
5-year Treasury Yield	-103,839.200 (+/- 13,313.540)
	p = 0.00000***
LN_5-year Treasury Yield	142,116.200 (+/- 19,130.220)
	p = 0.00000***
3-year Treasury Yield	147,427.800 (+/- 18,652.970)
	p = 0.00000***
LN_3-year Treasury Yield	-88,019.540 (+/- 13,558.430)
	p = 0.00001***
LN_1-year Treasury Yield	-11,718.380 (+/- 1,478.827)
	p = 0.00000***
3-year Treasury Yield_2	-12,106.900 (+/- 2,255.046)
	p = 0.00003***
3-month Treasury Yield_2	-29,591.620 (+/- 6,432.770)
	p = 0.0002***
1-month Treasury Yield_2	21,821.960 (+/- 5,196.119)
	p = 0.0005***

10-year Treasury Yield_2	5,560.697 (+/- 911.006)
	p = 0.00001***
Market Volatility Index_2	-3.511 (+/- 1.008)
	p = 0.003***
Observations	40
R^2	0.985
Adjusted R^2	0.973
Residual Std. Error	1,442.889 (df = 21)
F Statistic	77.660*** (df = 18; 21)
Note:	*p<0.1; **p<0.5; ***p<0.01

REGRESSION FOR SP500 STOCK PRICE INDEX

	Dependent variable (+/- SE):
	SP500 Stock Price Index
Constant	27,107.580 (+/- 2,799.379)
	p = 0.00000***
Moody's AAA Curve	2,029.635 (+/- 224.183)
	p = 0.00000***
Real GDP growth	115.319 (+/- 28.263)
	p = 0.001***
Nominal GDP growth	-110.928 (+/- 26.681)
	p = 0.001***
Real disposable income growth	444.197 (+/- 45.210)
	p = 0.00000***
Nominal disposable income growth	-423.470 (+/- 43.073)
	p = 0.00000***
CPI Inflation Rate	424.335 (+/- 39.382)
	p = 0.000***
BBB corporate yield	-674.355 (+/- 68.728)
	p = 0.00000***
Prime Rate	4,843.460 (+/- 531.094)
	p = 0.00000***
LN_Market Volatility Index	247.696 (+/- 42.735)
	p = 0.00003***
US Avg Retail Gasoline Price ($-gal; all grades, all formulations)	218.338 (+/- 54.416)
	p = 0.002***
30-year Treasury Yield	-85,956.000 (+/- 5,442.603)
	p = 0.000***
LN_30-year Treasury Yield	64,193.800 (+/- 5,085.448)
	p = 0.000***
20-year Treasury Yield	34,872.480 (+/- 2,077.757)
	p = 0.000***
LN_10-year Treasury Yield	-5,192.732 (+/- 721.826)
	p = 0.00001***
1-month Treasury Yield	-10,630.380 (+/- 939.708)
	p = 0.000***
LN_1-month Treasury Yield	400.981 (+/- 56.935)
	p = 0.00001***
3-month Treasury Yield	4,332.440 (+/- 529.709)

	p = 0.00000***
LN_6-month Treasury Yield	-370.615 (+/- 99.093)
	p = 0.002***
3-year Treasury Yield_2	-254.372 (+/- 75.761)
	p = 0.005***
6-month Treasury Yield_2	854.375 (+/- 89.097)
	p = 0.00000***
7-year Treasury Yield_2	895.392 (+/- 93.094)
	p = 0.00000***
20-year Treasury Yield_2	-6,827.441 (+/- 490.902)
	p = 0.000***
30-year Treasury Yield_2	10,787.170 (+/- 738.172)
	p = 0.000***
Observations	40
R^2	0.998
Adjusted R^2	0.995
Residual Std. Error	59.350 (df = 16)
F Statistic	340.646*** (df = 23; 16)
Note:	*p<0.1; **p<0.5; ***p<0.01

House and Commercial Real Estate Price Indexes

REGRESSION FOR HOME PRICE INDEX

	Dependent variable (+/- SE):
	Home Price Index
Constant	302.536 (+/- 11.024)
	p = 0.000***
US Fed Reserve O-N Loan Rate	31.871 (+/- 4.334)
	p = 0.00000***
Real GDP growth	-1.273 (+/- 0.245)
	p = 0.00002***
Real disposable income growth	-4.388 (+/- 0.992)
	p = 0.0002***
Nominal disposable income growth	4.340 (+/- 0.965)
	p = 0.0001***
Unemployment Rate	-13.690 (+/- 1.481)
	p = 0.000***
30-year Treasury Yield	91.829 (+/- 20.601)
	p = 0.0002***
LN_30-year Treasury Yield	-340.328 (+/- 50.354)
	p = 0.00000***
LN_1-year Treasury Yield	-23.123 (+/- 3.380)
	p = 0.00000***
Observations	40
R^2	0.949
Adjusted R^2	0.935
Residual Std. Error	8.686 (df = 31)
F Statistic	71.651*** (df = 8; 31)
Note:	*p<0.1; **p<0.5; ***p<0.01

REGRESSION FOR COMMERCIAL REAL ESTATE PRICE INDEX

	Dependent variable (+/- SE):
	Commercial Real Estate Price Index
Constant	416.871 (+/- 16.102)
	p = 0.000***
US Fed Reserve O-N Loan Rate	103.199 (+/- 18.474)
	p = 0.00001***
Real GDP growth	-5.532 (+/- 1.612)
	p = 0.002***
Nominal GDP growth	4.369 (+/- 1.430)
	p = 0.006***
Unemployment Rate	-17.369 (+/- 2.756)
	p = 0.00000***
Market Volatility Index	0.758 (+/- 0.258)
	p = 0.007***
30-year Treasury Yield	181.766 (+/- 32.164)
	p = 0.00001***
LN_30-year Treasury Yield	-614.544 (+/- 74.951)
	p = 0.000***
LN_1-month Treasury Yield	-11.031 (+/- 3.883)
	p = 0.009***
5-year Treasury Yield	-63.425 (+/- 20.295)
	p = 0.005***
LN_5-year Treasury Yield	71.480 (+/- 25.237)
	p = 0.009***
LN_1-year Treasury Yield	-20.523 (+/- 6.993)
	p = 0.007***
3-month Treasury Yield_2	-14.843 (+/- 3.910)
	p = 0.001***
Observations	40
R^2	0.976
Adjusted R^2	0.965
Residual Std. Error	8.393 (df = 27)
F Statistic	91.758*** (df = 12; 27)
Note:	*p<0.1; **p<0.5; ***p<0.01

Market Volatility Index

REGRESSION FOR MARKET VOLATILITY INDEX

	Dependent variable (+/- SE):
	Market Volatility Index
Constant	-348.412 (+/- 75.315)
	p = 0.0002***
SP500 Stock Price Index	0.018 (+/- 0.005)
	p = 0.005***
US Fed Reserve O-N Loan Rate	-73.362 (+/- 8.679)
	p = 0.00000***
Moody's AAA Curve	-52.146 (+/- 15.671)
	p = 0.004***
Real GDP growth	6.759 (+/- 1.807)
	p = 0.002***
Nominal GDP growth	-6.524 (+/- 1.683)
	p = 0.001***
Real disposable income growth	-13.063 (+/- 2.462)
	p = 0.00004***
Nominal disposable income growth	12.330 (+/- 2.320)
	p = 0.00004***
Unemployment Rate	13.480 (+/- 2.671)
	p = 0.0001***
CPI Inflation Rate	-7.712 (+/- 1.921)
	p = 0.001***
30-year Mortgate Rate	43.957 (+/- 10.726)
	p = 0.001***
Dow Total Stock Market Index	-0.003 (+/- 0.001)
	p = 0.0002***
Commercial Real Estate Price Index	1.060 (+/- 0.190)
	p = 0.00002***
30-year Treasury Yield	-252.517 (+/- 39.545)
	p = 0.00001***
LN_30-year Treasury Yield	983.555 (+/- 164.302)
	p = 0.00001***
LN_20-year Treasury Yield	-253.350 (+/- 79.100)
	p = 0.005***
LN_7-year Treasury Yield	-64.325 (+/- 14.903)
	p = 0.0004***

1-year Treasury Yield	58.281 (+/- 7.441)
	p = 0.00000***
5-year Treasury Yield_2	-7.974 (+/- 2.532)
	p = 0.006***
10-year Treasury Yield_2	20.545 (+/- 4.183)
	p = 0.0001***
Observations	40
R^2	0.956
Adjusted R^2	0.914
Residual Std. Error	3.728 (df = 20)
F Statistic	22.846*** (df = 19; 20)
Note:	*p<0.1; **p<0.5; ***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[57]
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[58]

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

[58] 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)[59].
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)[60].
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.

59 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

[60] 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/2022-table_1a_historic_domestic.csv and https://www.federalreserve.gov/supervisionreg/files/2022-table_1b_historic_international.csv (shown below, as of Feb 2022) by clicking the links marked "2022 Historical Domestic (CSV)" and "2022 Historical International (CSV)". Alternatively, downloading the files 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 using HTTP client software will also download the official datasets[61].

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

Since the CCAR dataset is only released annually (through 4Q2021 as of this writing), and Capitalytics provides quarterly updates to its forecasts, the CCAR dataset is supplemented by the data sources shown below on a quarterly basis. All datasets discussed herein are supplemented with data through (including) 4Q2021.

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) 4Q2021.

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[62] "forecast" package[63]; specifically, the "ets" function (see p.39 of https://cran.r-project.org/web/packages/forecast/forecast.pdf)[64] 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)[65], 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

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

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

[64] 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.

[65] 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)[66].

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[67];
   - 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

[66] It bears noting that a lower value for the "score" indicates better accuracy of an algorithm.
[67] 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[68].

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.

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

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

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 4: Correlation Factors found as of 4Q2021

Variable 1	Variable 2	Correlation
S&P 500 Stock Price Index	Moody's AAA Curve	-0.716866
S&P 500 Stock Price Index	Moody's BAA Curve	-0.817578
S&P 500 Stock Price Index	Dow Jones Total Stock Market Index	-0.888878
S&P 500 Stock Price Index	Residential Home Price Index	-0.936593
S&P 500 Stock Price Index	**Commercial Real Estate Price Index**	**-0.953374**
S&P 500 Stock Price Index	30-year Treasury Yield	-0.662876
Cost of Federal Funds	Moody's AAA Curve	0.809228
Cost of Federal Funds	Moody's BAA Curve	0.750222
Cost of Federal Funds	BBB Corporate Yield	-0.834765
Cost of Federal Funds	30-year Mortgage Rate	-0.821585
Cost of Federal Funds	Prime Rate	-0.769438
Cost of Federal Funds	Dow Jones Total Stock Market Index	0.688454
Cost of Federal Funds	Residential Home Price Index	0.736523
Cost of Federal Funds	Commercial Real Estate Price Index	0.691582
Cost of Federal Funds	US Average Retail Gasoline Price	-0.635925
Cost of Federal Funds	20-year Treasury Yield	0.797695
Cost of Federal Funds	10-year Treasury Yield	-0.798892
Cost of Federal Funds	**1-month Treasury Yield**	**0.993186**
Cost of Federal Funds	7-year Treasury Yield	0.89636
Cost of Federal Funds	3-month Treasury Yield	-0.756209
Cost of Federal Funds	5-year Treasury Yield	-0.79716
Cost of Federal Funds	**6-month Treasury Yield**	**0.994389**
Cost of Federal Funds	**3-year Treasury Yield**	**0.956685**
Cost of Federal Funds	**1-year Treasury Yield**	**0.988028**
Moody's AAA Curve	**Moody's BAA Curve**	**0.978862**
Moody's AAA Curve	BBB Corporate Yield	-0.89465
Moody's AAA Curve	30-year Mortgage Rate	-0.949382
Moody's AAA Curve	Prime Rate	-0.80279
Moody's AAA Curve	Dow Jones Total Stock Market Index	0.848207
Moody's AAA Curve	Residential Home Price Index	0.868537
Moody's AAA Curve	Commercial Real Estate Price Index	0.876333
Moody's AAA Curve	US Average Retail Gasoline Price	-0.725786
Moody's AAA Curve	**30-year Treasury Yield**	**0.964251**
Moody's AAA Curve	**20-year Treasury Yield**	**0.984122**
Moody's AAA Curve	10-year Treasury Yield	-0.94965
Moody's AAA Curve	**7-year Treasury Yield**	**0.967755**
Moody's AAA Curve	3-month Treasury Yield	-0.823149
Moody's AAA Curve	5-year Treasury Yield	-0.92594
Moody's AAA Curve	6-month Treasury Yield	0.822447
Moody's AAA Curve	3-year Treasury Yield	0.908114

Moody's AAA Curve	1-year Treasury Yield	0.840109
Moody's BAA Curve	BBB Corporate Yield	-0.86274
Moody's BAA Curve	30-year Mortgage Rate	-0.932173
Moody's BAA Curve	Prime Rate	-0.812526
Moody's BAA Curve	Dow Jones Total Stock Market Index	0.818562
Moody's BAA Curve	Residential Home Price Index	0.85007
Moody's BAA Curve	Commercial Real Estate Price Index	0.845514
Moody's BAA Curve	US Average Retail Gasoline Price	-0.679849
Moody's BAA Curve	30-year Treasury Yield	0.826216
Moody's BAA Curve	20-year Treasury Yield	0.932297
Moody's BAA Curve	10-year Treasury Yield	-0.935913
Moody's BAA Curve	7-year Treasury Yield	0.919199
Moody's BAA Curve	3-month Treasury Yield	-0.83457
Moody's BAA Curve	5-year Treasury Yield	-0.924385
Moody's BAA Curve	6-month Treasury Yield	0.761978
Moody's BAA Curve	3-year Treasury Yield	0.851221
Moody's BAA Curve	1-year Treasury Yield	0.780101
Real GDP Growth	**Nominal GDP Growth**	**0.978044**
Real Disposable Income Growth	**Nominal Disposable Income Growth**	**0.976198**
BBB Corporate Yield	30-year Mortgage Rate	0.941715
BBB Corporate Yield	Prime Rate	0.748534
BBB Corporate Yield	Dow Jones Total Stock Market Index	-0.811055
BBB Corporate Yield	Residential Home Price Index	-0.812807
BBB Corporate Yield	Commercial Real Estate Price Index	-0.782374
BBB Corporate Yield	US Average Retail Gasoline Price	0.743813
BBB Corporate Yield	30-year Treasury Yield	-0.663819
BBB Corporate Yield	20-year Treasury Yield	-0.812395
BBB Corporate Yield	10-year Treasury Yield	0.925057
BBB Corporate Yield	7-year Treasury Yield	-0.90666
BBB Corporate Yield	3-month Treasury Yield	0.767561
BBB Corporate Yield	5-year Treasury Yield	0.886678
BBB Corporate Yield	6-month Treasury Yield	-0.842825
BBB Corporate Yield	3-year Treasury Yield	-0.8895
BBB Corporate Yield	1-year Treasury Yield	-0.854716
30-year Mortgage Rate	Prime Rate	0.858253
30-year Mortgage Rate	Dow Jones Total Stock Market Index	-0.78705
30-year Mortgage Rate	Residential Home Price Index	-0.822499
30-year Mortgage Rate	Commercial Real Estate Price Index	-0.824777
30-year Mortgage Rate	US Average Retail Gasoline Price	0.755733
30-year Mortgage Rate	30-year Treasury Yield	-0.740266
30-year Mortgage Rate	20-year Treasury Yield	-0.89294
30-year Mortgage Rate	**10-year Treasury Yield**	**0.993432**
30-year Mortgage Rate	7-year Treasury Yield	-0.925164
30-year Mortgage Rate	3-month Treasury Yield	0.882213
30-year Mortgage Rate	**5-year Treasury Yield**	**0.981016**
30-year Mortgage Rate	6-month Treasury Yield	-0.827649
30-year Mortgage Rate	3-year Treasury Yield	-0.888744
30-year Mortgage Rate	1-year Treasury Yield	-0.841571
Prime Rate	20-year Treasury Yield	-0.700876
Prime Rate	10-year Treasury Yield	0.841974

Prime Rate	7-year Treasury Yield	-0.790025
Prime Rate	**3-month Treasury Yield**	**0.992411**
Prime Rate	5-year Treasury Yield	0.910136
Prime Rate	6-month Treasury Yield	-0.759347
Prime Rate	3-year Treasury Yield	-0.786897
Prime Rate	1-year Treasury Yield	-0.767667
Dow Jones Total Stock Market Index	Residential Home Price Index	0.883135
Dow Jones Total Stock Market Index	Commercial Real Estate Price Index	0.907583
Dow Jones Total Stock Market Index	US Average Retail Gasoline Price	-0.702431
Dow Jones Total Stock Market Index	30-year Treasury Yield	0.824949
Dow Jones Total Stock Market Index	20-year Treasury Yield	0.843448
Dow Jones Total Stock Market Index	10-year Treasury Yield	-0.789021
Dow Jones Total Stock Market Index	7-year Treasury Yield	0.841534
Dow Jones Total Stock Market Index	5-year Treasury Yield	-0.704883
Dow Jones Total Stock Market Index	6-month Treasury Yield	0.70428
Dow Jones Total Stock Market Index	3-year Treasury Yield	0.780403
Dow Jones Total Stock Market Index	1-year Treasury Yield	0.717967
Residential Home Price Index	**Commercial Real Estate Price Index**	**0.967792**
Residential Home Price Index	30-year Treasury Yield	0.654321
Residential Home Price Index	20-year Treasury Yield	0.863541
Residential Home Price Index	10-year Treasury Yield	-0.830677
Residential Home Price Index	7-year Treasury Yield	0.874713
Residential Home Price Index	3-month Treasury Yield	-0.607651
Residential Home Price Index	5-year Treasury Yield	-0.765754
Residential Home Price Index	6-month Treasury Yield	0.755537
Residential Home Price Index	3-year Treasury Yield	0.824631
Residential Home Price Index	1-year Treasury Yield	0.769472
Commercial Real Estate Price Index	US Average Retail Gasoline Price	-0.636211
Commercial Real Estate Price Index	30-year Treasury Yield	0.653683
Commercial Real Estate Price Index	20-year Treasury Yield	0.917028
Commercial Real Estate Price Index	10-year Treasury Yield	-0.842947
Commercial Real Estate Price Index	7-year Treasury Yield	0.869111
Commercial Real Estate Price Index	3-month Treasury Yield	-0.602495
Commercial Real Estate Price Index	5-year Treasury Yield	-0.772471
Commercial Real Estate Price Index	6-month Treasury Yield	0.713958
Commercial Real Estate Price Index	3-year Treasury Yield	0.801989
Commercial Real Estate Price Index	1-year Treasury Yield	0.731708
US Average Retail Gasoline Price	20-year Treasury Yield	-0.715936
US Average Retail Gasoline Price	10-year Treasury Yield	0.730675
US Average Retail Gasoline Price	7-year Treasury Yield	-0.752713
US Average Retail Gasoline Price	5-year Treasury Yield	0.661046
US Average Retail Gasoline Price	6-month Treasury Yield	-0.657581
US Average Retail Gasoline Price	3-year Treasury Yield	-0.735827
US Average Retail Gasoline Price	1-year Treasury Yield	-0.678704
30-year Treasury Yield	**20-year Treasury Yield**	**0.98984**
30-year Treasury Yield	10-year Treasury Yield	-0.712889
30-year Treasury Yield	7-year Treasury Yield	0.877436
30-year Treasury Yield	3-year Treasury Yield	0.649697
20-year Treasury Yield	10-year Treasury Yield	-0.892386
20-year Treasury Yield	**7-year Treasury Yield**	**0.97312**

20-year Treasury Yield	3-month Treasury Yield	-0.713076
20-year Treasury Yield	5-year Treasury Yield	-0.836819
20-year Treasury Yield	6-month Treasury Yield	0.81627
20-year Treasury Yield	3-year Treasury Yield	0.906047
20-year Treasury Yield	1-year Treasury Yield	0.839363
10-year Treasury Yield	7-year Treasury Yield	-0.918349
10-year Treasury Yield	3-month Treasury Yield	0.869626
10-year Treasury Yield	**5-year Treasury Yield**	**0.982639**
10-year Treasury Yield	6-month Treasury Yield	-0.805884
10-year Treasury Yield	3-year Treasury Yield	-0.873023
10-year Treasury Yield	1-year Treasury Yield	-0.820784
1-month Treasury Yield	7-year Treasury Yield	0.762336
1-month Treasury Yield	**6-month Treasury Yield**	**0.995288**
1-month Treasury Yield	3-year Treasury Yield	0.926782
1-month Treasury Yield	**1-year Treasury Yield**	**0.988116**
7-year Treasury Yield	3-month Treasury Yield	-0.79557
7-year Treasury Yield	5-year Treasury Yield	-0.888691
7-year Treasury Yield	6-month Treasury Yield	0.915221
7-year Treasury Yield	**3-year Treasury Yield**	**0.978306**
7-year Treasury Yield	1-year Treasury Yield	0.930879
3-month Treasury Yield	5-year Treasury Yield	0.935271
3-month Treasury Yield	6-month Treasury Yield	-0.746304
3-month Treasury Yield	3-year Treasury Yield	-0.781626
3-month Treasury Yield	1-year Treasury Yield	-0.75608
5-year Treasury Yield	6-month Treasury Yield	-0.796541
5-year Treasury Yield	3-year Treasury Yield	-0.852611
5-year Treasury Yield	1-year Treasury Yield	-0.809181
6-month Treasury Yield	**3-year Treasury Yield**	**0.974011**
6-month Treasury Yield	**1-year Treasury Yield**	**0.998115**
3-year Treasury Yield	**1-year Treasury Yield**	**0.98401**

Appendix D: Mortgage Delinquencies

The following tables, Table 5 through Table 9, present the delinquency rates of mortgages held by Freddie Mac for September 2021 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 5: Percentage of Freddie Mac Mortgages by Status (Current, 30 dpd and 30+ dpd) as of February 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	1263	1235	11	2	0	15	0.87%	1.35%	2.22%
	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	4993	4937	26	6	2	22	0.52%	0.60%	1.12%
	2 units	27	27	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	32723	32323	158	34	20	188	0.48%	0.74%	1.22%
	2 units	24	24	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	16	15	1	0	0	0	6.25%	0.00%	6.25%
Columbus, GA-AL	1 unit	380	366	2	1	1	10	0.53%	3.16%	3.68%
	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	8317	8229	37	7	2	42	0.45%	0.61%	1.06%
	2 units	16	16	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	2338	2307	17	1	0	13	0.73%	0.60%	1.33%
	2 units	5	5	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	10	10	0	0	0	0	0.00%	0.00%	0.00%
Dothan, AL	1 unit	2241	2210	14	3	2	12	0.63%	0.76%	1.38%
	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	2891	2839	23	2	2	25	0.80%	1.00%	1.80%
	2 units	3	3	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	0	0	0	0	0	0	0.00%	0.00%	0.00%
Gadsden, AL	1 unit	1325	1300	4	2	1	18	0.30%	1.59%	1.89%
	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	14950	14827	40	4	7	72	0.27%	0.56%	0.82%
	2 units	20	20	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	49	49	0	0	0	0	0.00%	0.00%	0.00%
Mobile, AL	1 unit	5936	5832	36	5	6	57	0.61%	1.15%	1.75%
	2 units	12	12	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	5	5	0	0	0	0	0.00%	0.00%	0.00%
Montgomery, AL	1 unit	6440	6354	34	0	4	48	0.53%	0.81%	1.34%

	2 units	18	18	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	5444	5369	34	7	2	32	0.63%	0.75%	1.38%
	2 units	4	4	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	11380	11165	82	21	11	101	0.72%	1.17%	1.89%
	2 units	43	43	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	10	10	0	0	0	0	0.00%	0.00%	0.00%

Source: STACR Freddie Mac, as of 23 February 2022

Table 6: Percentage of Freddie Mac Mortgages by Status (Current, 30 dpd and 30+ dpd) as of February 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	28337	28014	105	25	19	174	0.37%	0.77%	1.14%
	2 units	367	363	2	0	0	2	0.55%	0.55%	1.09%
	3+ units	40	39	1	0	0	0	2.50%	0.00%	2.50%
Crestview-Fort Walton Beach-Destin, FL	1 unit	7770	7691	39	12	3	25	0.50%	0.52%	1.02%
	2 units	16	16	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	19854	19606	106	18	11	113	0.53%	0.72%	1.25%
	2 units	158	151	3	0	0	4	1.90%	2.53%	4.43%
	3+ units	47	44	0	0	0	3	0.00%	6.38%	6.38%
Gainesville, FL	1 unit	6422	6366	18	3	6	29	0.28%	0.59%	0.87%
	2 units	24	24	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	15	13	2	0	0	0	13.33%	0.00%	13.33%
Homosassa Springs, FL	1 unit	3269	3229	13	8	3	16	0.40%	0.83%	1.22%
	2 units	22	21	1	0	0	0	4.55%	0.00%	4.55%
	3+ units	4	4	0	0	0	0	0.00%	0.00%	0.00%
Jacksonville, FL	1 unit	43166	42694	156	48	21	247	0.36%	0.73%	1.09%
	2 units	183	182	0	0	0	1	0.00%	0.55%	0.55%
	3+ units	113	113	0	0	0	0	0.00%	0.00%	0.00%
Lakeland-Winter Haven, FL	1 unit	15995	15799	63	20	17	96	0.39%	0.83%	1.23%
	2 units	98	96	0	0	0	2	0.00%	2.04%	2.04%
	3+ units	35	33	0	0	0	2	0.00%	5.71%	5.71%
Miami-Fort Lauderdale-Pompano Beach, FL	1 unit	145880	142761	845	235	151	1888	0.58%	1.56%	2.14%
	2 units	1244	1211	6	1	4	22	0.48%	2.17%	2.65%
	3+ units	541	530	3	0	0	8	0.56%	1.48%	2.03%
Naples-Marco Island, FL	1 unit	13394	13268	47	8	5	66	0.35%	0.59%	0.94%
	2 units	48	48	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	17	17	0	0	0	0	0.00%	0.00%	0.00%
North Port-Sarasota-Bradenton, FL	1 unit	33447	33148	98	32	9	160	0.29%	0.60%	0.89%
	2 units	182	182	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	30	30	0	0	0	0	0.00%	0.00%	0.00%
Ocala, FL	1 unit	8007	7895	45	9	6	52	0.56%	0.84%	1.40%

	2 units	25	25	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	20	20	0	0	0	0	0.00%	0.00%	0.00%
Orlando-Kissimmee-Sanford, FL	1 unit	78079	76858	363	108	81	669	0.47%	1.10%	1.56%
	2 units	314	313	0	0	0	1	0.00%	0.32%	0.32%
	3+ units	88	86	0	0	0	2	0.00%	2.27%	2.27%
Palm Bay-Melbourne-Titusville, FL	1 unit	20111	19859	98	24	10	120	0.49%	0.77%	1.25%
	2 units	58	58	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	26	25	0	0	0	1	0.00%	3.85%	3.85%
Panama City, FL	1 unit	4636	4563	36	8	4	25	0.78%	0.80%	1.58%
	2 units	42	42	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	15	15	0	0	0	0	0.00%	0.00%	0.00%
Pensacola-Ferry Pass-Brent, FL	1 unit	10197	10016	78	20	4	79	0.77%	1.01%	1.78%
	2 units	67	64	3	0	0	0	4.48%	0.00%	4.48%
	3+ units	38	38	0	0	0	0	0.00%	0.00%	0.00%
Port St. Lucie, FL	1 unit	16730	16507	86	20	15	102	0.51%	0.82%	1.33%
	2 units	68	65	0	0	0	3	0.00%	4.41%	4.41%
	3+ units	15	15	0	0	0	0	0.00%	0.00%	0.00%
Punta Gorda, FL	1 unit	7732	7653	24	9	2	44	0.31%	0.71%	1.02%
	2 units	30	29	1	0	0	0	3.33%	0.00%	3.33%
	3+ units	7	7	0	0	0	0	0.00%	0.00%	0.00%
Sebastian-Vero Beach, FL	1 unit	5913	5834	27	6	4	42	0.46%	0.88%	1.34%
	2 units	15	14	0	0	0	1	0.00%	6.67%	6.67%
	3+ units	7	7	0	0	0	0	0.00%	0.00%	0.00%
Sebring-Avon Park, FL	1 unit	1981	1948	17	3	1	12	0.86%	0.81%	1.67%
	2 units	15	15	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	4	4	0	0	0	0	0.00%	0.00%	0.00%
Tallahassee, FL	1 unit	9212	9107	45	8	9	43	0.49%	0.65%	1.14%
	2 units	52	52	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	35	35	0	0	0	0	0.00%	0.00%	0.00%
Tampa-St. Petersburg-Clearwater, FL	1 unit	96833	95550	378	111	81	713	0.39%	0.94%	1.33%
	2 units	506	497	4	1	0	4	0.79%	0.99%	1.78%
	3+ units	268	263	0	0	1	4	0.00%	1.87%	1.87%
The Villages, FL	1 unit	2740	2723	7	0	1	9	0.26%	0.37%	0.62%
	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	9747	9596	50	18	13	70	0.51%	1.04%	1.55%
	2 units	343	337	3	0	0	3	0.88%	0.88%	1.75%
	3+ units	55	53	1	0	0	1	1.82%	1.82%	3.64%

Source: STACR Freddie Mac, as of 23 February 2022

Table 7: Percentage of Freddie Mac Mortgages by Status (Current, 30 dpd and 30+ dpd) as of February 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	1679	1647	13	3	2	14	0.77%	1.13%	1.91%
	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	21741	21333	130	47	24	207	0.60%	1.28%	1.88%
	2 units	54	53	1	0	0	0	1.85%	0.00%	1.85%
	3+ units	64	64	0	0	0	0	0.00%	0.00%	0.00%
Hammond, LA	1 unit	2149	2101	13	3	7	25	0.61%	1.63%	2.23%
	2 units	13	13	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	9	9	0	0	0	0	0.00%	0.00%	0.00%
Houma-Thibodaux, LA	1 unit	3530	3401	30	16	5	78	0.85%	2.81%	3.65%
	2 units	5	2	0	2	0	1	0.00%	60.00%	60.00%
	3+ units	4	4	0	0	0	0	0.00%	0.00%	0.00%
Lafayette, LA	1 unit	9055	8842	55	21	11	126	0.61%	1.75%	2.35%
	2 units	12	12	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	27	26	1	0	0	0	3.70%	0.00%	3.70%
Lake Charles, LA	1 unit	3578	3506	16	4	8	44	0.45%	1.57%	2.01%
	2 units	13	13	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	2610	2546	15	9	6	34	0.58%	1.88%	2.45%
	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	28787	27991	194	65	52	485	0.67%	2.09%	2.77%
	2 units	1500	1469	3	1	0	27	0.20%	1.87%	2.07%
	3+ units	382	374	0	1	0	7	0.00%	2.09%	2.09%
Shreveport-Bossier City, LA	1 unit	7010	6857	55	9	9	80	0.79%	1.40%	2.18%
	2 units	4	4	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	8	8	0	0	0	0	0.00%	0.00%	0.00%
Outside all MSAs	1 unit	5779	5611	58	8	5	97	1.00%	1.90%	2.91%
	2 units	462	442	7	0	1	12	1.52%	2.81%	4.33%
	3+ units	96	96	0	0	0	0	0.00%	0.00%	0.00%

Source: STACR Freddie Mac, as of 23 February 2022

Table 8: Percentage of Freddie Mac Mortgages by Status (Current, 30 dpd and 30+ dpd) as of February 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	4280	4209	28	3	8	32	0.65%	1.01%	1.66%
	2 units	29	29	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	12	12	0	0	0	0	0.00%	0.00%	0.00%
Hattiesburg, MS	1 unit	2181	2148	14	4	2	13	0.64%	0.87%	1.51%
	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	8529	8387	41	20	4	77	0.48%	1.18%	1.67%
	2 units	11	11	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	3	3	0	0	0	0	0.00%	0.00%	0.00%
Memphis, TN-MS-AR	1 unit	5372	5296	28	12	5	31	0.52%	0.89%	1.42%
	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	10235	9990	84	20	15	126	0.82%	1.57%	2.39%
	2 units	13	13	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 February 2022

Table 9: Percentage of Freddie Mac Mortgages by Status (Current, 30 dpd and 30 + dpd) as of February 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	3640	3574	28	12	2	24	0.77%	1.04%	1.81%
	2 units	19	19	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	4189	4116	17	10	7	39	0.41%	1.34%	1.74%
	2 units	13	13	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	93271	92343	349	73	43	463	0.37%	0.62%	1.00%
	2 units	1068	1059	4	0	0	5	0.38%	0.47%	0.84%
	3+ units	220	217	0	0	0	3	0.00%	1.36%	1.36%
Beaumont-Port Arthur, TX	1 unit	5214	5091	35	19	10	59	0.67%	1.69%	2.36%
	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%
Brownsville-Harlingen, TX	1 unit	2557	2494	24	7	2	30	0.94%	1.53%	2.46%
	2 units	33	33	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	27	27	0	0	0	0	0.00%	0.00%	0.00%
College Station-Bryan, TX	1 unit	6482	6417	29	4	2	30	0.45%	0.56%	1.00%
	2 units	98	98	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	62	62	0	0	0	0	0.00%	0.00%	0.00%
Corpus Christi, TX	1 unit	6738	6596	57	11	9	65	0.85%	1.26%	2.11%
	2 units	16	16	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	15	15	0	0	0	0	0.00%	0.00%	0.00%
Dallas-Fort Worth-Arlington, TX	1 unit	251632	248361	1132	258	140	1741	0.45%	0.85%	1.30%
	2 units	803	794	3	0	0	6	0.37%	0.75%	1.12%
	3+ units	216	213	1	0	0	2	0.46%	0.93%	1.39%
El Paso, TX	1 unit	5884	5745	42	12	8	77	0.71%	1.65%	2.36%
	2 units	62	61	0	1	0	0	0.00%	1.61%	1.61%
	3+ units	30	30	0	0	0	0	0.00%	0.00%	0.00%
Houston-The Woodlands-Sugar Land, TX	1 unit	180546	177301	1016	247	193	1789	0.56%	1.24%	1.80%
	2 units	299	293	1	0	0	5	0.33%	1.67%	2.01%
	3+ units	265	257	3	2	0	3	1.13%	1.89%	3.02%
Killeen-Temple, TX	1 unit	5939	5840	30	10	4	55	0.51%	1.16%	1.67%

	2 units	196	192	1	1	2	0	0.51%	1.53%	2.04%
	3+ units	176	175	0	0	0	1	0.00%	0.57%	0.57%
Laredo, TX	1 unit	1764	1730	10	4	2	18	0.57%	1.36%	1.93%
	2 units	3	1	2	0	0	0	66.67%	0.00%	66.67%
	3+ units	9	9	0	0	0	0	0.00%	0.00%	0.00%
Longview, TX	1 unit	2571	2531	11	4	2	23	0.43%	1.13%	1.56%
	2 units	10	10	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	7740	7630	48	13	5	44	0.62%	0.80%	1.42%
	2 units	102	102	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	16	16	0	0	0	0	0.00%	0.00%	0.00%
McAllen-Edinburg-Mission, TX	1 unit	4020	3906	30	9	3	72	0.75%	2.09%	2.84%
	2 units	17	16	0	0	0	1	0.00%	5.88%	5.88%
	3+ units	179	177	0	0	0	2	0.00%	1.12%	1.12%
Midland, TX	1 unit	5841	5708	42	18	5	68	0.72%	1.56%	2.28%
	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	2162	2086	24	11	3	38	1.11%	2.41%	3.52%
	2 units	3	3	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	2383	2329	17	5	4	28	0.71%	1.55%	2.27%
	2 units	6	6	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	51639	50878	263	66	38	394	0.51%	0.96%	1.47%
	2 units	363	359	2	0	1	1	0.55%	0.55%	1.10%
	3+ units	205	202	0	0	0	3	0.00%	1.46%	1.46%
Sherman-Denison, TX	1 unit	4117	4058	28	5	3	23	0.68%	0.75%	1.43%
	2 units	30	30	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	1156	1132	6	0	2	16	0.52%	1.56%	2.08%
	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	4310	4235	21	10	7	37	0.49%	1.25%	1.74%
	2 units	9	9	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	1091	1064	8	0	2	17	0.73%	1.74%	2.48%

	2 units	3	3	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	4727	4657	39	5	3	23	0.83%	0.66%	1.48%
	2 units	45	45	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	1361	1331	7	1	2	20	0.51%	1.69%	2.20%
	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	33656	32960	272	57	34	333	0.81%	1.26%	2.07%
	2 units	469	465	2	0	0	2	0.43%	0.43%	0.85%
	3+ units	62	62	0	0	0	0	0.00%	0.00%	0.00%

Data: STACR Freddie Mac, as of 23 February 2022

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