Macroeconomic Forecasts, 4Q2022 Domestic Metrics



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Summary

Is the United States in an economic recession? If not, will the US be entering a recession shortly -- and is that recession inevitable? Despite a low and stable unemployment rate, we are more pessimistic than optimistic about the state of the economy moving forward. We would argue that the economy is currently experiencing a growth recession (similar to the argument forwarded by Krugman following the 2008 housing crisis¹), and we've likely been in a growth recession since the start of the pandemic.

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

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

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

¹ See https://money.cnn.com/2008/03/14/news/economy/krugman_subprime.fortune/index.htm and

https://www.lobservateur.com/2020/05/16/kruman-what-did-we-learn-from-the-2008-financial-crisis-that-can-help-us-now/

State of Affairs

For the last three years, we've started each report with an examination of the number of new COVID-19 cases and the trend of the 7-day moving average. Although COVID isn't the front-page story of the current economic trends it is important to keep an eye on this trend. (ref. Figure 1) We believe that the country is now operating in a "steady-state" situation where the number of new cases will be relatively stable for the foreseeable future (in the absence of a new variant or outbreak of a COVID related illness), and we acknowledge that COVID is one of the <u>underlying causes</u> (along with the conflict between Russia and Ukraine) of the issues the country is experiencing.



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

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

Inflation

The primary concerns of the economy are related to inflation and the policy responses to inflation. We believe that consumers are acutely aware of the prices changes in three areas: energy², food³, and housing⁴ (although there is evidence that the housing market is "cooling" relative to its upward price pressures). We begin by discussing overall inflation in the US. (See Figure 2.)





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

The continued increase in the Federal Funds target rate by the Federal Reserve seems to be having an impact on inflation. Although the rate of inflation is still 350 basis points higher than the Fed's 3% target, the rate of inflation has been trending down for the last 6 months. The Fed is not going stop the contractionary policy, but it is showing that it is modifying its contractionary movements with the understanding that its policy may very well contribute to an economic recession.⁵

² https://www.bloomberg.com/news/articles/2022-06-09/gasoline-food-and-power-inflation-slam-us-households-and-it-could-get-worse ³ ibid

⁴ https://money.com/housing-market-cooldown-signs-predictions/?ref=/housing-market-correction-federal-reserve/

⁵ ibid

Inflation: Fuel

Because fuel and food are two of the biggest components in consumer's budgets, it is critical to understand the inflationary aspects of these areas. Table 1 and Figure 3 highlight the issues that are troubling consumers – double-digit year-over-year inflation for gas prices. We are experiencing zero inflation between December 2021 and December 2022 with respect to average price per gallon of gasoline. However, the prices in December, 2022, are still higher than the average price for March 1, 2020 by approximately 40%.

Table 1: Average Gas Prices (per Gallon) in US, as of January 10, 2023

	Regular	Mid- Grade	Premium	Diesel	E85
Current Avg.	\$3.27	\$3.69	\$4.01	\$4.64	\$2.70
Yesterday Avg.	\$3.28	\$3.70	\$4.02	\$4.65	\$2.71
Week Ago Avg.	\$3.23	\$3.63	\$3.96	\$4.68	\$2.60
Month Ago Avg.	\$3.30	\$3.74	\$4.06	\$4.96	\$2.69
Year Ago Avg.	\$3.30	\$3.67	\$3.94	\$3.59	\$3.03

Source: https://gasprices.aaa.com

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



Source: https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=pet&s=emm_epm0_pte_nus_dpg&f=m



Figure 4: Price Changes Since Pandemic: Per Gallon Average Price of Gasoline

The current rate of inflation for gas prices is falling as of this writing -- that is, we are experiencing disinflation. The price per gallon for gasoline decreased so dramatically during the recession that a return to "normal" will correspond to quite high inflation rates. The year-over-year price changes peaked during the Spring of 2022, but the average price has fallen to levels fairly consistent with the price we saw just prior to the pandemic. We anticipate that average prices will remain between \$3.40/gallon and \$3.85/gallon throughout the next quarter, which would be consistent with lower inflationary pressures.

Inflation: Food

Although food inflation is not as high as gas-price inflation, the US is experiencing the highest year-overyear food price inflation seen since 1980 (~10% annual inflation, per Figure 5). The supply-chain issues that the US experienced early in the pandemic, from meat-processing closures⁶ to trucking and logistics⁷ issues have continued to cause disruptions in the food supply chain, increasing production and transportation costs and contributing to overall inflationary trends.

⁶ https://www.cnn.com/2020/04/26/business/meat-processing-plants-coronavirus/index.html

⁷ https://www.redwoodlogistics.com/five-challenges-in-food-and-beverage-supply-chains/



Figure 5: US National Food Price Inflation (at Home), 2000-Present

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

Figure 6: US National Prepared Food Price Inflation (Away from Home), 2008-Present



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

The upward pressure on food prices is not likely to abate soon; record droughts across Europe have decreased crop yields⁸ and, with a decrease in food supplies, will result in continued upward pressure in prices. The continued conflict in Ukraine will continue to put upward pressure on international food prices.

The price inflation of food away from home (restaurant meals) is smaller than that for food consumed in home. (See Figure 6.) In 1980 the US experienced year-over-year inflation for food away from the home at rates above 10%. The availability of less-expensive "fast food" options in the US and creates a system with a little less upward pressure than we saw in 1980 and lower inflationary rates relative to food in the home. Regardless, this type of inflation has a significant negative impact on consumer's budgets.



Figure 7: Percentage Change in Restaurant Reservations (Levels) Benchmarked Relative to same Month in 2019

Source: Open Table (https://www.opentable.com/state-of-industry)

The price increases for food, particularly restaurant prices, is a result of changes in both supply and demand. The war in Ukraine and severe droughts across Europe and the US have decrease supplies, putting upward pressure on price. An increase in restaurant demand, especially during the last quarter of 2022, is also consistent with upward pressure in prices.

Inflation: Housing

Since early in the pandemic the US has seen an upward spike in the price of single-family housing units. The year-over-year inflation for housing is now hovering between 7 and 8%. Figure 9 uses the Case-Shiller home price index to estimate annual inflation for single-family housing units.

⁸ https://phys.org/news/2022-07-drought-impacts-global-agricultural-production.html

We've already seen an uptick in the housing inventory (after the Federal Reserve started its hawkish interest rate changes in March 2022); this trend is likely to continue as the Federal Reserve Bank has indicated⁹ that its interest rate target changes will be 75 basis points for, perhaps, one more meeting and then a 50 bp increase towards the end of the year.

The see-saw nature of inventories (existing homes, per Figure 8) is coinciding with a pronounced decrease in new-home permits (

Figure 11), which is driving down the median price of homes. The increase in mortgage rates (Figure 12) is also driving down the quantity demand of house a consumer can purchase. In all, home prices are trending towards pre-pandemic levels. Rental rates, however, are continuing with their rapid increase. Quite a few new-home owners (those who purchased homes during the pandemic) are feeling buyers' remorse. Those that couldn't purchase and are stuck in rental housing have not seen a break. The double-impact of higher rent prices and a decrease in real earnings could push some renters into extreme shortfalls with respect to monthly budgets.



Figure 8: US National Residential Housing Inventory, August 2021-August 2022

⁹ https://www.businessinsider.com/federal-reserve-interest-rate-hikes-double-sized-future-meetings-powell-2022-5 and



Figure 9: US National Home Price Inflation Case-Shiller, 2008-Present

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







Figure 11: US National New Home Construction Permits, 2015-Present

Figure 12: 30-year Fixed Mortgage Rate



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



Figure 13: US National Residential Median Price per Square Foot, July 2016-Present

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

Figure 14: US National Median Sales Price, 2018-Present



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



Figure 15: US National Residential Rental Prices, 2008-Present

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

Figure 16: Percentage Change Median Price Since COVID: US (Blue), Nashville (Green), Dallas (Gray), Houston (Orange), and Atlanta (Red)



Figure 16 shows the percentage change in the prices since the start of COVID in the US (3/7/2020): United States (black), Atlanta, GA (red), Houston, TX (orange), Nashville, TN (green), and Dallas, TX (gray). The biggest spike was seen in the Nashville SMSA, while Atlanta, GA (red) saw the smallest changes. Prices for single family residences (SFR) for Nashville, TN, are nearly 45% higher than the start of the pandemic.

Inflation: Summary

Consumers are extremely aware of the inflationary trends of the US. The inflationary expectations (as shown in Figure 17, Figure 18, and Figure 19, from the University of Michigan) suggest that consumers have anticipated that inflation will start to fall by small amounts. This is probably less reflective of an awareness of how Federal Reserve Bank policies work and more a reflection that consumers have heard that an increase in interest rates "should" control inflationary trends. The Fed's policy has been broadly covered, by media sources on the left and right sides of the aisle (i.e., CNN¹⁰, Fox¹¹, and Newsmax¹²); consumers have been alerted to these policies and range of outcomes stemming from these policies (e.g., a recession¹³). Perhaps because of these revelations (or because consumers are having difficulties with their budgets) consumer confidence in the economy has continued to decline.

recession/2022/06/15/id/1074589/

¹⁰ https://www.cnn.com/2022/06/15/economy/fed-rate-hike-decision-june/index.html

¹¹ https://www.foxbusiness.com/economy/fed-could-break-economy-aggressive-rate-hike-campaign-analyst-says

¹² https://www.newsmax.com/finance/streettalk/federal-reserve-75-basis-point-rate-hike-inflation-jerome-powell-

¹³ Supra 16, 17, and 18

Figure 17: US Consumer Inflation Expectations



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

Figure 18: Consumer Inflationary Expectations



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

Figure 19: US National Consumer Confidence



Our models (both the 24-month and 36-month horizon) for forecasting inflation have proven to be true for the movement in inflation (See Figure 20 and Figure 21.) Our models continue to predict that inflation in the US will move toward 6% this Summer and perhaps land at 5.25 – 5.75% by the end of 2023.

Figure 20: 24-month ARIMA Model for US Inflation: Prediction from Q3 (Left Panel) and Current Prediction (Right Panel)





Figure 21: 36-month ARIMA Model for US Inflation: Prediction from Q3 (Left Panel) and Current Prediction (Right Panel

Figure 22: Effective Federal Funds Rate, 2010-Present



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

Macroeconomic Indicators: Other

The Real GDP of the United States is still growing, although we did experience two periods of negative quarter-over-quarter growth for the real GDP between 4Q2021 and 1Q2022 and 1Q2022 and 2Q2022. Although the definition of a recession isn't technically tied to this metric, it is important to note that the US real GDP did 'freeze' at the beginning of last year. The size of this negative growth is comparable to what we saw in this same period in 2011 and 2014 and isn't a concern by itself. When we look at this trend in conjunction with the high inflationary element of the economy, the lack of labor-force

participation, and the depressed market returns for the last year (-18% returns for the S&P for 2022), we *conclude that the US is operating in a growth recession.*



Figure 23: US Real Nominal Average Hourly Wages for Selected Industries

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

Figure 24: Y/Y Change in Real GDP



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



Figure 25: Y/Y Change in Real GDP

Figure 26: Q/Q % Change in Real GDP



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

Figure 27 and Figure 28 identify capacity utilization and industrial production have reached and surpassed pre-pandemic levels. We will need to keep a closer eye on these trends; historically, downward trends in these indicators are consistent with economic recessions.

Figure 27: Capacity Utilization



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



Figure 28: Industrial Production Index

Inflations & Real Wages

Figure 29 and Figure 30 show national overall average real wages, and national average real wages by industry. The real wages for the US have shown a continued downward trend. Although nominal wages are increasing slightly, the buying power of those wages have decreased significantly as the result of the near double-digit inflation. The construction sector and the manufacturing sector are showing slight upward trends in real wages. There is some concern that the US might be heading caught in an inflation-wage spiral – where overall inflation has upward pressure on wages, which, in turn, puts upward pressure on prices, which leads to more wage inflation. There is little evidence that the entire economy is caught in a wage-inflation web. Rather, there seems to be some wage inflation in a select number of industries. Most sectors are experiencing a decline in real wages.



Figure 29: Real Hourly Wages (Nationwide)

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



Figure 30: Real Hourly Wages for Select Industries (Nationwide)

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

Figure 31 and Figure 32 show the exchange rate between the dollar and the Euro and the dollar and the British Pound, respectively; the dollar is appreciating against both of those currencies. The political costs of changing prime ministers (following the turmoil of Prime Minster Boris Johnson), and the impact of the Russian-Ukraine conflict in Europe, has weakened the economies of the UK and of Europe, driving down the demand for Euros and Pounds relative to the dollar. Although the economic outlook of the US is not certain (and looks as if the US is either in a recession or headed towards one), the economic trends in the UK and Europe are no better. Although the appreciation of the dollar against these currencies may create opportunities for US foreign travel, the most likely impact will be in decreasing US exports to the UK and Europe.

Farmers are currently concerned about possible export bans of GMO corn to Mexico¹⁴ and additional soft demand for US agricultural products that could create a depressed situation in the Midwest farming communities. We believe that as the Midwest goes, so goes the rest of the United States. A decrease in farming exports will result in a decrease in the prices of corn and other US crops, placing downward pressure on farm revenues and increasing the likelihood of farm loan default. This scenario plays into the prediction that the US is either in or headed towards an economic slowdown.

¹⁴ https://www.kcur.org/news/2021-10-20/the-u-s-agriculture-secretary-says-mexicos-gmo-ban-wont-hurt-corn-exports





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



Figure 32: British Pound Sterling / US Dollar Spot Rate (BPS per USD)

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

Unemployment and Labor Force Participation

Although the current unemployment rate (3.6%) is nearly as low as the month before the start of the pandemic (3.5%, March 2020), the employment situation is still unstable and is a continued cause for concern. The labor force participation rate (Figure 34) has not reached pre-pandemic levels. The differences in the labor force participation rate across genders and races () shows that only black men and Hispanic men have surpassed their participation rates prior to the pandemic.

We do believe that, with the fear of the US slipping into a recession and the declines in the equities and crypto currency markets, *we are going to see an increase in the labor force participation rate*. Recent stories of rescinded offers¹⁵ and layoffs by Ford¹⁶, Stanley Black & Decker¹⁷, Peloton¹⁸, and Goldman Sachs¹⁹ is likely to push "potential" employees (those on the fence) back into the labor market. The labor market participants have continued to be stubborn; we anticipated that 'former' labor market participants would have made their re-entrance into the market after the omicron variant. The concern for this market, however, is that labor market hold-outs will enter back into the market as the economy is falling into a recession. In this case, the labor demand will be falling just as labor supply starts to uptick. This would not be a surprise given how asynchronous and out-of-step the labor market seems to be. (See Figure 36 and Figure 37.)





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

¹⁵ https://www.efinancialcareers.com/news/2022/09/revolut-graduates, https://www.wsj.com/articles/the-surprise-in-a-faltering-economy-laid-off-workers-quickly-find-jobs-11661333405, and https://www.nytimes.com/2022/09/07/technology/recruiters-tech-layoffs.html
¹⁶ https://www.wsj.com/articles/ford-confirms-layoffs-says-it-is-cutting-about-3-000-jobs-primarily-in-u-s-and-canada-11661180161

¹⁷ https://www.wsj.com/articles/stanley-black-decker-cuts-about-1-000-finance-jobs-as-part-of-cost-savings-drive-11664568393

 $^{^{18}\} https://www.wsj.com/articles/peloton-to-cut-another-500-jobs-in-last-bid-for-turn around - 11665011471$

¹⁹ https://www.wsj.com/articles/goldman-sachs-plans-to-cut-hundreds-of-jobs-11663002265



Figure 34: US National Labor Force Participation Rate



Figure 35: US National Labor Force Participation Rate per Race & Gender

Figure 36: US Employment to Population Ratio (%)



Figure 37: Employment Level (Nationwide)

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



Disruptive ("Black Swan") Events

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

- 1. Biological Events: The world has seen a number of new "Influenza-Like Illnesses" (ILI), with the latest now directly affecting virtually every country on the global in a crippling fashion.
 - A. SARS (2002 & 2004)
 - B. "Swine flu" (H1N1, 2009)
 - C. "Avian flu" (H5N1 in 1997; H7N9 in 2013; H5N6 in 2014; H5N8 in 2016)

D. COVID-19 (2019-2022), with several different strains (most recently, "Omicron") While questions during the handling of the COVID-19 emergency have shone a light on the globe's ability to address a new pathogen under pressure, any answer is still a function of the contagiousness of the pathogen. Depending on how quickly a new pathogen spreads, along with its incubation period and symptoms, could mean the difference between survival and massive devastation.

As China announces the loosening of their well-known "zero COVID" policies²⁰, likely destination countries prepare for an onslaught of tourists that may or may not have been immunized in parity with citizens²¹.

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 networks²². 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.

Russia has been found to be leveraging social media networks in order to sow distrust of Ukrainian refugees internationally²³.

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

²¹ Consider https://www.reuters.com/world/us-weighs-new-covid-rules-travelers-china-us-officials-say-2022-12-28/,

²⁰ https://www.washingtonpost.com/world/2022/12/27/china-covid-restrictions-eased/

https://www.washingtonpost.com/world/2022/12/28/china-reopening-travel-japan-restrictions/, and https://www.reuters.com/world/us-state-dept-says-toll-covid-china-concern-world-2022-12-19/

²² See https://www.nytimes.com/2020/09/01/technology/facebook-russia-disinformation-election.html

²³ Per https://www.oecd.org/ukraine-hub/policy-responses/disinformation-and-russia-s-war-of-aggression-against-ukraine-37186bde/ and https://www.washingtonpost.com/technology/2022/12/08/russian-disinfo-ukrainian-refugees-germany/

demand a ransom to restore access."²⁴ 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)²⁵. 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.

Per TechCrunch²⁶, "Despite this action, 2022 looks set to top last year as the worst year on record for ransomware attacks; a recent report shows that attacks have increased by 80% year-over-year and that the cybercriminals responsible for these attacks have easily dodged law enforcement action by taking advantage of ransomware as a service, or by simply rebranding."

- 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 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.²⁷
- 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 diversity²⁸ and wage protection²⁹, 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.

While rumors abound, President Biden's personal physician says that he is generally healthy³⁰. It is not clear if Biden will run for President in 2024 as an octogenarian³¹; if he does not run in 2024, it is similarly unclear if Vice President Harris will run in his stead, or if another candidate will emerge.

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 goods³². Notice that the Suez, the Panama Canal, the Strait of Hormuz, and the

 $^{27} See https://www.npr.org/2020/11/05/931829801/election-dispute-increases-risk-of-political-violence-analysts-warn\ ,$

²⁴ See https://us.norton.com/internetsecurity-malware-ransomware-5-dos-and-donts.html

 ²⁵ See https://security.berkeley.edu/faq/ransomware/ and https://securityintelligence.com/articles/6-ransomware-trends-2020/
 ²⁶ https://techcrunch.com/2022/11/18/combatting-ransomware

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/

²⁸ See, e.g., https://www.huffpost.com/entry/kamala-harris-vice-president-nominee-dnc_n_5f36f56bc5b69fa9e2fb7862

²⁹ See, e.g., https://www.shrm.org/resourcesandtools/hr-topics/benefits/pages/where-kamala-harris-stands-on-workers-pay-and-benefits.aspx

³⁰ https://www.whitehouse.gov/wp-content/uploads/2021/11/President-Biden-Current-Health-Summary-November-2021.pdf

³¹ See https://www.cnn.com/2022/09/25/politics/joe-biden-2024-run-democrats/index.html

³² See https://www.businessinsider.com/toilet-paper-coffee-products-delayed-suez-canal-blockage-impact-2021-3

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).³³

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 & Nevis³⁴. Ecuador, Senegal, and China have canceled or withdrawn their currencies³⁵.

Despite the hammering that cryptocurrencies have taken during 2022³⁶, and the dramatic collapse of FTX³⁷, many still believe in the basic tenets³⁸.

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

³³ See https://www.dw.com/en/suez-canal-blockage-4-of-the-biggest-trade-chokepoints/a-57020755

³⁴ https://www.atlanticcouncil.org/cbdctracker/

³⁵ Ibid.

³⁶ https://www.cnbc.com/2022/07/01/bitcoin-btc-posts-worst-quarter-in-more-than-a-decade-5-reasons-why.html

³⁷ https://www.cnbc.com/2022/12/13/live-updates-ftx-collapse-house-lawmakers-hold-hearing-following-arrest-of-founder-sam-bankmanfried.html

³⁸ https://www.coindesk.com/consensus-magazine/2022/12/20/10-predictions-for-the-future-of-crypto-in-2023/

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 following³⁹:

- 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)

³⁹ This study is motivated by the Federal Reserve Board's Dodd-Frank Act, which includes requirements to consider various international factors; however, those factors will not be discussed extensively in this particular report based on the target use and audience of this report.

Our procedure is as follows:

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

Correlations

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

Regression (Dependent) Variable		Independent Variable ⁴⁰	
Real GDP Growth		Nominal GDP Growth	
Prime rate		3-year Treasury yield [*]	
1-month, 3-year, and 5-year Treasury yield		1-year Treasury yield	
3-month, 6-month, 7-year, and 10-year Treasury yield	depends on	3-year Treasury yield*	
30-year Treasury yield		7-year Treasury yield [*]	
30-year Mortgage rate		3-year Treasury yield [*]	
Moody's BAA yield		30-year Mortgage rate [*]	
US Residential Home Price Index		Commercial Real Estate Price index	

Table 14: Variable Dependencies

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.

⁴⁰ It should be immediately apparent that some of the variables that are listed as "independent" are, in fact, dependent on other variables; these "independent" variables that actually have dependencies are noted by a trailing "*".

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

Analysis

GDP is driven by several factors:

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

Real GDP rose by 0.8% during 3Q2022, after dropping by 0.14% during 2Q2022⁴¹. As mentioned, rising prices are still the main issue facing the US economy. There are several causes of the increasing prices depending on the specific sector being discussed. Many sectors have been impacted by increased costs of raw materials and the demands of a churning workforce. The food sector has been affected by rising labor costs, costs of supplies, and transport labor costs. Energy costs have been similarly affected along with changes due to supply and demand.

We continue to believe that the effects of significant inflation are going to continue through most of **2023**. Employee retention and churn cannot help but impact sales, as personnel changes affect productivity, and relationships between businesses and customers. 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 US inflation will average 5.5% through 2023, possibly dropping to as low as 4% in 2024,** and **real GDP growth rates during 2023 and 2024 will most likely come in at no more than 0.75%** (Q/Q).

	1Q2022	2Q2022	3Q2022
Personal Income Growth, Q/Q	0.75%	1.2%	1.3%
Disposable Personal Income Growth, Q/Q	1.0%	1.2%	1.3%
Personal Consumption Growth, Q/Q	2.2%	2.3%	1.6%
CPI Growth for All Urban Consumers (i.e., Inflation): All Items in U.S. City Average, Q/Q (Y/Y)	2.2% (8.0%)	2.5% (8.6%)	1.4% (8.3%)

Table 2: Personal Income, Disposable Personal Income, Personal Consumption, and CPI Growth Rates (Q/Q) for 2022⁴²

From the data in Table 2, while personal income has grown super-linearly (albeit modestly), CPI growth has consistently outstripped that growth. In contrast, personal income growth and disposable personal income growth have approximately mirrored each other. Finally, while personal consumption has seen consistently higher growth than income, it appeared to be starting to waver during 3Q2022. **Given the estimated \$2.7T of savings that were held as of January 2022⁴³**, which was estimated as being

⁴¹ https://fred.stlouisfed.org/series/gdpc1

⁴² See https://fred.stlouisfed.org/series/PI, https://fred.stlouisfed.org/series/DSPI, and https://fred.stlouisfed.org/series/PCE

⁴³ https://www.wsj.com/articles/americans-tap-pandemic-savings-to-cope-with-inflation-11657013400

between \$1.2T and \$1.8T as of mid-year 2022⁴⁴ (nearly a 50% decline), it should not be a surprise that personal consumption is on the decline (and the backlogged savings are expected to be significantly depleted during 1H2023⁴⁵).

The US' net trade deficit was approximately \$70B during 3Q2022, a change of almost 20% Q/Q^{46} . Through 3Q, the trade deficit was volatile with continued recovery from COVID in the Far East, and economic issues starting to rear its head. More recently, the strength of the US dollar as compared to other currencies is expected to help stifle the deficit. Also, due to the global economic uncertainty, we expect global growth to continue slowing, which will drag on exports

Other Commentary

- "The narrowing of the trade deficit between March and August contributed to real GDP growth in the third quarter, but October data suggest that a reversal of that trend is on tap. While the trade deficit will be a drag on GDP growth, it will also help temper inflation in the Unites States." (https://www.kiplinger.com/economic-forecasts/trade-deficit, Dec. 16, 2022)
- " 'Cooling inflation will boost the markets and take pressure off the Fed for raising rates, but most importantly this spells real relief starting for Americans whose finances have been punished by higher prices,' said Robert Frick, corporate economist with Navy Federal Credit Union. 'This is especially true for lower-income Americans who are disproportionately hurt by inflation.' " (https://www.cnbc.com/2022/12/13/cpi-inflation-november-2022-.html, Dec. 13, 2022)

Employment

Analysis

With the post-COVID economic crisis unfolding over the past several months, the effect of a significant portion of the population's interest waning is starting to be felt. Changes in borrowing rates during 2022, intended to cause unemployment to increase, do not seem to have significantly affected employment per the BLS' surveys. (See Table 2, and Figure 38 through Figure 40.)

Date	Population	Employment-	Labor Force Level	US Unemployment %
	(Adult Civ. Noninst.)	Population ratio		
Feb. 2019	258.4M	60.7%	163.0M	3.8%
May 2019	258.9M	60.6%	162.8M	3.7%
Aug. 2019	259.4M	60.8%	163.8M	3.7%
Dec. 2019	260.2M	61.0%	164.7M	3.6%
Pre-COVID Rate	+ ~2M/yr	+ 0.3%/yr	+ ~1.5M/yr	
Feb. 2022	263.3M	59.8%	163.9M	3.8%
May 2022	263.7M	60.0%	164.3M	3.6%
Aug. 2022	264.2M	60.1%	164.7M	3.7%
Dec. 2022	264.8M	60.1%	165.0M	3.5%

Table 3: US Population, Employment-Population ratio, Labor Force Level, and Unemployment Rate % during 2019 & 2022

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

45 Ibid.

⁴⁴ https://www.wsj.com/articles/as-savings-slowly-shrink-consumer-spending-is-on-borrowed-time-11668956403

⁴⁶ https://fred.stlouisfed.org/series/BOPGSTB and https://www.census.gov/foreign-trade/Press-Release/current_press_release/ft900.pdf
Figure 38: US Unemployment Rate per County



Figure 39: US Employment and Unemployment



Figure 40: US Employment to Population Ratio (%)



Nor have the announcements of headcount reductions by dozens of firms appeared to make an impact. For instance, Amazon, CNN, Salesforce, Cisco, DoorDash, Redfin, Meta, Twitter, Zillow, Pratt & Whitney, Morgan Stanley, Stellantis, AMC Networks, Hewlett-Packard, and Stitch Fix have all announced substantial layoffs and cutbacks over the past year (most in 2H2022)⁴⁷. Similarly, the number of open positions appears to have peaked as of July 2022, and is now on the decline⁴⁸.

While the FOMC has said that it will slow the pace of interest rate increases during 2023 pending data that supports its hypotheses, the message is that the impending rumor of a recession (induced by the FOMC) has generated the expected press announcements. However, we are still waiting for the data to bear out that individuals and companies are, indeed, no longer spending as much money as during the 2020-2021 period, and, indeed slowing the rate of inflation.

One example of a sector that has been struggling with multiple economic forces, large-scale restaurant businesses have generally accumulated significant debt while weathering the COVID pandemic, and are now looking for ways to pay down that debt through improving efficiencies (and avoiding increased operational costs). The shrinking labor force and increasing demands by workers are pressing large scale operations to consider new options at the almost 200,000 fast food restaurants in the US⁴⁹.

 $https://intellizence.com/insights/layoff-downsizing/major-companies-that-announced-mass-layoffs/\ , and the second seco$

⁴⁷ See https://mondo.com/insights/mass-layoffs-in-2022-whats-next-for-employees/, https://news.crunchbase.com/startups/tech-layoffs-2023/, https://www.businessinsider.com/layoffs-sweeping-the-us-these-are-the-companies-making-cuts-2022-5,

https://www.forbes.com/sites/brianbushard/2023/01/04/amazon-reportedly-cutting-17000-jobs-as-major-layoffs-continue-into-2023/ ⁴⁸ https://data.bls.gov/timeseries/JTS000000000000000JOL

⁴⁹ https://www.ibisworld.com/industry-statistics/number-of-businesses/fast-food-restaurants-united-states/

Specifically, McDonald's⁵⁰ and other fast-food franchises are moving closer to automating an increasing amount of their retail operations⁵¹. Considering that these restaurants employ an average of just under 20 people each⁵², eliminating just half of those jobs would have a serious impact on the economy. Adding coffee shops (38,411 in the US⁵³, with about 10 people each⁵⁴), doughnut shops (over 13,000 in the US in 2021⁵⁵) and a few other industries, and the impact of automation in the manufacturing industry in the 1980s and 1990s, could reoccur and generate significant turmoil in the food service industry (potentially shedding over 2.5M low skill jobs) in the next 2-4 years.

In 2020, on average, 56.8% of workers changed jobs; in 2021, that fraction was 47.2%; these numbers are historically higher in the South, and lower in the Northeast; these figures are at or above typical prepandemic figures. See Figure 41.



Figure 41: Annual Total % Separations by Region

Source: https://www.bls.gov/news.release/jolts.t16.htm

⁵⁰ https://www.dailydot.com/irl/mcdonalds-automated-drive-thru/

⁵¹ See https://www.wsj.com/articles/krispy-kreme-outlines-plans-to-automate-doughnut-production-reduce-debt-11671231210 and https://www.cnbc.com/2022/12/27/restaurant-chains-are-investing-in-robots-bringing-change-for-workers.html

⁵² Ibid.

⁵³ https://www.statista.com/topics/1670/coffeehouse-chain-market

⁵⁴ https://coffeeshopstartups.com/how-many-baristas-do-you-need-to-hire/

⁵⁵ https://www.usatoday.com/story/money/2021/02/13/best-donut-shop-in-every-state-doughnuts-near-me/43378973/

Figure 42: Unemployment Rate per US SE MSA



Figure 43: US Employment Level by Industry







Figure 45: Hourly Wages per Industry







Per Figure 42, we see that Memphis' and Houston's respective unemployment rates exceeding that of New Orleans; Memphis' industries are driven by Healthcare, Transportation, Retail, Education, Manufacturing, and Hospitality,⁵⁶ including headquarters for Fedex, ServiceMaster, International Paper, and AutoZone, while Houston focuses on Energy, Healthcare, Chemical Manufacturing, and other technology spaces⁵⁷, and New Orleans' primary industries are Government, Hospitality, Education, Healthcare, and Business Services⁵⁸. Birmingham and Atlanta⁵⁹, which are focused on Banking, Retail, Trade, Healthcare, and Business Services, are at the lower end of the unemployment spectrum.

In Figure 43, we continue to see that Hospitality and Leisure is a growing sector, with many other sectors remaining flat. The unemployment rate for low-skilled workers appears to have rebounded in December after a drop in November per Figure 44. And, while nominal wages appear be continuing to grow, buying power is not significantly changed, at or below pre-pandemic levels (per Figure 45 and Figure 46).

Other Commentary

• "Primarily, the Fed is looking to bridge a gap between demand and supply. As of November, there were about 1.7 job openings for every available worker, an imbalance that has held steady despite the Fed's rate hikes. The strong demand has pushed wages higher, though they mostly

⁵⁶ See https://statisticalatlas.com/place/Tennessee/Memphis/Industries

⁵⁷ https://statisticalatlas.com/place/Texas/Houston/Industries

⁵⁸ https://statisticalatlas.com/metro-area/Louisiana/New-Orleans/Overview

⁵⁹ https://statisticalatlas.com/metro-area/Alabama/Birmingham/Industries and https://statisticalatlas.com/metro-

area/Georgia/Atlanta/Industries

haven't kept up with inflation." (https://www.cnbc.com/2023/01/06/jobs-report-december-2022-nonfarm-payrolls-rose-223000-in-december-as-strong-jobs-market-tops-expectations.html; Jan. 6. 2023)

"Fifty-two percent of respondents to an April 2022 survey by employee management software platform Lattice who had been at their job for three months or fewer said they're actively trying to leave. For those who'd been in a job for three to six months, that figure jumped to 59%. ... Nearly three-quarters (74%) of all 2,000 respondents said they'd leave their current role—regardless of how long they've been there—in the next six to 12 months. In 2021, only 47% said the same." (https://fortune.com/2023/01/05/gen-z-millennials-rage-applying-salary-raises/; Jan. 5, 2023)

Federal Funds (Primary Credit) Rate

Analysis

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

The FOMC was on a sprint to raise interest rates post-pandemic, in order to control prices; rates were raised seven times in 2022, putting the target overnight lending rate between 4.25% and 4.5%⁶⁰. Per Figure 47 and Figure 48, the FOMC has recently adjusted their belief that they will need to raise rates to slightly above 5% by the end of 2023. *We believe that the target overnight lending rate will rise to at least 5% by the end of 1H2023* due to a few reasons:

- 1. The amount of saved capital (by individuals and corporations) appears to be slowing the responsiveness of the market to the Fed's rate increases. While the need to cut spending appears to have been embraced by some parts of the market (based on the notable number of layoff announcements), cutbacks do not seem to be as impactful as the FOMC would like.
- 2. Given that the FOMC is assuming that slowed spending is indicated by a change by a point or more in the US unemployment rate⁶¹, we need to consider the reliability of that assumption. At the current time, there are over 1.7 advertised openings per unemployed person in the US⁶² (i.e., significant employment alternatives for disenchanted or laid-off workers, fueled by the previously mentioned corporate savings). Given the current acceptance of employment churn

⁶⁰ See https://time.com/nextadvisor/banking/fed-meeting-interest-rate-hike-december-15-2022/ and https://fred.stlouisfed.org/series/DFF ⁶¹ See, e.g., https://www.reuters.com/markets/us/fed-forecasts-show-fraying-faith-soft-landing-2022-09-21/ and

https://finance.yahoo.com/news/larry-summers-along-inflation-ominous-193034057.html

⁶² Per https://fred.stlouisfed.org/graph/?g=p9aA

that currently exists in the market⁶³, and the willingness of employees to "trade up" for more appealing opportunities (based on perceived future inflation, per Figure 49), it is not clear that the layoffs that have been announced will significantly affect the US unemployment rate. The point of this is to question whether the FOMC will perceive any change in spending until the number of advertised openings (across multiple sectors) drops substantially, *and* unemployment increases; further, the number of advertised openings will likely not decrease until savings are eroded over the previously discussed period of six to twelve months.

Given these concerns, it is extremely unclear whether the overnight lending rate will peak during 2023.



Figure 47: FOMC "Dot Plot" from September 2022 Board of Governors' Meeting

Source: https://www.federalreserve.gov/monetarypolicy/files/fomcprojtabl20220921.pdf

63 https://www.bls.gov/news.release/jolts.t16.htm



Figure 48: FOMC "Dot Plot" from December 2022 Board of Governors' Meeting

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

Figure 49: US Consumer Inflation Expectations



Inflation Expectation (per Univ. of Michigan)

Figure 50 shows the relationship that has existed historically between the Federal Funds rate and the 3-year T-bill yield.



Figure 50: Primary Credit, as a function of 3-year Treasury yield

Source: Authors' calculation

Other Commentary

- "The minutes [from the Dec. 13-14 FOMC policy meeting] strongly hint that the Fed will raise
 rates again when they next set rates on February 1. Also, it is important to note that even
 though we may be close to the top of the rate cycle, the Fed does not see rates coming down in
 2023." (https://www.forbes.com/sites/simonmoore/2023/01/04/fed-minutes-hint-at-optimismon-inflation-but-forecast-high-rates-for-2023/; Jan. 4, 2023)
- "... Bank of America Securities predicts the Fed will raise interest rates to a range of 5% to 5.25% before pausing. ... After the 50 bps rate hike in December, that means the Fed would be able to increase fed funds by another 75 bps in 2023. ... Conceivably, it could accomplish this by its second meeting of the year on March 21-22, which would mean the May 2023 FOMC meeting would be the first one without a rate hike in more than a year. ... But a soft landing scenario is only possible if inflation finally breaks. ... The second scenario foresees inflation becoming entrenched in the economy, requiring the Fed to implement even higher interest rates, significantly damaging the economy along the way."
- (https://www.forbes.com/advisor/investing/fed-outlook-2023/; Dec. 15, 2022)
 "Fewer than half of the economists [surveyed Dec. 2-7, ahead of the FOMC's Dec. 13-14 meeting,] are looking for rate cuts in 2023. Those who do are looking for the unemployment
- rate to jump to 5% from 3.7%, and most see rising joblessness and recession as the major cause

of the reversal." (https://www.bloomberg.com/news/articles/2022-12-09/fed-s-peak-rates-for-longer-seen-dashing-hopes-for-2023-cuts; Dec. 9, 2022)

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

Analysis

Figure 51 shows how the yield curve for T-bill's has evolved over the past 18 months. Rates were relatively moderate during 2021 as the market recovered from its COVID-induced returns. As inflation reared its head with US markets reopening, rates have generally increased, and short term rates have peaked, leaving some inversion in the yield curve while the market has come to grips with inflation and the FOMC's policies.

We think that yields will continue to rise until overnight lending rates stabilize. Once rates (and equity prices) stabilize, and we expect that bond yields will fall slightly. Corporate valuations will be off until employment stabilizes, which will affect bond prices that are found in the market. Safety motivated bond investors will be looking for yields that will guarantee some positive return (once offset by inflation), so a "pinch point" will continue to optimize around the 1-year maturity until it is proven that the FOMC has found a way through the inflationary forest. Unfortunately, it will likely require 12 to 24 months to prove that path as having been found.

Figure 51: Treasury Yield Curves based on maturity duration



Figure 52 through Figure 61 shows the relationships that have existed historically between the yields of Treasury bonds with differing maturities.

Other Commentary

- "US interest-rate strategists mostly expect that Treasuries will extend their recent rally, dragging yields lower and steepening the curve in the second half of 2023 so long as labor market conditions soften and inflation ebbs." (https://www.bloomberg.com/news/articles/2022-12-30/treasury-strategists-expect-lower-yields-steeper-curve-in-2023; Dec. 30, 2022)
- "Market experts surveyed by Bankrate expect Treasury yields to slightly increase over the next 12 months as the Federal Reserve continues to hike interest rates as part of its plan to bring down inflation. The Fourth-Quarter Market Mavens survey found that investment professionals see the 10-year Treasury yield at 3.8 percent a year from now, up from 3.58 percent at the end of the survey period on Dec. 9, 2022. (https://www.bankrate.com/investing/market-mavenssurvey-bonds-december-2022/; Dec. 15, 2022)



Figure 52: 1-month Treasury yield rates, as a function of 1-year Treasury yield rates

Source: Authors' calculation



Figure 53: 3-month Treasury yields, as a function of 3-year Treasury yields

Figure 54: 6-month Treasury yields, as a function of 3-year Treasury yields





Figure 55: 3-year Treasury yields, as a function of 1-year Treasury yields

Figure 56: 5-year Treasury yields, as a function of 1-year Treasury yields





Figure 57: 7-year Treasury yields, as a function of 3-year Treasury yields

Figure 58: 10-year Treasury yields, as a function of 5-year Treasury yields





Figure 59: 20-year Treasury yields, as a function of 7-year Treasury yields

Figure 60: 30-year Treasury yields, as a function of 7-year Treasury yields





Figure 61: 30-year Treasury yields, as a function of 7-year Treasury yields

30-year Mortgage Rate

Analysis

30-year fixed rate mortgages have been historically driven by mid-range (i.e., 7- to 10-year) treasury note yields, which are, in turn, affected by overnight lending rates. As the FOMC has raised overnight lending rates, so have banks raised mortgage rates. Daily 30-year fixed mortgage rates peaked at 7.08% in November 2022, and are 6.5% as of this writing⁶⁴. (See Figure 62.) The one point to note is our previous observation concerning the current inversion of yield curve around the 24-month maturity.

If Chairman Powell and the FOMC is willing to increase overnight lending rates to the 5.0% mark that we have previously suggested, *we still believe that mortgage rates could be as high as 8.0% by YE2023.* The effect of this would be to continue to stifle the housing market, and impact adjustable-rate mortgage and balloon mortgage holders.

Figure 63 shows the historical relationship between the US mortgage rate and Treasury bond yields.

⁶⁴ https://fred.stlouisfed.org/series/MORTGAGE30US





Figure 63: 30-year fixed rate mortgage rates, as a function of 3-year Treasury yields



Source: Authors' calculation

Other Commentary

- "Though home prices have retreated as demand has declined, they are still nearly 11% higher than a year ago. Higher prices and a doubling of mortgage rates have made homebuying much less affordable for many people." (https://apnews.com/article/inflation-business-mortgages-9081f7ed3008e0c56c7ddf237c65f578; Jan. 12, 2023)
- "Mortgage rates will likely ease further. 30-year fixed-rate loans are around 6.4%, after peaking at 7.1% in early November, while 15-year fixed-rate loans are around 5.7%. Mortgage rates are reacting to the recent decline in the 10-year Treasury yield, though they are still about a full percentage point higher in relation to the 10-year Treasury than would normally be expected. Mortgage rates tend to stay higher for longer when inflation is high, whereas Treasury rates tend to be more sensitive to signs of economic slowing." (https://www.kiplinger.com/economic-forecasts/interest-rates, Jan. 9, 2023)

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. BAA yields have historically tracked with AAA yields, with approximately 25 to 35 bp additional return to compensate for the risk associated with the BAA instruments. We would not be surprised to see that spread increase if the FOMC cannot manage the current inflation levels very quickly.

Capitalytics' quantitative models see AAA yields vascillating over the next several years around 4% to 4.25% until 2026. *We anticipate that AAA & BAA debt yields will need to appreciate more quickly than that (possibly crossing 5.0% briefly by YE2023), and will then rebound to current levels by YE2025 before stabilizing, if inflation is checked with 5.0% rates.* If inflation cannot be controlled by YE2023, AAA & BAA yields will increase beyond that target to remain competitive with other investment options.

See Figure 64 and Figure 65 for how Moody's AAA and BAA have tracked with other metrics.



Figure 64: Moody's AAA-grade investment yields, as a function of CCAR-published BBB-grade investment yields

Figure 65: Moody's BAA-grade investment yield, as a function of 30-year fixed rate mortgage rates



Other Commentary

- "Corporate high-yield bond rates have also peaked for the moment. AAA bonds are yielding 4.6%, BBB bonds, 5.7%, and CCC-rated bond yields are at 15.4%."
 (https://www.kiplinger.com/economic-forecasts/interest-rates; Jan 9, 2023)
- "Based on how much spreads have widened over the past year, it appears the corporate-bond market is already pricing in a mild recession and a slightly higher default rate. In our view, corporate bonds are poised to perform much better in 2023 as credit spreads already incorporate a weak economy and long-term interest rates are expected to begin declining in the second half of the year." (https://www.morningstar.com/articles/1129526/where-to-invest-inbonds-in-2023; Dec. 14, 2022)

Prime Rate

Analysis

The Prime Rate has historically been very tightly coupled to overnight lending rates, and the yields for very short-term Treasury Bills. As of this writing, the Prime Rate is 7.5%⁶⁵ with the Federal Funds Effective Rate being 4.33%. *We believe that trend will continue*, with the Prime Rate tracking with overnight rate increases. In other words, as the FOMC increases overnight lending rates, the Prime Rate will be comparably affected. As such, *we believe that it is likely that the Prime Rate will reach 8.5% by YE2023*, given our previous speculation about the Federal Funds Rate (see Figure 66).

65 See https://fred.stlouisfed.org/series/DPRIME



Figure 66: US Prime Rate, as a function of 1-year Treasury yield

US Average Retail Gasoline Price

Analysis

Changing gasoline prices have been the most obvious sign to consumers about the recent changes to inflation rates (see Figure 67). The US average retail gasoline price for regular unleaded gasoline is \$3.29/gallon⁶⁶ at the time of this writing, which is actually within a few percentage points of where it was one year ago. However, since then, retail gasoline prices peaked during June 2022 at over \$5/gallon⁶⁷.

Several trends became significant during the COVID pandemic that appear to be gaining momentum, and will help control retail gasoline prices.

 Work-from-home: WFH trends appear to have had an impact on vehicle miles driven in the US. Historically peaking in July, miles driven during 2018 peaked at 291M during July, and in 2019 at 293.3M during August. During 2021, they peaked at 296M in July (with the explosion of pent-up demand being released by the public). However, miles peaked at 289.3M in August⁶⁸. As WFH was increasingly adopted during COVID, it has become a sought-after benefit of some

⁶⁶ https://gasprices.aaa.com/

⁶⁷ Ibid.

⁶⁸ https://fred.stlouisfed.org/series/TRFVOLUSM227NFWA

employers. Many employees even claim that they will demand it due to its impact on work-life balance, the environment, and productivity⁶⁹.

- 2. EV technology: Electric vehicle technology has seemed to hit a "tipping point" (647 EVs sold in 2021, a 13x increase over 2012⁷⁰) with most major manufacturers adopting a stance of some or all of their portfolio turning from petroleum to electric based in the next few years. (For example, General Motors announced a year go that they intend to stop making gas-powered vehicles by 2035⁷¹.) Much of the momentum behind this stance is not domestically driven, as the US is actually a laggard in the widespread adoption of electric vehicles. However, when gas hit \$5/gallon in the summer of 2022, strong EV sales were seen, and electric cars are now viewed as an eventual outcome.
- 3. Tax incentives: Tax money has been widely publicized to become available to many EV buyers as part of President Biden's new climate bill, passed in 2022⁷², even though it appears that the fine print may hinder some purchases from qualifying. Additionally, the DOT has moved ahead with a \$5B plan for government subsidies to help states build out electric charging networks⁷³.

For these reasons we expect to see a slight to moderate decline in petroleum fuel demand over a relatively long horizon. As Russian oil has been re-accepted (with caveats) in international markets, and forecasters are back-pedaling on the expected harsh 2022-23 winter (meaning lower demand for different petroleum formulations)⁷⁴, we expect for prices to drop significantly. West Texas Intermediate crude is selling below \$90/barrel as of this writing (per Figure 68).

- ⁷³ https://highways.dot.gov/newsroom/biden-harris-administration-announces-approval-first-35-state-plans-build-out-ev-charging
- ⁷⁴ https://oilprice.com/Energy/Natural-Gas/Europes-Warm-Winter-May-Not-Be-Such-Good-News-For-Energy.html

⁶⁹ https://www.indeed.com/career-advice/career-development/benefits-of-work-from-home-for-employers

⁷⁰ https://environmentamerica.org/articles/youre-not-imagining-it-there-are-more-evs-on-the-road-today-and-even-more-are-on-their-way/
⁷¹ https://www.cnbc.com/2021/01/28/general-motors-plans-to-exclusively-offer-electric-vehicles-by-2035.html

⁷² https://www.npr.org/2023/01/07/1147209505/electric-car-tax-credit-climate-bill-tesla-volkswagen-ev

Figure 67: Crude Oil vs Retail Gasoline Prices



Figure 68: Global crude oil prices



Other Commentary

- "We forecast retail gasoline and diesel prices will decline in 2023 and 2024, according to our latest Short-Term Energy Outlook (STEO), after reaching multiyear highs in the first half of 2022. We forecast that retail prices for regular-grade gasoline will average \$3.32 per gallon (gal) in 2023 and continue to decrease to average \$3.09/gal in 2024, down from \$3.96/gal in 2022. ... These forecast price decreases are based on our expectation of lower demand growth for diesel and motor gasoline with continued high production of those products." (https://www.eia.gov/todayinenergy/detail.php?id=55179; January 12, 2023)
- "The U.S. Energy Information Administration said the upcoming European Union ban on seaborne imports of petroleum products from Russia on Feb. 5 could be more disruptive than the EU ban on seaborne imports of crude oil from Russia implemented in December 2022." (https://oilprice.com/Energy/Energy-General/Dont-Expect-A-Major-Rally-In-Oil.html; January 13, 2023)

House and Commercial Real Estate Price Indexes

Analysis

As the COVID pandemic has become increasingly controlled over the past 12 months, mortgage rates have more than doubled, As we mentioned, the US housing inventory has increased since its low in the Spring of 2022, and is now declining again based on typical seasonality (per Figure 69); this behavior is despite the Y/Y change in housing inventory is positive and increasing for the first time since the beginning of the pandemic (per

Figure 70). As we mentioned, this trend is likely to continue as the Federal Reserve Bank has stated⁷⁵ that its interest rate target changes are expected to be 75 basis points for no more than one more meeting, followed by a 50 bp increase during 2H2023. Along with home sales, new housing starts have decreased precipitously, though, with the chill in the market and closings, with builders "hunkering down" pending a warming of the market. Historically, at times like these, homeowners have used these opportunities to take on home improvement projects (although we question whether this will actually occur given the ample opportunities homeowners have had to do so over the past few years, and the expected tightening of liquidity).

Regarding commercial real estate, holders seem to be developing a sense of the businesses that will demand workers return to the office (an increasing number⁷⁶). Following Elon Musk's very public ultimatum to Twitter employees⁷⁷, and the fallout thereof, many companies appear to be pushing back on their employees' desires to work-from-home indefinitely. Many companies appear to be accommodating those perks to varying degrees, but the question of who exactly is allowed to do what is what is fueling the demand side of commercial real estate. Entities that rely on highly cohesive groups will be less likely to let go of as much of their floor space when compared to those that are comprised of more decoupled and independent workers in more urban areas. High interest rates will compel property owners to be more reticent in offering upgrades and letting go of leases in the pandemic's "jet wash".⁷⁸

⁷⁵ https://www.businessinsider.com/federal-reserve-interest-rate-hikes-double-sized-future-meetings-powell-2022-5 and ⁷⁶ https://www.wsj.com/articles/more-bosses-order-workers-back-to-the-office-as-job-market-shifts-11672689665 and https://www.northspyre.com/blog/the-return-to-the-office-trend-is-accelerating-on-the-east-coast

⁷⁷ https://www.washingtonpost.com/technology/2022/11/16/musk-twitter-email-ultimatum-termination/

⁷⁸ https://www.cbre.com/insights/books/us-real-estate-market-outlook-2023













National New Single Family Housing Starts

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

Other Commentary

- "High interest rates and a recession will make 2023 a challenging year for commercial real estate. Though inflation eased in late 2022, it was still running at more than 7%. The Fed will continue raising rates until it sees a marked reduction in inflation nearer to its 2% target. Weakening fundamentals and higher cost of capital will generally lower asset values." (https://www.cbre.com/insights/books/us-real-estate-market-outlook-2023; Dec. 13, 2022)
- "'The housing market will be tepid in 2023, with only lukewarm demand and a limited amount of inventory available for sale,' [Greg McBride, chief financial analyst for Bankrate,] predicts. However, 'mortgage rates could pull back meaningfully next year if inflation pressures ease.'" (https://www.bankrate.com/real-estate/housing-market-predictions-2023/; Jan. 3, 2023)



Figure 72: US Residential Home Price Index, as a function of US Commercial Real Estate Index

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 4, 4Q2022 has seen a small rebound, but 2022 has seen marked overall declines.

Period	Index Range ⁷⁹	Trading Days	Avg points/day
1Q2022 (1/1/2022-3/31/2021)	48634.31 → 45847.30	63	-44.2
2Q2022 (4/1/2022-6/30/2022)	45847.30 → 37976.52	63	-124.93
3Q2022 (7/1/2022-9/30/2022)	37976.52→ 36097.99	64	-29.4
4Q2022 (10/1/2022-12/31/2022)	36097.99 → 38520.60	61	39.7

We note in Table 5 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. During 4Q2022, we saw another bright spot in a weak year (we previously mentioned a decline of 18% during 2022). "Volatility" has been the word for both indexes, seeing multi-point swings daily on a regular basis during 2022, which we expect to continue.

⁷⁹ Index values found at https://www.marketwatch.com/investing/index/dwcf

Period	Index Range ⁸⁰	Trading Days	Avg points/day
1Q2022 (1/1/2022-3/31/2021)	4766.18 → 4530.41	63	-3.74
2Q2022 (4/1/2022-6/30/2022)	4530.41→ 3785.38	63	-11.82
3Q2022 (7/1/2022-9/30/2022)	3785.38 → 3585.62	64	-3.12
4Q2022 (10/1/2022-12/31/2022)	3585.62 → 3839.50	61	4.16

 Table 5: Approximate Quarterly Milestones for the Standard and Poor's 500 ("SP500") Index

We expect to see index levels continue to generally decline over the next several quarters as the economy "bottoms out". As long as short-term bond yields are as high as they are, and at least until the unemployment rate starts to significantly increase (current expectations are that unemployment needs to approach 5%), then the trading markets will likely continue to be volatile day-to-day. The VIX has continued to drop; it has now closed at 18.3, implying to some that the markets are due for another significant decline⁸¹.



Figure 73: SP500 Total Index, as a function of US Commercial Real Estate Index

Source: Authors' calculation

Other Commentary

• "We want to make one thing clear: our bearish trade on the S&P 500 is designed to profit from the index dropping over the next month or so. We are looking for a decline to 3,800 or 3,700 over the next month - that's it - beyond that we are not sure where the index will move - it will depend on the economic data inputs over the next few months, how the Fed reacts to this data,

⁸⁰ Index values found at https://www.marketwatch.com/investing/index/spx

 $^{^{81}\} https://seekingalpha.com/article/4570114-beware-the-vix-markets-likely-topped-out-for-now-spy-could-go-lower-spy-could-gy-spy-could-go-lower-spy-could-go-lower-spy-could-go-lo$

how much the jobs markets softens (or not), and when corporate earnings start to show a slope to the upside. ... Unless the Fed pivots earlier than expected, jobs numbers do not turn negative, and corporate earnings come in better than expected in Q1 2023, the S&P 500 is most likely going lower from here." (https://seekingalpha.com/article/4570114-beware-the-vix-markets-likely-topped-out-for-now-spy-could-go-lower; Jan. 16, 2023)

 "Now, if stocks continue to struggle—as many fear they will—people need ways to get paid to be long-term investors and to enhance returns. This is especially true as the Cboe Volatility Index, or VIX, edges higher, reflecting greater uncertainty about the stock market's near-term future." (https://www.barrons.com/articles/stock-market-options-buy-rent-51672872575; Jan. 5, 2023)

Regression Analyses

The following section document the linear regression coefficients found for each of the aforementioned variables, as a function of other variables (which are not significantly correlated with the control variable). With this report, we have also included the natural log and the square of all variables as experimental (dependent) variables; these variables are denoted by a "LN_" prefix and a "²" suffix below (respectively).

To compare the effectiveness of these regressions, we calculate the percentage error between the forecasted value (based on the given regression, using the values from the immediately preceding quarter) and the actual value for the period between 4Q2012 and 3Q2022, inclusive.

Variable	Min Abs. Error	Average Error	Max Abs. Error
Real GDP Growth	627.33%	***	***
Nominal GDP Growth	***	**	***
Real Disposable Income Growth	***	***	***
Nominal Disposable Income Growth	217.27%	***	***
Inflation	0.00%	**	***
Unemployment Rate	28.27%	-696.84%	***
1-month Treasury Yield	348.05%	**	***
3-month Treasury Yield	0.00%	-2.26%	***
6-month Treasury Yield	0.91%	43.00%	***
1-year Treasury Yield	1.59%	5.91%	817.74%
3-year Treasury Yield	2.15%	-88.90%	720.52%
5-year Treasury Yield	12.45%	399.30%	***
7-year Treasury Yield	0.15%	46.74%	415.88%
10-year Treasury Yield	0.56%	-0.58%	186.35%
20-year Treasury Yield	0.01%	2.91%	102.65%
30-year Treasury Yield	2.19%	-48.44%	115.76%
30-year Mortgage Rate	1.59%	21.94%	49.59%
Moody's AAA Curve	5.46%	-32.47%	72.10%
Moody's BAA Curve	0.53%	-24.29%	67.75%
BBB Corporate Yield	2.75%	-27.85%	84.13%
Prime Rate	52.80%	-170.17%	274.45%
US Average Retail Gasoline Price	57.18%	-957.87%	***
Cost of Federal Funds	5.03%	145.60%	***
Dow Jones Total Stock Market Index	80.18%	-600.66%	***
S&P 500 Stock Price Index	322.95%	***	***
Commercial Real Estate Price Index	0.04%	-1.18%	66.32%
Residential Home Price Index	65.92%	-462.38%	792.11%
Market Volatility Index	4.60%	137.14%	315.83%

Table 15: Regression Aggregate Errors for 4Q2012 through 3Q2022

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

 $\ast\ast\ast$ The indicated value has a percentage error greater than 1000%.

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

	Dependent variable (+/- SE):
	Real GDP growth
Constant	-115.845 (+/- 24.535)
	p = 0.0002 ^{***}
Moody's BAA Curve	-22.398 (+/- 5.322)
	p = 0.0005 ^{***}
Unemployment Rate	-6.790 (+/- 0.443)
	p = 0.000***
BBB corporate yield	18.206 (+/- 5.387)
	p = 0.004***
30-year Mortgate Rate	-16.808 (+/- 3.662)
	p = 0.0002***
Commercial Real Estate Price Index	0.131 (+/- 0.045)
	p = 0.009***
LN_30-year Treasury Yield	227.888 (+/- 38.875)
	p = 0.00002***
LN_20-year Treasury Yield	-90.490 (+/- 27.275)
	p = 0.004***
10-year Treasury Yield	204.050 (+/- 22.090)
	p = 0.00000 ^{***}
LN_10-year Treasury Yield	-409.082 (+/- 31.046)
	p = 0.000 ^{***}
7-year Treasury Yield	-328.996 (+/- 35.615)
	p = 0.00000 ^{***}
LN_7-year Treasury Yield	460.294 (+/- 46.257)
	p = 0.000***
5-year Treasury Yield	281.280 (+/- 31.235)
	p = 0.00000 ^{***}
LN_5-year Treasury Yield	-241.102 (+/- 26.681)
	p = 0.00000***
6-month Treasury Yield	72.324 (+/- 16.721)
	p = 0.0004 ^{***}
LN_6-month Treasury Yield	-17.461 (+/- 3.412)
	p = 0.0001***
1-year Treasury Yield	-92.182 (+/- 21.320)
	p = 0.0004 ^{***}

REGRESSION FOR REAL GDP GROWTH

LN_1-year Treasury Yield	18.547 (+/- 4.526)
	p = 0.001***
3-year Treasury Yield_2	22.225 (+/- 4.672)
	p = 0.0002 ^{***}
6-month Treasury Yield_2	-8.158 (+/- 1.759)
	p = 0.0002***
5-year Treasury Yield_2	-31.210 (+/- 5.419)
	p = 0.00002 ^{***}
Observations	40
R ²	0.980
Adjusted R ²	0.960
Residual Std. Error	1.539 (df = 19)
F Statistic	47.404 ^{***} (df = 20; 19)
Note:	*p**p***p<0.01

	Dependent variable (+/- SE):
	Nominal GDP growth
Constant	138.900 (+/- 73.561)
	p = 0.071 [*]
Moody's BAA Curve	-6.140 (+/- 1.556)
	p = 0.001***
Unemployment Rate	-7.736 (+/- 0.557)
	p = 0.000***
Dow Total Stock Market Index	0.001 (+/- 0.0002)
	p = 0.007***
Home Price Index	-0.124 (+/- 0.035)
	p = 0.002***
30-year Treasury Yield	-624.265 (+/- 149.251)
	p = 0.0004***
LN_30-year Treasury Yield	915.619 (+/- 188.469)
	p = 0.0001***
10-year Treasury Yield	746.409 (+/- 93.489)
	p = 0.00000 ^{***}
LN_10-year Treasury Yield	-733.460 (+/- 67.246)
	p = 0.000***
7-year Treasury Yield	-344.406 (+/- 47.606)
	p = 0.00000 ^{***}
LN_7-year Treasury Yield	243.744 (+/- 37.147)
	p = 0.00000 ^{***}
LN_6-month Treasury Yield	-2.758 (+/- 0.465)
	p = 0.00001***
7-year Treasury Yield_2	49.734 (+/- 7.298)
	p = 0.00000 ^{***}
10-year Treasury Yield_2	-90.409 (+/- 13.932)
	p = 0.00000 ^{***}
30-year Treasury Yield_2	55.577 (+/- 14.089)
	p = 0.001***
Observations	40
R ²	0.965
Adjusted R ²	0.946
Residual Std. Error	2.018 (df = 25)
F Statistic	49.935 ^{***} (df = 14; 25)

REGRESSION FOR NOMINAL GDP GROWTH

Note:

*p**p***p<0.01
	Dependent variable (+/- SE):
	Real disposable income growth
Constant	388.955 (+/- 88.678)
	p = 0.001***
US Fed Reserve O-N Loan Rate	-241.828 (+/- 37.481)
	p = 0.00003***
Moody's BAA Curve	156.942 (+/- 21.956)
	p = 0.00001***
Real GDP growth	-9.467 (+/- 2.478)
	p = 0.003 ^{***}
Nominal GDP growth	12.447 (+/- 2.346)
	p = 0.0002***
Unemployment Rate	34.160 (+/- 4.383)
	p = 0.00001***
CPI Inflation Rate	-7.116 (+/- 1.242)
	p = 0.0001***
BBB corporate yield	-138.693 (+/- 18.917)
	p = 0.00001***
30-year Mortgate Rate	65.849 (+/- 16.311)
	p = 0.002***
Dow Total Stock Market Index	-0.008 (+/- 0.001)
	p = 0.0002***
Home Price Index	3.596 (+/- 0.515)
	p = 0.00001***
Commercial Real Estate Price Index	-2.155 (+/- 0.371)
	p = 0.0001***
Market Volatility Index	-0.727 (+/- 0.197)
	p = 0.003***
LN_30-year Treasury Yield	-1,129.083 (+/- 175.073)
	p = 0.00003***
20-year Treasury Yield	-324.176 (+/- 100.463)
	p = 0.007***
LN_20-year Treasury Yield	1,009.487 (+/- 325.677)
	p = 0.009 ^{***}
10-year Treasury Yield	-857.221 (+/- 117.385)
	p = 0.00001***
LN_10-year Treasury Yield	1,871.126 (+/- 227.973)

REGRESSION FOR REAL DISPOSABLE INCOME GROWTH

	p = 0.00001***
1-month Treasury Yield	320.738 (+/- 41.139)
	p = 0.00001***
7-year Treasury Yield	1,869.532 (+/- 245.253)
	p = 0.00001***
LN_7-year Treasury Yield	-2,823.444 (+/- 379.614)
	p = 0.00001***
5-year Treasury Yield	-1,324.584 (+/- 211.232)
	p = 0.00003***
LN_5-year Treasury Yield	1,852.817 (+/- 285.143)
	p = 0.00003***
LN_3-year Treasury Yield	-391.671 (+/- 62.052)
	p = 0.00003***
LN_1-year Treasury Yield	89.092 (+/- 9.860)
	p = 0.00000***
3-year Treasury Yield_2	-44.238 (+/- 9.202)
	p = 0.0004***
5-year Treasury Yield_2	82.767 (+/- 21.387)
	p = 0.002***
Observations	40
R ²	0.960
Adjusted R ²	0.880
Residual Std. Error	4.604 (df = 13)
F Statistic	12.010 ^{***} (df = 26; 13)
Note:	*p**p***p<0.01

	Dependent variable (+/- SE):
	Nominal disposable income growth
Constant	129.519 (+/- 37.089)
	p = 0.002***
Unemployment Rate	7.618 (+/- 1.755)
	p = 0.0002***
Dow Total Stock Market Index	-0.001 (+/- 0.0004)
	p = 0.004***
LN_30-year Treasury Yield	-312.780 (+/- 65.228)
	p = 0.00004***
LN_10-year Treasury Yield	262.865 (+/- 54.449)
	p = 0.00004***
LN_3-year Treasury Yield	-50.088 (+/- 13.823)
	p = 0.001***
LN_1-year Treasury Yield	12.534 (+/- 4.253)
	p = 0.006***
Observations	40
R ²	0.496
Adjusted R ²	0.404
Residual Std. Error	10.147 (df = 33)
F Statistic	5.415 ^{***} (df = 6; 33)
Note:	*p**p***p<0.01

REGRESSION FOR NOMINAL DISPOSABLE INCOME GROWTH

MACROECONOMIC FORECASTS, 4Q2022 - DRAFT VERSION

	Dependent variable (+/- SE):
	CPI Inflation Rate
Constant	-13.613 (+/- 1.770)
	p = 0.00000***
US Fed Reserve O-N Loan Rate	-20.194 (+/- 1.979)
	p = 0.000***
Real disposable income growth	-1.109 (+/- 0.027)
	p = 0.000***
Nominal disposable income growth	n 1.049 (+/- 0.027)
	p = 0.000 ^{***}
Unemployment Rate	0.281 (+/- 0.057)
	p = 0.0002***
Dow Total Stock Market Index	-0.0003 (+/- 0.00003)
	p = 0.00000 ^{***}
Home Price Index	0.106 (+/- 0.009)
	p = 0.000***
LN_Market Volatility Index	-1.073 (+/- 0.166)
	p = 0.00001***
30-year Treasury Yield	-29.152 (+/- 2.368)
	p = 0.000***
LN_30-year Treasury Yield	81.901 (+/- 6.843)
	p = 0.000****
10-year Treasury Yield	-4.424 (+/- 1.325)
	p = 0.004 ^{***}
1-month Treasury Yield	28.413 (+/- 2.427)
	p = 0.000***
7-year Treasury Yield	34.781 (+/- 3.183)
	p = 0.000***
LN_7-year Treasury Yield	-48.239 (+/- 5.490)
	p = 0.00000***
3-month Treasury Yield	-5.749 (+/- 0.881)
	p = 0.00001***
5-year Treasury Yield	-10.071 (+/- 2.237)
	p = 0.0004***
LN_5-year Treasury Yield	22.849 (+/- 3.237)
	p = 0.00001***
LN_6-month Treasury Yield	-2.047 (+/- 0.390)

REGRESSION FOR CPI INFLATION RATE

	p = 0.0001***
3-year Treasury Yield	-20.842 (+/- 2.088)
	p = 0.00000***
1-year Treasury Yield	7.273 (+/- 1.138)
	p = 0.00001***
LN_1-year Treasury Yield	3.420 (+/- 0.591)
	p = 0.00003***
1-year Treasury Yield_2	-2.342 (+/- 0.303)
	p = 0.00000 ^{***}
3-year Treasury Yield_2	2.019 (+/- 0.389)
	p = 0.0001***
Observations	40
R ²	0.997
Adjusted R ²	0.994
Residual Std. Error	0.181 (df = 17)
F Statistic	288.851 ^{***} (df = 22; 17)
Note:	*p**p***p<0.01

Unemployment Rate

	Dependent variable (+/- SE):
	Unemployment Rate
Constant	0.218 (+/- 1.653)
	p = 0.897
US Fed Reserve O-N Loan Rate	6.008 (+/- 1.188)
	p = 0.0001***
Moody's BAA Curve	-1.892 (+/- 0.441)
	p = 0.0004***
Nominal GDP growth	-0.108 (+/- 0.008)
	p = 0.000 ^{***}
Real disposable income growth	0.014 (+/- 0.003)
	p = 0.001***
CPI Inflation Rate	0.113 (+/- 0.027)
	p = 0.0005 ^{***}
BBB corporate yield	2.005 (+/- 0.524)
	p = 0.002***
Dow Total Stock Market Index	0.0001 (+/- 0.00002)
	p = 0.0001 ^{***}
Home Price Index	-0.042 (+/- 0.005)
	p = 0.00000 ^{***}
30-year Treasury Yield	3.225 (+/- 0.666)
	p = 0.0002 ^{***}
10-year Treasury Yield	18.697 (+/- 2.797)
	p = 0.00001***
LN_10-year Treasury Yield	-41.767 (+/- 4.037)
	p = 0.000***
1-month Treasury Yield	-8.055 (+/- 1.332)
	p = 0.00001***
7-year Treasury Yield	-31.843 (+/- 4.016)
	p = 0.00000 ^{***}
LN_7-year Treasury Yield	52.300 (+/- 5.633)
	p = 0.00000 ^{***}
5-year Treasury Yield	13.146 (+/- 2.329)
	p = 0.00002***
LN_5-year Treasury Yield	-24.139 (+/- 2.690)
	p = 0.00000 ^{***}

REGRESSION FOR UNEMPLOYMENT RATE

3-year Treasury Yield	9.860 (+/- 1.444)	
	p = 0.00001 ^{***}	
LN_1-year Treasury Yield	-1.469 (+/- 0.196)	
	p = 0.00000 ^{***}	
1-year Treasury Yield_2	0.674 (+/- 0.173)	
	p = 0.001***	
3-year Treasury Yield_2	-1.588 (+/- 0.312)	
	p = 0.0001 ^{***}	
Observations	40	
R ²	0.995	
Adjusted R ²	0.990	
Residual Std. Error	0.186 (df = 19)	
F Statistic	194.816 ^{***} (df = 20; 19)	
Note:	*p**p***p<0.01	

Treasury Yields (1, 3	, & 6-month; 1	, 3, 5, 7, 10, 20,	& 30-year series)
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	Dependent variable (+/- SE):
	1-month Treasury Yield
Constant	-0.320 (+/- 1.262)
	p = 0.802
Moody's AAA Curve	-4.148 (+/- 0.688)
	p = 0.00000 ^{***}
BBB corporate yield	1.739 (+/- 0.266)
	p = 0.00000 ^{***}
Home Price Index	-0.030 (+/- 0.006)
	p = 0.00003***
Commercial Real Estate Price Index	0.031 (+/- 0.006)
	p = 0.00002 ^{***}
LN_30-year Treasury Yield	7.244 (+/- 1.097)
	p = 0.00000 ^{***}
Observations	40
R ²	0.823
Adjusted R ²	0.797
Residual Std. Error	0.370 (df = 34)
F Statistic	31.681 ^{***} (df = 5; 34)
Note:	*p**p***p<0.01

REGRESSION FOR 1-MONTH TREASURY YIELD

	Dependent variable (+/- SE):
	3-month Treasury Yield
Constant	2.812 (+/- 0.700)
	p = 0.0003 ^{***}
Moody's BAA Curve	-2.208 (+/- 0.429)
	p = 0.00001 ^{***}
Unemployment Rate	-0.137 (+/- 0.050)
	p = 0.010 ^{***}
BBB corporate yield	2.249 (+/- 0.396)
	p = 0.00001 ^{***}
Observations	40
R ²	0.664
Adjusted R ²	0.636
Residual Std. Error	0.514 (df = 36)
F Statistic	23.743 ^{***} (df = 3; 36)
Note:	*p**p***p<0.01

REGRESSION FOR 3-MONTH TREASURY YIELD

	Dependent variable (+/- SE):
	6-month Treasury Yield
Constant	2.886 (+/- 0.675)
	p = 0.0002 ^{***}
Moody's BAA Curve	-2.381 (+/- 0.414)
	p = 0.00001***
Unemployment Rate	-0.148 (+/- 0.048)
	p = 0.005 ^{***}
BBB corporate yield	2.478 (+/- 0.382)
	p = 0.00000 ^{***}
Observations	40
R ²	0.722
Adjusted R ²	0.699
Residual Std. Error	0.496 (df = 36)
F Statistic	31.198 ^{***} (df = 3; 36)
Note:	*p**p***p<0.01

REGRESSION FOR 6-MONTH TREASURY YIELD

	Dependent variable (+/- SE):
	1-year Treasury Yield
Constant	2.906 (+/- 0.624)
	p = 0.00005 ^{***}
Moody's BAA Curve	-2.443 (+/- 0.383)
	p = 0.00000 ^{***}
Unemployment Rate	-0.160 (+/- 0.045)
	p = 0.001***
BBB corporate yield	2.589 (+/- 0.353)
	p = 0.000***
Observations	40
R ²	0.775
Adjusted R ²	0.756
Residual Std. Error	0.459 (df = 36)
F Statistic	41.228 ^{***} (df = 3; 36)
Note:	*p**p***p<0.01

REGRESSION FOR 1-YEAR TREASURY YIELD

	Dependent variable (+/- SE):
	3-year Treasury Yield
Constant	-3.864 (+/- 1.176)
	p = 0.003***
SP500 Stock Price Index	-0.002 (+/- 0.0003)
	p = 0.00001***
Unemployment Rate	-0.227 (+/- 0.042)
	p = 0.00001 ^{***}
Commercial Real Estate Price Index	0.035 (+/- 0.006)
	p = 0.00001***
US Avg Retail Gasoline Price (\$-gal; all grades, all formulations)	0.542 (+/- 0.128)
	p = 0.0002***
Observations	40
R ²	0.754
Adjusted R ²	0.726
Residual Std. Error	0.440 (df = 35)
F Statistic	26.786 ^{***} (df = 4; 35)
Note:	*p**p***p<0.01

REGRESSION FOR 3-YEAR TREASURY YIELD

	Dependent variable (+/- SE):
	5-year Treasury Yield
Constant	9.285 (+/- 4.269)
	p = 0.038 ^{**}
SP500 Stock Price Index	-0.001 (+/- 0.0003)
	p = 0.00001***
Unemployment Rate	-0.276 (+/- 0.043)
	p = 0.00000 ^{***}
Commercial Real Estate Price Index	0.024 (+/- 0.005)
	p = 0.0001 ^{***}
Market Volatility Index	0.374 (+/- 0.128)
	p = 0.007 ^{***}
LN_Market Volatility Index	-5.802 (+/- 2.082)
	p = 0.009 ^{***}
US Avg Retail Gasoline Price (\$-gal; all grades, all formulations)	0.638 (+/- 0.116)
	p = 0.00001***
Market Volatility Index_2	-0.002 (+/- 0.001)
	p = 0.005 ^{***}
Observations	40
R ²	0.794
Adjusted R ²	0.749
Residual Std. Error	0.367 (df = 32)
F Statistic	17.657 ^{***} (df = 7; 32)
Note:	*p**p***p<0.01

REGRESSION FOR 5-YEAR TREASURY YIELD

	Dependent variable (+/- SE):
	7-year Treasury Yield
Constant	1.747 (+/- 0.709)
	p = 0.019 ^{**}
SP500 Stock Price Index	-0.001 (+/- 0.0003)
	p = 0.0005 ^{***}
Unemployment Rate	-0.230 (+/- 0.040)
	p = 0.00001***
Home Price Index	0.023 (+/- 0.007)
	p = 0.003***
Observations	40
R ²	0.594
Adjusted R ²	0.560
Residual Std. Error	0.440 (df = 36)
F Statistic	17.554 ^{***} (df = 3; 36)
Note:	*p**p***p<0.01

REGRESSION FOR 7-YEAR TREASURY YIELD

	Dependent variable (+/- SE):
	10-year Treasury Yield
Constant	2.839 (+/- 0.407)
	p = 0.00000 ^{***}
SP500 Stock Price Index	-0.0004 (+/- 0.0001)
	p = 0.00002***
Unemployment Rate	-0.206 (+/- 0.034)
	p = 0.00000 ^{***}
US Avg Retail Gasoline Price (\$-gal; all grades, all formulations)	0.471 (+/- 0.099)
	p = 0.00004***
Observations	40
R ²	0.654
Adjusted R ²	0.625
Residual Std. Error	0.385 (df = 36)
F Statistic	22.650 ^{***} (df = 3; 36)
Note:	*p**p***p<0.01

REGRESSION FOR 10-YEAR TREASURY YIELD

	Dependent variable (+/- SE):
	20-year Treasury Yield
Constant	2.569 (+/- 0.346)
	p = 0.000 ^{***}
SP500 Stock Price Index	-0.0004 (+/- 0.0001)
	p = 0.00000 ^{***}
Unemployment Rate	-0.139 (+/- 0.029)
	p = 0.00004***
US Avg Retail Gasoline Price (\$-gal; all grades, all formulations)) 0.609 (+/- 0.085)
	p = 0.00000 ^{***}
Observations	40
R ²	0.724
Adjusted R ²	0.701
Residual Std. Error	0.327 (df = 36)
F Statistic	31.541 ^{***} (df = 3; 36)
Note:	*p**p***p<0.01

REGRESSION FOR 20-YEAR TREASURY YIELD

	Dependent variable (+/- SE):
	30-year Treasury Yield
Constant	3.264 (+/- 0.309)
	p = 0.000 ^{***}
SP500 Stock Price Index	-0.001 (+/- 0.0001)
	p = 0.000 ^{***}
Unemployment Rate	-0.124 (+/- 0.026)
	p = 0.00004***
US Avg Retail Gasoline Price (\$-gal; all grades, all formulations)	0.524 (+/- 0.075)
	p = 0.00000 ^{***}
Observations	40
R ²	0.781
Adjusted R ²	0.762
Residual Std. Error	0.292 (df = 36)
F Statistic	42.703 ^{***} (df = 3; 36)
Note:	*p**p***p<0.01

REGRESSION FOR 30-YEAR TREASURY YIELD

30-year Mortgage Rate

	Dependent variable (+/- SE):
	30-year Mortgate Rate
Constant	1.186 (+/- 0.467)
	p = 0.016 ^{**}
SP500 Stock Price Index	-0.001 (+/- 0.0003)
	p = 0.00002 ^{***}
Home Price Index	0.024 (+/- 0.006)
	p = 0.0002***
US Avg Retail Gasoline Price (\$-gal; all grades, all formulations)	0.388 (+/- 0.089)
	p = 0.0002***
1-month Treasury Yield	0.353 (+/- 0.068)
	p = 0.00001 ^{***}
Observations	40
R ²	0.742
Adjusted R ²	0.712
Residual Std. Error	0.324 (df = 35)
F Statistic	25.129 ^{***} (df = 4; 35)
Note:	*p**p***p<0.01

REGRESSION FOR 30-YEAR MORTGATE RATE

Moody's AAA & BAA Rates

	Dependent variable (+/- SE):
	Moody's AAA Curve
Constant	4.501 (+/- 0.322)
	p = 0.000 ^{***}
SP500 Stock Price Index	-0.001 (+/- 0.0001)
	p = 0.000 ^{***}
Unemployment Rate	-0.133 (+/- 0.027)
	p = 0.00003***
US Avg Retail Gasoline Price (\$-gal; all grades, all formulations)	0.453 (+/- 0.079)
	p = 0.00001***
Observations	40
R ²	0.772
Adjusted R ²	0.753
Residual Std. Error	0.304 (df = 36)
F Statistic	40.627 ^{***} (df = 3; 36)
Note:	*p**p***p<0.01

REGRESSION FOR MOODY'S AAA CURVE

	Dependent variable (+/- SE):
	Moody's BAA Curve
Constant	5.787 (+/- 0.136)
	p = 0.000 ^{***}
SP500 Stock Price Index	-0.001 (+/- 0.00005)
	p = 0.000 ^{***}
3-month Treasury Yield	-2.210 (+/- 0.302)
	p = 0.000 ^{***}
1-year Treasury Yield	1.544 (+/- 0.195)
	p = 0.000 ^{***}
3-month Treasury Yield_2	0.375 (+/- 0.079)
	p = 0.00004 ^{***}
Observations	40
R ²	0.850
Adjusted R ²	0.833
Residual Std. Error	0.260 (df = 35)
F Statistic	49.478 ^{***} (df = 4; 35)
Note:	*p**p***p<0.01

REGRESSION FOR MOODY'S BAA CURVE

BBB Corporate Yield

	Dependent variable (+/- SE):
	BBB corporate yield
Constant	4.947 (+/- 0.170)
	p = 0.000***
SP500 Stock Price Index	-0.001 (+/- 0.0001)
	p = 0.000***
US Fed Reserve O-N Loan Rate	-1.032 (+/- 0.190)
	p = 0.00001 ^{***}
1-year Treasury Yield	1.359 (+/- 0.168)
	p = 0.000 ^{***}
Observations	40
R ²	0.804
Adjusted R ²	0.788
Residual Std. Error	0.327 (df = 36)
F Statistic	49.283 ^{***} (df = 3; 36)
Note:	*p**p***p<0.01

REGRESSION FOR BBB CORPORATE YIELD

Prime Rate

	Dependent variable (+/- SE):
	Prime Rate
Constant	2.799 (+/- 1.210)
	p = 0.027**
Moody's AAA Curve	-3.783 (+/- 0.659)
	p = 0.00001***
BBB corporate yield	1.557 (+/- 0.255)
	p = 0.00000 ^{***}
Home Price Index	-0.030 (+/- 0.006)
	p = 0.00002***
Commercial Real Estate Price Index	0.031 (+/- 0.006)
	p = 0.00002***
LN_30-year Treasury Yield	6.749 (+/- 1.052)
	p = 0.00000 ^{***}
Observations	40
R ²	0.815
Adjusted R ²	0.788
Residual Std. Error	0.354 (df = 34)
F Statistic	29.930 ^{***} (df = 5; 34)
Note:	*p**p***p<0.01

REGRESSION FOR PRIME RATE

US Average Retail Gasoline Price

	Dependent variable (+/- SE):
	US Avg Retail Gasoline Price (\$-gal; all grades, all formulations)
Constant	2.963 (+/- 0.713)
	p = 0.004***
US Fed Reserve O-N Loan Rate	5.841 (+/- 0.587)
	p = 0.00001***
Moody's AAA Curve	-1.989 (+/- 0.270)
	p = 0.0001***
Moody's BAA Curve	-0.630 (+/- 0.119)
	p = 0.001***
Real GDP growth	0.438 (+/- 0.038)
	p = 0.00001***
Nominal GDP growth	-0.400 (+/- 0.036)
	p = 0.00001***
Real disposable income growth	-0.215 (+/- 0.021)
	p = 0.00001***
Nominal disposable income growth	0.231 (+/- 0.020)
	p = 0.00001***
30-year Mortgate Rate	2.185 (+/- 0.248)
	p = 0.00003***
Dow Total Stock Market Index	0.0003 (+/- 0.00002)
	p = 0.00000***
Home Price Index	-0.103 (+/- 0.007)
	p = 0.00000***
Commercial Real Estate Price Index	0.039 (+/- 0.004)
	p = 0.00001***
Market Volatility Index	0.033 (+/- 0.002)
	p = 0.00000***
30-year Treasury Yield	-7.009 (+/- 2.083)
	p = 0.010***
LN_30-year Treasury Yield	27.227 (+/- 4.554)
	p = 0.0004***
20-year Treasury Yield	21.901 (+/- 2.060)
	p = 0.00001***
LN_20-year Treasury Yield	-48.210 (+/- 4.268)
	p = 0.00001***

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

I-month heasing heid -5.	025 (+/-0.095)
р) = 0.00005 ^{***}
7-year Treasury Yield -27	.235 (+/- 1.814)
р) = 0.00000 ^{***}
LN_7-year Treasury Yield 45.	138 (+/- 4.049)
р	$0 = 0.00001^{***}$
5-year Treasury Yield 26.	365 (+/- 2.271)
р	$0 = 0.00001^{***}$
LN_5-year Treasury Yield -54	.212 (+/- 4.503)
р	$0 = 0.00001^{***}$
6-month Treasury Yield -28	.294 (+/- 1.783)
р	= 0.00000 ^{***}
LN_6-month Treasury Yield 2.6	547 (+/- 0.221)
р	$0 = 0.00001^{***}$
3-year Treasury Yield -25	.047 (+/- 2.468)
р	$0 = 0.00001^{***}$
LN_3-year Treasury Yield 28.	077 (+/- 2.037)
ρ	$0 = 0.00000^{***}$
1-year Treasury Yield 37.	870 (+/- 2.284)
ρ) = 0.00000 ^{***}
LN_1-year Treasury Yield -8.	101 (+/- 0.414)
ρ	= 0.00000 ^{***}
1-year Treasury Yield_2 -8.	927 (+/- 0.515)
p	= 0.00000 ^{***}
3-year Treasury Yield_2 3.3	376 (+/- 0.296)
p	$0 = 0.00001^{***}$
6-month Treasury Yield_2 8.8	303 (+/- 0.536)
p	$0 = 0.00000^{***}$
3-month Treasury Yield_2 -1.	678 (+/- 0.204)
р	9 = 0.00004 ^{***}
Observations	40
R ²	0.999
Adjusted R ²	0.997
Residual Std. Error 0	0.037 (df = 8)
F Statistic 361.4	485 ^{***} (df = 31; 8)

Note:

*p**p***p<0.01

	Dependent variable (+/- SE):
	US Fed Reserve O-N Loan Rate
Constant	-5.525 (+/- 0.887)
	p = 0.00000 ^{***}
BBB corporate yield	0.700 (+/- 0.129)
	p = 0.00001 ^{***}
Home Price Index	-0.034 (+/- 0.008)
	p = 0.0002 ^{***}
Commercial Real Estate Price Index	0.039 (+/- 0.007)
	p = 0.00001***
Observations	40
R ²	0.599
Adjusted R ²	0.566
Residual Std. Error	0.528 (df = 36)
F Statistic	17.956 ^{***} (df = 3; 36)
Note:	*p**p***p<0.01

REGRESSION FOR US FED RESERVE O-N LOAN RATE

REGRESSION FOR DOW TOTA	L STOCK MARKET INDEX
	Dependent variable (+/- SE):
	Dow Total Stock Market Index
Constant	4,205.537 (+/- 8,202.881)
	p = 0.613
Real GDP growth	-794.382 (+/- 87.257)
	p = 0.000***
Real disposable income growth	-1,712.001 (+/- 266.304)
	p = 0.00000***
Nominal disposable income growth	1,669.634 (+/- 258.037)
	p = 0.00000 ^{***}
Unemployment Rate	-4,764.274 (+/- 733.647)
	p = 0.00000 ^{***}
LN_10-year Treasury Yield	-172,261.400 (+/- 14,972.300)
	p = 0.000***
LN_7-year Treasury Yield	173,388.100 (+/- 17,739.540)
	p = 0.000***
3-year Treasury Yield	94,964.960 (+/- 10,792.250)
	p = 0.000 ^{***}
LN_3-year Treasury Yield	-71,644.130 (+/- 5,798.130)
	p = 0.000***
1-year Treasury Yield	-23,242.850 (+/- 3,494.202)
	p = 0.00000 ^{***}
7-year Treasury Yield_2	-26,962.400 (+/- 3,551.161)
	p = 0.00000 ^{***}
10-year Treasury Yield_2	16,393.660 (+/- 2,328.776)
	p = 0.00000***
Market Volatility Index_2	-1.825 (+/- 0.456)
	p = 0.0005 ^{***}
Observations	40
R ²	0.955
Adjusted R ²	0.935
Residual Std. Error	2,265.023 (df = 27)
F Statistic	47.797 ^{***} (df = 12; 27)
Note:	*p**p***p<0.01

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

	Dependent variable (+/- SE):
	SP500 Stock Price Index
Constant	2,038.786 (+/- 1,162.124)
	p = 0.097 [*]
US Fed Reserve O-N Loan Rate	2,240.057 (+/- 364.939)
	p = 0.00001 ^{***}
Real GDP growth	66.621 (+/- 21.902)
	p = 0.008 ^{***}
Nominal GDP growth	-70.714 (+/- 21.204)
	p = 0.004 ^{***}
Real disposable income growth	156.751 (+/- 24.605)
	p = 0.00001***
Nominal disposable income growth	-148.229 (+/- 23.372)
	p = 0.00001***
Unemployment Rate	-95.523 (+/- 18.130)
	p = 0.0001***
CPI Inflation Rate	212.423 (+/- 22.566)
	p = 0.00000***
Prime Rate	1,557.385 (+/- 348.848)
	p = 0.0003***
30-year Treasury Yield	11,732.530 (+/- 1,442.531)
	p = 0.00000***
LN_30-year Treasury Yield	-38,916.260 (+/- 3,287.379)
	p = 0.000 ^{***}
20-year Treasury Yield	-9,446.428 (+/- 1,214.592)
	p = 0.00000***
LN_20-year Treasury Yield	25,891.590 (+/- 2,380.037)
	p = 0.000***
1-month Treasury Yield	-7,182.322 (+/- 552.150)
	p = 0.000****
LN_7-year Treasury Yield	3,032.606 (+/- 386.012)
	p = 0.00000 ^{***}
3-month Treasury Yield	2,612.856 (+/- 309.666)
	$p = 0.00000^{***}$
5-year Treasury Yield	-958.613 (+/- 251.321)
	p = 0.002***
LN_6-month Treasury Yield	591.178 (+/- 88.828)

REGRESSION FOR SP500 STOCK PRICE INDEX

	p = 0.00001 ^{***}
3-year Treasury Yield	1,900.156 (+/- 262.883)
	p = 0.00001***
LN_3-year Treasury Yield	-1,208.673 (+/- 165.751)
	p = 0.00000 ^{***}
LN_1-year Treasury Yield	-995.632 (+/- 104.719)
	p = 0.00000 ^{***}
1-month Treasury Yield 2	331.192 (+/- 30.445)
	p = 0.000***
Observations	p = 0.000*** 40
Observations R ²	p = 0.000*** 40 0.999
Observations R ² Adjusted R ²	p = 0.000*** 40 0.999 0.997
Observations R ² Adjusted R ² Residual Std. Error	p = 0.000*** 40 0.999 0.997 47.502 (df = 18)
Observations R ² Adjusted R ² Residual Std. Error F Statistic	p = 0.000*** 40 0.999 0.997 47.502 (df = 18) 642.639*** (df = 21; 18)

MACROECONOMIC FORECASTS, 4Q2022 - DRAFT VERSION

House and Commercial Real Estate Price Indexes

	Dependent variable (+/- SE):
	Home Price Index
Constant	357.485 (+/- 88.386)
	p = 0.001***
US Fed Reserve O-N Loan Rate	244.181 (+/- 44.135)
	p = 0.00003***
Real GDP growth	-3.412 (+/- 0.286)
	p = 0.000 ^{***}
Unemployment Rate	-15.200 (+/- 2.479)
	p = 0.00001***
CPI Inflation Rate	5.654 (+/- 0.671)
	p = 0.00000 ^{***}
Market Volatility Index	-1.965 (+/- 0.437)
	p = 0.0003 ^{***}
LN_Market Volatility Index	59.367 (+/- 14.891)
	p = 0.001***
20-year Treasury Yield	61.408 (+/- 18.003)
	p = 0.003***
LN_10-year Treasury Yield	-1,006.554 (+/- 65.221)
	p = 0.000 ^{***}
1-month Treasury Yield	-272.576 (+/- 41.811)
	p = 0.00001***
7-year Treasury Yield	-1,135.454 (+/- 113.045)
	p = 0.000***
LN_7-year Treasury Yield	1,578.316 (+/- 127.322)
	p = 0.000***
6-month Treasury Yield	217.226 (+/- 44.719)
	p = 0.0001***
3-year Treasury Yield	1,217.520 (+/- 108.267)
	p = 0.000***
LN_3-year Treasury Yield	-503.200 (+/- 37.181)
	p = 0.000
1-year Treasury Yield	-486.739 (+/- 57.311)
	p = 0.00000
1-year Treasury Yield_2	119.675 (+/- 21.202)
	p = 0.00002

REGRESSION FOR HOME PRICE INDEX

MACROECONOMIC FORECASTS, 4Q2022 - DRAFT VERSION

3-year Treasury Yield_2	-165.914 (+/- 20.590)		
	p = 0.00000 ^{***}		
3-month Treasury Yield_2	-64.877 (+/- 14.656)		
	p = 0.0003 ^{***}		
10-year Treasury Yield_2	116.130 (+/- 13.458)		
	p = 0.00000***		
Observations	40		
Observations R ²	40 0.988		
Observations R ² Adjusted R ²	40 0.988 0.977		
Observations R ² Adjusted R ² Residual Std. Error	40 0.988 0.977 6.161 (df = 20)		
Observations R ² Adjusted R ² Residual Std. Error F Statistic	40 0.988 0.977 6.161 (df = 20) 89.955 ^{***} (df = 19; 20)		

	Dependent variable (+/- SE):
	Commercial Real Estate Price Index
Constant	-230.201 (+/- 130.548)
	p = 0.090*
Real disposable income growth	-7.865 (+/- 1.410)
	p = 0.00001***
Nominal disposable income growth	7.433 (+/- 1.453)
	p = 0.00003***
7-year Treasury Yield	882.573 (+/- 151.889)
	p = 0.00001***
LN_7-year Treasury Yield	-1,525.251 (+/- 173.315)
	p = 0.000***
3-month Treasury Yield	-241.487 (+/- 71.092)
	p = 0.003***
5-year Treasury Yield	-927.875 (+/- 132.370)
	p = 0.00000***
LN_5-year Treasury Yield	1,887.063 (+/- 204.028)
	p = 0.000***
6-month Treasury Yield	556.464 (+/- 121.157)
	p = 0.0001***
3-year Treasury Yield	810.957 (+/- 84.598)
	p = 0.000***
LN_3-year Treasury Yield	-761.853 (+/- 78.201)
	$p = 0.000^{***}$
1-year Treasury Yield	-410.094 (+/- 82.138)
	p = 0.00004***
7-year Treasury Yield_2	-107.818 (+/- 24.171)
	p = 0.0002***
1-month Treasury Yield_2	-18.781 (+/- 5.826)
	p = 0.004***
Observations	40
R ²	0.943
Adjusted R ²	0.914
Residual Std. Error	13.635 (df = 26)
F Statistic	32.910 ^{***} (df = 13; 26)
Note:	*p**p***p<0.01

Market Volatility Index

	Dependent variable (+/- SE):
	Market Volatility Index
Constant	54.474 (+/- 6.895)
	p = 0.000 ^{***}
LN_30-year Treasury Yield	-28.737 (+/- 6.855)
	p = 0.0002 ^{***}
Observations	40
R ²	0.316
Adjusted R ²	0.298
Residual Std. Error	10.621 (df = 38)
F Statistic	17.575 ^{***} (df = 1; 38)
Note:	*p**p***p<0.01

REGRESSION FOR MARKET VOLATILITY INDEX

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.

Tahle	16.	Data	Values	and	Reference	ed Sources
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Attribute	Referenced Source ⁸²
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 [BAMLCOA4CBBBEY], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/BAMLCOA4CBBBEY ⁸³

⁸² Per https://www.federalreserve.gov/newsevents/pressreleases/files/bcreg20190213a1.pdf

⁸³ 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) ⁸⁴ .
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) ⁸⁵ .
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.

⁸⁴ 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

⁸⁵ 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_1a_historic_domestic.csv and https://www.federalreserve.gov/supervisionreg/files/2022-table_1a_historic_international.csv using HTTP client software will also download the official datasets⁸⁶.

⁸⁶ 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 1Q2022 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) 1Q2022.

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

Table 17: Supplementary Data Sources for Data Attributes
BBB corporate vield	Federal Reserve Economic Research website (https://fred.stlouisfed.org/series/BAMI COA4CBBBEY), with					
	"Ouarterly" frequency and "Average" aggregation method					
	Federal Reserve Economic Research website					
Mortgage rate	(https://fred_stlouisfed_org/series/MORTGAGE30US)_with					
	"Ouarterly" frequency and "Average" aggregation method					
	Federal Reserve Economic Research website					
Prime rate	(https://fred_stlouisfed_org/series/MPRIME), with "Quarterly"					
	frequency and "Average" aggregation method					
Dow Jones Total Stock Market	Dow-lones as provided by the Wall Street Journal					
Index (end-of-qtr value)	(https://guotes.wsi.com/index/DWCF/advanced-chart)					
	https://data.nasdag.com/data/FED/FL075035243 Q-interest-					
House Price Index	rates-and-price-indexes-owneroccupied-real-estate-corelogic-					
	national-sa-quarterly-levels-nsa					
	https://data.nasdag.com/data/FED/FL075035503 Q-interest-					
Commercial Real Estate Price	rates-and-price-indexes-commercial-real-estate-price-index-					
lindex	quarterly-levels-nsa					
	Federal Reserve Economic Research website					
Market Volatility Index (VIX)	(https://fred.stlouisfed.org/series/VIXCLS), with "Quarterly"					
	frequency and "Average" aggregation method					
Euro Area Baal GDB Growth	Quarterly series for "European Union GDP Annual Growth					
Eulo Alea Real GDF Glowin	Rate" per tradingeconomics.com					
Euro Area Inflation	Quarterly average of monthly series for "European Union					
	Inflation Rate" per tradingeconomics.com					
Euro Area Bilateral Dollar	End-of-quarter rates from the H.10 Release, Foreign Exchange					
Exchange Rate (USD/Euro)	Rates, Federal Reserve Board.					
Doveleping Asia Boal GDP	The nominal GDP-weighted aggregate of the Real GDP growth					
Growth	for China, India, South Korea, Hong Kong Special					
	Administrative Region, and Taiwan per OECD					
	The nominal GDP-weighted aggregate of the inflation rate for					
Developing Asia Inflation	China, India, South Korea, Hong Kong Special Administrative					
	Region, and Taiwan per OECD					
Developing Asia bilateral dollar	End-of-quarter rates from the H.10 Release, Foreign Exchange					
exchange rate (F/USD, index)	Rates, Federal Reserve Board.					
Japan Beal 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	End-of-quarter rates from the H.10 Release, Foreign Exchange					
Rate (Yen/USD)	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	End-of-quarter rates from the H.10 Release, Foreign Exchange					
(USD/Pound)	Rates, Federal Reserve Board.					

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

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's⁸⁷ "forecast" package⁸⁸; specifically, the "ets" function (see p.39 of https://cran.r-project.org/web/packages/forecast/forecast.pdf)⁸⁹ 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)</pre>

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)⁹⁰, 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

⁸⁷ As of this writing, v.4.1.2 of the "R" language is available at <u>https://cran.r-project.org/</u>.

⁸⁸ As of this writing, v.8.16 of the forecast package is available at <u>https://CRAN.R-project.org/package=forecast</u>.

⁸⁹ 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.

⁹⁰ 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)⁹¹.
- 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 guarter 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))</pre>
       > sp_ts
          Qtr1
                    0tr2
                               0tr3
                                         0tr4
                130.6591 1250.5201 998.4077
2008
2009 812.0470 799.5264 927.5045 1041.3728
       > m<-ets(sp_ts,model='ZZZ',opt.crit=c('mae'),additive.only=TRUE)</pre>
       > dsp_ts<-diff(sp_ts)</pre>
       > dsp_ts
            Qtr1
                        Qtr2
                                     Qtr3
                                                  0tr4
                              1119.860980 -252.112424
2008
2009 -186.360685 -12.520593 127.978126 113.868293
       > m<-ets(dsp_ts,model='ZZZ',opt.crit=c('mae'),additive.only=TRUE</pre>
```

- 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 values⁹²;
 - 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

⁹¹ It bears noting that a lower value for the "score" indicates better accuracy of an algorithm.

⁹² 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 slopes⁹³.

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.

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

⁹³ 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.

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

Table 18: Mathematical Methods Associated with Trend & Seasonal Components

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 "Im" 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	Α	M
Ν	$\hat{y}_{t+h t} = \ell_t$ $\ell_t = lpha y_t + (1-lpha)\ell_{t-1}$	$egin{aligned} \hat{y}_{t+h t} &= \ell_t + s_{t-m+h_m^+} \ \ell_t &= lpha(y_t - s_{t-m}) + (1-lpha)\ell_{t-1} \ s_t &= \gamma(y_t - \ell_{t-1}) + (1-\gamma)s_{t-m} \end{aligned}$	$egin{aligned} \hat{y}_{t+h t} &= \ell_t s_{t-m+h_m^+} \ \ell_t &= lpha(y_t/s_{t-m}) + (1-lpha)\ell_{t-1} \ s_t &= \gamma(y_t/\ell_{t-1}) + (1-\gamma)s_{t-m} \end{aligned}$
A	$\hat{y}_{t+h t} = \ell_t + hb_t$ $\ell_t = lpha y_t + (1-lpha)(\ell_{t-1} + b_{t-1})$ $b_t = eta^*(\ell_t - \ell_{t-1}) + (1-eta^*)b_{t-1}$	$\begin{split} \hat{y}_{t+h t} &= \ell_t + hb_t + s_{t-m+h_m^+} \\ \ell_t &= \alpha(y_t - s_{t-m}) + (1-\alpha)(\ell_{t-1} + b_{t-1}) \\ b_t &= \beta^*(\ell_t - \ell_{t-1}) + (1-\beta^*)b_{t-1} \\ s_t &= \gamma(y_t - \ell_{t-1} - b_{t-1}) + (1-\gamma)s_{t-m} \end{split}$	$\begin{split} \hat{y}_{t+h t} &= (\ell_t + hb_t)s_{t-m+h_m^+} \\ \ell_t &= \alpha(y_t/s_{t-m}) + (1-\alpha)(\ell_{t-1} + b_{t-1}) \\ b_t &= \beta^*(\ell_t - \ell_{t-1}) + (1-\beta^*)b_{t-1} \\ s_t &= \gamma(y_t/(\ell_{t-1} + b_{t-1})) + (1-\gamma)s_{t-m} \end{split}$
$\mathbf{A}_{\mathbf{d}}$	$egin{aligned} \hat{y}_{t+h t} &= \ell_t + \phi_h b_t \ \ell_t &= lpha y_t + (1-lpha)(\ell_{t-1} + \phi b_{t-1}) \ b_t &= eta^*(\ell_t - \ell_{t-1}) + (1-eta^*)\phi b_{t-1} \end{aligned}$	$\begin{aligned} \hat{y}_{t+h t} &= \ell_t + \phi_h b_t + s_{t-m+h_m^+} \\ \ell_t &= \alpha(y_t - s_{t-m}) + (1-\alpha)(\ell_{t-1} + \phi_{t-1}) \\ b_t &= \beta^*(\ell_t - \ell_{t-1}) + (1-\beta^*)\phi_{t-1} \\ s_t &= \gamma(y_t - \ell_{t-1} - \phi_{t-1}) + (1-\gamma)s_{t-m} \end{aligned}$	$\begin{aligned} \hat{y}_{t+h t} &= (\ell_t + \phi_h b_t) s_{t-m+h_m^+} \\ \ell_t &= \alpha(y_t/s_{t-m}) + (1-\alpha)(\ell_{t-1} + \phi b_{t-1}) \\ b_t &= \beta^*(\ell_t - \ell_{t-1}) + (1-\beta^*)\phi b_{t-1} \\ s_t &= \gamma(y_t/(\ell_{t-1} + \phi b_{t-1})) + (1-\gamma)s_{t-m} \end{aligned}$
м	$egin{aligned} \hat{y}_{t+h t} &= \ell_t b_t^h \ \ell_t &= lpha y_t + (1-lpha) \ell_{t-1} b_{t-1} \ b_t &= eta^* (\ell_t / \ell_{t-1}) + (1-eta^*) b_{t-1} \end{aligned}$	$\begin{split} \hat{y}_{t+h t} &= \ell_t b_t^h + s_{t-m+h_m^+} \\ \ell_t &= \alpha(y_t - s_{t-m}) + (1-\alpha)\ell_{t-1}b_{t-1} \\ b_t &= \beta^*(\ell_t/\ell_{t-1}) + (1-\beta^*)b_{t-1} \\ s_t &= \gamma(y_t - \ell_{t-1}b_{t-1}) + (1-\gamma)s_{t-m} \end{split}$	$\begin{aligned} \hat{y}_{t+h t} &= \ell_t b_t^h s_{t-m+h_m^+} \\ \ell_t &= \alpha(y_t/s_{t-m}) + (1-\alpha)\ell_{t-1}b_{t-1} \\ b_t &= \beta^*(\ell_t/\ell_{t-1}) + (1-\beta^*)b_{t-1} \\ s_t &= \gamma(y_t/(\ell_{t-1}b_{t-1})) + (1-\gamma)s_{t-m} \end{aligned}$
$\mathbf{M}_{\mathbf{d}}$	$\begin{split} \hat{y}_{t+h t} &= \ell_t b_t^{\phi_h} \\ \ell_t &= \alpha y_t + (1-\alpha)\ell_{t-1}b_{t-1}^{\phi} \\ b_t &= \beta^*(\ell_t/\ell_{t-1}) + (1-\beta^*)b_{t-1}^{\phi} \end{split}$	$\begin{split} \hat{y}_{t+h t} &= \ell_t b_t^{\phi_h} + s_{t-m+h_m^+} \\ \ell_t &= \alpha(y_t - s_{t-m}) + (1-\alpha)\ell_{t-1}b_{t-1}^{\phi} \\ b_t &= \beta^*(\ell_t/\ell_{t-1}) + (1-\beta^*)b_{t-1}^{\phi} \\ s_t &= \gamma(y_t - \ell_{t-1}b_{t-1}^{\phi}) + (1-\gamma)s_{t-m} \end{split}$	$\begin{split} \hat{y}_{t+h t} &= \ell_t b_t^{\phi_h} s_{t-m+h_m^+} \\ \ell_t &= \alpha(y_t/s_{t-m}) + (1-\alpha)\ell_{t-1} b_{t-1}^{\phi} \\ b_t &= \beta^* (\ell_t/\ell_{t-1}) + (1-\beta^*) b_{t-1}^{\phi} \\ s_t &= \gamma(y_t/(\ell_{t-1} b_{t-1}^{\phi})) + (1-\gamma) s_{t-m} \end{split}$

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 6: Correlation Factors found as of 1Q2022 Image: Correlation Factors found as of 1Q2022

Variable 1	Variable 2	Correlation
S&P 500 Stock Price Index	Moody's AAA Curve	-0.605681
S&P 500 Stock Price Index	Moody's BAA Curve	-0.659909
S&P 500 Stock Price Index	Dow Jones Total Stock Market Index	0.983217
S&P 500 Stock Price Index	Residential Home Price Index	0.970927
S&P 500 Stock Price Index	Commercial Real Estate Index	0.958325
Cost of Federal Funds	Moody's AAA Curve	0.811222
Cost of Federal Funds	Moody's BAA Curve	0.753525
Cost of Federal Funds	BBB Corporate Yield	0.768449
Cost of Federal Funds	30-year Mortgage Rate	0.874936
Cost of Federal Funds	Prime Rate	0.996582
Cost of Federal Funds	US Average Retail Gasoline Price	-0.622188
Cost of Federal Funds	30-year Treasury Yield	0.796590
Cost of Federal Funds	20-year Treasury Yield	0.797994
Cost of Federal Funds	10-year Treasury Yield	0.859541
Cost of Federal Funds	1-month Treasury Yield	0.993231
Cost of Federal Funds	7-year Treasury Yield	0.897099
Cost of Federal Funds	3-month Treasury Yield	0.996027
Cost of Federal Funds	5-year Treasury Yield	0.922706
Cost of Federal Funds	6-month Treasury Yield	0.993097
Cost of Federal Funds	3-year Treasury Yield	0.954852
Cost of Federal Funds	1-year Treasury Yield	0.985924
Moody's AAA Curve	Moody's BAA Curve	0.979328
Moody's AAA Curve	BBB Corporate Yield	0.951249
Moody's AAA Curve	30-year Mortgage Rate	0.982653
Moody's AAA Curve	Prime Rate	0.795145
Moody's AAA Curve	Dow Jones Total Stock Market Index	-0.827804
Moody's AAA Curve	Residential Home Price Index	-0.855560
Moody's AAA Curve	Commercial Real Estate Index	-0.872374
Moody's AAA Curve	US Average Retail Gasoline Price	-0.723905
Moody's AAA Curve	30-year Treasury Yield	0.985245
Moody's AAA Curve	20-year Treasury Yield	0.984045
Moody's AAA Curve	10-year Treasury Yield	0.985273
Moody's AAA Curve	7-year Treasury Yield	0.966336
Moody's AAA Curve	3-month Treasury Yield	0.815611
Moody's AAA Curve	5-year Treasury Yield	0.946381
Moody's AAA Curve	6-month Treasury Yield	0.819559
Moody's AAA Curve	3-year Treasury Yield	0.903194
Moody's AAA Curve	1-year Treasury Yield	0.835530
Moody's BAA Curve	BBB Corporate Yield	0.986421
Moody's BAA Curve	30-year Mortgage Rate	0.955096
Moody's BAA Curve	Prime Rate	0.736492
Moody's BAA Curve	Dow Jones Total Stock Market Index	-0.848229
Moody's BAA Curve	Residential Home Price Index	-0.842581
Moody's BAA Curve	Commercial Real Estate Index	-0.846350
Moody's BAA Curve	US Average Retail Gasoline Price	-0.687078
Moody's BAA Curve	30-year Treasury Yield	0.949027
Moody's BAA Curve	20-year Treasury Yield	0.933477
Moody's BAA Curve	10-year Treasury Yield	0.948697
Moody's BAA Curve	7-year Treasury Yield	0.918484
Moody's BAA Curve	3-month Treasury Yield	0.755142

Moody's BAA Curve	5-year Treasury Yield	0.895579
Moody's BAA Curve	6-month Treasury Yield	0.760412
Moody's BAA Curve	3-year Treasury Yield	0.847002
Moody's BAA Curve	1-year Treasury Yield	0.776645
Real GDP Growth Rate	Nominal GDP Growth Rate	0.976912
Real Disposable Income Growth Rate	Nominal Disposable Income Growth Rate	0.975480
BBB Corporate Yield	30-year Mortgage Rate	0.941791
BBB Corporate Yield	Prime Rate	0.752101
BBB Corporate Yield	Dow Jones Total Stock Market Index	-0.794613
BBB Corporate Yield	Residential Home Price Index	-0.782593
BBB Corporate Yield	Commercial Real Estate Index	-0.770093
BBB Corporate Yield	US Average Retail Gasoline Price	-0.637558
BBB Corporate Yield	30-year Treasury Yield	0.908801
BBB Corporate Yield	20-year Treasury Yield	0.887806
BBB Corporate Yield	10-year Treasury Yield	0.926329
BBB Corporate Yield	7-year Treasury Yield	0.902257
BBB Corporate Yield	3-month Treasury Yield	0.769190
BBB Corporate Yield	5-vear Treasury Yield	0.886706
BBB Corporate Yield	6-month Treasury Yield	0.775919
BBB Corporate Yield	3-vear Treasury Yield	0.848047
BBB Corporate Yield	1-year Treasury Yield	0.789912
30-year Mortgage Rate	Prime Rate	0.859044
30-year Mortgage Rate	Dow Jones Total Stock Market Index	-0.761039
30-year Mortgage Rate	Residential Home Price Index	-0.777452
30-year Mortgage Rate	Commercial Real Estate Index	-0.798636
30-year Mortgage Rate	US Average Retail Gasoline Price	-0.706497
30-year Mortgage Rate	30-year Treasury Yield	0.973389
30-year Mortgage Rate	20-year Treasury Yield	0.979046
30-year Mortgage Rate	10-year Treasury Yield	0.992587
30-year Mortgage Bate	1-month Treasury Yield	0.676768
30-year Mortgage Rate	7-vear Treasury Yield	0.988679
30-year Mortgage Rate	3-month Treasury Yield	0.882590
30-year Mortgage Rate	5-vear Treasury Yield	0.980966
30-year Mortgage Rate	6-month Treasury Yield	0.888457
30-year Mortgage Rate	3-vear Treasury Yield	0.954590
30-year Mortgage Rate	1-year Treasury Yield	0.903312
Prime Rate	US Average Retail Gasoline Price	-0.613083
Prime Rate	30-year Treasury Yield	0.776490
Prime Rate	20-year Treasury Yield	0.790252
Prime Rate	10-year Treasury Yield	0.843660
Prime Rate	1-month Treasury Yield	0.991063
Prime Rate	7-vear Treasury Yield	0.882662
Prime Rate	3-month Treasury Yield	0.991984
Prime Rate	5-vear Treasury Yield	0.909953
Prime Bate	6-month Treasury Yield	0.989276
Prime Rate	3-year Treasury Yield	0.945616
Prime Rate	1-vear Treasury Yield	0.981462
Dow Jones Total Stock Market Index	Residential Home Price Index	0.898073
Dow Jones Total Stock Market Index	Commercial Real Estate Index	0.917399
Dow Jones Total Stock Market Index	30-year Treasury Yield	-0.824686
Dow Jones Total Stock Market Index	20-year Treasury Yield	-0.776866
Dow Jones Total Stock Market Index	10-year Treasury Yield	-0.773674
Dow Jones Total Stock Market Index	7-year Treasury Yield	-0 720242
Dow Jones Total Stock Market Index	5-year Treasury Yield	-0.680627
Dow Jones Total Stock Market Index	3-year Treasury Yield	-0.617105
Residential Home Price Index	Commercial Real Estate Index	0.969542
Residential Home Price Index	US Average Retail Gasoline Price	0.688121
Residential Home Price Index		-0.845867
Residential Home Price Index	20-year Treasury Vield	-0.043007
Residential Home Price Index		-0.7080317
Posidential Home Price Index		0.750931
Residential Home Price Index	5 year Trocsury Yield	-0.730014
Residential Llong Price Index		-0.722040
I RESIDENTIAL HOME PLICE INDEX	3-year freasury field	-0.002705

Commercial Real Estate Index	US Average Retail Gasoline Price	0.702078
Commercial Real Estate Index	30-year Treasury Yield	-0.877082
Commercial Real Estate Index	20-year Treasury Yield	-0.852508
Commercial Real Estate Index	10-year Treasury Yield	-0.826605
Commercial Real Estate Index	7-year Treasury Yield	-0.785828
Commercial Real Estate Index	5-year Treasury Yield	-0.746552
Commercial Real Estate Index	3-year Treasury Yield	-0.684923
Commercial Real Estate Index	1-year Treasury Yield	-0.602322
US Average Retail Gasoline Price	30-year Treasury Yield	-0.709157
US Average Retail Gasoline Price	20-year Treasury Yield	-0.705141
US Average Retail Gasoline Price	10-year Treasury Yield	-0.722768
US Average Retail Gasoline Price	7-year Treasury Yield	-0.725582
US Average Retail Gasoline Price	3-month Treasury Yield	-0.629485
US Average Retail Gasoline Price	5-year Treasury Yield	-0.721458
US Average Retail Gasoline Price	6-month Treasury Yield	-0.624675
US Average Retail Gasoline Price	3-year Treasury Yield	-0.693180
US Average Retail Gasoline Price	1-year Treasury Yield	-0.639134
30-year Treasury Yield	20-year Treasury Yield	0.995852
30-year Treasury Yield	10-year Treasury Yield	0.987403
30-year Treasury Yield	7-year Treasury Yield	0.968804
30-year Treasury Yield	3-month Treasury Yield	0.805622
30-year Treasury Yield	5-year Treasury Yield	0.945754
30-year Treasury Yield	6-month Treasury Yield	0.809468
30-year Treasury Yield	3-year Treasury Yield	0.899832
20 year Treasury Yield	1-year Trocsury Yield	0.827423
20-year Treasury Yield	7 year Treasury Held	0.992828
20-year Treasury Vield	3-month Treasury Vield	0.972451
20-year Treasury Yield	5-vear Treasury Vield	0.804803
20-year Treasury Yield	6-month Treasury Yield	0.813195
20-year Treasury Yield	3-year Treasury Yield	0.901708
20-year Treasury Yield	1-vear Treasury Yield	0.834789
10-year Treasury Yield	1-month Treasury Yield	0.655812
10-year Treasury Yield	7-vear Treasury Yield	0.993601
10-year Treasury Yield	3-month Treasury Yield	0.869336
10-year Treasury Yield	5-year Treasury Yield	0.981473
10-year Treasury Yield	6-month Treasury Yield	0.874679
10-year Treasury Yield	3-year Treasury Yield	0.949991
10-year Treasury Yield	1-year Treasury Yield	0.891093
1-month Treasury Yield	7-year Treasury Yield	0.762699
1-month Treasury Yield	3-month Treasury Yield	0.997475
1-month Treasury Yield	5-year Treasury Yield	0.838711
1-month Treasury Yield	6-month Treasury Yield	0.991547
1-month Treasury Yield	3-year Treasury Yield	0.918745
1-month Treasury Yield	1-year Treasury Yield	0.980943
7-year Treasury Yield	3-month Treasury Yield	0.908888
7-year Treasury Yield	5-year Treasury Yield	0.996239
7-year Treasury Yield	6-month Treasury Yield	0.914531
7-year Treasury Yield	3-year Treasury Yield	0.977248
7-year Treasury Yield	1-year Treasury Yield	0.929668
3-month Treasury Yield	5-year Treasury Yield	0.935075
3-month Treasury Yield	6-month Treasury Yield	0.998711
3-month Treasury Yield	3-year Treasury Yield	0.967607
3-month Treasury Yield	1-year Treasury Yield	0.994393
5-year Treasury Yield	6-month Treasury Yield	0.940905
5-year Treasury Yield	3-year Treasury Yield	0.991158
5-year Treasury Yield	1-year Treasury Yield	0.954464
6-month Treasury Yield	3-year Treasury Yield	0.973567
6-month Treasury Yield	1-year Treasury Yield	0.997947
2 Maan Traasury Vield		

Appendix D: Mortgage Delinquencies

The following tables, Table 7 through Table 11, present the delinquency rates of mortgages held by Freddie Mac for May 2022 in several southeastern states, broken down by MSA. As we have provided this information for many previous reports, but the information does not appear pertinent to the main portion of the paper, we have included it here for continuity and general interest.

MSA	# Units	Total	Current	30-59 dpd	60-89 dpd	90-119 dpd	120+ dpd	% 30dpd	% >30 dpd	% >= 30 dpd
Anniston-Oxford, AL	1 unit	1407	1385	11	2	2	7	0.78%	0.78%	1.56%
	2 units	3	3	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	7	7	0	0	0	0	0.00%	0.00%	0.00%
Auburn-Opelika, AL	1 unit	5424	5377	20	7	0	20	0.37%	0.50%	0.87%
	2 units	36	36	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	1	1	0	0	0	0	0.00%	0.00%	0.00%
Birmingham-Hoover, AL	1 unit	35772	35366	176	53	22	155	0.49%	0.64%	1.14%
	2 units	30	30	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	18	18	0	0	0	0	0.00%	0.00%	0.00%
Columbus, GA-AL	1 unit	419	414	1	0	1	3	0.24%	0.96%	1.19%
	2 units	5	5	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	0	0	0	0	0	0	0.00%	0.00%	0.00%
Daphne-Fairhope-Foley, AL	1 unit	9536	9437	63	8	6	22	0.66%	0.38%	1.04%
	2 units	18	18	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	4	4	0	0	0	0	0.00%	0.00%	0.00%
Decatur, AL	1 unit	2593	2558	22	2	2	9	0.85%	0.50%	1.35%
	2 units	6	6	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	12	12	0	0	0	0	0.00%	0.00%	0.00%
Dothan, AL	1 unit	2440	2407	15	1	4	13	0.62%	0.74%	1.35%
	2 units	1	1	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	2	2	0	0	0	0	0.00%	0.00%	0.00%
Florence-Muscle Shoals, AL	1 unit	3116	3063	31	0	1	21	1.00%	0.71%	1.70%
	2 units	3	3	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	1	1	0	0	0	0	0.00%	0.00%	0.00%
Gadsden, AL	1 unit	1470	1444	11	2	2	11	0.75%	1.02%	1.77%
	2 units	2	2	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	1	1	0	0	0	0	0.00%	0.00%	0.00%
Huntsville, AL	1 unit	16558	16409	83	11	7	48	0.50%	0.40%	0.90%
	2 units	25	25	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	58	58	0	0	0	0	0.00%	0.00%	0.00%
Mobile, AL	1 unit	6713	6612	48	12	2	39	0.72%	0.79%	1.51%
	2 units	16	16	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	6	6	0	0	0	0	0.00%	0.00%	0.00%
Montgomery, AL	1 unit	7125	7031	40	13	6	35	0.56%	0.76%	1.32%

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

	2 units	25	25	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	11	11	0	0	0	0	0.00%	0.00%	0.00%
Tuscaloosa, AL	1 unit	5928	5853	41	3	4	27	0.69%	0.57%	1.27%
	2 units	4	4	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	2	2	0	0	0	0	0.00%	0.00%	0.00%
Outside all MSAs	1 unit	12622	12402	103	20	14	83	0.82%	0.93%	1.74%
	2 units	45	45	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	11	11	0	0	0	0	0.00%	0.00%	0.00%

			Curren							
MSA	# Units	Total	t	30-59 dpd	60-89 dpd	90-119 dpd	120+ dpd	% 30dpd	% >30 dpd	% >= 30 dpd
Cape Coral-Fort Myers, FL	1 unit	31879	31090	392	271	24	102	1.23%	1.25%	2.48%
	2 units	437	416	12	9	0	0	2.75%	2.06%	4.81%
	3+ units	48	44	3	1	0	0	6.25%	2.08%	8.33%
Crestview-Fort Walton Beach-	A 11	0054	0504	54	10	0	05	0 500/	0.45%	4.040/
Destin, FL		8654	8564	51	12	2	25	0.59%	0.45%	1.04%
	2 units	20	20	0	0	0	0	0.00%	0.00%	0.00%
Deltana Deutana Basah	3+ units	19	19	0	0	0	0	0.00%	0.00%	0.00%
Ormond Beach, FL	1 unit	22518	22198	158	72	12	78	0.70%	0.72%	1 42%
	2 units	203	200	2	1	0	0	0.99%	0.49%	1.42%
	3+ units	56	55	0	0	0	1	0.00%	1 79%	1.40%
Gainesville, El	1 unit	7057	6989	36	10	1	21	0.51%	0.45%	0.96%
	2 unite	28	28	0	0	0	0	0.01%	0.40%	0.00%
	2 units	16	1/	0	0	0	2	0.00%	12 50%	12 50%
Homosassa Springs El	1 unit	3795	3750	22	3	3	17	0.58%	0.61%	1 19%
	2 unite	33	3730	0	0	0	0	0.00%	0.01%	0.00%
	2 units	33	33	0	0	0	0	0.00%	0.00%	0.00%
	1 unit	48577	48125	216	56	28	152	0.00%	0.00%	0.00%
Jacksonvine, TL	2 unite	211	200	210		20	102	0.43%	0.43%	0.95%
	2 units	120	128	1	0	0	0	0.47 %	0.47 %	0.95%
Lakaland Winter Haven, El	1 unit	10540	10060	121	64	19	61	0.70%	0.00%	1 /00/
	2 unite	10042	10200	131	04	10	0	0.71%	0.77%	0.00%
	2 units	F2	52	0	0	0	0	0.00%	0.00%	0.00%
Miami-Fort Lauderdale-	S+ units	16024	52 15778	1	0	0	0	1.09%	0.00%	1.09%
Pompano Beach, FL	1 unit	7	9	1053	297	159	949	0.66%	0.88%	1.53%
	2 units	1395	1374	10	1	2	8	0.72%	0.79%	1.51%
	3+ units	617	611	2	0	0	4	0.32%	0.65%	0.97%
Naples-Marco Island, FL	1 unit	14932	14745	87	38	5	57	0.58%	0.67%	1.25%
	2 units	54	52	1	1	0	0	1.85%	1.85%	3.70%
	3+ units	18	17	1	0	0	0	5.56%	0.00%	5.56%
North Port-Sarasota-Bradenton,	0 01110				<u> </u>			0.0070	0.0070	0.0070
FL	1 unit	37348	36850	228	141	19	110	0.61%	0.72%	1.33%
	2 units	208	205	1	0	0	2	0.48%	0.96%	1.44%
	3+ units	33	33	0	0	0	0	0.00%	0.00%	0.00%
Ocala, FL	1 unit	9191	9069	64	20	7	31	0.70%	0.63%	1.33%

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

	2 units	28	28	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	24	24	0	0	0	0	0.00%	0.00%	0.00%
Orlando-Kissimmee-Sanford,										
FL	1 unit	87051	85807	567	219	84	374	0.65%	0.78%	1.43%
	2 units	362	360	0	0	0	2	0.00%	0.55%	0.55%
	3+ units	99	97	2	0	0	0	2.02%	0.00%	2.02%
Palm Bay-Melbourne-Titusville,	1 unit	22240	22077	100	27	15	02	0.57%	0.60%	1 100/
FL	1 unit	22340	22077	120	37	15	03	0.00%	0.00%	1.10%
	2 units	20	00	1	0	0	1	0.00%	0.00%	0.00%
	3+ units	30	28		0	0	10	3.33%	3.33%	0.07%
Panama City, FL		5179	5105	41	8	6	19	0.79%	0.64%	1.43%
	2 units	49	49	0	0	0	0	0.00%	0.00%	0.00%
Developed a Development	3+ units	16	16	0	0	0	0	0.00%	0.00%	0.00%
FL	1 unit	11580	11419	74	25	4	58	0.64%	0.75%	1.39%
	2 units	84	84	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	46	46	0	0	0	0	0.00%	0.00%	0.00%
Port St. Lucie, FL	1 unit	18865	18637	100	36	16	76	0.53%	0.68%	1.21%
	2 units	75	74	0	0	0	1	0.00%	1.33%	1.33%
	3+ units	17	17	0	0	0	0	0.00%	0.00%	0.00%
Punta Gorda, FL	1 unit	8724	8508	91	79	6	40	1.04%	1.43%	2.48%
	2 units	37	36	1	0	0	0	2.70%	0.00%	2.70%
	3+ units	7	7	0	0	0	0	0.00%	0.00%	0.00%
Sebastian-Vero Beach, FL	1 unit	6532	6453	27	7	6	39	0.41%	0.80%	1.21%
	2 units	16	15	0	0	0	1	0.00%	6.25%	6.25%
	3+ units	10	10	0	0	0	0	0.00%	0.00%	0.00%
Sebring-Avon Park, FL	1 unit	2212	2182	22	3	1	4	1.00%	0.36%	1.36%
	2 units	23	23	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	6	6	0	0	0	0	0.00%	0.00%	0.00%
Tallahassee, FL	1 unit	10032	9913	69	14	3	33	0.69%	0.50%	1.19%
	2 units	59	59	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	40	40	0	0	0	0	0.00%	0.00%	0.00%
Tampa-St. Petersburg-		10811	10685							
Clearwater, FL	1 unit	3	8	600	185	80	390	0.56%	0.61%	1.16%
	2 units	588	582	3	1	0	2	0.51%	0.51%	1.02%
	3+ units	301	298	2	0	1	0	0.66%	0.33%	1.00%
The Villages, FL	1 unit	3102	3088	5	3	1	5	0.16%	0.29%	0.45%
	2 units	1	1	0	0	0	0	0.00%	0.00%	0.00%

	3+ units	0	0	0	0	0	0	0.00%	0.00%	0.00%
Outside all MSAs	1 unit	10539	10368	77	18	15	61	0.73%	0.89%	1.62%
	2 units	352	345	4	1	0	2	1.14%	0.85%	1.99%
	3+ units	60	58	1	0	0	1	1.67%	1.67%	3.33%

										% >= 30
MSA	# Units	Total	Current	30-59 dpd	60-89 dpd	90-119 dpd	120+ dpd	% 30dpd	% >30 dpd	dpd
Alexandria, LA	1 unit	1839	1805	18	3	2	11	0.98%	0.87%	1.85%
	2 units	1	1	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	0	0	0	0	0	0	0.00%	0.00%	0.00%
Baton Rouge, LA	1 unit	23697	23315	169	46	18	149	0.71%	0.90%	1.61%
	2 units	62	59	1	1	0	1	1.61%	3.23%	4.84%
	3+ units	68	68	0	0	0	0	0.00%	0.00%	0.00%
Hammond, LA	1 unit	2410	2368	18	7	1	16	0.75%	1.00%	1.74%
	2 units	13	13	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	10	10	0	0	0	0	0.00%	0.00%	0.00%
Houma-Thibodaux, LA	1 unit	3674	3585	43	11	3	32	1.17%	1.25%	2.42%
	2 units	5	2	2	0	0	1	40.00%	20.00%	60.00%
	3+ units	5	5	0	0	0	0	0.00%	0.00%	0.00%
Lafayette, LA	1 unit	9829	9619	74	23	12	101	0.75%	1.38%	2.14%
	2 units	12	12	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	33	31	2	0	0	0	6.06%	0.00%	6.06%
Lake Charles, LA	1 unit	3955	3875	41	6	5	28	1.04%	0.99%	2.02%
	2 units	15	15	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	7	7	0	0	0	0	0.00%	0.00%	0.00%
Monroe, LA	1 unit	2876	2817	24	2	6	27	0.83%	1.22%	2.05%
	2 units	2	2	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	0	0	0	0	0	0	0.00%	0.00%	0.00%
New Orleans-Metairie, LA	1 unit	31237	30694	206	65	29	243	0.66%	1.08%	1.74%
,	2 units	1677	1656	11	3	0	7	0.66%	0.60%	1.25%
	3+ units	407	394	2	0	0	11	0.49%	2.70%	3.19%
Shreveport-Bossier City, LA	1 unit	7607	7455	74	16	6	56	0.97%	1.03%	2.00%
,,	2 units	5	5	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	9	9	0	0	0	0	0.00%	0.00%	0.00%
Outside all MSAs	1 unit	6184	6036	60	13	5	70	0.97%	1.42%	2.39%
	2 units	470	461	0	0	0	9	0.00%	1.92%	1.92%
	3+ units	96	96	0	0	0	0	0.00%	0.00%	0.00%

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

MSA	# Units	Total	Current	30-59 dpd	60-89 dpd	90-119 dpd	120+ dpd	% 30dpd	% >30 dpd	% >= 30 dpd
Gulfport-Biloxi, MS	1 unit	4940	4872	32	6	2	28	0.65%	0.73%	1.38%
	2 units	37	37	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	14	14	0	0	0	0	0.00%	0.00%	0.00%
Hattiesburg, MS	1 unit	2389	2350	21	4	0	14	0.88%	0.75%	1.63%
	2 units	4	4	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	2	2	0	0	0	0	0.00%	0.00%	0.00%
Jackson, MS	1 unit	9265	9118	60	16	7	64	0.65%	0.94%	1.59%
	2 units	12	11	1	0	0	0	8.33%	0.00%	8.33%
	3+ units	4	4	0	0	0	0	0.00%	0.00%	0.00%
Memphis, TN-MS-AR	1 unit	6005	5924	41	11	7	22	0.68%	0.67%	1.35%
	2 units	2	2	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	0	0	0	0	0	0	0.00%	0.00%	0.00%
Outside all MSAs	1 unit	11310	11075	102	25	11	97	0.90%	1.18%	2.08%
	2 units	16	16	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	3	3	0	0	0	0	0.00%	0.00%	0.00%

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

						90-119				
MSA	# Units	Total	Current	30-59 dpd	60-89 dpd	dpd	120+ dpd	% 30dpd	% >30 dpd	% >= 30 dpd
Abilene, TX	1 unit	3883	3825	25	12	1	20	0.64%	0.85%	1.49%
	2 units	20	19	1	0	0	0	5.00%	0.00%	5.00%
	3+ units	2	2	0	0	0	0	0.00%	0.00%	0.00%
Amarillo, TX	1 unit	4546	4477	29	6	8	26	0.64%	0.88%	1.52%
	2 units	15	15	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	5	5	0	0	0	0	0.00%	0.00%	0.00%
Austin-Round Rock-										
Georgetown, TX	1 unit	99910	99017	439	124	42	288	0.44%	0.45%	0.89%
	2 units	1139	1135	3	0	0	1	0.26%	0.09%	0.35%
	3+ units	237	233	1	0	0	3	0.42%	1.27%	1.69%
Beaumont-Port Arthur, TX	1 unit	5659	5543	47	16	8	45	0.83%	1.22%	2.05%
	2 units	4	4	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	9	9	0	0	0	0	0.00%	0.00%	0.00%
Brownsville-Harlingen, TX	1 unit	2827	2763	32	9	2	21	1.13%	1.13%	2.26%
	2 units	36	36	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	33	33	0	0	0	0	0.00%	0.00%	0.00%
College Station-Bryan, TX	1 unit	6957	6906	29	1	3	18	0.42%	0.32%	0.73%
	2 units	106	106	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	68	68	0	0	0	0	0.00%	0.00%	0.00%
Corpus Christi, TX	1 unit	7241	7115	57	12	9	48	0.79%	0.95%	1.74%
· · · ·	2 units	17	17	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	18	18	0	0	0	0	0.00%	0.00%	0.00%
Dallas-Fort Worth-Arlington,										
ТХ	1 unit	271369	268522	1368	356	179	944	0.50%	0.55%	1.05%
	2 units	879	872	4	1	0	2	0.46%	0.34%	0.80%
	3+ units	238	237	1	0	0	0	0.42%	0.00%	0.42%
El Paso, TX	1 unit	6627	6500	63	18	7	39	0.95%	0.97%	1.92%
	2 units	74	73	0	0	1	0	0.00%	1.35%	1.35%
	3+ units	32	32	0	0	0	0	0.00%	0.00%	0.00%
Houston-The Woodlands-										
Sugar Land, TX	1 unit	195538	192652	1294	333	168	1091	0.66%	0.81%	1.48%
	2 units	349	344	2	0	0	3	0.57%	0.86%	1.43%
	3+ units	294	289	2	0	0	3	0.68%	1.02%	1.70%
Killeen-Temple, TX	1 unit	6766	6678	45	9	2	32	0.67%	0.64%	1.30%

Table 11: Percentage of Freddie Mac Mortgages by Status (Current, 30 dpd and 30 + dpd) as of December 2022: Texas & SMSAs

	2 units	225	225	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	189	187	0	0	0	2	0.00%	1.06%	1.06%
Laredo, TX	1 unit	1885	1851	16	7	4	7	0.85%	0.96%	1.80%
	2 units	4	2	2	0	0	0	50.00%	0.00%	50.00%
	3+ units	11	11	0	0	0	0	0.00%	0.00%	0.00%
Longview, TX	1 unit	2903	2848	23	7	2	23	0.79%	1.10%	1.90%
	2 units	17	17	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	2	2	0	0	0	0	0.00%	0.00%	0.00%
Lubbock, TX	1 unit	8417	8326	46	15	3	27	0.55%	0.54%	1.08%
	2 units	124	124	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	19	19	0	0	0	0	0.00%	0.00%	0.00%
McAllen-Edinburg-Mission, TX	1 unit	4454	4343	56	11	6	38	1.26%	1.24%	2.49%
	2 units	17	16	0	0	0	1	0.00%	5.88%	5.88%
	3+ units	208	207	0	0	0	1	0.00%	0.48%	0.48%
Midland, TX	1 unit	6158	6047	42	14	4	51	0.68%	1.12%	1.80%
	2 units	15	15	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	2	2	0	0	0	0	0.00%	0.00%	0.00%
Odessa, TX	1 unit	2326	2255	33	10	1	27	1.42%	1.63%	3.05%
	2 units	5	5	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	0	0	0	0	0	0	0.00%	0.00%	0.00%
San Angelo, TX	1 unit	2575	2534	19	5	3	14	0.74%	0.85%	1.59%
	2 units	7	7	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	3	3	0	0	0	0	0.00%	0.00%	0.00%
San Antonio-New Braunfels, TX	1 unit	56805	56097	363	81	27	237	0.64%	0.61%	1.25%
	2 units	418	414	3	0	0	1	0.72%	0.24%	0.96%
	3+ units	222	222	0	0	0	0	0.00%	0.00%	0.00%
Sherman-Denison, TX	1 unit	4519	4446	45	9	2	17	1.00%	0.62%	1.62%
	2 units	40	40	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	1	1	0	0	0	0	0.00%	0.00%	0.00%
Texarkana, TX-AR	1 unit	1236	1209	13	3	4	7	1.05%	1.13%	2.18%
	2 units	6	6	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	4	4	0	0	0	0	0.00%	0.00%	0.00%
Tyler, TX	1 unit	4758	4695	32	5	2	24	0.67%	0.65%	1.32%
	2 units	13	13	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	1	1	0	0	0	0	0.00%	0.00%	0.00%
Victoria, TX	1 unit	1182	1163	8	4	1	6	0.68%	0.93%	1.61%

	2 units	5	5	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	0	0	0	0	0	0	0.00%	0.00%	0.00%
Waco, TX	1 unit	5144	5073	40	8	6	17	0.78%	0.60%	1.38%
	2 units	53	53	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	2	2	0	0	0	0	0.00%	0.00%	0.00%
Wichita Falls, TX	1 unit	1577	1552	9	3	0	13	0.57%	1.02%	1.59%
	2 units	7	7	0	0	0	0	0.00%	0.00%	0.00%
	3+ units	3	3	0	0	0	0	0.00%	0.00%	0.00%
Outside all MSAs	1 unit	36528	35893	296	83	39	217	0.81%	0.93%	1.74%
	2 units	480	478	0	0	0	2	0.00%	0.42%	0.42%
	3+ units	64	64	0	0	0	0	0.00%	0.00%	0.00%

Data: STACR Freddie Mac, as of 23 Dec 2022

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