Macroeconomic Forecasts, 3Q2023 Domestic Metrics



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Summary

Looking at 2Q of 2023 (and forecasting 3Q), the United States is in a state of transition. After inflationary pressures took control of the economy during a post-COVID period lasting approximately 16 months (March 2021 through June 2022), the economy experienced disinflation brought on by robust contractionary monetary policy. The worries that the Fed's policies would create an economic recessionary were based on previous circumstances (e.g. the Volker recession) when the Fed took control of inflation by increasing interest rate targets. The economy experienced more of a soft-landing during the current period, but not without some nagging economic worries. The prevailing 'sore spots' of the economy include:

- A prolonged period of under-employment, particularly for males, highlighted by a low labor force participation rate;
- Stagnant real wages for most industries;
- High interest rates;
- Continued disinterest in 'returning to the office' for workers, correlating with lower 'office space' utilization and pressures on the real estate market.

Although there might be "a light at the end of the (proverbial) tunnel" for the economy, it could possibly be an oncoming train! That is to say, although the economy looks like it is on solid footing, there are potential issues that could have a negative impact on the economy. Inflation pressures and an unstable housing and rental real estate market must be monitored and evaluated; a large drop in real wages and an increase in real estate loan defaults are possible and would signal an economic movement in a recessionary direction.

State of Affairs: Macroeconomic Indicators

Inflation

The primary concerns of the economy (dating back to 1Q2022) are related to inflation and the policy responses to inflation. Consumers are acutely aware of the prices changes in three areas: energy¹, food², and housing³. We have entered a period of dis-inflation (where price increases are becoming smaller). The rate of inflation fell under 4% annually but has recently ticked back up again to nearly 4% again. The Fed' is contemplating another 25 bp interest rate target hike⁴ to keep inflation at bay.



Figure 1: National Overall Rate of Inflation, 2008-Present

Inflation has been trending downward since the 2nd quarter of 2022. However, persistently high prices (particularly for grocery-store food) contributed to the negative movement of consumer confidence. The increase in interest rate targets for the Fed has been successful in creating downward momentum in price changes. Prices are increasing but at a decreasing rate. However, inflation took a small upward turn at the end of the Summer. This movement in inflation could signal a change in the economy from a soft-landing to an economic recession.

¹ https://www.bloomberg.com/news/articles/2022-06-09/gasoline-food-and-power-inflation-slam-us-households-and-it-could-get-worse ² ibid

³ https://money.com/housing-market-cooldown-signs-predictions/?ref=/housing-market-correction-federal-reserve/

⁴ https://www.bankrate.com/banking/federal-reserve/how-much-will-fed-raise-rates-in-2023/

Inflation: Fuel

Because fuel, food, and housing are the biggest components in consumer's budgets, it is critical to understand the inflationary aspects of these areas. Table 1 and Figure 2 identify the trends of fuel prices in the US.

Figure 2Table 1 (and Figure 2) highlight the issues that have troubled consumers and now seem to be closer to pre-pandemic levels. Fuel prices as of July 1, 2023, are nearly 20% lower than the prices from July 1, 2022. This corresponds with the over-all lower inflationary trend (see preceding graph of inflation).

Table 1: Average Gas Prices (per Gallon) in US, as of October 3, 2023

	Regular	Mid- Grade	Premium	Diesel	E85
Current Avg.	\$3.814	\$4.280	\$4.614	\$4.557	\$3.099
Yesterday Avg.	\$3.815	\$4.288	\$4.623	\$4.560	\$3.110
Week Ago Avg.	\$3.849	\$4.300	\$4.636	\$4.574	\$3.183
Month Ago Avg.	\$3.815	\$4.248	\$4.581	\$4.460	\$3.093
Year Ago Avg.	\$3.796	\$4.261	\$4.571	\$4.873	\$3.101

Source: https://gasprices.aaa.com



Figure 2: US National Energy Price Inflation, 2009-Present

The price of energy in US cities fell considerably from July 2022 through July, 2023. The movement in oil and gas prices has been quite mild. Although we have seen consumer confidence fall, relatively stable gas prices have kept confidence from falling into the basement.

Inflation: Food

We are seeing the overall price of food decreasing for food at home as well as restaurant meals. This is a divergence from the previous trend, where prices for food at home were falling while restaurant meals were spiking. The drop in food prices is consistent with the overall drop in inflation.



Figure 3: US National Food Price Inflation (at Home), 2000-Present

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Figure 4: US National Prepared Food Price Inflation (Away from Home), 2008-Present

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

The decrease in food inflation does not mean that food has become cheaper. In fact, the prices of groceries – from eggs and milk to bread and proteins – has increased from pre-pandemic levels. The price increases in grocery-purchased foods have declined but is not negative. It is unlikely that the price of eggs or milk will return to pre-pandemic level.

Housing Prices and Housing Inflation

Since early in the pandemic, the US has seen an upward spike in the price of single-family housing units. The median price of houses spiked in early Summer 2022 and then fell through early Summer 2023. The last spike was not as high as the 2022 increase, but was still considerably larger than the Pre-pandemic median-sales price. The Case-Shiller index revealed a decrease in the year-over-year movement in housing prices and, very briefly, showed a small negative movement in housing price movement (indicating deflation in housing prices). The negative trend was short lived and housing prices are starting to increase again.

Overall, an increase in mortgage rates and an increase in the median price per square foot of residential housing is making it much more difficult for families to own a home. The trend towards rental properties is likely contributing to the overall inflationary pressure for rental prices. We have not seen an increase in default rates for home mortgages yet. We could see an increase in default rates if unemployment rates spiked. Luckily, this hasn't occurred.



Figure 5: US National Residential Housing Inventory, February 2018-November 2022





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Figure 7: Median Sales Price



Figure 8: US National Home Price Inflation (Redfin), Feb 2018-Nov 2022



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

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Figure 9: US National New Home Construction Permits, January 2015-Present



Figure 10: 30-year Fixed Mortgage Rate

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Rate of Inflation: Residential Rental Prices

Inflation: Summary

Consumers are extremely aware of the inflationary trends of the US. The inflationary expectations (as shown in Figure 13 and Figure 14, 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 downward trend in inflation and inflationary expectations seems to be strongly correlated to an increase in consumer confidence.



Figure 13: US Consumer Inflation Expectations

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Figure 15: 24-month ARIMA Model for US Inflation





Figure 16: 36-month ARIMA Model for US Inflation

Source: Authors' calculations based on CPI

Figure 17: Effective Federal Funds Rate, 2010-Present



Macroeconomic Indicators: Other

The Real GDP of the United States is still growing, although we did experience two periods of negative quarter-over-quarter growth for the real GDP during 1Q2022 and 2Q2022 (see Figure 18 and Figure 19). 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. Although we've suggested that the economy has been operating in a growth recession, we are less certain that this is still the case. The current GDP growth is slightly under 2.5 percent annually.



Figure 18: Y/Y Change in Real GDP

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Figure 19: Q/Q % Change in Real GDP



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

Figure 20 and Figure 21 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.

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Inflations & Real Wages

Figure 22 and Figure 24 show national overall average real wages, and national average real wages by industry. The real wages for the US have shown a continued downward trend. Although nominal wages are increasing slightly, the buying power of those wages have decreased significantly as the result of the near double-digit inflation.





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Figure 23: Real Hourly Wages (Nationwide)



Source: Federal Reserve Economic Database (https://fred.stlouisfed.org) Figure 24: Real Hourly Wages for Select Industries (Nationwide)



Unemployment and Labor Force Participation

Although the current unemployment rate (3.6%) is nearly as low as the month before the start of the pandemic (3.5%, March 2020, per Figure 25), the employment situation is still unstable and is a continued cause for concern. The labor force participation rate (Figure 26) has not reached prepandemic levels. The labor force participation rate is ticking up a little bit, but not at the magnitude needed to fulfill the plethora of job vacancies. The differences in the labor force participation rates genders and races shows that only black men and Hispanic men have surpassed their participation rates prior to the pandemic.

The labor market participants have continued to be stubborn; we are seeing some movements in the labor force participation, but the gains are marginal.



Figure 25: US National Unemployment Rate



Figure 26: US National Labor Force Participation Rate











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



Figure 29: Employment Level (Nationwide)

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Real Estate Focus

In spite of the trend in commercial real estate (office space), the market for home real estate is showing small but stable improvements. According to the Mortgage Bankers Association⁵, delinquency rates on mortgages are falling.

- The 30-day delinquency rate fell by 2 basis points to 1.75%.
- The 60-day delinquency rate remained steady at 0.55%.
- The 90-day delinquency rate fell by 17 basis points to 1.07%.



Figure 30 Vacancy Rates and New Supply of Office Space (in Millions of Square Feet)

⁵ https://nationalmortgageprofessional.com/news/mba-mortgage-delinquency-rates-hit-historic-low-q2-2023



Figure 31 Changes in Vacancy Rates by Metropolitan Area (Q4: 2019 - Q1: 2023)

Although the overall trends are showing improvements, there are five states experiencing increases in their non-seasonally adjusted delinquency rates: Indiana (37 basis points), Michigan (35 basis points), Ohio (35 basis points), Pennsylvania (32 basis points), and Texas (31 basis points) all saw increases in conventional loan delinquency rates.

Disruptive ("Black Swan") Events

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

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

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

- 2. Disinformation Campaigns: A staple of international conflicts (both military and otherwise), organized campaigns based on disinformation or propaganda have been around for hundreds of years. Most recently, the US has made allegations against foreign governments that there has been interference in federal elections (and caused social unrest) by using freely available social networks⁶. It is expected that the same types of propaganda that was made noteworthy in 2016 will continue to be seen in future elections at all levels of government, and as part of other key events.
- 3. Disruptive Malware and Ransomware: Malware has been an issue for computers for decades, dating back to the initial hypothesized versions of "worms" in US universities of the 1960s and 1970s (as "thought exercises"). More recently, however, sophisticated attacks on businesses have (literally) become a business for some entities, foreign and domestic. "Ransomware" is the latest version of malware that "... [locks and encrypts] a victim's computer or device data, then demand a ransom to restore access."⁷ 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)⁸. And, just to add an interesting twist, ransomware is now even offered as a *service* in which a criminal may sell a *license* to a (software) ransomware variant to another criminal, who will then infect a system and demand a fee for the decryption key. As our society becomes more dependent on automated systems, disruptions to those systems will have an increasing impact on us.
- 4. Societal Unrest, including Domestic Social Changes and Terrorism: During 2020, we saw many social protests turn violent on both ends of the political spectrum. Without warning, these movements have caused rapid and unexpected upheavals in social climates, and upended

⁶ See https://www.nytimes.com/2020/09/01/technology/facebook-russia-disinformation-election.html

⁷ See https://us.norton.com/internetsecurity-malware-ransomware-5-dos-and-donts.html

⁸ See https://security.berkeley.edu/faq/ransomware/ and https://securityintelligence.com/articles/6-ransomware-trends-2020/

assumptions on which financial decisions were made. As these questions have been explored socially and officially, the discussions have led to questions of how deep the disdain in the country remains on both sides of the political fence, and what societal and legislative impacts these investigations may carry.⁹

- 5. Unanticipated Changes in Leadership: President Biden is currently 80 years old (the oldest seated President of the United States). While he is now expected to run for President again in 2024¹⁰, his age is a recurring topic of conversation. 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 diversity¹¹ and wage protection¹², but we are most concerned about how she will be perceived on the international stage in negotiations with, e.g., Saudi Arabia, and countries in the Far East.
- 6. Supply Chain Disruptions: The blockage of the Suez Canal by the tanker Ever Given in March 2021 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 goods¹³. Notice that the Suez, the Panama Canal, the Strait of Hormuz, and the Malacca Strait are the four most noteworthy trade chokepoints. If closed, the Panama Canal would impact 5% of global trade (and 60% of US imports and exports); closing the Strait of Hormuz would affect 25% of seaborne oil and a third of global liquified natural gas; and the Malacca Strait carries 40% of all global trade (including 16M barrels of oil per day globally).¹⁴
- 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 & Nevis¹⁵. Ecuador, Senegal, and China have canceled or withdrawn their currencies¹⁶.
- 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.

⁹ See https://www.npr.org/2020/11/05/931829801/election-dispute-increases-risk-of-political-violence-analysts-warn , https://www.independent.co.uk/news/world/americas/us-election-2020/election-results-2020-riots-trump-biden-b1700559.html , and https://www.brookings.edu/blog/fixgov/2020/10/27/why-the-risk-of-election-violence-is-high/

¹⁰ https://www.cnn.com/2023/02/16/politics/joe-biden-age-question/index.html

¹¹ See, e.g., https://www.huffpost.com/entry/kamala-harris-vice-president-nominee-dnc_n_5f36f56bc5b69fa9e2fb7862

¹² See, e.g., https://www.shrm.org/resourcesandtools/hr-topics/benefits/pages/where-kamala-harris-stands-on-workers-pay-and-benefits.aspx ¹³ See https://www.businessinsider.com/toilet-paper-coffee-products-delayed-suez-canal-blockage-impact-2021-3

¹⁴ See https://www.dw.com/en/suez-canal-blockage-4-of-the-biggest-trade-chokepoints/a-57020755

¹⁵ https://www.atlanticcouncil.org/cbdctracker/

¹⁶ Ibid.

Data Analysis

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

Capitalytics provides the results of a rigorous analysis of every variable that is included in our quarterly macroeconomic study. These variables include the following¹⁷:

- 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)

¹⁷ 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 164 pairs of variables that showed absolute correlation values greater than or equal to 0.6. As part of this portion of the study, Capitalytics identified the following sets of strong dependencies (correlations with magnitudes greater than 0.95) between variables that were subsequently validated as significant, long-term, recurring correlations as part of the nature of the variables; these pairings of variables are viewed as extremely significant based on the respective definitions of the variables and will be leveraged as discussed in Section I of Appendix B.

Table 14: Variable Dependencies

Regression (Dependent) Variable	depends on	Independent Variable ¹⁸
1-month, 3-year, and 5-year Treasury yield		1-year Treasury yield
3-month, 6-month and 7-year Treasury yield		3-year Treasury yield [*]
20-year and 30-year Treasury yield, and Moody's AAA yield		7-year Treasury yield [*]
30-year Mortgage rate	-	3-year Treasury yield [*]
Prime Rate		1-year Treasury yield

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

¹⁸ 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

Real GDP increased to an annualized rate of 2.1% in 2Q2023¹⁹, continuing to slip slightly from annualized rates of 2.2% in 1Q2023 and 2.6% in 4Q2022²⁰ (from \$22.0T in 4Q2022 -- in 2017 US\$ -- to \$22.1T, and now to \$22.2T). Per the BEA, the decrease during 2Q2023 was due to a drop in consumer spending (due to general awareness of the impact of inflation), a drop in exports, and a deceleration in federal government spending²¹. Nominal GDP rose by an annualized rate of 3.8% (i.e., \$249.4B).²²

We have previously noted that GDP is impacted by personal consumption, retail sales, government spending, international trade, and interest rates. We will consider these items individually.

Overall real disposable personal income increased by an annualized 3.5%, versus an annualized 10.4% during 1Q2023 (now \$16.8T in 2017 US\$)²³; these figures equate to just under \$50k per person (again in 2017 US\$), a decline of approximately \$100 since 1Q2023²⁴. In contrast, nominal disposable personal income growth went from 15.4% annualized during 1Q2023 to 6.1% during 2Q2023²⁵; since the end of 2Q2023, nominal personal income has remained almost flat on an annualized basis²⁶. Real disposable personal income has increased linearly over the past several years, and *we expect that to continue growing at the rate of approximately \$100B/quarter* (in 2017 US\$).

Inflation, and the residual concerns about its looming presence, is noteworthy in both of these sets of figures. Peaking in 2Q2022 at 9.7%, annualized inflation then declined to 5.5% in 3Q2022, then 4.2% in 4Q2022, 3.8% in 1Q2023, and – now – 2.7% in 2Q2023²⁷. Annualized core inflation (i.e., excluding food and energy prices) has gone from 6.2% in 3Q2022, to 5.1% in 4Q2022, and then dropped linearly (through 1Q2023) to 4.7% in 2Q2023²⁸.

Inflation is current projected by government economists to drop to 2.6% by YE2024²⁹, with consumers feeling that 2.8% in 12 months is realistic³⁰. On the other hand, the potential for a federal shutdown, resumed student load debt payments, increasingly expensive money, and inflation in the food and energy sectors are inducing a palpable amount of fear into the system³¹. *We agree that inflation will drop to around 2.5-2.75% (annualized) by YE2024.*

2. Retail sales were essentially flat from 1Q2023 through 2Q2023 at just under \$600B per quarter. While growth was dramatic since emerging from the COVID-lockdown driven recession in

¹⁹ https://www.bea.gov/news/2023/gross-domestic-product-third-estimate-corporate-profits-revised-estimate-second-quarter ²⁰ https://fred.stlouisfed.org/series/GDPC1

²¹ https://www.bea.gov/news/2023/gross-domestic-product-third-estimate-corporate-profits-revised-estimate-second-quarter ²² lbid.

²³ https://fred.stlouisfed.org/series/DSPIC96

²⁴ https://fred.stlouisfed.org/series/A229RX0

²⁵ https://fred.stlouisfed.org/series/DSPI

²⁶ https://www.bea.gov/news/2023/personal-income-and-outlays-august-2023

²⁷ https://fred.stlouisfed.org/series/CPIAUCSL

²⁸ https://fred.stlouisfed.org/series/CPILFESL

²⁹ https://www.investors.com/news/fed-key-inflation-rate-is-set-to-fall-again-so-why-are-treasury-yields-rising-sp-500/

³⁰ https://www.reuters.com/markets/us/us-consumer-spending-rises-august-underlying-inflation-slows-2023-09-29/

³¹ https://finance.yahoo.com/news/asia-stocks-set-drop-slump-221028338.html

2Q2020, that same growth came to a screeching halt in 2Q2022 at \$595B, only growing about 1% overall in the past year.³² Advance sales estimates appear to confirm and continue that trend³³.

Government spending experienced some noteworthy shocks during the COVID pandemic, settling to \$8.3T in 1Q2022 (in current-day US\$). Since then, it has grown to \$9.4T in 2Q2023. Its (annualized) compounded growth rate, though, has gone from 23% in 2Q2022 to a current rate of 4.2% in 2Q2023. The volatility over this period is by no means unprecedented, and is typical when looking back through the period from the 1960s through the early 2000s³⁴.

We expect the growth in government spending to slow but still continue for the near term, with the only potential hindrance being the opportunity for a US government shutdown in November. The current drama that is unfolding in the US Congress, and caused a turnover in the Speaker of the House, seems to be likely heading to showdown with the White House that could result in a protracted governmental shutdown.

- 4. The quarterly trade deficit increased from \$201.88 to \$203.58 during 2Q2023, an annualized increase of 3.4%³⁵ The trade deficit has generally been slowly declining from \$70B, monthly, (with some stochastic behavior) since 3Q2022 after becoming engorged, and then contracting, during the COVID pandemic³⁶. This behavior is expected to generally continue pending.
- 5. As GDP increases, we expect an increased demand on the money supply, prices will increase, and interest rates will increase (and the converse, as well). Interest rates in most portions of the world have risen dramatically over the past year³⁷ with various countries' re-adaptation from loose economic policies. Looking back to the US, Chairman Jerome Powell and others³⁸ have repeatedly stated that increased interest rates are necessary to dampen otherwise untamed inflation, and he expects for rates to remain "higher for longer" than may be expected by the markets, with the latest dot plot by the FOMC painting the picture of the opinions of those on the Board.^{39,40} We feel that interest rates will be increased by 25bp before YE2023, then increased by as much as another 50bp to 75bp during 2024, and that it will be unlikely that any rate reductions will occur before YE2024.

Given these changes, we expect global GDP strength to improve with *annualized US GDP to increase to as high as 3% by YE2024*.

Other Commentary

• "Cleveland Fed President Loretta Mester said policymakers will likely need to raise rates once more this year and then hold them at higher levels for some time to get inflation back to its 2% target. The final decision will depend on how the economy evolves, amid risks including a

³² https://fred.stlouisfed.org/series/MRTSSM44000USS

³³ https://fred.stlouisfed.org/series/RSXFS

³⁴ https://fred.stlouisfed.org/series/W068RCQ027SBEA

³⁵ https://fred.stlouisfed.org/series/BOPGSTB

 $^{^{\}rm 36}\,https://www.bea.gov/news/2023/us-international-trade-goods-and-services-june-2023$

³⁷ https://www.global-rates.com/en/interest-rates/central-banks/central-banks.aspx

³⁸ https://finance.yahoo.com/news/fed-officials-warn-rates-may-rise-again-and-stay-higher-for-longer-161115365.html

³⁹ https://www.federalreserve.gov/monetarypolicy/files/fomcprojtabl20230920.pdf

⁴⁰ https://www.wsj.com/economy/central-banking/higher-interest-rates-not-just-for-longer-but-maybe-forever-d5891964

slowdown in China and the possibility of an extended strike by auto workers, she said." (https://www.bloomberg.com/news/newsletters/2023-10-03/five-things-you-need-to-know-to-start-your-day; Oct. 3, 2023)

- "A 45-day deal to keep the government open has kicked one risk from October into November a point where it could end up doing more damage to the fourth quarter GDP numbers. Bloomberg Economics estimates that each week of shutdown takes about 0.2 percentage points off annualized GDP growth, with most but not all of that recouped once the government reopens." (https://www.bloomberg.com/news/articles/2023-10-01/6-reasons-why-a-usrecession-is-likely-and-coming-soon; Oct. 2, 2023)
- "But given its confidence in the economy's resilience, the Fed also signaled that it expects to keep its benchmark rate higher for longer, potentially raising it once more this year and keeping it above 5% well into 2024." (https://abcnews.go.com/Business/wireStory/feds-powell-gets-earful-inflation-interest-rates-small-103668849; Oct. 2, 2023)
- "The banking system should be fine, but banks are going to be reluctant to press their luck with much additional lending after the recent rise in interest rates inflicted losses on banks' portfolios of Treasury bonds. Instead, they appear to be in the process of tightening lending standards because of the many economic uncertainties." (https://www.kiplinger.com/economicforecasts/gdp; Sept. 30, 2023)
- "The Fed revised its GDP projections higher for the year. It was 1%. Now it's 2.1%. And even next year, when officials forecast growth to slow substantially, the latest outlook is higher too, rising to 1.5% from 1.1%." (https://finance.yahoo.com/news/the-fed-looks-past-its-preferred-inflation-gauge-100033221.html; Sept 28, 2023)

Employment

Analysis

The civilian unemployment rate came in at 3.6% during 2Q2023⁴¹, with total nonfarm payroll employment increasing by 187,000 in August and 336,000 in September, and the unemployment rate rising to 3.8 percent⁴² (see Figure 32 and Figure 33). Hiring increased in health care, leisure & hospitality, and construction, but fell in transportation and warehousing. 9.6M job openings were recorded by the Bureau of Labor Statistics in August, an increase of about 690,000 (+5.8%) openings. (See Figure 34.) New hires were at 5.9M (3.7% of the workforce) in August 2023, and there were approximately 5.7M (3.6% of the workforce) separations, including quits, layoffs, and discharges⁴³. All of this is despite the FOMC's money tightening policy to which the administration has not made changes during their past two meetings.

We have pointed out that, the public appears to be starting to respond to the obvious day-to-day indicators of inflation, including the stated intentions of the Fed' to slow down the economy by raising the cost of money. Inkeeping with those messages, per Figure 35 and Figure 36, the US has seen an increase of approximately 4M people (between 0.5% and 1%) return to the workforce since the FOMC started raising the target federal funds rate in early 2022. The employment-population ratio has shown minimal change since YE2022 (per Figure 37). We have mentioned for some time that there was a sense

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

⁴² https://www.bls.gov/news.release/pdf/empsit.pdf

⁴³ We note that reports for September can be challenging given that summer seasonal workers generally exit their jobs around this time, and many educational workers begin their tenures coincidentally.

that a certain portion of the population was waiting "on the sidelines" before being properly motivated to return to the workforce, and it seems that this conclusion is being born out.

Considering the Fed's position that they expect for job opportunities in the market to diminish, and hiring to slow as they work to control inflation, total nonfarm payroll employment increased by 603,000 (Q/Q), significantly less than the average monthly gain of 271,000 (i.e., quarterly gain of 813,000) over the prior 12 months⁴⁴. Hiring is consistently slowing from previous months, and *we expect hiring rates to slow even further over the next 12 months as more people (who have been caregivers, etc.) exhaust their savings and feel financial pressure to rejoin the labor pool.*





Figure 33: US Unemployment Rate per County (June 2023 and September 2023, respectively)



44 https://fred.stlouisfed.org/series/PAYEMS

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Figure 34: Job Openings



Figure 35: US Labor Force Participation Rate







Figure 37: US Employment to Population Ratio (%)


Nominal wages in many sectors appear to be still linearly increasing based on labor supply and demand, as well as competitive forces impacting the ability to retain workers. (See Figure 38.) We notice that there are initial signs that the Leisure & Hospitality sector may be peaking in terms of employers' willingness to continue to increase wages, signifying the point at which (a) profitability may be affected for enterprises as labor costs increase, and (b) the elasticity of end consumers' requirements may be tested given the level of service provided.

The wage increases for the various sectors shown are apparently on the cusp of keeping up with inflation rates per the information in Figure 39; a noticeable "hop" in the trajectory of real wages in June 2022 can be seen, and subsequent adjustments to wage levels can be clearly observed.

Figure 38: Hourly Wages per Industry



Other Commentary

- "Federal Reserve policymakers have tried to rein in both wages and prices by pulling up interest rates. Some financial analysts believe that continued resilience in wage gains and job growth could hasten a downturn by prompting the Fed to raise borrowing costs further during its next meeting in early November." (https://www.nytimes.com/live/2023/10/06/business/jobs-reportseptember-economy; Oct. 6, 2023)
- "Private payroll growth tailed off sharply in September, according to an ADP report Wednesday
 that provides a counterweight to other signs that the labor market is still running strong. ... The
 payroll processing firm said job growth totaled just 89,000 for the month, down from an
 upwardly revised 180,000 in August and below the 160,000 estimate from economists polled by
 Dow Jones. ... Job gains [] came almost exclusively from services, which contributed a net 81,000
 to the total. Of that total, virtually all came from leisure and hospitality, which added 92,000."

(https://www.cnbc.com/2023/10/04/private-payrolls-rose-89000-in-september-much-fewer-than-expected-adp-says.html; Oct. 4, 2023)

 "The United States added 187,000 jobs in August but the unemployment rate jumped unexpectedly, reflecting the impact of high interest rates and the US economy's gradual cooling from the boom that following pandemic lockdowns. ... After a run of 29 months in which job growth never dipped below 200,000, ... the last three months have all fallen short of that mark. ... The unemployment rate rose [] for a good reason: More people started to look for work. ... Still, there is no sign of an imminent recession that would result in widespread joblessness, and the August gain was still significantly above the number of jobs required to absorb the flow of people into the labor force." (https://www.nytimes.com/live/2023/09/01/business/jobs-reportaugust-economy; Sept 1, 2023)

Figure 39: Real Hourly Wages per Industry



Federal Funds (Primary Credit) Rate

Analysis

When a depository institution has a shortfall and need for liquidity, it may borrow funds on a short-term basis from the Federal Reserve. The "discount rate" is the interest rate charged to commercial banks and other depository institutions on loans they receive from their regional Federal Reserve Bank's "discount window". The Federal Reserve Banks offer three discount window programs to depository institutions: Primary Credit, Secondary Credit, and Seasonal Credit, each with its own interest rate. Under the Primary Credit program, loans are extended for a very short term (usually overnight) to depository institutions in generally sound financial condition. (Secondary Credit & Seasonal Credit may

be available to institutions that do not meet the "sound financial condition" criteria.) The discount rate charged for primary credit (the primary credit rate) is set above the usual level of short-term market interest rates.

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

Based on the most recent two "dot plots" from the FOMC Board of Governors' meetings (Figure 40 and Figure 41), the Governors have shifted their opinions (between their June and September meetings) as follows, reflecting the "higher, for longer" mantra that has been publicized lately:

Year	June 2023 median	June 2023 range	September 2023 median	September 2023 range
2023	5.5%-5.75%	5.0%-6.25%	5.5%-5.75%	5.25%-5.75%
2024	4.5%-4.75%	3.5%-6.0%	4.75%-5.0%	4.25%-6.25%
2025	3.25%-3.5%	2.25%-5.75%	3.5%-3.75%	2.25%-5.75%
2026			2.5%-2.75%	2.25%-5.0%

Figure 40: FOMC "Dot Plot" from June 2023 Board of Governors' Meeting



Source: https://www.federalreserve.gov/monetarypolicy/files/fomcprojtabl20230614.pdf

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

Source: https://www.federalreserve.gov/monetarypolicy/files/fomcprojtabl20230920.pdf

The takeaways from the "dot plots" is not only that the pervasive thoughts are that rates will be "higher, for longer", but also that the spread of beliefs between the FOMC members is significantly wider in September than it was in June. Note that the range of expected rates by the Governors for 2024 narrowed, but the low, high, and median all increased, indicating a pessimistic view becoming thoroughly entrenched within the group through 2024. The view for YE2025 was "concentrated" between 3.25% and 4.25% with 8 of the 19 Governors outside of that range (5 above, going as high as 5.75%, and 3 below, going as low as 2.5%). We interpret that spread of values as meaning that there is a palpable amount of uncertainty in the markets and many factors that could swing the outcome at this time. These factors include, but are not limited to,

- the Ukraine invasion that is now going on 18 months -- longer than most experts imagined (and which we've already mentioned had a significant impact on food and energy prices);
- the upcoming 2024 Presidential election, which is already provoking questions about candidates on both sides of the aisle;
- a sagging labor force participation rate (which can only hamper domestic productivity measures);
- an emerging mismatch in supply and demand for commercial real estate, that is currently causing some owners to relinquish their collateral properties to banks;
- a near-term threat of a US federal government shutdown; and
- stubborn inflation that isn't succumbing to "traditional" techniques including quantitative tightening.

In Figure 42, we see the historical and projected relationship between the effective overnight lending rate and the 3-year T-bill yield.





Other Commentary

- "Still, Dimon says, there are two 'extraordinary' potential storm clouds on the horizon. ... The first is government spending. ... Spending by the US government is the highest it has ever been outside of wartime, and deficits are already very high. ... The second: Rising geopolitical tensions. ... Russia's war on Ukraine is a humanitarian crisis, he said, and will also impact all global relationships, including US trade with China."
 (https://www.cnn.com/2023/10/02/investing/jamie-dimon-jpmorgan-7-percent-interest-rate-recession/index.html; Oct. 2, 2023)
- "[Fed Governor Michelle Bowman] expects inflation to stay above the Fed's target of 2% at least until the end of 2025, underscoring that progress is likely to be slow and will require more work.
 ... Another Fed official, Boston Fed President Susan Collins, echoed Bowman's hawkish approach, saying she favors one more rate hike this year and warning that more tightening may also be possible." (https://finance.yahoo.com/news/fed-officials-warn-rates-may-rise-againand-stay-higher-for-longer-161115365.html; September 22, 2023)

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

Analysis

The US Treasury yield curve is still exhibiting the pronounced inversion that has been seen for more than a year (Figure 43), with yields as of this writing at a low for 5-year maturities. Given this inversion, we interpret the markets as feeling that a short-term recession is still likely in the near future. Unlike previous reports, though, we are no longer seeing a short-term spike in yields, but are instead seeing the highest yields (almost 6%) for the shortest period instruments. Twenty-year yields are peaking (as of this writing) at almost 5%; the fact that both 10-year and 30-year bond yields are below that threshold is

also very concerning⁴⁵. Despite that fact, the yield on 10-year Treasuries, which rises when prices fall, is at its highest level since 2007⁴⁶. Based on the current situation, *we do not expect the yield curve's shape to change substantially until at least 2H2024, or, more likely, at the point that interest rates begin to falter.*

Figure 44 through Figure 52 illustrate the most significant correlations between Treasury yield rates.

Other Commentary

- "As a result, the gap between the 10-year yield and the 2-year yield ---- which has been in inverted territory for 317 trading days through Friday, the longest such stretch since a 446-day streak that ended in May 1980 --- narrowed to its least-inverted level since Sept. 12, 2022, according to DJMD. ... Economists see an inverted yield curve as a reliable if lagging harbinger of recession. But in the past, the curve un-inverting has signaled that the recession predicted by yield-curve inversion could be just around the corner."
 (https://www.marketwatch.com/livecoverage/stock-market-today-stock-futures-steady-ahead-of-jobs-report/card/treasury-yield-curve-hits-least-inverted-level-in-more-than-a-year-as-bonds-tumble-lblLd7RRVbLaGh4TDtOE; Oct. 6, 2023)
- "The 2-10 year yield curve is starting to de-invert as the 10-year Treasury note soars past a 16-year-high to edge closer to the two-year bond, a move that has commentators and top investors sounding the alarm. ... 'This very recent move in Treasurys has been a little bit more dangerous,' JPMorgan Asset Management fixed income portfolio manager Priya Misra told CNBC on Wednesday. 'I think the move in the Treasury market, the disinversion of the curve, I think that actually makes a hard landing much more likely,' she warned." (https://finance.yahoo.com/news/theres-signal-flashing-bond-market-032849850.html; Oct. 4, 2023)
- "The 3m-2y spread is inverted, meaning that the market anticipates that average Fed Funds over the next two years will be lower than they are right now (i.e. cuts). But the inversion is slowly fading, with the shallowest inversion since March. In other words, the market still sees some cutting, though not nearly as much as it did earlier this year."

(https://www.bloomberg.com/news/newsletters/2023-09-21/five-things-you-need-to-know-to-start-your-day; Sept. 21, 2023)

⁴⁵ Per https://www.marketwatch.com/livecoverage/stock-market-today-stock-futures-steady-ahead-of-jobs-report/card/treasury-yield-curvehits-least-inverted-level-in-more-than-a-year-as-bonds-tumble-lblLd7RRVbLaGh4TDtOE

⁴⁶ See https://www.ft.com/content/42968686-926c-4a32-8868-494f891d0e26

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Figure 43: Treasury Yield Curves based on maturity duration



Figure 44: 1-month Treasury yield rates, as a function of 1-year Treasury yield rates

Source: Authors' calculation

Figure 45: 3-month Treasury yields, as a function of 3-year Treasury yields



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

Source: Authors' calculation

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



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Figure 48: 5-year Treasury yields, as a function of 1-year Treasury yields







Figure 50: 20-year Treasury yields, as a function of 7-year Treasury yields







Figure 52: 30-year Treasury yields, as a function of 7-year Treasury yields

30-year Mortgage Rate

Analysis

Mortgage rates have been traditionally tightly correlated with mid-duration Treasury yields given the typical sources of funding and duration of held mortgages. Day-to-day, interest rates are driven by traditional economic supply-and-demand forces. As of this writing, mortgage rates are essentially at 7.50%⁴⁷. Again, we are envisioning another 25bp rate increase by YE2023, and a likely 50bp to 75bp increase during 2024. Hence, while homebuying for the YE2023 is occurring as of this writing, *we anticipate 30-year fixed mortgage rates to skirt 8% before the selling season of 2024, and rates will stay at approximately that level through YE2024*.

As employment becomes more of an issue due to rising costs of money (which should, in turn, drive industries to slow hiring and even begin labor cutbacks), home listings should pick up; it stands to reason that some of the "dream homes" that were purchased during the pandemic, will likely become nightmares for their owners during 2024 and 2025.

⁴⁷ https://www.cnn.com/2023/10/05/homes/mortgage-rates-october-5/index.html





Other Commentary

- "'Several factors, including shifts in inflation, the job market and uncertainty around the Federal Reserve's next move, are contributing to the highest mortgage rates in a generation,' said Sam Khater, Freddie Mac's chief economist. 'Unsurprisingly, this is pulling back homebuyer demand.'" (https://www.cnn.com/2023/10/05/homes/mortgage-rates-october-5/index.html; Oct. 5, 2023)
- "The average 30-year fixed mortgage rate has risen from 6.9% in July to 7.07% in August. Meanwhile, the inventory of existing homes on the market fell 14% from a year ago. This translates to 3.3 months' worth of supply at the current sales pace, which is unchanged from the previous month. Inventories are unlikely to improve in the coming months, as more homeowners choose to stay put rather than list their homes on the market." (https://www.kiplinger.com/economic-forecasts/housing; Oct. 3, 2023)
- "New US home construction dropped in August to the lowest level since June 2020, highlighting the toll of declining housing affordability. ... Residential starts decreased 11.3% last month to a 1.28 million annualized rate, according to government data released Tuesday. The drop was largely driven by a sharp decline in multifamily construction."
 (https://www.bloomberg.com/news/articles/2023-09-19/us-housing-starts-drop-to-lowest-since-2020-while-permits-rise; Sept. 19, 2023)

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

Analysis

AAA bond rates tend to track with mid-duration Treasury yields, with rates for bonds with lower grades tending to be higher (in conjunction with their risk ratings). On a quarterly basis, Moody's Seasoned AAA Corporate Bond yield was 4.52% in 1Q2023, 4.60% in 2Q2023, and 4.91% in 3Q2023; Moody's BAA yields were 5.60%, 5.68%, and 5.97%, respectively. The quarterly averages for the 1-year and 7-year Treasury yields were 4.77% and 3.74% (respectively) in 1Q2023, 4.94% and 3.64% in 2Q2023, and 5.39% and 4.25% in 3Q2023. We present these numbers, and comparable numbers for the more familiar 10-year/2-year yield spread, in Table 2⁴⁸.

Instrument	1Q2023	2Q2023	∆(1Q->2Q)	3Q2023	∆(2Q->3Q)
Moody's AAA Bonds	4.52%	4.60%	+0.08%	4.91%	+0.31%
Moody's BAA Bonds	5.60%	5.68%	+0.08%	5.97%	+0.29%
BAA-AAA Yield Spread	+1.08%	+1.08%		+1.06%	
1-year Treasury Yield	4.76%	4.94%	+0.16%	5.39%	+0.45%
7-year Treasury Yield	3.74%	3.64%	-0.09%	4.25%	+0.61%
2-year Treasury Yield	4.34%	4.26%	-0.08%	4.92%	+0.66%
10-year Treasury Yield	3.65%	3.60%	-0.05%	4.15%	+0.55%
10 yr-2 yr Yield Spread	-0.69%	-0.66%		-0.77%	

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

Obviously, 3Q2023 has been a period of significantly increasing yields for AAA & BAA bonds, as well as government bonds. Corporate bonds are under increased pressure based on rising government bond yields, and are being offered at over than 50% discounts. The obvious concern of this type of phenomena is, even though the bonds under consideration are AAA & BAA grade, the expectation of reduced credit rating and even default is high in the industry⁴⁹. FitchRatings, for instance, is in fact expecting that bond default rates will double through 2024.⁵⁰ (See Figure 54.)

⁴⁸ See https://fred.stlouisfed.org/series/DGS10, https://fred.stlouisfed.org/series/DGS7, https://fred.stlouisfed.org/series/DGS1, https://fred.stlouisfed.org/series/aaa, and https://fred.stlouisfed.org/series/baa
⁴⁹ See https://www.schwab.com/learn/story/what-happens-when-corporate-defaults-rise and

https://www.moodys.com/creditfoundations/Default-Trends-and-Rating-Transitions-05E002

⁵⁰ https://www.fitchratings.com/research/corporate-finance/lifting-us-corporate-default-rate-forecasts-in-2023-2024-30-05-2023

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Figure 54: Moody's Seasoned AAA & BAA Corporate Bond Yields (less Fed' Funds Rate) versus 2-Year Treasury Yield

See Figure 55 for how Moody's AAA yields have historically tracked with the 7-year Treasury yield.



Figure 55: Moody's AAA-grade investment yields, as a function of 7-year Treasury yields



Figure 56: Moody's BAA-grade investment yields, as a function of BofA BBB yields

Other Commentary

- "Rising government borrowing costs combined with an expected higher for longer mantra from the Fed has made U.S. corporate bond investors more defensive. ... 'If rates continue to move higher or simply remain at these elevated levels for a significant period of time, it is going to have a pronounced effect on the credit worthiness of corporate borrowers, particularly in the high yield space,' [Dan Krieter, head of fixed income strategy at BMO Capital Markets] noted." (https://www.reuters.com/markets/rates-bonds/us-corporate-bond-spreads-widen-hopes-dimsoft-landing-2023-10-04/; Oct. 4, 2023)
- "With investment-grade issuance hitting its highest daily level since 2020 last week, the shortened maturities underscore how companies are adapting their funding strategies to a backdrop of drastically elevated interest rates. Many are hoping that borrowing costs will have fallen when they come to refinance their shorter-dated debt."
 (https://www.ft.com/content/3846fc4a-c2b3-405c-80ae-d7ef1e5f4bf4; Sept. 11, 2023)
- "After the easy-money years of the pandemic left corporations with a slew of debt maturing in a new era of higher rates, the lagged effects of the central bank's tightening will be what finally pushes the economy over the edge, said [Fidelity International's Salman Ahmed] who contributes to asset allocation strategy for Fidelity's \$47 billion multi-asset business. ... Higher debt-servicing costs tend to reduce the firepower companies have to invest and pay workers, other things being equal. Rich stock valuations and tight credit spreads are a sign that the coming downturn is not yet fully priced into markets."

(https://fortune.com/2023/09/01/recession-2024-likely-corporate-debt-strategist-warns/; Sept. 1, 2023)

Prime Rate

Analysis

The Prime Rate is a benchmark rate that many banks use for setting consumer credit rates for creditworthy customers. It is generally based on the federal funds rate, and a spread (typically 3%) is dictated by banks as a matter of policy to specify lending rates for mortgages, small business loans, and personal loans⁵¹. The quarterly average of the Prime Rate is currently (as of this writing) 8.43%, and the daily value is currently 8.50%⁵².

We do not expect the relationship between the federal funds rate and the Prime Rate to change in the near future. *We do believe that it is possible that the FOMC could raise the federal funds rate as much as 75 bp before YE2024, causing the Prime Rate to increase to a level between 9.25% and 9.50% by YE2024.*





US Average Retail Gasoline Price

Analysis

The US average retail gasoline price for regular unleaded gasoline is \$3.72/gallon⁵³ at the time of this writing, about 4.4% less than it was one year ago. (See Figure 58 and Figure 59.) Further, retail gasoline is up about 2% in the past month⁵⁴.

Brent crude prices spiked at \$95/barrel, but have now retreated to \$84/barrel. The sense is that, with prices at the pump spiking to the point that demand has been hampered, \$100/barrel prices will not be

⁵¹ https://www.investopedia.com/terms/p/primerate.asp

⁵² https://fred.stlouisfed.org/series/DPRIME

⁵³ https://gasprices.aaa.com/

⁵⁴ Ibid.

realized in the near term⁵⁵. In fact, despite the tensions that exist between the US White House and Riyadh, Saudi Arabia has agreed that it would be willing to boost oil production (thereby reducing prices) in 2024 if crude prices are too high in order to win goodwill with the US Congress; this is surprising given Saudi Arabia's history for negotiating in lock-step with Russia⁵⁶.

As of mid-September, EIA forecasted that oil prices would rise to \$94/barrel (which it did), and then retreat to \$84/barrel by the end of 1H2024⁵⁷. EIA also expects demand to decline which would apply downward pressure on retail gasoline prices. As a result, *we expect retail fuel prices to remain essentially level until there are changes to production levels*; production cuts by oil producing EMEA countries are set to expire at YE2023⁵⁸, but the alliances with Russia could prevent increases in production from occurring⁵⁹.

A final note: since originally drafting this work, Hamas has launched a surprise attack on Israel, resulting in Brent crude futures rising by over 3% to over \$87/barrel⁶⁰. First, this even underscores how unexpected actions will have a dramatic immediate affect here at home, as the violence can only potentially harm the availability of oil. It also could potentially impact Saudi Arabia's willingness to raise oil production as previously mentioned. At this point, we cannot foresee any significant impact to the US' affairs due to this action, but this conflict could easily escalate and dramatically impact petroleum supplies.

Other Commentary

- "Any move by the Saudis to raise output would be complicated by its energy-production alliance with Russia, itself one of the world's largest oil producers. The kingdom has moved in lockstep with Moscow, which has tried to keep oil prices high by restricting production, keeping oil money flowing into its coffers to fund its war in Ukraine." (https://www.wsj.com/world/middleeast/saudi-arabia-israel-talks-riyadh-oil-increase-a25d6106; Oct. 6, 2023)
- "A surge in crude prices hitting every household in the pocket book is one of the handful of truly reliable indicators that a downturn is coming. Oil prices have climbed nearly \$25 from their summer lows, pushing above \$95 a barrel." (https://www.bloomberg.com/news/articles/2023-10-01/6-reasons-why-a-us-recession-is-likely-and-coming-soon; Oct. 2, 2023)
- "Crude oil prices have been trending higher this summer, due in part to Russia and Saudi Arabia reducing their oil exports. The two recently announced that they will keep their current production cuts in place longer than previously planned, which should keep the global oil market tight. Meanwhile, the U.S. economy remains surprisingly resilient, pointing to continued strong fuel demand. So, we look for gas prices to stay elevated, perhaps declining by a few cents as cooler weather arrives." (https://www.kiplinger.com/economic-forecasts/energy; Sept. 7, 2023)

⁵⁵ See, e.g., https://oilprice.com/Energy/Energy-General/100-Oil-Is-Now-Firmly-Out-Of-Reach.html

⁵⁶ https://www.wsj.com/articles/saudi-arabia-charts-solo-path-on-opec-policy-ab9a436c

⁵⁷ https://www.eia.gov/outlooks/steo/report/global_oil.php

⁵⁸ https://www.eia.gov/outlooks/steo/report/petro_prod.php

⁵⁹ https://www.wsj.com/world/middle-east/saudi-arabia-israel-talks-riyadh-oil-increase-a25d6106

⁶⁰ https://www.wsj.com/livecoverage/israel-hamas-gaza-rockets-attack-palestinians/card/why-oil-prices-have-jumped-after-attacks-on-israel-ZqEts9sfr9AtRcJ5wU84

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Figure 58: Crude Oil vs Retail Gasoline Prices



Figure 59: Global crude oil prices



House and Commercial Real Estate Price Indexes

Analysis

As we mentioned previously, housing prices spiked in early Summer 2022, fell through early 2023 in many markets, and have started to rebound⁶¹, but buying is still an uphill process for many (particularly first-time buyers⁶²) due to higher mortgage rates, more selectiveness on the part of lenders, and low inventory⁶³. Housing prices will likely remain generally elevated⁶⁴ for the near term due to higher market prices (fueled by high demand) & mortgage rates⁶⁵. Rental rates are also remaining high per our previous discussion. Given that the FOMC will likely raise the Federal funds rates by another 25 bps before YE2023, and potentially another 50bp or more during 2024, we do not expect to see either inventories or sales to move significantly from their current levels (accounting for typical seasonality).

On the other hand, Commercial Real Estate is a more significant issue. As loans backed by these commercial properties come due (and cannot be affordably refinanced with heightened rates), struggling office buildings, shopping malls, and multi-dwelling units (MDUs) are at risk of defaulting. According to CRED iQ, during September 2023, overall "distressed rates"⁶⁶ have increased (M/M) from 7.17% to 7.43%, with ...

- Distressed rates for retail properties increased (M/M) from 10.66% to 11.18%;
- Distressed rates for MDUs decreased (M/M) from 4.96% to 4.66%;
- Distressed rates for offices increased from 3.5% (in Sept '22) to 9.36% (in Aug '23) to 10.75% (in Sept '23); and
- Distressed rates for lodging properties increased (M/M) from 7.7% to 8.34%.⁶⁷

CRED iQ purports that "distressed" property rates are up 54% during 2023⁶⁸. Trepp reported that "special servicing" rates increased by 20bp in September 2023, comprised of \$2.4B of loans⁶⁹, with office "special servicing" not above 8%.

Regarding office space, businesses have tried begging, luring, blackmailing, and (now) threatened to get workers to return to the office post-COVID⁷⁰. Instead, occupancy rates continue to waffle between one quarter and two-thirds attendance on any given day in major markets.⁷¹ Business owners are not motivated to hold employees to task on the issue of attendance, balancing the cost of rent off against the risk of pushing employees away (and potentially to competition).

63 Ibid.

⁶⁷ See https://cred-iq.com/blog/2023/10/05/cred-iq-september-2023-cmbs-delinquency-report/

68 Ibid.

estate/commercial/tougher-return-to-office-policies-are-no-remedy-for-half-empty-buildings-57f41886

⁶¹ https://www.bankrate.com/real-estate/case-shiller/

⁶² https://www.realtor.com/research/july-2023-site-visitor-survey/

⁶⁴ https://www.forbes.com/advisor/mortgages/real-estate/housing-market-predictions/

⁶⁵ See https://www.forbes.com/advisor/mortgages/mortgage-interest-rates-forecast/ and https://www.wsj.com/finance/investing/why-8-percent-mortgage-rates-arent-crazy-590d887f

⁶⁶ "Distressed properties" are those that are either delinquent on payments, or have negotiated "special service" arrangements.

⁶⁹ See https://www.trepp.com/trepptalk/special-servicing-rate-climbs-in-september-2023-office-jumps-again

⁷⁰ See, e.g., https://www.forbes.com/sites/forbesbusinesscouncil/2023/10/04/companies-want-employees-back-in-the-office-post-pandemicbut-do-employees-want-to-return/?sh=6c13cdb52a55, https://www.globest.com/2023/09/25/companies-are-trying-these-perks-to-getemployees-back-in-the-office/?slreturn=20230908185856, https://www.raconteur.net/talent-culture/return-office-incentives, https://www.washingtonpost.com/technology/2023/09/21/return-office-mandates-employees-quit/, and https://www.wsj.com/real-

⁷¹ https://www.wsj.com/real-estate/commercial/tougher-return-to-office-policies-are-no-remedy-for-half-empty-buildings-57f41886

Looking at retail space, we are seeing a culmination of effects: shopping mall values have collapsed due to high rents and lack of shoppers⁷², resulting in a domino effect in which commercial mortgage-backed securities lose value and risk default, along with follow-on ramifications for institutional investors and pension funds. With several high-profile bankruptcies pending (e.g., Christmas Tree Shops⁷³, Bed Bath and Beyond⁷⁴, Sears, and Macy's⁷⁵), owners/operators are handing back keys to financiers⁷⁶ in an effort to allow for alternative strategies to be formulated; without anchor stores attracting customers, rent payments are not forthcoming.

Finally, multi-dwelling units (MDUs) have similar issues: the inability of tenants to pay rapidly increasing rents (whether tenants are living in apartment buildings, or evicted) will cause similar pressures for landlords that may have purchased using floating rate loans that, again, cannot be refinanced cost-effectively⁷⁷. Some owners will flip their properties, finding "white knights" to take an asset off their hands at low prices, and other properties will be abandoned for lenders to deal with⁷⁸. While this phenomena will not lead to immediate homelessness of tenants, it will result in property devaluation if banks are relied on to invest in maintaining buildings and performing more than superficial upkeep.

Assuming that the relatively high interest rates continue (which we expect through at least 2024), the result will be devaluation of CRE properties and their (geographic) peers, as well as losses for the underlying owners and/or lenders. In the case of the latter, the banking sector could be substantially impacted on a regional basis (as we have discussed in previous reports)⁷⁹. Some are reporting that they anticipate property values not returning for ten to 15 years.⁸⁰ Building owners returning their assets to lenders will lead to banks owning, managing, and operating commercial real estate properties for which they are ill-equipped, then leading to outcomes similar to that when banks held residential homes in 2008.

Other Commentary

- "Making matters worse, business leaders and city officials say they see more forces at work that could slow the return to office than those that could accelerate it. ... Covid-19 cases are up and will likely increase further in the fall and winter months. 'If we have to go back to distancing and mask protocols, that really breaks the office culture,' said Kathryn Wylde, head of the business group Partnership for New York City." (https://www.wsj.com/real-estate/commercial/tougher-return-to-office-policies-are-no-remedy-for-half-empty-buildings-57f41886; Oct. 2, 2023)
- "The losses from last year's seven-month decline have now been wiped out, [Craig J. Lazzara, managing director at S&P Dow-Jones Indices] said. 'We have previously noted that home prices peaked in June 2022 and fell through January of 2023, declining by 5.0 percent in those seven

⁷² https://cre.moodysanalytics.com/insights/cre-news/get-in-loser-were-going-shopping-checking-in-on-us-malls/ and https://www.wsj.com/articles/local-malls-stuck-in-death-spiral-plunge-in-value-a7998b7d

⁷³ https://www.reuters.com/legal/litigation/christmas-tree-shops-bankruptcy-converted-chapter-7-2023-08-16/

⁷⁴ https://www.cnbc.com/2023/06/22/overstockcom-wins-bed-bath-beyond-auction.html

⁷⁵ See https://www.retaildive.com/news/retailers-at-risk-of-bankruptcy-2023/694548/ and https://cre.moodysanalytics.com/insights/crenews/get-in-loser-were-going-shopping-checking-in-on-us-malls/

⁷⁶ https://www.wsj.com/real-estate/commercial/a-mall-owners-about-face-bet-on-americas-high-end-malls-a32d9487

⁷⁷ https://www.bisnow.com/national/news/multifamily/storm-clouds-gather-as-apartment-owners-with-floating-rate-debt-scramble-to-pay-loans-118872

⁷⁸ See https://www.wsj.com/articles/a-real-estate-haven-turns-perilous-with-roughly-1-trillion-coming-due-74d20528

⁷⁹ See https://www.wsj.com/real-estate/how-to-play-the-property-meltdown-in-five-charts-8bd765a0 and https://www.wsj.com/real-estate/commercial-real-estate-regional-banks-9f8f591d .

⁸⁰ https://fortune.com/2023/06/26/commercial-real-estate-office-downturn-outlook-goldman-sachs-morgan-stanley-ubs-pwc-bofa/ and https://www.bloomberg.com/news/articles/2023-06-22/office-owners-get-dire-warning-rebound-unlikely-before-2040

months. The increase in prices that began in January [2023] has now erased the earlier decline, so that July represents a new all-time high for the national composite,' he said. 'Moreover, this recovery in home prices is broadly based. As was the case last month, 10 of the 20 cities in our sample have reached all-time high levels. In July, prices rose in all 20 cities after seasonal adjustment (and in 19 of them before adjustment).' " (https://www.bankrate.com/real-estate/case-shiller/; Sept. 26, 2023)

"The burden of defaulted loans and declining property values [of declining shopping malls] ultimately falls on the shoulders of individuals, particularly in the form of their retirement funds.
 ... Mall values have collapsed, leaving pensioners and retirement account holders holding the bag for investments that were not worth what they claimed to be." (https://eightify.app/summary/real-estate-and-homeownership/mall-value-collapse-sparks-bankruptcies-pension-losses; Sept 22, 2023)

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

Analysis

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

Table 3. Annrovimate	Quarterly	Milectones	for the	Dow-lones	Total	Market Indev
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Period	Index Range ⁸¹	Trading Days	Avg points/day
3Q2022 (7/1/2022-9/30/2022)	37976.52→ 36097.99	64	-29.4
4Q2022 (10/1/2022-12/31/2022)	36097.99 → 38520.60	61	39.7
1Q2023 (1/1/2023-3/31/2023)	38520.60 → 41136.55	62	42.2
2Q2023 (4/1/2023-6/30/2023)	41136.55 → 44411.47	61	53.7
3Q2022 (7/1/2023-9/30/2023)	44411.47 → 42788.69	63	-25.8

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

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

Period	Index Range ⁸²	Trading Days	Avg points/day
3Q2022 (7/1/2022-9/30/2022)	3785.38 → 3585.62	64	-3.12
4Q2022 (10/1/2022-12/31/2022)	3585.62 → 3839.50	61	4.16
1Q2023 (1/1/2023-3/31/2023)	3839.50 → 4109.31	62	4.35
2Q2023 (4/1/2023-6/30/2023)	4109.31 → 4450.38	61	5.59
3Q2023 (7/1/2023-9/30/2023)	4450.38 → 4288.05	63	-2.58

Equity markets and indexes are stressed given the pressure of low-risk government bond yields. With the ten-year bond yield flirting with the 5% level, the challenge for stocks (and the broader economy) is

⁸¹ Index values found at https://www.marketwatch.com/investing/index/dwcf

⁸² Index values found at https://www.marketwatch.com/investing/index/spx

that much greater. Additionally, CNN's "Fear & Greed Index" entered a " fear" phase during mid-September as investors fret about high interest rates⁸³.

However, the notable point of this section is that of the VIX: its quarterly average has gone from 25.0 in 4Q2022, to 20.7 in 1Q2023, to 16.4 in 2Q2023, to 15.0 in 3Q2023⁸⁴. The crux of these numbers is the perception of *decreasing* forward-looking market volatility. Generally speaking, with decreasing volatility, we should see increasing levels of the DWCF and the SP500; instead, both broad-based indexes declined (just as they did during 3Q2022). The intuitive interpretation of the VIX' values, despite the issues with inflation, yield rates, housing, and so on, is that everything is "business as usual"; surprisingly, the VIX' figures have not been this low since 2019.

Other Commentary

- "Pain in the stock market is unlikely to end anytime soon as investors grapple with three ongoing headwinds, according to a Wednesday note from JPMorgan. ... The bank highlighted that as bond yields surge to levels not seen since 2007, it will be difficult for stocks to mount a recovery in an environment that has parallels to 2008."
 (https://markets.businessinsider.com/news/stocks/stock-market-selloff-higher-bond-yields-extreme-fear-oil-recession-2023-10; Oct. 4, 2023)
- "Following a 1.5% tumble ..., the S&P 500 (.SPX) is now down more than 7% from its July highs, stung by sharp declines in shares of some of this year's biggest winners -- including Apple (AAPL.O), Amazon.com (AMZN.O) and Nvidia (NVDA.O). At the same time, yields on the U.S. benchmark 10-year Treasury stand near a 16-year peak at 4.55%."
 (https://www.reuters.com/markets/us/harsh-reality-higher-for-longer-rates-looms-over-us-stocks-2023-09-27/; Sept. 27, 2023)

⁸³ https://www.cnn.com/markets/fear-and-greed

⁸⁴ See https://fred.stlouisfed.org/series/VIXCLS

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 3Q2014 and 2Q2023, inclusive.

Variable	Min Abs. Error	Average Error	Max Abs. Error
Real GDP Growth	132.39%	***	***
Nominal GDP Growth	196.10%	**	***
Real Disposable Income Growth	1.42%	11.03%	***
Nominal Disposable Income Growth	7.22%	21.40%	400.65%
Inflation	0.00%	**	***
Unemployment Rate	8.11%	-297.42%	614.62%
1-month Treasury Yield	61.56%	**	***
3-month Treasury Yield	0.00%	220.29%	***
6-month Treasury Yield	263.82%	**	***
1-year Treasury Yield	2.02%	6.68%	***
3-year Treasury Yield	11.93%	-105.47%	582.84%
5-year Treasury Yield	0.02%	115.70%	843.97%
7-year Treasury Yield	0.22%	11.91%	250.75%
10-year Treasury Yield	0.33%	-1.17%	92.17%
20-year Treasury Yield	0.44%	-1.39%	80.56%
30-year Treasury Yield	9.69%	-38.42%	96.94%
30-year Mortgage Rate	10.09%	36.21%	80.12%
Moody's AAA Curve	4.72%	-23.80%	66.37%
Moody's BAA Curve	1.92%	-15.92%	49.22%
BBB Corporate Yield	0.03%	8.55%	58.48%
Prime Rate	4.24%	-840.83%	***
US Average Retail Gasoline Price	98.16%	917.90%	***
Cost of Federal Funds	32.45%	75.29%	***
Dow Jones Total Stock Market Index	0.26%	43.56%	390.41%
S&P 500 Stock Price Index	263.40%	867.62%	***
Commercial Real Estate Price Index	0.11%	13.59%	59.05%
Residential Home Price Index	2.70%	2.77%	256.65%
Market Volatility Index	214.98%	***	***

Table 4: Regression Aggregate Errors for 3Q2014 through 2Q2023

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

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

	Dependent variable (+/- SE):
	Real GDP growth
Constant	140.814 (+/- 23.833)
	p = 0.00001***
SP500 Stock Price Index	-0.012 (+/- 0.002)
	p = 0.0001 ^{***}
US Fed Reserve O-N Loan Rate	-15.248 (+/- 2.603)
	p = 0.00001***
Unemployment Rate	-8.684 (+/- 0.545)
	p = 0.000***
Prime Rate	23.799 (+/- 3.812)
	p = 0.00001***
Commercial Real Estate Price Index	-0.199 (+/- 0.059)
	p = 0.003***
US Avg Retail Gasoline Price (\$-gal; all grades, all formulations)	7.756 (+/- 1.738)
	p = 0.0003 ^{***}
30-year Treasury Yield	154.047 (+/- 41.361)
	p = 0.002***
LN_30-year Treasury Yield	-517.281 (+/- 105.340)
	p = 0.0001***
20-year Treasury Yield	-238.333 (+/- 35.910)
	p = 0.00001***
LN_20-year Treasury Yield	612.108 (+/- 81.184)
	p = 0.00000***
10-year Treasury Yield	179.612 (+/- 20.285)
	p = 0.00000 ^{***}
LN_10-year Treasury Yield	-375.569 (+/- 31.143)
	p = 0.000***
7-year Treasury Yield	-142.156 (+/- 18.414)
	p = 0.00000 ^{***}
LN_7-year Treasury Yield	338.712 (+/- 41.877)
	p = 0.00000 ^{***}
LN_5-year Treasury Yield	-116.940 (+/- 18.037)
	p = 0.00001***
3-year Treasury Yield_2	-6.324 (+/- 1.848)
	p = 0.003***

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

REGRESSION FOR REAL GDP GROWTH

 $\ensuremath{\mathbb{C}}$ 2022, Capitalytics, LLC; Do not distribute – DRAFT VERSION

6-month Treasury Yield_2	1.772 (+/- 0.323)		
	p = 0.00002***		
5-year Treasury Yield_2	13.125 (+/- 2.625)		
	p = 0.0001***		
Observations	40		
R ²	0.972		
Adjusted R ²	0.947		
Residual Std. Error	1.767 (df = 21)		
F Statistic	39.973 ^{***} (df = 18; 21)		
Note:	*p<0.1; **p<0.05; ***p<0.01		

	Dependent variable (+/- SE):
	Nominal GDP growth
Constant	-16.491 (+/- 5.693)
	p = 0.008 ^{***}
Unemployment Rate	-7.015 (+/- 0.602)
	p = 0.000***
US Avg Retail Gasoline Price (\$-gal; all grades, all formulations)	3.845 (+/- 1.239)
	p = 0.005 ^{***}
20-year Treasury Yield	-126.317 (+/- 14.472)
	p = 0.000***
LN_20-year Treasury Yield	377.254 (+/- 48.351)
	p = 0.00000 ^{***}
10-year Treasury Yield	165.480 (+/- 18.019)
	p = 0.000***
LN_10-year Treasury Yield	-417.835 (+/- 31.657)
	p = 0.000***
LN_1-month Treasury Yield	5.102 (+/- 1.653)
	p = 0.005 ^{***}
7-year Treasury Yield	-63.284 (+/- 10.172)
	p = 0.00001***
LN_7-year Treasury Yield	166.828 (+/- 31.430)
	p = 0.00002***
LN_6-month Treasury Yield	-22.895 (+/- 6.096)
	p = 0.001***
LN_3-year Treasury Yield	-35.288 (+/- 8.799)
	p = 0.0005 ^{***}
LN_1-year Treasury Yield	26.164 (+/- 6.742)
	p = 0.001 ^{***}
Observations	40
R ²	0.941
Adjusted R ²	0.914
Residual Std. Error	2.551 (df = 27)
F Statistic	35.741 ^{***} (df = 12; 27)
Note:	*p<0.1; **p<0.05; ***p<0.01

REGRESSION FOR	NOMINAL	GDP	GROWTH
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	Dependent variable (+/- SE):
	Real disposable income growth
Constant	8.485 (+/- 2.518)
	p = 0.002***
CPI Inflation Rate	-2.073 (+/- 0.644)
	p = 0.003***
Observations	40
R ²	0.214
Adjusted R ²	0.194
Residual Std. Error	11.360 (df = 38)
F Statistic	10.359 ^{***} (df = 1; 38)
Note:	*p<0.1; **p<0.05; ***p<0.01

	Dependent variable (+/- SE):
	Nominal disposable income growth
Constant	8.237 (+/- 2.033)
	p = 0.0003***
Nominal GDP growth	-0.652 (+/- 0.204)
	p = 0.003***
Observations	40
R ²	0.211
Adjusted R ²	0.191
Residual Std. Error	11.119 (df = 38)
F Statistic	10.185 ^{***} (df = 1; 38)
Note:	*p<0.1; **p<0.05; ***p<0.01

REGRESSION FOR NOMINAL DISPOSABLE INCOME GROWTH

	Dependent variable (+/- SE):
	CPI Inflation Rate
Constant	-26.906 (+/- 3.111)
	p = 0.00000 ^{***}
US Fed Reserve O-N Loan Rate	7.067 (+/- 0.949)
	p = 0.00001 ^{***}
Moody's AAA Curve	-2.739 (+/- 0.917)
	p = 0.010 ^{***}
Moody's BAA Curve	3.353 (+/- 0.396)
	p = 0.00000 ^{***}
Real GDP growth	-0.810 (+/- 0.104)
	p = 0.00001***
Nominal GDP growth	0.844 (+/- 0.105)
	p = 0.00000 ^{***}
Real disposable income growth	-0.683 (+/- 0.102)
	p = 0.00001***
Nominal disposable income growth	0.636 (+/- 0.099)
	p = 0.00002 ^{***}
Unemployment Rate	0.581 (+/- 0.081)
	p = 0.00001 ^{***}
30-year Mortgate Rate	1.085 (+/- 0.218)
	p = 0.0002***
Home Price Index	0.073 (+/- 0.008)
	p = 0.00000 ^{***}
Market Volatility Index	0.047 (+/- 0.006)
	p = 0.00000 ^{***}
US Avg Retail Gasoline Price (\$-gal; all grades, all formulations)) -1.916 (+/- 0.273)
	p = 0.00001 ^{***}
LN_30-year Treasury Yield	63.269 (+/- 5.462)
	p = 0.000***
20-year Treasury Yield	-18.458 (+/- 3.391)
	p = 0.0001 ^{***}
10-year Treasury Yield	-4.971 (+/- 1.387)
	p = 0.003***
LN_7-year Treasury Yield	-58.354 (+/- 5.388)
	p = 0.00000 ^{***}
3-month Treasury Yield	-3.172 (+/- 0.857)

REGRESSION FOR CPI INFLATION RATE

	p = 0.003***
LN_5-year Treasury Yield	57.812 (+/- 5.517)
	p = 0.00000***
LN_3-year Treasury Yield	-14.679 (+/- 1.722)
	p = 0.00000***
5-year Treasury Yield_2	-8.291 (+/- 0.626)
	p = 0.000***
3-month Treasury Yield_2	-0.499 (+/- 0.069)
	p = 0.00001***
7-year Treasury Yield_2	9.876 (+/- 0.748)
	p = 0.000***
20-year Treasury Yield_2	3.835 (+/- 0.609)
	p = 0.00002***
30-year Treasury Yield_2	-4.083 (+/- 0.477)
	p = 0.00000***
Observations	40
R ²	0.998
Adjusted R ²	0.996
Residual Std. Error	0.185 (df = 15)
F Statistic	378.824 ^{***} (df = 24; 15)
Note:	*p<0.1; **p<0.05; ***p<0.01

Unemployment Rate

	Dependent variable (+/- SE):
	Unemployment Rate
Constant	-10.159 (+/- 1.907)
	p = 0.00001***
Nominal GDP growth	-0.078 (+/- 0.007)
	p = 0.000 ^{***}
10-year Treasury Yield	20.067 (+/- 2.031)
	p = 0.000 ^{***}
LN_10-year Treasury Yield	-20.902 (+/- 1.791)
	p = 0.000 ^{***}
7-year Treasury Yield	-2.458 (+/- 0.703)
	p = 0.002 ^{***}
LN_6-month Treasury Yield	-0.485 (+/- 0.084)
	p = 0.00001 ^{***}
10-year Treasury Yield_2	-1.679 (+/- 0.270)
	p = 0.00000 ^{***}
Observations	40
R ²	0.962
Adjusted R ²	0.955
Residual Std. Error	0.383 (df = 33)
F Statistic	138.254 ^{***} (df = 6; 33)
Note:	*p<0.1; **p<0.05; ***p<0.01

REGRESSION FOR UNEMPLOYMENT RATE

	Dependent variable (+/- SE):
	1-month Treasury Yield
Constant	2.958 (+/- 0.629)
	p = 0.0001 ^{***}
Moody's AAA Curve	-3.415 (+/- 0.620)
	p = 0.00001***
Moody's BAA Curve	1.767 (+/- 0.358)
	p = 0.00003 ^{***}
Real GDP growth	0.228 (+/- 0.035)
	p = 0.00000 ^{***}
Nominal GDP growth	-0.228 (+/- 0.032)
	p = 0.00000 ^{***}
Unemployment Rate	-0.329 (+/- 0.085)
	p = 0.001***
BBB corporate yield	-1.553 (+/- 0.273)
	p = 0.00001***
30-year Mortgate Rate	1.154 (+/- 0.251)
	p = 0.0001***
20-year Treasury Yield	3.009 (+/- 0.558)
	p = 0.00001***
LN_10-year Treasury Yield	-6.204 (+/- 1.772)
	p = 0.002***
LN_7-year Treasury Yield	4.548 (+/- 1.059)
	p = 0.0002***
Observations	40
R ²	0.958
Adjusted R ²	0.943
Residual Std. Error	0.307 (df = 29)
F Statistic	65.817 ^{***} (df = 10; 29)
Note:	*p<0.1; **p<0.05; ***p<0.01

REGRESSION FOR 1-MONTH TREASURY YIELD

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

	Dependent variable (+/- SE):
	3-month Treasury Yield
Constant	-0.301 (+/- 0.610)
	p = 0.625
Real disposable income growth	0.286 (+/- 0.043)
	p = 0.00000***
Nominal disposable income growth	-0.265 (+/- 0.043)
	p = 0.00000***
Unemployment Rate	-0.636 (+/- 0.063)
	p = 0.000 ^{***}
Dow Total Stock Market Index	0.0001 (+/- 0.00001)
	p = 0.0001***
20-year Treasury Yield	5.793 (+/- 0.691)
	p = 0.000 ^{***}
LN_20-year Treasury Yield	-12.737 (+/- 1.802)
	p = 0.00000 ^{***}
Observations	40
R ²	0.921
Adjusted R ²	0.906
Residual Std. Error	0.414 (df = 33)
F Statistic	63.856 ^{***} (df = 6; 33)
Note:	*p<0.1; **p<0.05; ***p<0.01

REGRESSION FOR 3-MONTH TREASURY YIELD

	Dependent variable (+/- SE):
	6-month Treasury Yield
Constant	-18.772 (+/- 4.760)
	p = 0.0005 ^{***}
Real disposable income growth	0.233 (+/- 0.036)
	p = 0.00000***
Nominal disposable income growth	-0.215 (+/- 0.036)
	p = 0.00001***
Unemployment Rate	-0.530 (+/- 0.070)
	p = 0.00000 ^{***}
Commercial Real Estate Price Index	0.023 (+/- 0.004)
	p = 0.00001***
LN_30-year Treasury Yield	8.156 (+/- 2.915)
	p = 0.009 ^{***}
20-year Treasury Yield	18.341 (+/- 4.690)
	p = 0.0005***
LN_20-year Treasury Yield	-31.722 (+/- 6.580)
	p = 0.00004 ^{***}
20-year Treasury Yield_2	-1.417 (+/- 0.479)
	p = 0.006***
Observations	40
R ²	0.953
Adjusted R ²	0.941
Residual Std. Error	0.342 (df = 31)
F Statistic	78.172 ^{***} (df = 8; 31)
Note:	*p<0.1; **p<0.05; ***p<0.01

REGRESSION FOR 6-MONTH TREASURY YIELD

	Dependent variable (+/- SE):
	1-year Treasury Yield
Constant	-8.858 (+/- 1.203)
	p = 0.00000 ^{***}
Moody's BAA Curve	1.018 (+/- 0.141)
	p = 0.00000 ^{***}
Real GDP growth	0.238 (+/- 0.055)
	p = 0.0002 ^{***}
Nominal GDP growth	-0.223 (+/- 0.050)
	p = 0.0001 ^{***}
Unemployment Rate	-0.183 (+/- 0.056)
	p = 0.003 ^{***}
Commercial Real Estate Price Index	0.025 (+/- 0.002)
	p = 0.000 ^{***}
Observations	40
R ²	0.869
Adjusted R ²	0.850
Residual Std. Error	0.529 (df = 34)
F Statistic	45.207 ^{***} (df = 5; 34)
Note:	*p<0.1; **p<0.05; ***p<0.01

REGRESSION FOR 1-YEAR TREASURY YIELD
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	Dependent variable (+/- SE):
	3-year Treasury Yield
Constant	-0.794 (+/- 0.622)
	p = 0.210
SP500 Stock Price Index	-0.002 (+/- 0.0003)
	p = 0.00002 ^{***}
Real disposable income growth	0.148 (+/- 0.049)
	p = 0.005 ^{***}
Nominal disposable income growth	-0.138 (+/- 0.049)
	p = 0.008 ^{***}
Unemployment Rate	-0.358 (+/- 0.050)
	p = 0.00000 ^{***}
Home Price Index	0.041 (+/- 0.006)
	p = 0.00000 ^{***}
Observations	40
R ²	0.827
Adjusted R ²	0.801
Residual Std. Error	0.488 (df = 34)
F Statistic	32.453 ^{***} (df = 5; 34)
Note:	*p<0.1; **p<0.05; ***p<0.01

REGRESSION FOR 3-YEAR TREASURY YIELD

	Dependent variable (+/- SE).
	5-year Treasury Yield
Constant	-0.192 (+/- 0.534)
	p = 0.722
SP500 Stock Price Index	-0.001 (+/- 0.0003)
	p = 0.001***
Real disposable income growth	0.154 (+/- 0.047)
	p = 0.003***
Nominal disposable income growth	-0.144 (+/- 0.047)
	p = 0.005***
Unemployment Rate	-0.307 (+/- 0.042)
	p = 0.00000 ^{***}
Home Price Index	0.026 (+/- 0.006)
	p = 0.0001 ^{***}
US Avg Retail Gasoline Price (\$-gal; all grades, all formulations)	0.493 (+/- 0.152)
	p = 0.003***
Observations	40
R ²	0.833
Adjusted R ²	0.803
Residual Std. Error	0.406 (df = 33)
F Statistic	27.498 ^{***} (df = 6; 33)
Note:	*p<0.1; **p<0.05; ***p<0.01

REGRESSION FOR 5-YEAR TREASURY YIELD

	Dependent variable (+/- SE):
	7-year Treasury Yield
Constant	6.309 (+/- 0.503)
	p = 0.000***
Real GDP growth	-0.147 (+/- 0.047)
	p = 0.004***
Nominal GDP growth	0.128 (+/- 0.044)
	p = 0.007***
Unemployment Rate	-0.135 (+/- 0.037)
	p = 0.001***
Home Price Index	0.026 (+/- 0.006)
	p = 0.0001***
Commercial Real Estate Price Index	-0.035 (+/- 0.005)
	p = 0.00000 ^{***}
1-month Treasury Yield	0.537 (+/- 0.080)
	p = 0.00000***
Observations	40
R ²	0.886
Adjusted R ²	0.865
Residual Std. Error	0.299 (df = 33)
F Statistic	42.576 ^{***} (df = 6; 33)
Note:	*p<0.1; **p<0.05; ***p<0.01

REGRESSION FOR 7-YEAR TREASURY YIELD

	Dependent variable (+/- SE):	
	10-year Treasury Yield	
Constant	3.068 (+/- 0.385)	
	p = 0.000***	
Unemployment Rate	-0.099 (+/- 0.029)	
	p = 0.002***	
Commercial Real Estate Price Index	-0.009 (+/- 0.001)	
	p = 0.00000 ^{***}	
US Avg Retail Gasoline Price (\$-gal; all grades, all formulations)	0.639 (+/- 0.078)	
	p = 0.000***	
1-month Treasury Yield	0.371 (+/- 0.044)	
	p = 0.000***	
Market Volatility Index_2	-0.0001 (+/- 0.00004)	
	p = 0.006***	
Observations	40	
R ²	0.885	
Adjusted R ²	0.868	
Residual Std. Error	0.274 (df = 34)	
F Statistic	52.355 ^{***} (df = 5; 34)	
Note:	*p<0.1; **p<0.05; ***p<0.01	

REGRESSION FOR 10-YEAR TREASURY YIELD

	Dependent variable (+/- SE):
	20-year Treasury Yield
Constant	2.478 (+/- 0.433)
	p = 0.00001***
US Fed Reserve O-N Loan Rate	-0.443 (+/- 0.107)
	p = 0.0003***
Real GDP growth	-0.016 (+/- 0.006)
	p = 0.007 ^{***}
Real disposable income growth	-0.127 (+/- 0.031)
	p = 0.0003***
Nominal disposable income growth	0.121 (+/- 0.030)
	p = 0.0004 ^{***}
Prime Rate	0.541 (+/- 0.101)
	p = 0.00001 ^{***}
Home Price Index	-0.017 (+/- 0.001)
	p = 0.000***
US Avg Retail Gasoline Price (\$-gal; all grades, all formulations)	0.450 (+/- 0.082)
	p = 0.00001 ^{***}
6-month Treasury Yield_2	0.093 (+/- 0.019)
	p = 0.00003***
Observations	40
R ²	0.943
Adjusted R ²	0.928
Residual Std. Error	0.192 (df = 31)
F Statistic	63.873 ^{***} (df = 8; 31)
Note:	*p<0.1; **p<0.05; ***p<0.01

REGRESSION FOR 20-YEAR TREASURY YIELD

	Dependent variable (+/- SE)
	30-year Treasury Yield
Constant	2.187 (+/- 0.364)
	p = 0.00000 ^{***}
SP500 Stock Price Index	-0.001 (+/- 0.00005)
	p = 0.000***
US Fed Reserve O-N Loan Rate	-0.433 (+/- 0.152)
	p = 0.008***
Unemployment Rate	-0.090 (+/- 0.028)
	p = 0.003***
Prime Rate	0.383 (+/- 0.109)
	p = 0.002***
US Avg Retail Gasoline Price (\$-gal; all grades, all formulations)	0.476 (+/- 0.081)
	p = 0.00001***
1-month Treasury Yield_2	0.072 (+/- 0.022)
	p = 0.003***
Observations	40
R ²	0.901
Adjusted R ²	0.883
Residual Std. Error	0.227 (df = 33)
F Statistic	49.868 ^{***} (df = 6; 33)
Note:	*p<0.1; **p<0.05; ***p<0.01

REGRESSION FOR 30-YEAR TREASURY YIELD

30-year Mortgage Rate

	Dependent variable (+/- SE):
	30-year Mortgate Rate
Constant	0.589 (+/- 0.569)
	p = 0.308
SP500 Stock Price Index	-0.001 (+/- 0.0003)
	p = 0.00001***
Unemployment Rate	-0.112 (+/- 0.038)
	p = 0.007***
Home Price Index	0.030 (+/- 0.006)
	p = 0.00004***
US Avg Retail Gasoline Price (\$-gal; all grades, all formulations)	0.601 (+/- 0.126)
	p = 0.00004***
1-month Treasury Yield_2	0.059 (+/- 0.017)
	p = 0.002***
Observations	40
R ²	0.876
Adjusted R ²	0.858
Residual Std. Error	0.391 (df = 34)
F Statistic	48.084 ^{***} (df = 5; 34)
Note:	*p<0.1; **p<0.05; ***p<0.01

REGRESSION FOR 30-YEAR MORTGATE RATE

Moody's AAA & BAA Rates

	Dependent variable (+/- SE):
	Moody's AAA Curve
Constant	3.240 (+/- 0.340)
	p = 0.000***
SP500 Stock Price Index	-0.001 (+/- 0.00004)
	p = 0.000***
US Fed Reserve O-N Loan Rate	-0.555 (+/- 0.125)
	p = 0.0001 ^{***}
Unemployment Rate	-0.100 (+/- 0.024)
	p = 0.0003 ^{***}
Prime Rate	0.493 (+/- 0.096)
	p = 0.00002***
US Avg Retail Gasoline Price (\$-gal; all grades, all formulations)	0.372 (+/- 0.071)
	p = 0.00001 ^{***}
3-month Treasury Yield_2	0.067 (+/- 0.017)
	p = 0.0004 ^{***}
Observations	40
R ²	0.926
Adjusted R ²	0.913
Residual Std. Error	0.199 (df = 33)
F Statistic	68.934 ^{***} (df = 6; 33)
Note:	*p<0.1; **p<0.05; ***p<0.01

REGRESSION FOR MOODY'S AAA CURVE

	Dependent variable (+/- SE):	
	Moody's BAA Curve	
Constant	5.763 (+/- 0.287)	
	p = 0.000***	
SP500 Stock Price Index	-0.001 (+/- 0.0001)	
	p = 0.000***	
US Fed Reserve O-N Loan Rate	-0.578 (+/- 0.138)	
	p = 0.0002 ^{***}	
US Avg Retail Gasoline Price (\$-gal; all grades, all formulations)	0.319 (+/- 0.082)	
	p = 0.0005 ^{***}	
LN_6-month Treasury Yield	0.197 (+/- 0.054)	
	p = 0.001***	
1-year Treasury Yield_2	0.168 (+/- 0.024)	
	p = 0.00000***	
Observations	40	
R ²	0.889	
Adjusted R ²	0.872	
Residual Std. Error	0.257 (df = 34)	
F Statistic	54.332 ^{***} (df = 5; 34)	
Note:	*p<0.1; **p<0.05; ***p<0.01	

REGRESSION FOR MOODY'S BAA CURVE

BBB Corporate Yield

	Dependent variable (+/- SE):
	BBB corporate yield
Constant	4.974 (+/- 0.343)
	p = 0.000***
US Fed Reserve O-N Loan Rate	-1.347 (+/- 0.153)
	p = 0.000***
Home Price Index	-0.010 (+/- 0.001)
	p = 0.000***
US Avg Retail Gasoline Price (\$-gal; all grades, all formulations)	0.770 (+/- 0.082)
	p = 0.000***
LN_1-year Treasury Yield	0.791 (+/- 0.066)
	p = 0.000***
6-month Treasury Yield_2	0.245 (+/- 0.025)
	p = 0.000***
Observations	40
R ²	0.932
Adjusted R ²	0.922
Residual Std. Error	0.263 (df = 34)
F Statistic	93.738 ^{***} (df = 5; 34)
Note:	*p<0.1; **p<0.05; ***p<0.01

REGRESSION FOR BBB CORPORATE YIELD

Prime Rate

	Dependent variable (+/- SE):
	Prime Rate
Constant	-16.544 (+/- 3.471)
	p = 0.00005 ^{***}
Real disposable income growth	0.186 (+/- 0.029)
	p = 0.00000 ^{***}
Nominal disposable income growth	-0.171 (+/- 0.029)
	p = 0.00001***
Unemployment Rate	-0.497 (+/- 0.056)
	p = 0.000***
Dow Total Stock Market Index	0.0001 (+/- 0.00001)
	p = 0.00000 ^{***}
30-year Treasury Yield	-11.089 (+/- 1.892)
	p = 0.00001***
LN_30-year Treasury Yield	34.740 (+/- 5.199)
	p = 0.00000***
20-year Treasury Yield	31.531 (+/- 3.974)
	p = 0.000***
LN_20-year Treasury Yield	-55.819 (+/- 6.090)
	p = 0.000***
20-year Treasury Yield_2	-1.882 (+/- 0.390)
	p = 0.00004***
Observations	40
R ²	0.973
Adjusted R ²	0.965
Residual Std. Error	0.262 (df = 30)
F Statistic	121.131 ^{***} (df = 9; 30)
Note:	*p<0.1; **p<0.05; ***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	21.429 (+/- 2.609)
	p = 0.00001***
Moody's BAA Curve	1.959 (+/- 0.273)
	p = 0.00001 ^{***}
Real GDP growth	-0.397 (+/- 0.066)
	p = 0.00005***
Nominal GDP growth	0.411 (+/- 0.066)
	p = 0.00004***
Real disposable income growth	-0.327 (+/- 0.053)
	p = 0.00004***
Nominal disposable income growth	0.307 (+/- 0.050)
	p = 0.00004***
Unemployment Rate	0.455 (+/- 0.111)
	p = 0.002***
Prime Rate	2.068 (+/- 0.279)
	p = 0.00001***
Home Price Index	-0.071 (+/- 0.008)
	p = 0.00001***
30-year Treasury Yield	-19.307 (+/- 2.204)
	p = 0.00000 ^{***}
20-year Treasury Yield	16.855 (+/- 1.596)
	p = 0.00000 ^{***}
10-year Treasury Yield	-15.385 (+/- 2.168)
	p = 0.00001***
LN_10-year Treasury Yield	34.252 (+/- 5.022)
	p = 0.00002***
LN_1-month Treasury Yield	-0.696 (+/- 0.118)
	p = 0.0001***
LN_7-year Treasury Yield	-24.107 (+/- 3.108)
	p = 0.00001***
5-year Treasury Yield	7.899 (+/- 1.622)
	p = 0.0004***
6-month Treasury Yield	11.566 (+/- 2.098)
	p = 0.0001***

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

LN_6-month Treasury Yield	4.786 (+/- 0.567)	
	p = 0.00001****	
LN_3-year Treasury Yield	4.544 (+/- 0.659)	
	p = 0.00002***	
1-year Treasury Yield	-20.136 (+/- 3.217)	
	p = 0.00003***	
LN_1-year Treasury Yield	-3.067 (+/- 0.411)	
	p = 0.00001***	
1-year Treasury Yield_2	5.955 (+/- 0.922)	
	p = 0.00003***	
3-year Treasury Yield_2	-1.000 (+/- 0.256)	
	p = 0.002***	
6-month Treasury Yield_2	-5.154 (+/- 0.824)	
	p = 0.00003***	
5-year Treasury Yield_2	-2.214 (+/- 0.442)	
	p = 0.0003***	
3-month Treasury Yield_2	1.132 (+/- 0.194)	
	p = 0.0001***	
7-year Treasury Yield_2	2.611 (+/- 0.472)	
	p = 0.0001***	
Observations	40	
R ²	0.993	
Adjusted R ²	0.979	
Residual Std. Error	0.091 (df = 13)	
F Statistic	69.366 ^{***} (df = 26; 13)	

Note:

*p<0.1; **p<0.05; ***p<0.01

US Federal Reserve Overnight Lending Rate

	Dependent variable (+/- SE):
	US Fed Reserve O-N Loan Rate
Constant	3.277 (+/- 0.532)
	p = 0.00000 ^{***}
Real disposable income growth	0.665 (+/- 0.109)
	p = 0.00000 ^{***}
Nominal disposable income growth	-0.618 (+/- 0.103)
	p = 0.00001***
Unemployment Rate	-0.847 (+/- 0.059)
	p = 0.000***
CPI Inflation Rate	0.379 (+/- 0.084)
	p = 0.0001***
BBB corporate yield	-0.582 (+/- 0.148)
	p = 0.0005 ^{***}
20-year Treasury Yield	7.411 (+/- 0.596)
	p = 0.000***
LN_20-year Treasury Yield	-16.146 (+/- 1.382)
	p = 0.000***
Observations	40
R ²	0.923
Adjusted R ²	0.907
Residual Std. Error	0.386 (df = 32)
F Statistic	55.039 ^{***} (df = 7; 32)
Note:	*p<0.1; **p<0.05; ***p<0.01

REGRESSION FOR US FED RESERVE O-N LOAN RATE

	Dependent variable (+/- SE):
	Dow Total Stock Market Index
Constant	194,291.000 (+/- 12,890.830)
	p = 0.000***
US Fed Reserve O-N Loan Rate	-13,633.570 (+/- 1,396.743)
	p = 0.000 ^{***}
BBB corporate yield	-3,844.699 (+/- 768.229)
	p = 0.00004 ^{***}
Prime Rate	10,621.550 (+/- 1,486.380)
	p = 0.00000 ^{***}
US Avg Retail Gasoline Price (\$-gal; all grades, all formulations)	4,248.976 (+/- 1,026.668)
	p = 0.0004 ^{***}
30-year Treasury Yield	-184,558.600 (+/- 12,813.680)
	p = 0.000***
LN_20-year Treasury Yield	158,346.800 (+/- 16,861.240)
	p = 0.000***
LN_7-year Treasury Yield	53,479.390 (+/- 16,327.240)
	p = 0.003***
LN_5-year Treasury Yield	-35,564.580 (+/- 8,758.942)
	p = 0.0004***
LN_1-year Treasury Yield	2,667.250 (+/- 859.912)
	p = 0.005***
1-year Treasury Yield_2	2,510.564 (+/- 300.018)
	p = 0.000***
20-year Treasury Yield_2	-14,042.810 (+/- 1,387.866)
	p = 0.000***
30-year Treasury Yield_2	31,016.400 (+/- 2,711.048)
	p = 0.000***
Observations	40
R ²	0.988
Adjusted R ²	0.982
Residual Std. Error	1,190.606 (df = 27)
F Statistic	179.784 ^{***} (df = 12; 27)
Note:	*p<0.1; **p<0.05; ***p<0.01

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

	Dependent variable (+/- SE):
	SP500 Stock Price Index
Constant	4,466.584 (+/- 517.495)
	p = 0.000***
US Fed Reserve O-N Loan Rate	-753.952 (+/- 117.063)
	p = 0.00000 ^{***}
Unemployment Rate	-239.243 (+/- 51.107)
	p = 0.0001***
Prime Rate	1,558.026 (+/- 200.690)
	p = 0.000***
30-year Treasury Yield	4,011.896 (+/- 781.785)
	p = 0.00002***
LN_30-year Treasury Yield	-20,774.970 (+/- 2,380.451)
	p = 0.000***
LN_7-year Treasury Yield	12,180.890 (+/- 1,238.151)
	p = 0.000***
LN_5-year Treasury Yield	-5,690.813 (+/- 793.606)
	p = 0.00000 ^{***}
3-year Treasury Yield	-1,225.597 (+/- 294.253)
	p = 0.0003 ^{***}
Observations	40
R ²	0.946
Adjusted R ²	0.932
Residual Std. Error	236.605 (df = 31)
F Statistic	67.861 ^{***} (df = 8; 31)
Note:	*p<0.1; **p<0.05; ***p<0.01

House and Commercial Real Estate Price Indexes

	Dependent variable (+/- SE):
	Home Price Index
Constant	-312.022 (+/- 187.482)
	p = 0.107
US Fed Reserve O-N Loan Rate	-19.295 (+/- 5.921)
	p = 0.003 ^{***}
Real GDP growth	-13.389 (+/- 0.982)
	p = 0.000 ^{***}
Nominal GDP growth	11.652 (+/- 0.933)
	p = 0.000 ^{***}
Unemployment Rate	-12.708 (+/- 3.905)
	p = 0.003 ^{***}
20-year Treasury Yield	797.534 (+/- 261.264)
	p = 0.005***
LN_20-year Treasury Yield	-925.387 (+/- 292.343)
	p = 0.004***
7-year Treasury Yield	-50.332 (+/- 15.900)
	p = 0.004***
1-year Treasury Yield_2	13.023 (+/- 1.768)
	p = 0.00000***
20-year Treasury Yield_2	-80.618 (+/- 26.108)
	p = 0.005 ^{***}
Observations	40
R ²	0.963
Adjusted R ²	0.951
Residual Std. Error	10.138 (df = 30)
F Statistic	85.726 ^{***} (df = 9; 30)
Note:	*p<0.1; **p<0.05; ***p<0.01

REGRESSION FOR HOME PRICE INDEX

	Dependent variable (+/- SE):
	Commercial Real Estate Price Index
Constant	314.925 (+/- 7.257)
	p = 0.000 ^{***}
Real GDP growth	-13.579 (+/- 1.060)
	p = 0.000***
Nominal GDP growth	12.601 (+/- 0.940)
	p = 0.000***
1-month Treasury Yield	42.778 (+/- 15.345)
	p = 0.009***
7-year Treasury Yield	-88.149 (+/- 9.090)
	p = 0.000***
3-year Treasury Yield	98.928 (+/- 20.705)
	p = 0.00005***
1-year Treasury Yield	-68.476 (+/- 23.853)
	p = 0.008***
3-month Treasury Yield_2	28.619 (+/- 7.113)
	p = 0.0004***
1-month Treasury Yield_2	-28.172 (+/- 8.334)
	p = 0.002***
Observations	40
R ²	0.959
Adjusted R ²	0.949
Residual Std. Error	10.373 (df = 31)
F Statistic	91.060 ^{***} (df = 8; 31)
Note:	*p<0.1; **p<0.05; ***p<0.01

REGRESSION FOR COMMERCIAL REAL ESTATE PRICE INDEX

Market Volatility Index

	Dependent variable (+/- SE):
	Market Volatility Index
Constant	967.529 (+/- 150.916)
	p = 0.00001 ^{***}
Real GDP growth	8.751 (+/- 2.336)
	p = 0.002***
Nominal GDP growth	-9.199 (+/- 2.316)
	p = 0.001***
Real disposable income growth	0.407 (+/- 0.138)
	p = 0.007 ^{***}
CPI Inflation Rate	9.164 (+/- 1.950)
	p = 0.0001 ^{***}
Home Price Index	-0.682 (+/- 0.150)
	p = 0.0002***
LN_30-year Treasury Yield	-295.300 (+/- 88.913)
	p = 0.003 ^{***}
20-year Treasury Yield	-1,106.721 (+/- 191.991)
	p = 0.00001***
LN_20-year Treasury Yield	1,246.863 (+/- 279.358)
	p = 0.0002***
1-month Treasury Yield	-13.056 (+/- 3.321)
	p = 0.001***
LN_7-year Treasury Yield	552.184 (+/- 163.839)
	p = 0.003 ^{***}
5-year Treasury Yield	288.824 (+/- 70.822)
	p = 0.0005 ^{***}
LN_5-year Treasury Yield	-856.287 (+/- 153.460)
	p = 0.00002 ^{***}
LN_3-year Treasury Yield	262.945 (+/- 43.764)
	p = 0.00001 ^{***}
LN_1-year Treasury Yield	-29.835 (+/- 7.333)
	p = 0.0005 ^{***}
7-year Treasury Yield_2	-53.617 (+/- 13.998)
	p = 0.001***
20-year Treasury Yield_2	133.951 (+/- 22.674)
	p = 0.00001 ^{***}

REGRESSION FOR MARKET VOLATILITY INDEX

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Observations	40
R ²	0.831
Adjusted R ²	0.714
Residual Std. Error	6.942 (df = 23)
F Statistic	7.088 ^{***} (df = 16; 23)
Note:	*p<0.1; **p<0.05; ***p<0.01

Appendix A: Data Sources

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

Tahle	16.	Data	Values	and	Referenced	Sources
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Attribute	Referenced Source ⁸⁵
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 ⁸⁶

⁸⁵ Per https://www.federalreserve.gov/newsevents/pressreleases/files/bcreg20190213a1.pdf

⁸⁶ 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) ⁸⁷ .
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) ⁸⁸ .
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.

⁸⁷ 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

⁸⁸ Capitalytics accesses this series from the data provided by https://www.quandl.com/data/FED/FL075035503_Q-Interest-rates-and-price-indexes-commercial-real-estate-price-index-Quarterly-Levels-NSA

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

The above dataset from the Federal Reserve can be downloaded manually or automatically. Manual downloads are available at https://www.federalreserve.gov/supervisionreg/files/2023-Table_1A_Historic_Domestic.csv and https://www.federalreserve.gov/supervisionreg/files/2023-Table_1B_Historic_International.csv (shown below, as of March 2023) by clicking the links marked "2023 Historical Domestic (CSV)" and "2023 Historical International (CSV)"⁸⁹.



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

⁸⁹ Again, due to the requirements of this client, international data elements are not being discussed in this document.

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

Table 17: Supplementary Data Sources for Data Attributes

Attribute	Supplementary Data Source
Real GDP growth	Bureau of Economic Analysis (NIPA table 1.1.6, line 1)
Nominal GDP growth	Bureau of Economic Analysis (NIPA table 1.1.5, line 1)
Real disposable income growth	Bureau of Economic Analysis (NIPA table 2.1, line 27, and NIPA table 1.1.4, line 2)
Nominal disposable income growth	Bureau of Economic Analysis (NIPA table 2.1, line 27)
Unemployment rate	Bureau of Labor Statistics (series LNS14000000)
CPI inflation rate	Bureau of Labor Statistics (series CUSR0000SA0)
3-month Treasury yield	Quarterly average of 3-month Treasury bill secondary market rate on a discount basis, H.15 Release
5-year Treasury yield	Federal Reserve Economic Research website (https://fred.stlouisfed.org/series/GS5), with "Quarterly" frequency and "Average" aggregation method
10-year Treasury yield	Federal Reserve Economic Research website (https://fred.stlouisfed.org/series/GS10), with "Quarterly" frequency and "Average" aggregation method
BBB corporate yield	Federal Reserve Economic Research website (https://fred.stlouisfed.org/series/BAMLCOA4CBBBEY), with "Quarterly" frequency and "Average" aggregation method
Mortgage rate	Federal Reserve Economic Research website (https://fred.stlouisfed.org/series/MORTGAGE30US), with "Quarterly" frequency and "Average" aggregation method
Prime rate	Federal Reserve Economic Research website (https://fred.stlouisfed.org/series/MPRIME), with "Quarterly" frequency and "Average" aggregation method
Dow Jones Total Stock Market Index (end-of-qtr value)	Dow-Jones as provided by the Wall Street Journal (https://quotes.wsj.com/index/DWCF/advanced-chart)
House Price Index	https://data.nasdaq.com/data/FED/FL075035243_Q-interest- rates-and-price-indexes-owneroccupied-real-estate-corelogic- national-sa-quarterly-levels-nsa
Commercial Real Estate Price Index	https://data.nasdaq.com/data/FED/FL075035503_Q-interest- rates-and-price-indexes-commercial-real-estate-price-index- quarterly-levels-nsa
Market Volatility Index (VIX)	Federal Reserve Economic Research website (https://fred.stlouisfed.org/series/VIXCLS), with "Quarterly" frequency and "Average" aggregation method

Euro Area Real GDP Growth	Quarterly series for "European Union GDP Annual Growth	
	Rate" per tradingeconomics.com	
Euro Area Inflation	Quarterly average of monthly series for "European Union	
	Inflation Rate" per tradingeconomics.com	
Euro Area Bilateral Dollar	End-of-quarter rates from the H.10 Release, Foreign Exchange	
Exchange Rate (USD/Euro)	Rates, Federal Reserve Board.	
Developing Asia Real 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.	
LIK Beal GDP Growth	Quarterly average of monthly series for "United Kingdom GDP	
	Growth Rate" per tradingeconomics.com	
LIK 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.

Table 17: Supplementary Data Attributes and Sources

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

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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's⁹⁰ "forecast" package⁹¹; specifically, the "ets" function (see p.39 of https://cran.r-project.org/web/packages/forecast/forecast.pdf)⁹² 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)⁹³, 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

⁹⁰ As of this writing, v.4.1.2 of the "R" language is available at <u>https://cran.r-project.org/</u>.

⁹¹ As of this writing, v.8.16 of the forecast package is available at <u>https://CRAN.R-project.org/package=forecast</u>.

⁹² 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.

 $^{^{93}}$ 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)⁹⁴.
- 2. The second forecast uses the differences between successive quarterly values in order to forecast the future quarterly differences. It should be noted that these sequences are (obviously) one data-point shorter than those in the preceding procedure. These values are forecasted using the same procedure as described in the first section, with forecasted values for the actual metric being built using the last known value for the metric and forecasts of incremental changes to the metric provided.

An edited example for loading the SP500 end-of quarter values, and the differences between successive guarterly 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
                     Qtr2
                               Qtr3
                                         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
                                                  Qtr4
2008
                             1119.860980 -252.112424
2009 -186.360685 -12.520593 127.978126 113.868293
       > m<-ets(dsp_ts,model='ZZZ',opt.crit=c('mae'),additive.only=TRUE</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 values⁹⁵;
 - 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

⁹⁴ It bears noting that a lower value for the "score" indicates better accuracy of an algorithm.

⁹⁵ 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 slopes⁹⁶.

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.

$$\hat{y}_{\scriptscriptstyle T^{+1}\mid T} = \alpha y_{\scriptscriptstyle T} + \alpha (1 - \alpha) y_{\scriptscriptstyle T^{-1}} + \alpha (1 - \alpha)^2 y_{\scriptscriptstyle T^{-2}} + \dots + \epsilon_{\scriptscriptstyle T^{+1}}$$

⁹⁶ 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	Μ
Ν	$\hat{y}_{t+h t} = \ell_t$ $\ell_t = lpha y_t + (1-lpha)\ell_{t-1}$	$egin{aligned} \hat{y}_{t+h t} &= \ell_t + s_{t-m+h_m^+} \ \ell_t &= lpha(y_t - s_{t-m}) + (1-lpha)\ell_{t-1} \ s_t &= \gamma(y_t - \ell_{t-1}) + (1-\gamma)s_{t-m} \end{aligned}$	$\hat{y}_{t+h t} = \ell_t s_{t-m+h_m^+} \\ \ell_t = lpha(y_t/s_{t-m}) + (1-lpha)\ell_{t-1} \\ s_t = \gamma(y_t/\ell_{t-1}) + (1-\gamma)s_{t-m}$
Α	$\hat{y}_{t+h t} = \ell_t + hb_t$ $\ell_t = lpha y_t + (1-lpha)(\ell_{t-1} + b_{t-1})$ $b_t = eta^*(\ell_t - \ell_{t-1}) + (1-eta^*)b_{t-1}$	$\begin{split} \hat{y}_{t+h t} &= \ell_t + hb_t + s_{t-m+h_m^+} \\ \ell_t &= \alpha(y_t - s_{t-m}) + (1-\alpha)(\ell_{t-1} + b_{t-1}) \\ b_t &= \beta^*(\ell_t - \ell_{t-1}) + (1-\beta^*)b_{t-1} \\ s_t &= \gamma(y_t - \ell_{t-1} - b_{t-1}) + (1-\gamma)s_{t-m} \end{split}$	$\begin{aligned} \hat{y}_{t+h t} &= (\ell_t + hb_t)s_{t-m+h_m^+} \\ \ell_t &= \alpha(y_t/s_{t-m}) + (1-\alpha)(\ell_{t-1} + b_{t-1}) \\ b_t &= \beta^*(\ell_t - \ell_{t-1}) + (1-\beta^*)b_{t-1} \\ s_t &= \gamma(y_t/(\ell_{t-1} + b_{t-1})) + (1-\gamma)s_{t-m} \end{aligned}$
$\mathbf{A}_{\mathbf{d}}$	$egin{aligned} \hat{y}_{t+h t} &= \ell_t + \phi_h b_t \ \ell_t &= lpha y_t + (1-lpha)(\ell_{t-1} + \phi b_{t-1}) \ b_t &= eta^*(\ell_t - \ell_{t-1}) + (1-eta^*)\phi b_{t-1} \end{aligned}$	$\begin{aligned} \hat{y}_{t+h t} &= \ell_t + \phi_h b_t + s_{t-m+h_m^+} \\ \ell_t &= \alpha(y_t - s_{t-m}) + (1-\alpha)(\ell_{t-1} + \phi b_{t-1}) \\ b_t &= \beta^*(\ell_t - \ell_{t-1}) + (1-\beta^*)\phi b_{t-1} \\ s_t &= \gamma(y_t - \ell_{t-1} - \phi b_{t-1}) + (1-\gamma)s_{t-m} \end{aligned}$	$\begin{aligned} \hat{y}_{t+h t} &= (\ell_t + \phi_h b_t) s_{t-m+h_m^+} \\ \ell_t &= \alpha(y_t/s_{t-m}) + (1-\alpha)(\ell_{t-1} + \phi b_{t-1}) \\ b_t &= \beta^* (\ell_t - \ell_{t-1}) + (1-\beta^*) \phi b_{t-1} \\ s_t &= \gamma(y_t/(\ell_{t-1} + \phi b_{t-1})) + (1-\gamma) s_{t-m} \end{aligned}$
М	$egin{aligned} \hat{y}_{t+h t} &= \ell_t b^h_t \ \ell_t &= lpha y_t + (1-lpha) \ell_{t-1} b_{t-1} \ b_t &= eta^* (\ell_t / \ell_{t-1}) + (1-eta^*) b_{t-1} \end{aligned}$	$\begin{split} \hat{y}_{t+h t} &= \ell_t b_t^h + s_{t-m+h_m^+} \\ \ell_t &= \alpha(y_t - s_{t-m}) + (1-\alpha)\ell_{t-1}b_{t-1} \\ b_t &= \beta^*(\ell_t/\ell_{t-1}) + (1-\beta^*)b_{t-1} \\ s_t &= \gamma(y_t - \ell_{t-1}b_{t-1}) + (1-\gamma)s_{t-m} \end{split}$	$\begin{aligned} \hat{y}_{t+h t} &= \ell_t b_t^h s_{t-m+h_m^+} \\ \ell_t &= \alpha(y_t/s_{t-m}) + (1-\alpha)\ell_{t-1}b_{t-1} \\ b_t &= \beta^*(\ell_t/\ell_{t-1}) + (1-\beta^*)b_{t-1} \\ s_t &= \gamma(y_t/(\ell_{t-1}b_{t-1})) + (1-\gamma)s_{t-m} \end{aligned}$
$\mathbf{M}_{\mathbf{d}}$	$\begin{split} \hat{y}_{t+h t} &= \ell_t b_t^{\phi_h} \\ \ell_t &= \alpha y_t + (1-\alpha)\ell_{t-1}b_{t-1}^{\phi} \\ b_t &= \beta^*(\ell_t/\ell_{t-1}) + (1-\beta^*)b_{t-1}^{\phi} \end{split}$	$\begin{split} \hat{y}_{t+h t} &= \ell_t b_t^{\phi_h} + s_{t-m+h_m^+} \\ \ell_t &= \alpha(y_t - s_{t-m}) + (1-\alpha)\ell_{t-1}b_{t-1}^{\phi} \\ b_t &= \beta^*(\ell_t/\ell_{t-1}) + (1-\beta^*)b_{t-1}^{\phi} \\ s_t &= \gamma(y_t - \ell_{t-1}b_{t-1}^{\phi}) + (1-\gamma)s_{t-m} \end{split}$	$\begin{split} \hat{y}_{t+h t} &= \ell_t b_t^{\phi_h} s_{t-m+h_m^+} \\ \ell_t &= \alpha(y_t/s_{t-m}) + (1-\alpha)\ell_{t-1}b_{t-1}^{\phi} \\ b_t &= \beta^*(\ell_t/\ell_{t-1}) + (1-\beta^*)b_{t-1}^{\phi} \\ s_t &= \gamma(y_t/(\ell_{t-1}b_{t-1}^{\phi})) + (1-\gamma)s_{t-m} \end{split}$

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 5: Correlation Factors found as of 3Q2023 Image: Control of the second secon

Variable 1	Variable 2	Correlation
Annualized US Inflation Rate (all items, all urban		
S&P 500 Stock Price Index	areas)	0.685854
S&P 500 Stock Price Index	Down Jones Total Stock Market Index	0.977417
S&P 500 Stock Price Index	US Nat'l Residential Home Price Index	0.950409
S&P 500 Stock Price Index	US Nat'l Commercia Real Estate Index	0.96678
Cost of Federal Funds	Moody's AAA Yield	0.794157
Cost of Federal Funds	Moody's BAA Yield	0.738826
Cost of Federal Funds	BofA BBB Corporate Yield	0.760317
Cost of Federal Funds	30-year Fixed Mortgage Rate	0.87299
Cost of Federal Funds	US Prime Rate	0.996514
Cost of Federal Funds	30-year Treasury Yield	0.78045
Cost of Federal Funds	20-year Treasury Yield	0.783175
Cost of Federal Funds	10-year Treasury Yield	0.847502
Cost of Federal Funds	1-month Treasury Yield	0.993495
Cost of Federal Funds	7-year Treasury Yield	0.889022
Cost of Federal Funds	3-month Treasury Yield	0.995482
Cost of Federal Funds	5-year Treasury Yield	0.916993
Cost of Federal Funds	6-month Treasury Yield	0.992434
Cost of Federal Funds	3-year Treasury Yield	0.95249
Cost of Federal Funds	1-year Treasury Yield	0.985533
Moody's AAA Yield	Moody's BAA Yield	0.979355
Moody's AAA Yield	BofA BBB Corporate Yield	0.948881
Moody's AAA Yield	30-year Fixed Mortgage Rate	0.974239
Moody's AAA Yield	US Prime Rate	0.775264
Moody's AAA Yield	Down Jones Total Stock Market Index	-0.798585
Moody's AAA Yield	US Nat'l Residential Home Price Index	-0.815998
Moody's AAA Yield	US Nat'l Commercia Real Estate Index	-0.849697
Moody's AAA Yield	Average Retail Gasoline Price (all grades)	-0.719002
Moody's AAA Yield	30-year Treasury Yield	0.985296
Moody's AAA Yield	20-year Treasury Yield	0.983718
Moody's AAA Yield	10-year Treasury Yield	0.984694
Moody's AAA Yield	7-year Treasury Yield	0.96443
Moody's AAA Yield	3-month Treasury Yield	0.791892
Moody's AAA Yield	5-year Treasury Yield	0.942427
Moody's AAA Yield	6-month Treasury Yield	0.796893
Moody's AAA Yield	3-year Treasury Yield	0.895152
Moody's AAA Yield	1-year Treasury Yield	0.81593
Moody's BAA Yield	BofA BBB Corporate Yield	0.984661
Moody's BAA Yield	30-year Fixed Mortgage Rate	0.948261
Moody's BAA Yield	US Prime Rate	0.719239
Moody's BAA Yield	Down Jones Total Stock Market Index	-0.813963
Moody's BAA Yield	US Nat'l Residential Home Price Index	-0.800154
Moody's BAA Yield	US Nat'l Commercia Real Estate Index	-0.824434
Moody's BAA Yield	Average Retail Gasoline Price (all grades)	-0.680422
Moody's BAA Yield	30-year Treasury Yield	0.949169
Moody's BAA Yield	20-year Treasury Yield	0.933472
Moody's BAA Yield	10-year Treasury Yield	0.948494
Moody's BAA Yield	7-year Treasury Yield	0.917335
Moody's BAA Yield	3-month Treasury Yield	0.734545
Moody's BAA Yield	5-year Treasury Yield	0.892631

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Moody's BAA Yield	6-month Treasury Yield	0.740819
Moody's BAA Yield	3-year Treasury Yield	0.840549
Moody's BAA Yield	1-year Treasury Yield	0.759837
Real GDP Growth Rate	Nominal GDP Growth Rate	0.961803
Real Disposable Income Growth Rate	Nominal Disposable Income Growth Rate	0.972829
BofA BBB Corporate Yield	30-year Fixed Mortgage Rate	0.939938
BofA BBB Corporate Yield	US Prime Rate	0.742232
BofA BBB Corporate Yield	Down Jones Total Stock Market Index	-0.744153
BofA BBB Corporate Yield	US Nat'l Residential Home Price Index	-0.722829
BofA BBB Corporate Yield	US Nat'l Commercia Real Estate Index	-0.735839
BofA BBB Corporate Yield	Average Retail Gasoline Price (all grades)	-0.615145
BofA BBB Corporate Yield	30-year Treasury Yield	0.906443
BofA BBB Corporate Yield	20-year Treasury Yield	0.886139
BofA BBB Corporate Yield	10-year Treasury Yield	0.925725
BofA BBB Corporate Yield	7-year Treasury Yield	0.902374
BofA BBB Corporate Yield	3-month Treasury Yield	0.757255
BofA BBB Corporate Yield	5-year Treasury Yield	0.886614
BofA BBB Corporate Yield	6-month Treasury Yield	0.765226
BofA BBB Corporate Yield	3-year Treasury Yield	0.846606
BofA BBB Corporate Yield	1-year Treasury Yield	0.781562
30-year Fixed Mortgage Rate	US Prime Rate	0.856439
30-year Fixed Mortgage Rate	Down Jones Total Stock Market Index	-0.691088
30-year Fixed Mortgage Rate	US Nat'l Residential Home Price Index	-0.694734
30-year Fixed Mortgage Rate	US Nat'l Commercia Real Estate Index	-0.73942
30-year Fixed Mortgage Rate	Average Retail Gasoline Price (all grades)	-0.666111
30-year Fixed Mortgage Rate	30-year Treasury Yield	0.965275
30-year Fixed Mortgage Rate	20-year Treasury Yield	0.970566
30-year Fixed Mortgage Rate	10-year Treasury Yield	0.988032
30-year Fixed Mortgage Rate	1-month Treasury Yield	0.701973
30-year Fixed Mortgage Rate	7-year Treasury Yield	0.9865
30-year Fixed Mortgage Rate	3-month Treasury Yield	0.878389
30-year Fixed Mortgage Rate	5-year Treasury Yield	0.980116
30-year Fixed Mortgage Rate	6-month Treasury Yield	0.885033
30-year Fixed Mortgage Rate	3-year Treasury Yield	0.954717
30-year Fixed Mortgage Rate	1-year Treasury Yield	0.901099
US Prime Rate	30-year Treasury Yield	0.757626
US Prime Rate	20-year Treasury Yield	0.773877
US Prime Rate	10-year Treasury Yield	0.829289
	1-month Treasury Yield	0.992143
	7-year Treasury Yield	0.8/2/4/
	3-month Treasury Yield	0.992052
	S-year freasury field	0.902783
US Prime Rate	6-month Treasury field	0.989196
		0.942475
Down Jones Total Stock Market Index	1-year fredsury freu LIS Nat'l Residential Home Brice Index	0.30140
Down Jones Total Stock Market Index	US Nat'l Commercia Real Estate Index	0.913337
Down Jones Total Stock Market Index	30-year Treasury Vield	-0 794835
Down Jones Total Stock Market Index	20-year Treasury Yield	-0 733857
Down Jones Total Stock Market Index	10-year Treasury Yield	-0 736915
Down Jones Total Stock Market Index	7-year Treasury Yield	-0.677724
Down Jones Total Stock Market Index	5-year Treasury Yield	-0.630945
US Nat'l Residential Home Price Index	US Nat'l Commercia Real Estate Index	0.973733
US Nat'l Residential Home Price Index	Average Retail Gasoline Price (all grades)	0.700606
US Nat'l Residential Home Price Index	30-vear Treasury Yield	-0.806476
US Nat'l Residential Home Price Index	20-year Treasury Yield	-0.732853
US Nat'l Residential Home Price Index	10-year Treasury Yield	-0.751674
US Nat'l Residential Home Price Index	7-vear Treasury Yield	-0.704492
US Nat'l Residential Home Price Index	5-year Treasury Yield	-0.660011
US Nat'l Commercia Real Estate Index	Average Retail Gasoline Price (all grades)	0.722588
US Nat'l Commercia Real Estate Index	30-year Treasury Yield	-0.852491
US Nat'l Commercia Real Estate Index	20-year Treasury Yield	-0.813147
US Nat'l Commercia Real Estate Index	10-year Treasury Yield	-0.795818
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US Nat'l Commercia Real Estate Index	7-vear Treasury Yield	-0.748613
US Nat'l Commercia Real Estate Index	5-year Treasury Yield	-0.702781
US Nat'l Commercia Real Estate Index	3-year Treasury Yield	-0.630813
Average Retail Gasoline Price (all grades)	30-year Treasury Yield	-0.704567
Average Retail Gasoline Price (all grades)	20-year Treasury Yield	-0.695877
Average Retail Gasoline Price (all grades)	10-year Treasury Yield	-0.710108
Average Retail Gasoline Price (all grades)	7-vear Treasury Yield	-0.706332
Average Retail Gasoline Price (all grades)	5-vear Treasury Yield	-0.694919
Average Retail Gasoline Price (all grades)	3-year Treasury Yield	-0.656739
30-year Treasury Yield	20-year Treasury Yield	0.995554
30-year Treasury Yield	10-year Treasury Yield	0.986818
30-year Treasury Yield	7-vear Treasury Yield	0.966975
30-year Treasury Yield	3-month Treasury Yield	0.782863
30-year Treasury Yield	5-vear Treasury Yield	0.941871
30-year Treasury Yield	6-month Treasury Yield	0.787569
30-year Treasury Yield	3-vear Treasury Yield	0.891994
30-year Treasury Yield	1-year Treasury Yield	0.808419
20-year Treasury Yield	10-year Treasury Yield	0.99268
20-year Treasury Yield	7-vear Treasury Yield	0.971265
20-year Treasury Yield	3-month Treasury Yield	0.782924
20-year Treasury Yield	5-vear Treasury Yield	0.943826
20-year Treasury Yield	6-month Treasury Yield	0.79249
20-year Treasury Yield	3-year Treasury Yield	0.894801
20-year Treasury Yield	1-year Treasury Yield	0.817097
10-year Treasury Yield	1-month Treasury Yield	0.634265
10-year Treasury Yield	7-year Treasury Yield	0.993231
10-year Treasury Yield	3-month Treasury Yield	0.851531
10-year Treasury Yield	5-vear Treasury Yield	0.979966
10-year Treasury Yield	6-month Treasury Yield	0.857967
10-year Treasury Yield	3-year Treasury Yield	0.945599
10-year Treasury Yield	1-year Treasury Yield	0.877121
1-month Treasury Yield	7-year Treasury Yield	0.753891
1-month Treasury Yield	3-month Treasury Yield	0.99764
1-month Treasury Yield	5-year Treasury Yield	0.833927
1-month Treasury Yield	6-month Treasury Yield	0.991877
1-month Treasury Yield	3-year Treasury Yield	0.919016
1-month Treasury Yield	1-year Treasury Yield	0.982237
7-year Treasury Yield	3-month Treasury Yield	0.895855
7-year Treasury Yield	5-year Treasury Yield	0.995863
7-year Treasury Yield	6-month Treasury Yield	0.902504
7-year Treasury Yield	3-year Treasury Yield	0.975054
7-year Treasury Yield	1-year Treasury Yield	0.919933
3-month Treasury Yield	5-year Treasury Yield	0.925198
3-month Treasury Yield	6-month Treasury Yield	0.998508
3-month Treasury Yield	3-year Treasury Yield	0.962368
3-month Treasury Yield	1-year Treasury Yield	0.993828
5-year Treasury Yield	6-month Treasury Yield	0.932145
5-year Treasury Yield	3-year Treasury Yield	0.990356
5-year Treasury Yield	1-year Treasury Yield	0.947758
6-month Treasury Yield	2	0.000288
-	3-year Treasury Field	0.969288
6-month Treasury Yield	1-year Treasury Yield	0.997808

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