Macroeconomic Forecasts, 1Q2019

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Introduction

Capitalytics performs a rigorous analysis of every variable that is included in our quarterly macroeconomic study. These variables include the following[1]:

1. Real GDP growth
2. Nominal GDP growth
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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
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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. Primary Credit Rate
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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)

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).

[1] 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.

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. The rationale for these analyses, modifications, and the conclusions thereto are documented in the following section of this report, "Data Series Conclusions".

Data Series Conclusions

This report documents Capitalytics' forecasts and analyses for approximately 28 macro-economic variables using data up to, and including, that for 4Q2018. Most domestic variables are driven by T-bill yields and inflation.

- Overview

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."

This report documents Capitalytics' forecasts and analyses for the domestically focused macro-economic values specified. Most domestic variables are driven by T-bill yields, which drive mortgages & real estate, borrowing rates, and credit rates, and indirectly impact GDP, inflation & unemployment. We continue to see economic growth, now tempered by rising interest rates and housing prices. The current news of scuffles between Congress and the White House is foreshadowed in our results, and should be a concern going forward.

- Correlations

Part of Capitalytics' analysis of macro-economic variables entails computing the correlation between variables, in order to establish the existence and level of interdependence of variables.

In Appendix C of this document, we document the 37 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 II of Appendix B.

Regression (Dependent) Variable		Independent Variable[2]
6-month Treasury yield	… depends on …	1-year Treasury yield
Prime rate		3-month Treasury yield
1-month Treasury yield		6-month Treasury yield*
3-year Treasury yield		1-year Treasury yield
7-year Treasury yield		3-year Treasury yield*
30-year Mortgage rate		10-year Treasury yield
Moody's AAA Rate		20-year Treasury yield
30-year Treasury yield		20-year Treasury yield
Primary Credit rate		6-month Treasury yield*

- Analysis of Variables

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

Analysis

While US GDP growth slowed to 2.7% in 4Q2018, Capitalytics expects it to continue to gradually slow to around 2.5% through 2019 and thereafter (while accounting for a certain amount of seasonal volatility, etc.). This is slightly more aggressive than the FOMC is predicting at this time, with their prediction being that real GDP will drop to 2.3% during 2019, and even slower thereafter. The main concern at this time, and the main bellweather for the economy as a whole, seems to be the actions that the Fed' takes with regard to interest: if the Fed' stays its course, interest rates may rise to 3%. This, however, is viewed as unlikely as potentially making the US a target for inflation.

Given the White House's readiness to directly intervene in every aspect of monetary policy (from tense overseas trade negotiations, to domestic fiscal policy, to government spending, to tax lawmaking, etc.), it is difficult to have any sense of which way the markets and market forces will respond. With inflation having rebounded during 4Q2018 to 3.7%, Capitalytics sees inflation settling back near 3.0% by YE2019; during 2020 through 2022, inflation will slowly drop towards 2.75%.

Disposable income has grown in the US -- up to almost 2.0% during 4Q2018. Capitalytics views aggregates spending on the decline in the coming years, with overall spending rates remaining at an overall rate of approximately 2.0%.

Other Commentary

- Kiplinger reports that it believes inflation should end 2019 at 2.3% (see https://www.kiplinger.com/article/business/T019-C000-S010-inflation-rate-forecast.html; May 10, 2019)

[2] 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 "*".

- Further, "… GDP growth is expected to slow from 2.5% this year to about 1.8% next year but could drop more if a U.S.-China trade deal doesn't happen, or because of other negative economic shocks." (see https://www.kiplinger.com/article/business/T019-C000-S010-interest-rate-forecast.html, May 22, 2019)
- "[T]he FOMC judged that an inflation rate of 2 percent, as measured by the price index for personal consumption expenditures (PCEPI). The FOMC judged this rate to be the longer-run rate most consistent with the Federal Reserve's statutory mandate of promoting maximum employment, stable prices and moderate long-term interest rates. … Since then, inflation has averaged under 2 percent … Thus, it appears that inflation in 2018 will fall short of the FOMC's inflation target for the seventh straight year." (see https://www.stlouisfed.org/on-the-economy/2019/february/inflation-forecasted-remain-two-percent-2019; Feb 25, 2019)
- "… [C]onsumer spending has been brisk and appreciably stronger than real after-tax incomes. At some point, though, the growth of consumer spending is likely to slow to more closely match income growth. (see https://www.stlouisfed.org/publications/regional-economist/fourth-quarter-2018/forecasters-gdp-growth-2019)

Unemployment Rate

Analysis

Unemployment shows no sign of breaking from its historic sub-4% low levels in the foreseeable future, still likely staying near and just below 3.7% through 2019, and slowly dropping to 3.25% by 2022. The issues with this phenomena are become more social than anything – specifically, what happens when a substantial portion of the population has essentially gives up and becomes "unemployable" (or unwilling to maintain a traditional schedule) as a mindset. While the economy is trending towards more contractor-assigned tasks, particularly in urban areas where there is an increasing demand for delivery services and other independent task-oriented & transactional positions, the wages and requirements for that type of lifestyle are already becoming viewed as unable to support basic living requirements.

Other Commentary

- "Meanwhile, the unemployment rate has fallen sharply over the past seven years, from 8.3 percent in January 2012 to 4 percent in January 2019. Indeed, in early 2017 the unemployment rate fell below the Congressional Budget Office's estimate of the economy's natural rate of unemployment (4.6 percent), when the unemployment rate fell from 4.7 percent in February to 4.4 percent in March. … Many economists and policymakers expect the unemployment rate to continue to fall farther below the natural rate of unemployment … this year. For example, the FOMC's Summary of Economic Projections released in December 2018 showed that the median FOMC participant projects that the unemployment rate will average 3.5 percent in the fourth quarter of 2019." (see https://www.stlouisfed.org/on-the-economy/2019/february/inflation-forecasted-remain-two-percent-2019, Feb 25, 2019)

- The unemployment rate—at 3.7% in October—sits near a 50-year low. When unemployment gets so low, it has tended to be a sign that economic resources are running tight. In the 1960s, low unemployment was followed by a decade-long run toward double-digit inflation. In the 1990s, low unemployment came with an epoch of asset bubbles that ended badly. (see https://www.wsj.com/articles/the-economic-forecast-for-2019-less-growth-and-more-uncertainty-1543892700; Jan 7, 2019)

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

Analysis

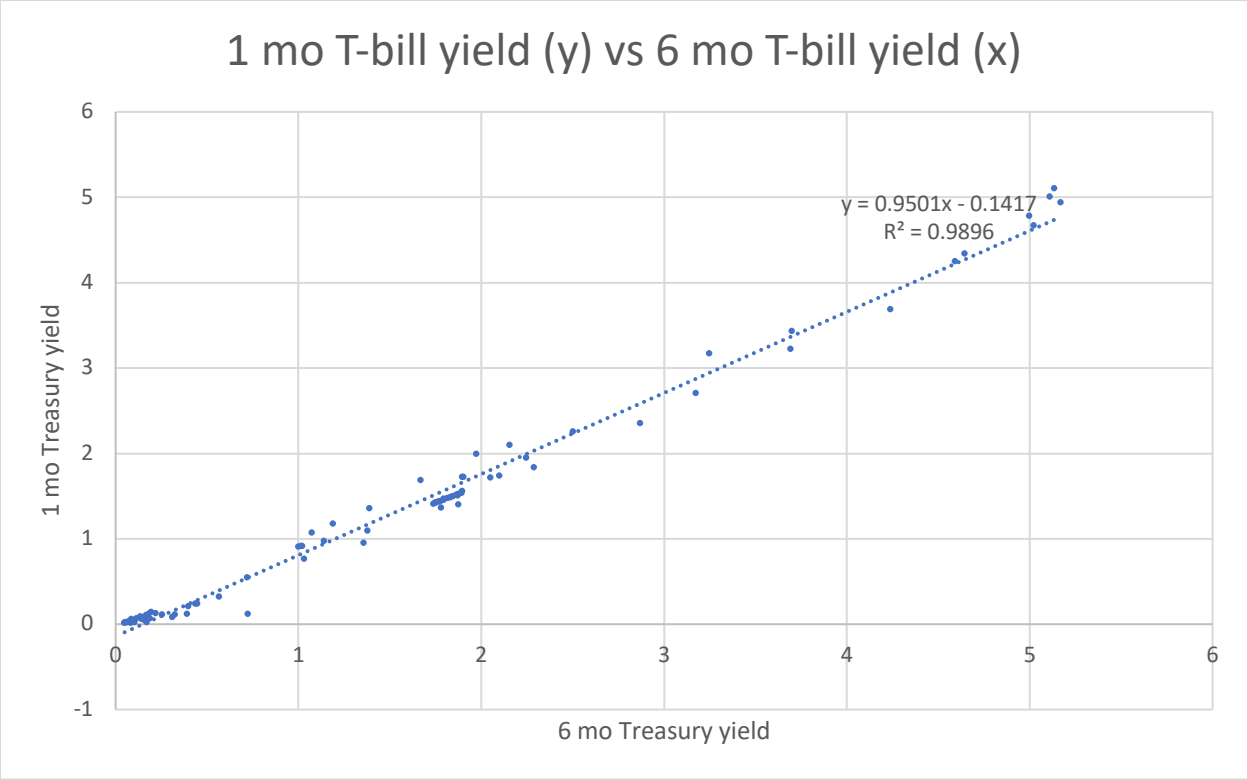
Based on the US Treasury's CCAR data, Capitalytics anticipates the 3-month Treasury yield to fairly steadily climb towards 1.5% by mid-2021. We expect that 5-year Treasury yield rates to steadily grow, hitting 2.2% by the beginning of 2021. Additionally, the 10-year Treasury yield rates will come close to 2.5% but will not stand firmly in that region for several years. Data acquired directly from the Federal Reserve Economic Research website is more conservative than CCAR data, showing generally lower yields.

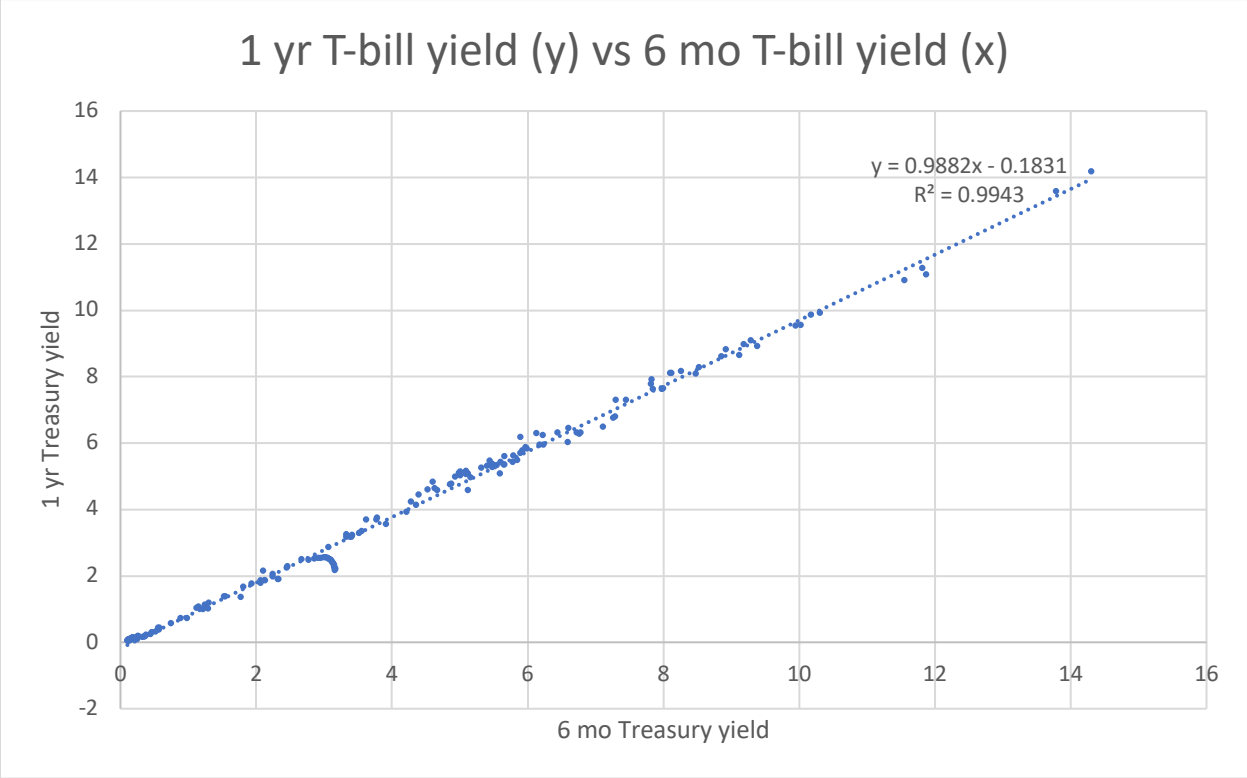
Like many others, Capitalytics is seeing a flattening of the yield curve, with the *likelihood* of an inversion in the near future. (It should be noted that inversions for short periods of time are not unprecedented and are not necessarily *directly* related to any immediate, specific outcome.) The Fed' remains insistent that it will manage the US' money supply in order to ensure that an inversion does not lead to either a recession or a depression.

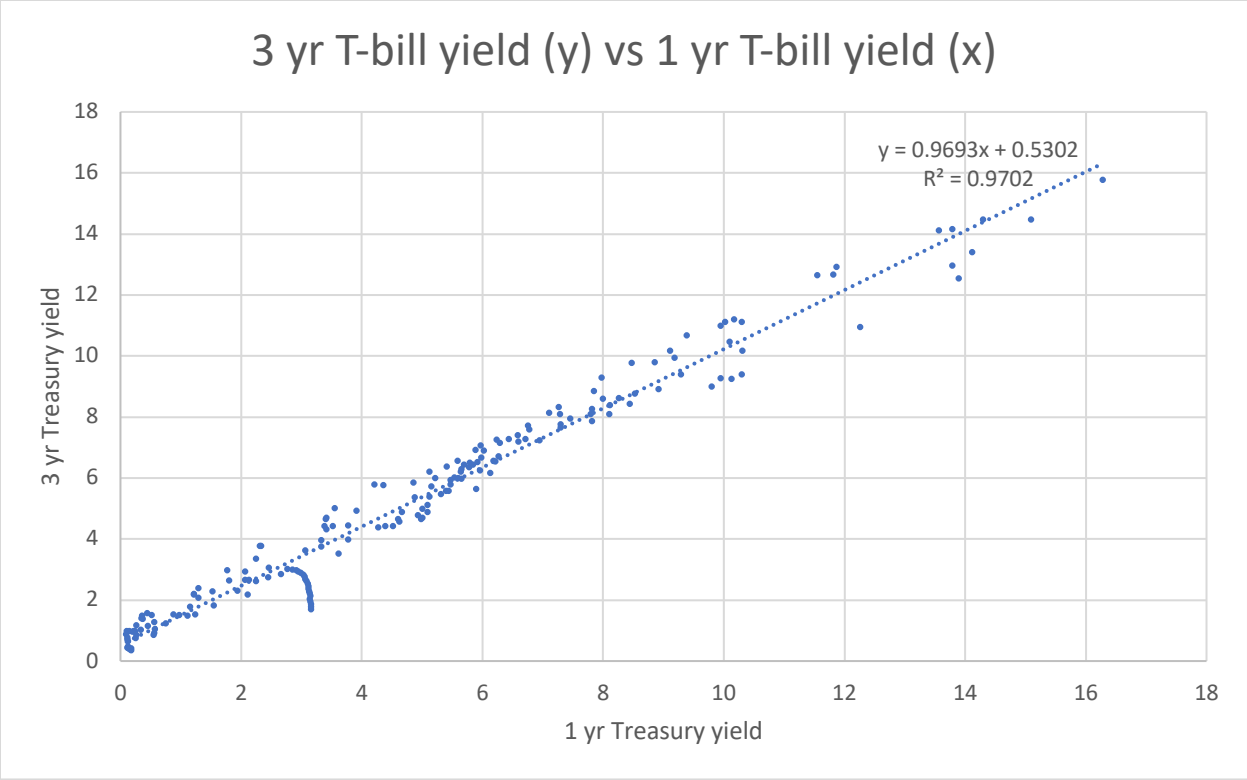
Because of Capitalytics aggressive long-term forecast for the 10-yield Treasury yield, we still anticipate the 5-year Treasury yield sporadically exceeding that of the 10-year during within the next three years.

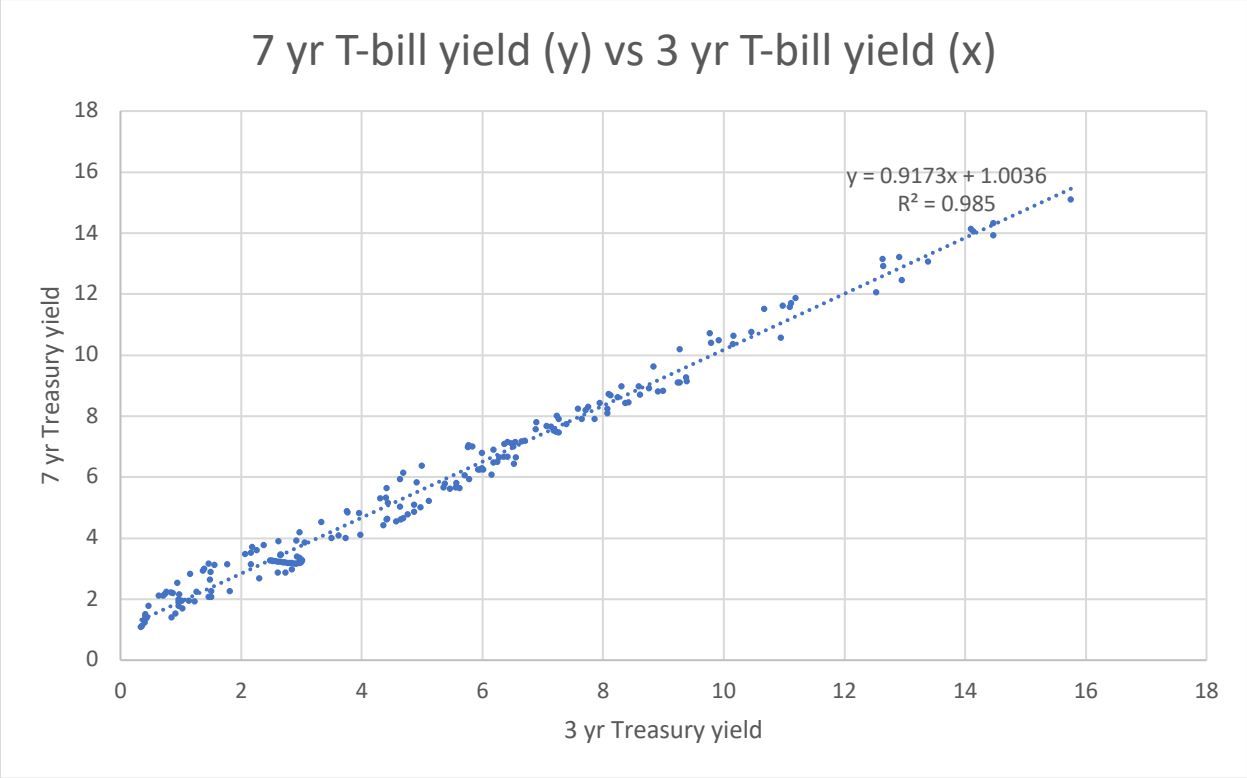
Other Commentary

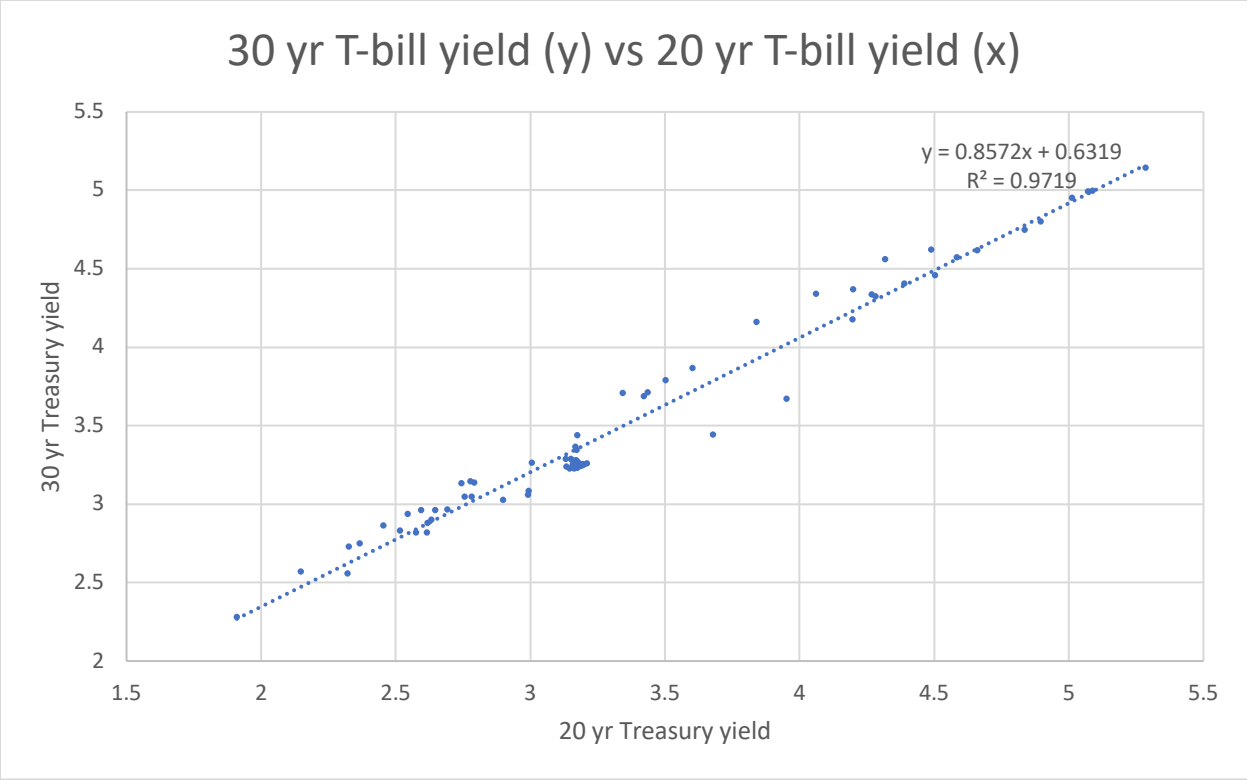
- Kiplinger states, due to the perception that the Fed' is "unlikely to increase to hike or cut interest rates in 2019", that rates may climb as far as 2.8% by YE2019. (see https://www.kiplinger.com/article/business/T019-C000-S010-interest-rate-forecast.html, May 22, 2019)
- ITR Economics (which has a 90% accuracy rate in forecasting economic predictions during the past two years) anticipates a dip in GDP to 0.5%, rebounding to 2.7% in 2020, and then trending towards a recession over the next decade. "Growing national debt is a big reason we're predicting a fairly significant downturn in the economy when we get into the 2030s," [Alex] Chausovsky said. "Eventually, it will combine with a culmination of other factors: demographics from baby boomers retiring at the rate of 10,000 per day for the next decade; rising health care costs, with massive increases in end-of-life care; growth of entitlement spending for Social Security, Medicare and Medicaid, which are all going to balloon because of the swelling ranks of baby boomers entering retirement. We're also expecting inflation to take off at the end of the late 2020s, toward 1970s levels." (see https://www.bizjournals.com/kansascity/news/2019/01/11/economist-expect-gdp-to-dramatically-slow-in-2019.html, Jan 11, 2019)









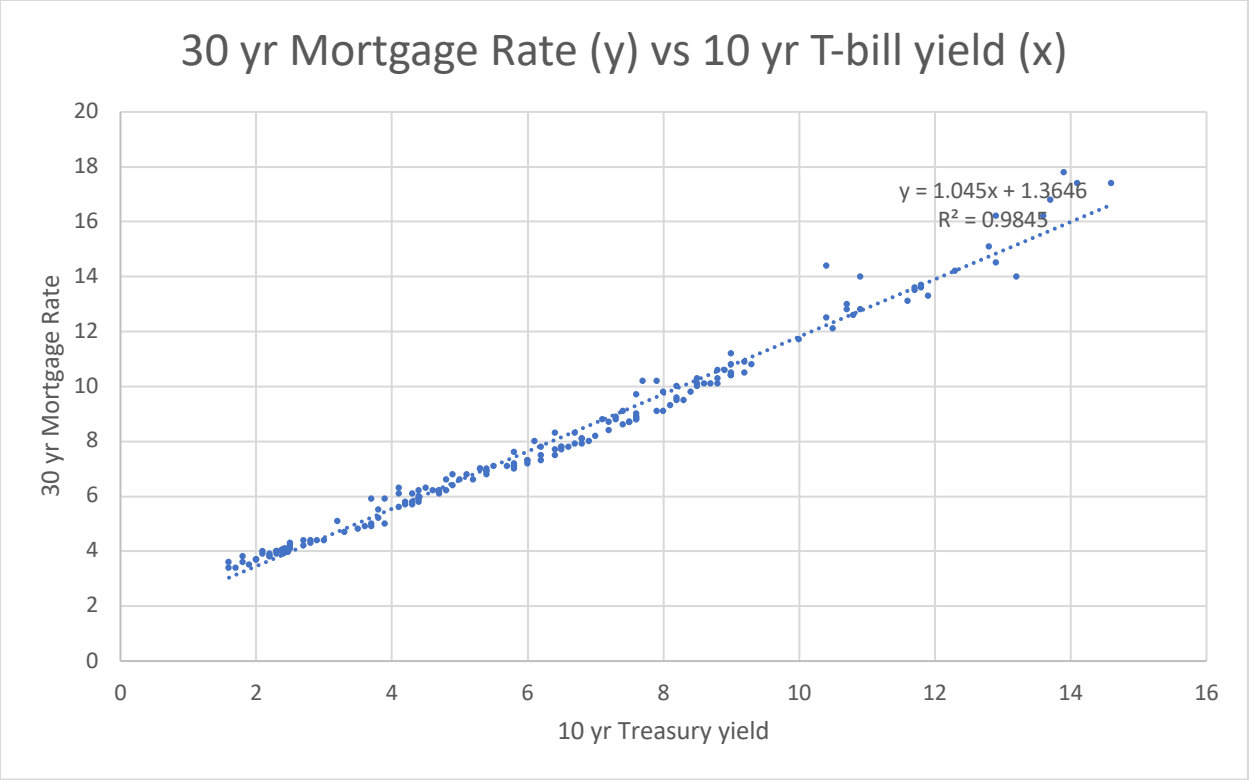


30-year Mortgage Rate

Mild weather, eased prices, and lower mortgage rates have kick-started housing purchases over the past several months, tempered only by slowing changes in the jobs reports and slowly growing inventory levels. The 30-year mortgage rate peaked during 4Q2018 and has fallen off noticeably since that time. Uncertainty surrounding the Fed's interest rates have continued to slow home prices. Mortgage rates appear to be stabilizing below 4%, and the Fed' appears to be exercising increased caution in changing interest rates, meaning that the economy may be continued to allow to grow cautiously for the foreseeable future.

Analysis

The following chart serves to illustrate the strong connection between mortgage rates and the 10-year T-bill.



Other Commentary

- "The rate for the 30-year, fixed-rate mortgage has come down more than half a percentage point since peaking in November. That has juiced the market, just as rising rates last year slowed sales." (Per https://www.kiplinger.com/article/business/T019-C000-S003-housing-market-forecast-housing-starts-home-sales.html; May 1, 2019)
- "The benchmark 30-year fixed [mortgage rate] topped 5 percent just over a month ago. While rates are retreating, it's a much different story when it comes to home prices, which continue to edge higher, although at a slowing pace." (See https://www.bankrate.com/mortgages/analysis/; Jan 3, 2019)

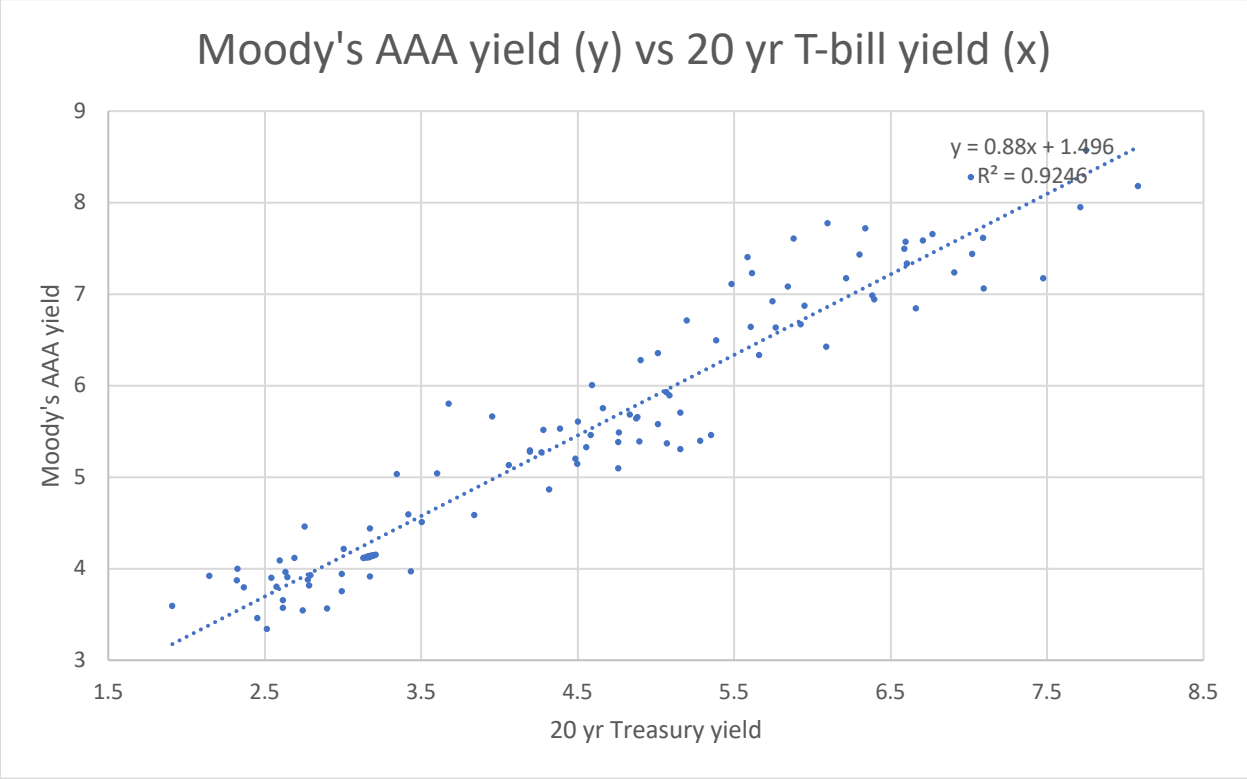
Moody's AAA & BAA Rates

Analysis

Moody's AAA bond rates tend to track in conjunction with mid-duration T-bill yields (i.e., 10- and 20-year maturities). Moody's BAA rates tend to be higher, and more volatile, than AAA rates.

Capitalytics sees AAA rates being relatively stable over the next several years at around 4% yields (slightly higher since our last report); given the projected climate, and the connection between these bonds and the 10- and 20-year Treasury yields, these values are not surprising. As we speculated previously, BAA rates will fluctuate between 4.7% and 4.8% in the near term, with rates eroding several points (in conjunction with volatility) over the next several years.

The following chart illustrates the strong historical relationship between Moody's AAA rate and the 20-year T-bill yield.



BBB Corporate Yield

Analysis

The BBB Corporate Yield is generally tied to Moody's indices (particularly the Moody's BAA bond yield), and the 30-year Mortgage Rate, even though these bonds are generally 10 years in duration. Over the past few years, the volume of bonds that are rated generally in the BBB range has grown dramatically, to take up a significant portion of the investment grade market. This aggregation implies that this slab of the market is all within one to three grades of "junk bond" status, and could be easily downgraded if the ability of the market to absorb defaults is hampered in a down cycle. This point has not been lost on the Fed', but the market is still remarkably open to investing in these instruments individually, and as part of index funds.

Capitalytics sees returns on BBB investments dropping, and then returning, to 4.0% provided that dramatic changes in the market can be held off by the Fed'.

Other Commentary

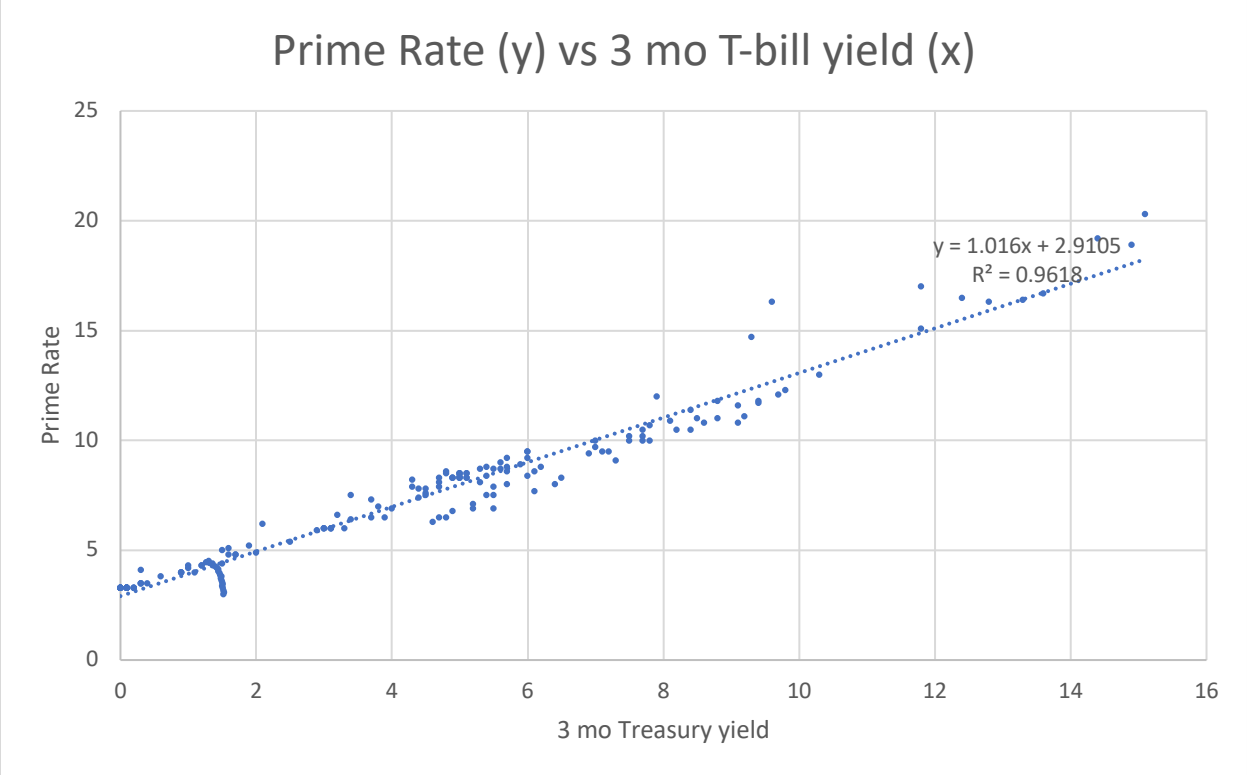
- "On balance, anyone seeking to make a reasoned observation as to the outlook for the 'BBB'-rated sector needs to have a level of conviction in two areas: the probability of a U.S. recession and the likely impact of a recession on corporate balance sheets." (see https://www.lordabbett.com/en/perspectives/marketview/corporate-debt-sizing-up-risk-opportunity-in-bbb-bonds.html; April 22, 2019)
- "BBB-rated bonds have a much larger weighting in the investment-grade bond market than prior to the crisis, which is a bearish sign." (see https://seekingalpha.com/article/4224172-outlook-investment-grade-corporate-bonds; Nov 23, 2018)

Prime Rate

Analysis

The Prime Rate is historically very tightly coupled to very short-term Treasury Bills (specifically, 3-month yields). Capitalytics expects the Prime Rate to, at most, fluctuate by 50 bps from its current 3.7% level during the next four years.

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



Other Commentary

- "Expect these rates to be stable [sic] over the next two years." (per https://www.thebalance.com/when-will-interest-rates-go-up-3306125, April 20, 2019)

US Average Retail Gasoline Price

Analysis

Gasoline prices are expected to remain relatively stable over the next several years, with typically expected fluctuations occurring during the summer and winter months. During the course of a CY2019, gasoline is expected to rise around $2.85/year on an annual basis during 2019 (peaking in winter months with prices 5 to 10 cents higher than annual averages), and will inch up by as much as a nickel (on average) each year thereafter.

Other Commentary

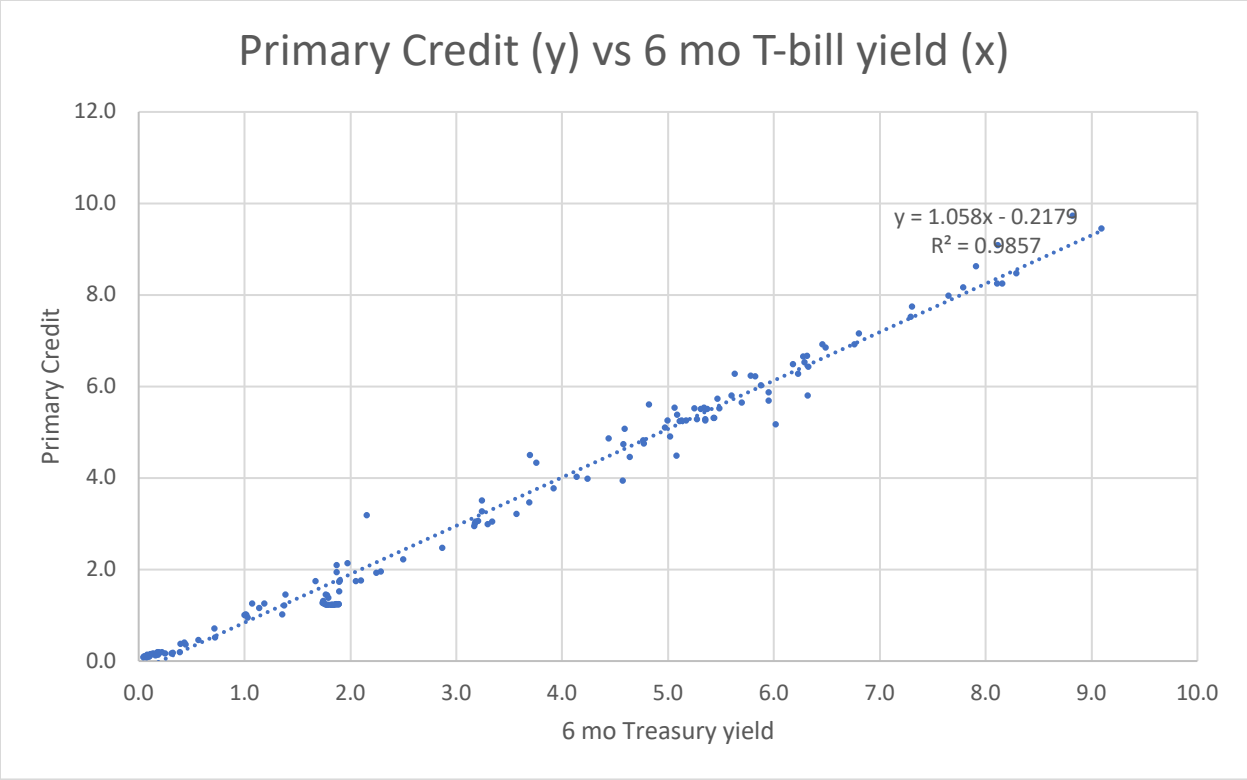
- Global tensions (including US issues with Iran, Saudi Arabia, and the rest of the Persian Gulf) appear to be helping raise fuel prices, despite recent relief at the pump. (see https://www.kiplinger.com/article/business/T019-C000-S010-energy-price-forecast.html; May 20, 2019)
- "A weaker inflation trajectory largely reflected the plunge in crude oil prices over [the second half of 2018 and into January 2019] from a little less than $71 per barrel to about $51.50 per barrel. Lower oil prices translated into falling prices for refined products like gasoline and diesel, helping to bolster the purchasing power of consumers." (per https://www.stlouisfed.org/publications/regional-economist/first-quarter-2019/headwinds-tailwinds-whirlwinds-forecasting-economy)

Primary Credit Rate

Analysis

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

The accompanying chart serves to illustrate the relationship between the Primary Credit rate and the 6-month T-bill yield.



Other Commentary

- At most one rate increase is expected through 2020. (per https://www.reuters.com/article/us-usa-rates-poll/fed-done-raising-interest-rates-significant-chance-of-cut-in-2020-reuters-poll-idUSKCN1RA00K, Mar 28,2019)

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

Given the business- and investor-friendly administration that is currently installed in the United States, we expect solid growth occurring in 2019 and 2020. While we have previously called for very strong growth in this area, we're tempering some of that enthusiasm given pessimism by industry surrounding global trade conditions and uncertainty.

Based on our current research (and no significant changes to the legislative composition in the federal government), Capitalytics sees the Dow-Jones index' growth slowing below what we've previously published, so that the Dow will grow to between 29,000 and 30,000 within the next 5 years. We also anticipate slower growth of the S&P500, with it rising from its reported level of 2600 by about 50 points/quarter for the foreseeable term.

House and Commercial Real Estate Price Indexes

New housing starts have dropped by almost 0.5% during 1Q2019, while new home sales have increased by over 4%. In spite of the profit collection by renovators and high-end home flippers over the past six months, the US is now seeing more younger and lower-end buyers consummating business. These trends will be reflected in the Home Real Estate Price Index as it may grow by as much as 3% per annum nationally over the next few years.

The Commercial Real Estate Price index is projected to increase by more than 1% per quarter. As has been previously discussed, residential and commercial trends ideally parallel each other, and that has been the case for the past 24-36 months. The Commercial Real Estate Price index is expected to slowly grow from 282 to 312 over the next 60 months.

Other Commentary

- "After reaching a peak of 2.9 percent in July 2018, inflation slowed to a 1.5 percent rate in January 2019 … Falling inflation rates have also helped to lower market-based measures of inflation expectations, thereby putting downward pressure on long-term nominal interest rates. Lower interest rates, in turn, have spurred a modest uptick in mortgage applications." (see https://www.stlouisfed.org/publications/regional-economist/first-quarter-2019/headwinds-tailwinds-whirlwinds-forecasting-economy)
- "At the end of 2005, residential investment represented about 6.7 percent of U.S. GDP. At the end of 2018, this figure was only 3.8 percent of GDP. … Declining affordability, higher mortgage rates, higher construction costs and declines in equity prices slowed the U.S. and District housing markets in 2018." (per https://www.stlouisfed.org/publications/regional-economist/first-quarter-2019/slowing-us-housing-sector)

Market Volatility Index

Analysis

While the numbers appear to be showing some signs of stability in the CBOE Market Volatility Index, we continues to feel that "stability" to be fairly unlikely for next few years, and would caution clients in relying on this information. The currently VIX levels are seen as approximately 13.0, and that overall average level is expected to decline over the next several years (potentially as the market develops a tolerance for current White House operating tactics). It should again be noted that a value of 40.7 was recorded in Q3 of 2015 (immediately prior to the last US Presidential election), and a value of 37.32 was recorded in Q1 of 2018.

Other Commentary

- "S&P Volatility Index is expected to trade around 27 by the end of this quarter, according to Trading Economics global macro models and analysts expectations. Looking forward, we estimate it to trade around 26 in 12 months time." (see https://tradingeconomics.com/vix:ind/forecast, downloaded on Jan 11, 2019)

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 "2018 Supervisory Scenarios for Annual Stress Tests Required under the Dodd-Frank Act Stress Testing Rules and the Capital Plan Rule" (found at https://www.federalreserve.gov/supervisionreg/files/bcreg20180201a1.pdf) are listed. Please note that shaded attributes are not discussed within this report.

Attribute	Referenced Source[3]
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	Merrill Lynch 10-year BBB corporate bond yield, Z.1 Release (Financial Accounts of the United States), Federal Reserve Board (series FL073163013.Q).

[3] Per https://www.federalreserve.gov/supervisionreg/files/bcreg20180201a1.pdf

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).
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).
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 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/ccar-2019.htm (shown below, as of May 2019) by clicking the link marked "Historical data (ZIP)". Alternatively, downloading the file at https://www.federalreserve.gov/supervisionreg/files/2019-historical-data.zip using HTTP client software will also download the official dataset.

Decompressing the zip-file will provide two files in CVS format: one containing US domestic data elements on a quarterly basis, and the other containing international data elements on a quarterly basis[4].

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

Since the CCAR dataset is only released annually (through 4Q2018 as of this writing), and Capitalytics provides quarterly updates to its forecasts, the CCAR dataset is supplemented by the data sources shown below on a quarterly basis. All datasets discussed herein are supplemented with data through (including) 4Q2018.

Attribute	Supplementary Data Source
Real GDP growth	Bureau of Economic Analysis (NIPA table 1.1.6, line 1)
Nominal GDP growth	Bureau of Economic Analysis (NIPA table 1.1.5, line 1)
Real disposable income growth	Bureau of Economic Analysis (NIPA table 2.1, line 27, and NIPA table 1.1.4, line 2)
Nominal disposable income growth	Bureau of Economic Analysis (NIPA table 2.1, line 27)
Unemployment rate	Bureau of Labor Statistics (series LNS14000000)
CPI inflation rate	Bureau of Labor Statistics (series CUSR0000SA0)
3-month Treasury yield	Quarterly average of 3-month Treasury bill secondary market rate on a discount basis, H.15 Release
5-year Treasury yield	Federal Reserve Economic Research website (https://fred.stlouisfed.org/series/GS5), with "Quarterly" frequency and "Average" aggregation method
10-year Treasury yield	Federal Reserve Economic Research website (https://fred.stlouisfed.org/series/GS10), with "Quarterly" frequency and "Average" aggregation method
BBB corporate yield	Federal Reserve Economic Research website (https://fred.stlouisfed.org/series/BAMLC0A4CBBBEY),

	with "Quarterly" frequency and "Average" aggregation method
Mortgage rate	Federal Reserve Economic Research website (https://fred.stlouisfed.org/series/MORTGAGE30US), with "Quarterly" frequency and "Average" aggregation method
Prime rate	Federal Reserve Economic Research website (https://fred.stlouisfed.org/series/MPRIME), with "Quarterly" frequency and "Average" aggregation method
Dow Jones Total Stock Market Index (end-of-qtr value)	Dow-Jones as provided by the Wall Street Journal (https://quotes.wsj.com/index/DWCF/advanced-chart)
House Price Index	CoreLogic, index level (end-of-quarter)
Commercial Real Estate Price Index	From the Financial Accounts of the United States, Federal Reserve Board (Z.1 release); the series corresponds to the data for price indexes: Commercial Real Estate Price Index (series FL075035503.Q, divided by 1000). Series FL075035503.Q is also available at https://www.quandl.com/data/FED/FL075035503_Q-Interest-rates-and-price-indexes-commercial-real-estate-price-index-Quarterly-Levels-NSA
Market Volatility Index (VIX)	Federal Reserve Economic Research website (https://fred.stlouisfed.org/series/VIXCLS), with "Quarterly" frequency and "Average" aggregation method
Euro Area Real GDP Growth	Quarterly series for "European Union GDP Annual Growth Rate" per tradingeconomics.com
Euro Area Inflation	Quarterly average of monthly series for "European Union Inflation Rate" per tradingeconomics.com
Euro Area Bilateral Dollar Exchange Rate (USD/Euro)	End-of-quarter rates from the H.10 Release, Foreign Exchange Rates, Federal Reserve Board.
Developing Asia Real GDP Growth	The nominal GDP-weighted aggregate of the Real GDP growth for China, India, South Korea, Hong Kong Special Administrative Region, and Taiwan per OECD
Developing Asia Inflation	The nominal GDP-weighted aggregate of the inflation rate for China, India, South Korea, Hong Kong Special Administrative Region, and Taiwan per OECD
Developing Asia bilateral dollar exchange rate (F/USD, index)	End-of-quarter rates from the H.10 Release, Foreign Exchange Rates, Federal Reserve Board.
Japan Real GDP Growth	Quarterly average of monthly series for "Japan GDP Growth Rate" per tradingeconomics.com
Japan Inflation	Quarterly average of monthly series for "Japan Inflation Rate" per tradingeconomics.com
Japan Bilateral Dollar Exchange Rate (Yen/USD)	End-of-quarter rates from the H.10 Release, Foreign Exchange Rates, Federal Reserve Board.

UK Real GDP Growth	Quarterly average of monthly series for "United Kingdom GDP Growth Rate" per tradingeconomics.com
UK Inflation	Quarterly average of monthly series for "United Kingdom Inflation Rate" per tradingeconomics.com
UK Bilateral Dollar Exchange Rate (USD/Pound)	End-of-quarter rates from the H.10 Release, Foreign Exchange Rates, Federal Reserve Board.

While all data that is required for the Annual Stress Tests is available from https://www.federalreserve.gov/supervisionreg/files/2019-historical-data.zip, 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) 4Q2018.

Attribute	Capitalytics Source
1-month Treasury yield	https://fred.stlouisfed.org/series/dgs1mo
6-month Treasury yield	https://fred.stlouisfed.org/series/dgs6mo
1-year Treasury yield	https://fred.stlouisfed.org/series/dgs1
3-year Treasury yield	https://fred.stlouisfed.org/series/dgs3
7-year Treasury yield	https://fred.stlouisfed.org/series/dgs7
20-year Treasury yield	https://fred.stlouisfed.org/series/dgs20
30-year Treasury yield	https://fred.stlouisfed.org/series/dgs30
US Average Retail Gasoline Price ($/gal; all grades, all formulations)	https://fred.stlouisfed.org/series/gasallm
S&P 500 Stock Price Index	https://fred.stlouisfed.org/series/S&P 500 Stock Price Index
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.

- General Forecasting Methodology

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

For each metric, four distinct forecasts are produced.

1. The first forecast uses the full quarterly history of the metric as an input to an additive exponential smoothing representation. The process that is executed is that provided by R's[5] "forecast" package[6]; specifically, the "ets" function (see p.39 of https://cran.r-project.org/web/packages/forecast/forecast.pdf)[7] is designed to automatically determine the best fitting representation out of the "Generic 'ETS' Methodology" (discussed later in this section), including optimal parameters thereto, given a sequence of values. In our work, we have restricted our study to only "additive" forms (i.e., we set "`additive.only=TRUE`" in our calls), and our optimization criteria is set to the mean of absolute residuals (i.e., "`opt.crit=mae`"). Therefore, calls to generate our estimates through this procedure look something like the following command, where "`s`" is an appropriately populated array, vector, time series, or similar object.

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

   The results of this call are shown above each dataset, including the representation type returned (as described later this section), the initial values that are used by the software, the optimal smoothing parameters estimated, and the $n+1^{st}$ forecasted value given the first n values of the metric's sequence (the "fitted" values)[8], and the determined parameters. While fitting forecasts to previous values,

[5] As of this writing, v.3.6.0 of the "R" language is available at https://cran.r-project.org/.
[6] As of this writing, v.8.7 of the forecast package is available at https://CRAN.R-project.org/package=forecast .
[7] 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.
[8] 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

- "forecast error" is defined as being actual values less forecasted values,
- "% error" is defined as forecast error divided by actual value, and
- "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)[9].

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

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

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

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

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

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

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

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.

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

- the slope of the "best fitting" line (based on minimizing the total absolute error) using the immediately preceding 2 years of values[10];
- 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 estimate for an "economic cycle") would allow for a much more slowly moving change in average window for a counterbalance.

Using these datasets independently, we are able to use our previous procedure to generate forecasts for each slope, and then average the results on a quarterly basis. Multiplying the average slope by the duration of the following quarter (in days) provides an estimate for the change in the metric's value during that following quarter, just as in our second forecast.

Obviously, this technique requires at least eight years of data to pass before being able to produce any data. However, in order to err on the side of conservatism, we generally allow a sequence to "mature" for two to four years before believing that its initial transience has become less significant and its results are trustworthy. If a dataset does not have enough data to complete one of these analyses, the analysis is dropped. In other words, if the metric does not have +/-11 years of data available, the 8-year slopes cannot be reliably calculated, and the average slope is only based on the 2- & 4-year slopes[11].

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.

[10] 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.
[11] See the SP500 metric's analysis.

- 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 $0 \leq \alpha \leq 1$, and estimates future values of $\hat{y}$ given a history of values denoted as y_t. The ε_{T+1} term denotes an error term, the *residual*, which determines the value of the forecasting function.) This framework generates reliable forecasts quickly and for a wide spectrum of time series.

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

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

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.

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

Appendix C: Variable Correlations

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

We note that previous versions of this list have included *cumulative* datasets of all variables meeting the noted criteria (i.e., pairs of variables meeting the threshold for all quarters in our database). This error has been corrected for this paper, and will be correct in the future.

Variable 1	Variable 2	Correlation
Primary Credit	**1-month Treasury Yield**	**0.993073**
Primary Credit	**6-month Treasury Yield**	**0.993983**
Primary Credit	US Average Retail Gasoline Price	-0.629564
Primary Credit	**1-year Treasury Yield**	**0.987413**
Primary Credit	20-year Treasury Yield	0.809432
Primary Credit	30-year Treasury Yield	0.621314
Primary Credit	**3-year Treasury Yield**	**0.956861**
Primary Credit	7-year Treasury Yield	0.900054
1-month Treasury Yield	**6-month Treasury Yield**	**0.995783**
1-month Treasury Yield	**1-year Treasury Yield**	**0.990126**
1-month Treasury Yield	3-year Treasury Yield	0.942724
1-month Treasury Yield	7-year Treasury Yield	0.813159
6-month Treasury Yield	**1-year Treasury Yield**	**0.998135**
6-month Treasury Yield	**3-year Treasury Yield**	**0.975155**
US Average Retail Gasoline Price	6-month Treasury Yield	-0.652577
US Average Retail Gasoline Price	1-year Treasury Yield	-0.675415
US Average Retail Gasoline Price	20-year Treasury Yield	-0.758559
US Average Retail Gasoline Price	3-year Treasury Yield	-0.744548
US Average Retail Gasoline Price	7-year Treasury Yield	-0.782845
S&P 500 Stock Price Index	Primary Credit	0.685957
S&P 500 Stock Price Index	1-month Treasury Yield	0.693753
S&P 500 Stock Price Index	6-month Treasury Yield	0.644909
S&P 500 Stock Price Index	1-year Treasury Yield	0.621287
S&P 500 Stock Price Index	20-year Treasury Yield	-0.605375
S&P 500 Stock Price Index	30-year Treasury Yield	-0.606977
20-year Treasury Yield	6-month Treasury Yield	0.828678
20-year Treasury Yield	1-year Treasury Yield	0.849262
20-year Treasury Yield	3-year Treasury Yield	0.908138
20-year Treasury Yield	**7-year Treasury Yield**	**0.970242**
30-year Treasury Yield	1-month Treasury Yield	0.602887
30-year Treasury Yield	**20-year Treasury Yield**	**0.989043**
30-year Treasury Yield	3-year Treasury Yield	0.655027
30-year Treasury Yield	7-year Treasury Yield	0.850815
3-year Treasury Yield	**1-year Treasury Yield**	**0.984636**
7-year Treasury Yield	6-month Treasury Yield	0.919756
7-year Treasury Yield	1-year Treasury Yield	0.934003
7-year Treasury Yield	**3-year Treasury Yield**	**0.979186**

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