Macroeconomic Forecasts, 4Q2019
Domestic Metrics

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Table of Contents

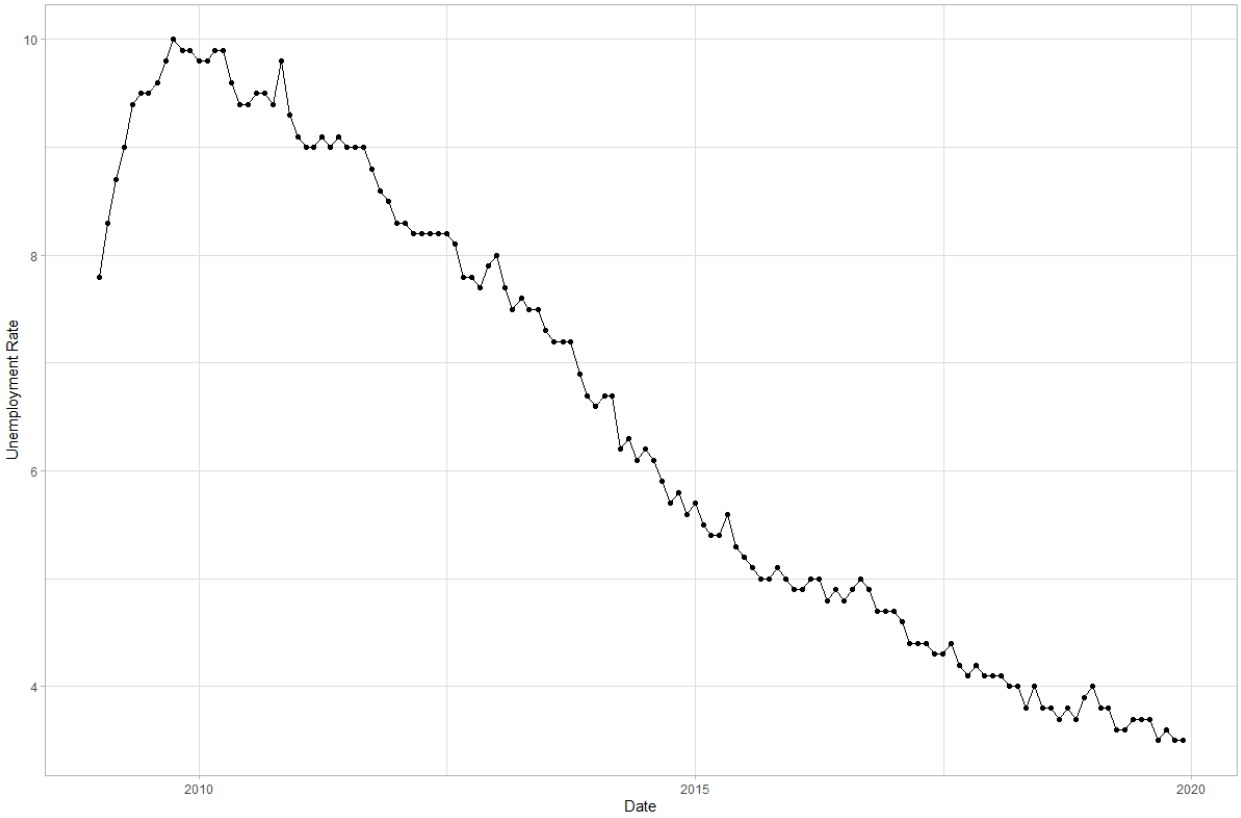
Macroeconomic Overview

The current economic climate is quite strong. However, there are several troubling indicators that support a view that the US economy has a number of soft-spots and is likely headed towards an economic recession in the next 12 – 18 months.

The Strengths of the US Economy

The unemployment rate in the US has been on a steady decline since the first quarter of 2010. Although there are occasional small upticks, the overall trend has not deviated in the last nine years. The current unemployment rate (December 2019[1]) is 3.5%.

Figure 1: Unemployment Rate 2009 – 2019



source: BLS.gov, https://fred.stlouisfed.org/

The year-over-year change in real GDP has shown some variability since the last recession – with annual growth fluctuating between 1% and 3% in the last 12 quarters. The projected annual growth rate of real GDP is in the range of 1.5% - 2.5% for the next two quarters. Real GDP growth is strong but does show a trend, as of late, that suggest the US economy is weakening.

[1] https://www.bls.gov/news.release/empsit.nr0.htm; https://www.cnbc.com/2020/01/10/us-nonfarm-payrolls-december-2019.html

Figure 2: Year-over-Year Change in Real GDP (2009 - 2019)

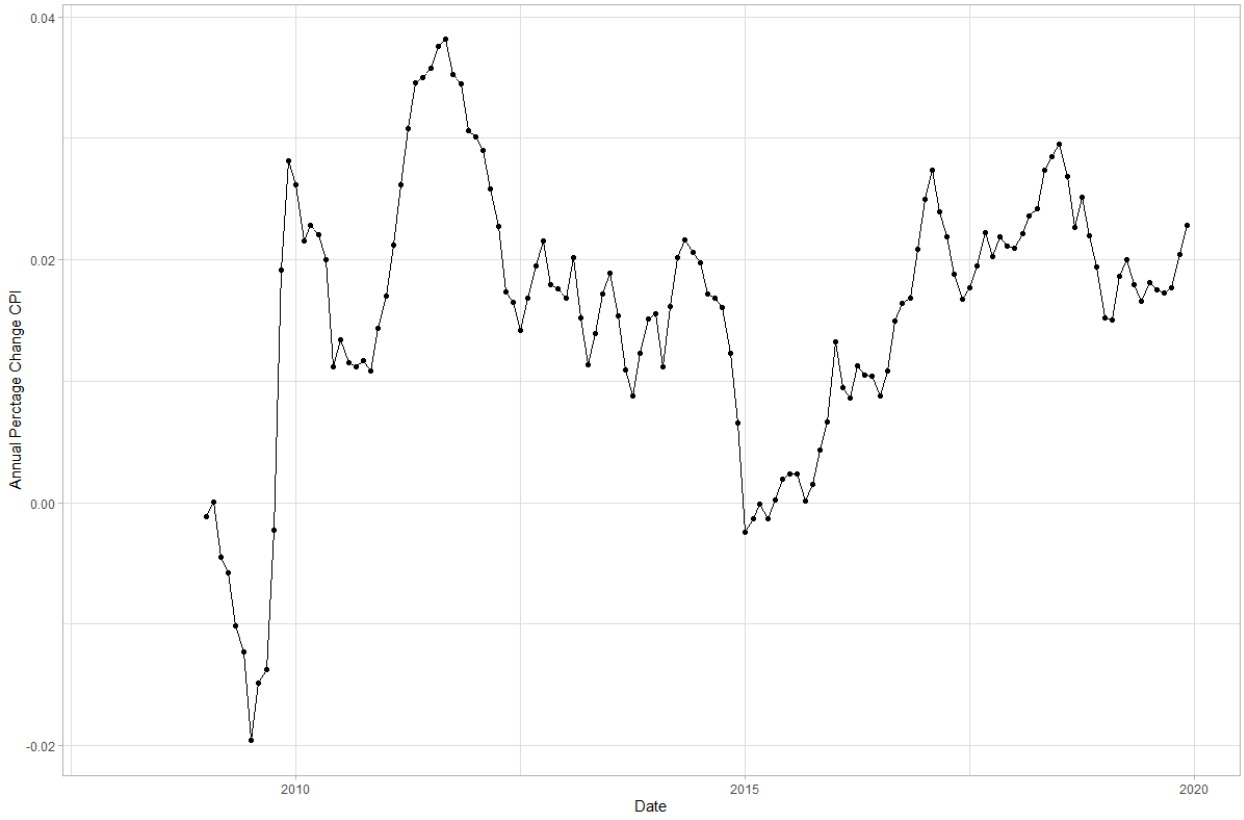
Source: BLS.gov, https://fred.stlouisfed.org/series/GDPC1

Another very positive aspect of the current US economy is the lack of inflationary pressures. The year-over-year change in the CPI continues to fluctuate around 2%. The Federal Reserve Bank generally follows the Taylor Rule[2], which establishes a core-inflation target at or near 2%. That is to say that the US economy is operating at an inflation rate that is consistent with the Fed's target rate.

The US is experiencing quarterly growth in productivity[3] between 1.5% and 3.5%, and adding between 50,000 and 300,000 non-farm employment[4] per quarter in the last twelve months. With an increase in non-farm employment, a decrease in unemployment, stable prices and increases in productivity, it is clear that the current economic condition is strong.

[2] https://www.federalreserve.gov/monetarypolicy/policy-rules-and-how-policymakers-use-them.htm
[3] https://data.bls.gov/timeseries/PRS85006092
[4] https://data.bls.gov/timeseries/CES0000000001?output_view=net_1mth

Figure 3: Year-Over-Year Change in CPI (2009-2019)



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

Weak Spots of the Current US Economy

Although the current US economic condition presents with a number of strong indicators, there is some pessimism about the strength of the economy in the near term. First, the Federal Reserve Board Open Market Committee (FOMC) continues to vacillate between increasing the federal funds rate, decreasing the federal funds rate and keeping this rate constant. Historically, when the economy is growing, the FOMC, has increased rates in 25 basis point intervals. Between 2005 and 2007, for example, the Fed continued to increase the Federal Funds rate while the unemployment rate was falling. Once the unemployment rate stalled (at 4.7%) and started increasing (to 5.0%), the Fed engaged in expansionary monetary policy and started dropping rates. At the September 2019 FMOC meeting, the Fed dropped rates by 25 basis points even though the unemployment rate is continuing to fall. This suggests that the Fed is concerned about the growth of the economy in the short run.

The Fed's internal poll of where the federal funds rate should be (the dot-plot) also shows short-run pessimism about the strength of the US economy. The dot-plot (shown in the proceeding graph), shows the "ideal" federal funds rate as identified by each member of the FOMC. A federal funds rate at 1.75% - 2.00% with 5 dots indicates that 5 members of the FOMC have identified 1.75% - 2.00% as the ideal federal funds rate range. A rate (or range of rates) with more dots indicates more members suggesting the corresponding rate as the ideal level given economic conditions or forecasted economic condition. The current median dot is located at a

federal funds rate between 1.75% - 2.00%. The median dot for 2020, however, shows a decrease in the ideal federal funds rate to 1.50%- 1.75%. This suggests that more FOMC members are inclined to push for a drop in the federal funds target by an additional 25 to 50 basis points.

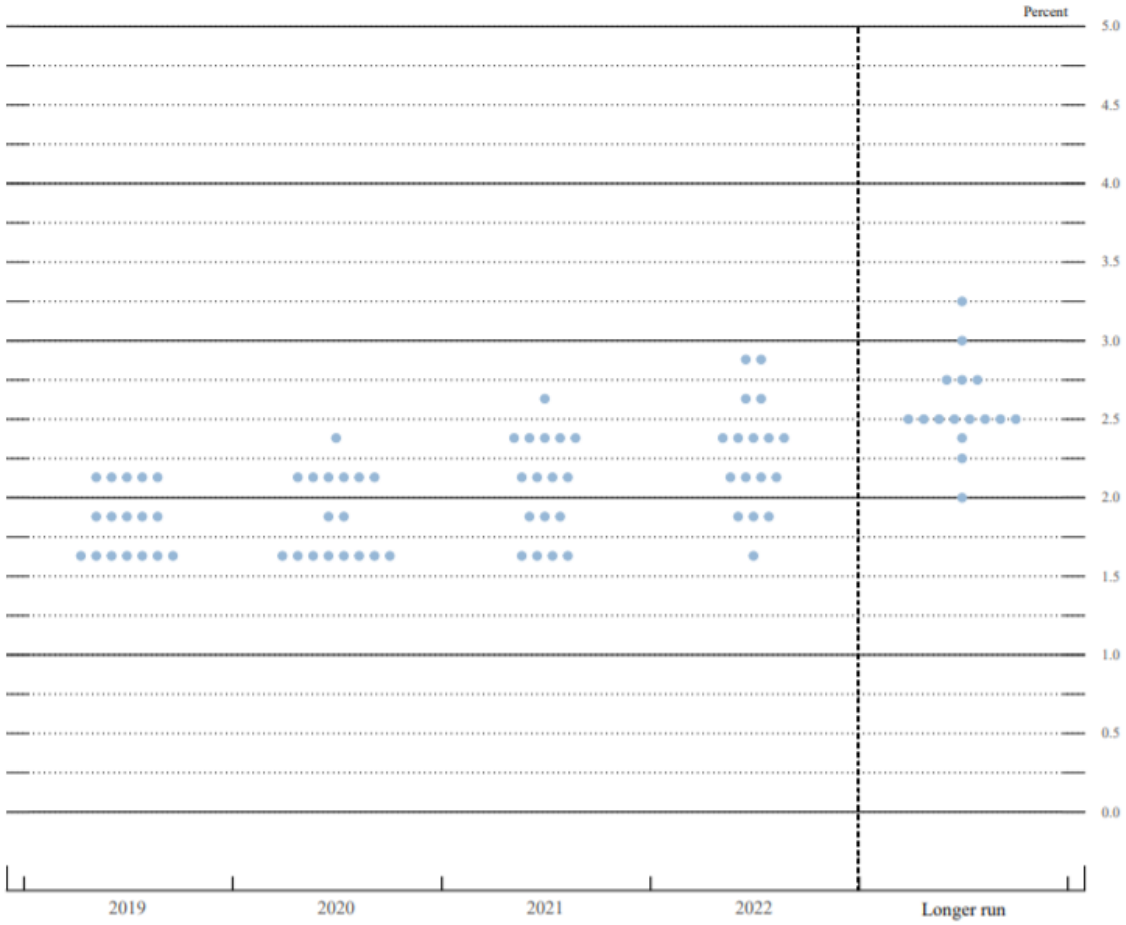
Table 1: Federal Funds Rate (and Changes) 2005 - 2007

Date	Increase	Decrease	Fed Funds Rate (%)	Unemployment Rate (%)
2/2/2005	25	...	2.50	5.40
3/22/2005	25	...	2.75	5.20
5/3/2005	25	...	3.00	5.10
6/30/2005	25	...	3.25	5.00
8/9/2005	25	...	3.50	4.90
9/20/2005	25	...	3.75	5.00
11/1/2005	25	...	4.00	5.00
12/13/2005	25	...	4.25	4.90
1/31/2006	25	...	4.50	4.70
3/28/2006	25	...	4.75	4.70
5/10/2006	25	...	5.00	4.60
6/29/2006	25	...	5.25	4.60
9/18/2007	...	50	4.75	4.70
10/31/2007	...	25	4.50	4.70
12/11/2007	...	25	4.25	5.00

Source: https://www.federalreserve.gov/monetarypolicy/openmarket.htm, BLS.gov

The Fed is not the only group that is skeptical about the long-run stability of the US economy. Institutional and casual investors drive the market for US securities. The US Treasury yield curve shows the yield of US Treasuries of different maturities. When the economy is strong, investors are willing to trade interest for maturity date – preferring higher interest for longer maturity dates. When the economy is trending towards an economic recession, investors push the market to trade interest for short-term liquidity, driving up the short-term rates relative to longer maturity rates. When short term rates fall above longer maturity rates, the yield curve inverts. This inverted yield curve is evident during early 2007 (as shown in Figure 5). As we know, the inverted yield curve was forecasting the great recession, which hit the US approximately 10 months after the yield curve started inverting.

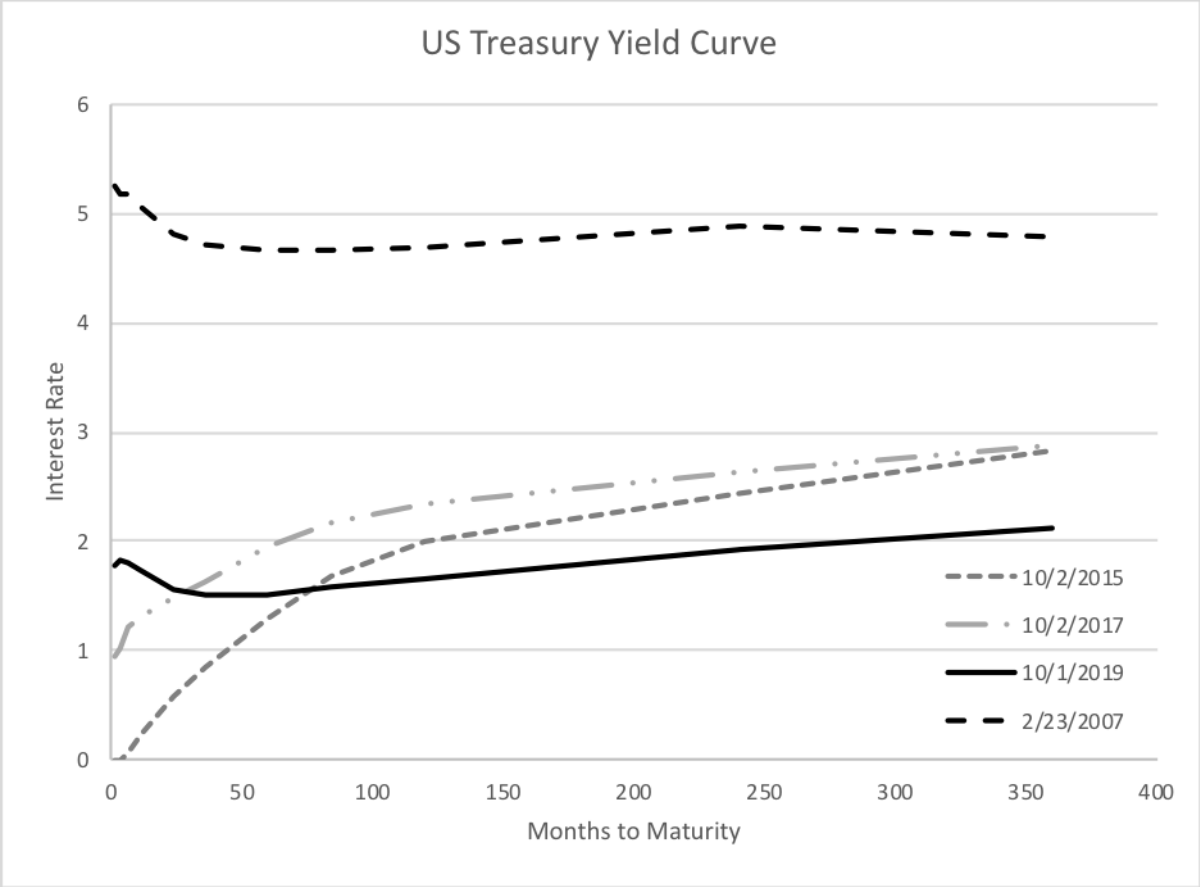
Figure 4: FOMC Member's Ideal/Target Federal Funds Rate



Source: https://www.federalreserve.gov/monetarypolicy/files/fomcprojtabl20190918.pdf

The current yield curve (October 2019) look much more like the inverted yield curve of 2007 rather than the positive yield curve for 2015 and 2017.

Figure 5: US Treasury Yield Curve: Comparison Between 2007, 2015, 2017 and 2019



Source: https://www.treasury.gov/resource-center/data-chart-center/interest-rates/Pages/TextView.aspx?data=yield

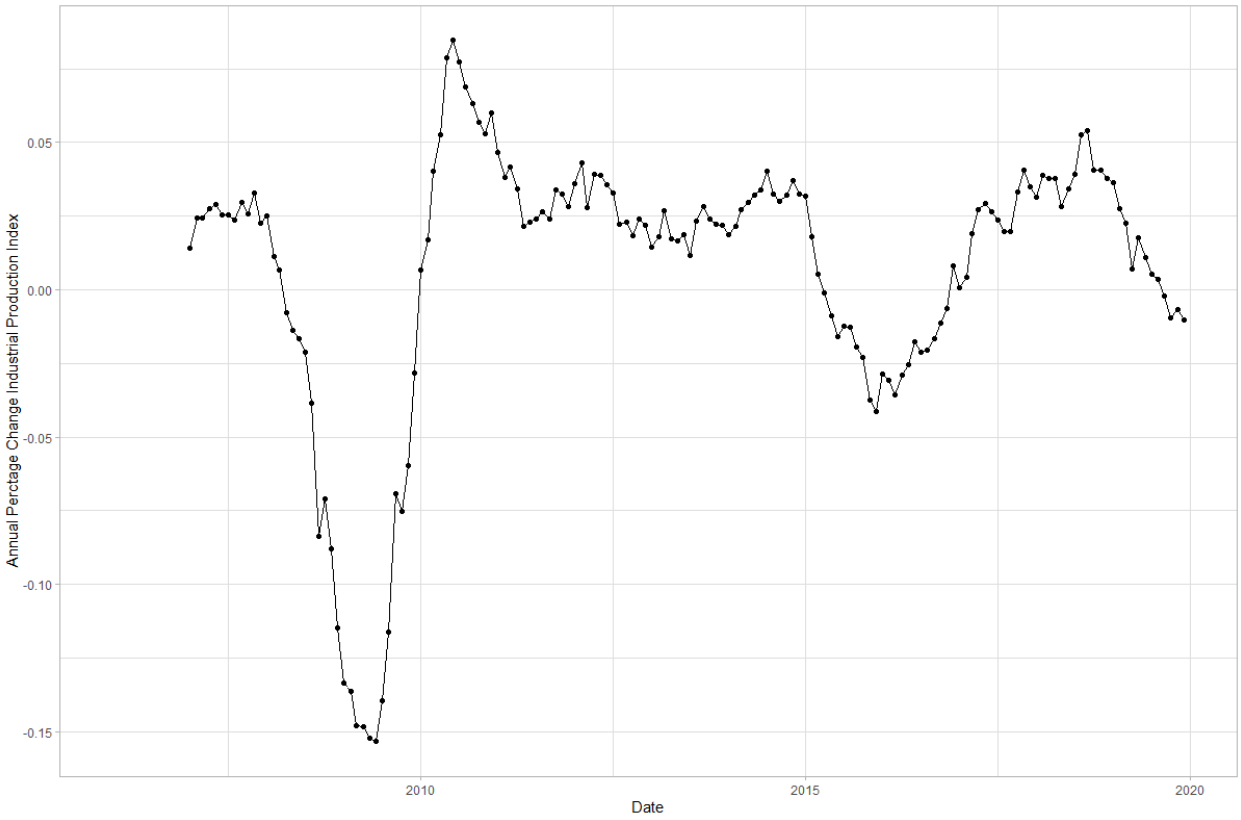
Two metrics that measure output and production are Industrial Production Index, which measure the value of produced output, and total capacity utilization, which measure the actual output of firms relative to what they can produce. The downward trend in both of these metrics over the last 10 months indicates that value of output is falling and firms are using a smaller percentage of their capital. In general, firms are exhibiting more productive capacity. The accompanying trend of an increase in inventory to sales ratio, starting in May 2018, suggests that output is sitting longer in inventory. This change is likely due to an over-production of goods influenced by optimism associated with the Tax Cut and Jobs Act. The Tax Cut and Jobs Act was signed into law at the tail end of 2017 and took effect in early 2018[5] and changed how companies and consumers were taxed. Some companies used these tax benefits to re-tool and invest[6], which may have had a positive impact on production. Companies also may have been overly optimistic regarding how the tax cut would impact wages or purchasing power by consumers. Consumer disposable income did grow between then end of 2017 to the beginning of 2018[7], however this growth tapered off quickly (and consumer spending actually took a bit of a downturn right at the

[5] https://fortune.com/2017/12/20/gop-tax-bill-cuts-start/
[6] https://www.cnbc.com/2018/06/20/now-we-know-how-major-corporations-are-spending-tax-cuts.html
[7] https://www.wsj.com/articles/are-the-tax-cuts-working-what-to-watch-in-12-charts-1529323200

start of 2018). A combination of company optimism and lack of consumer spending created an increase in inventory relative to sales.

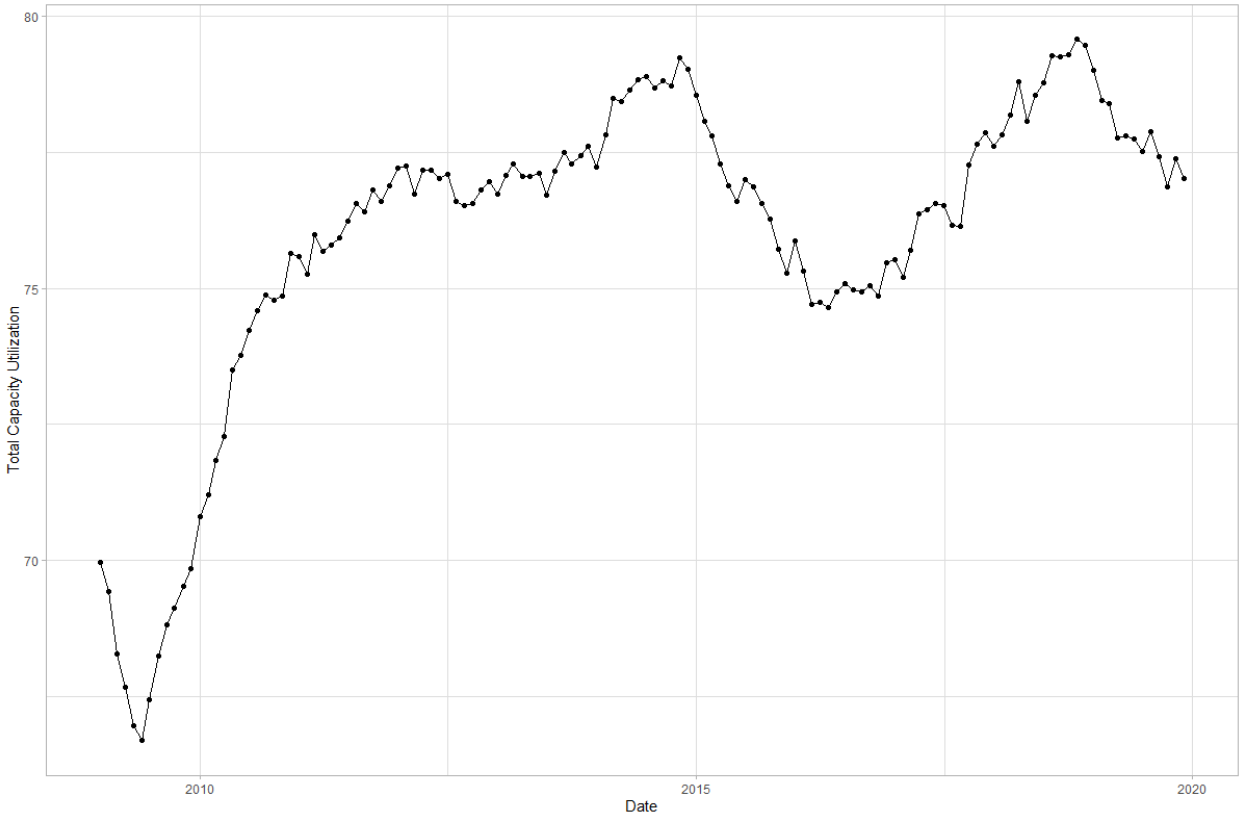
A decrease in capacity utilization, a decrease in industrial production and an increase in inventories relative to sales suggests an overall slowing of production and a softening of consumer demand. The reaction of firms to lower demand is to reduce output and use a smaller percentage of their productive resources.

Figure 6: Year-Over-Year Change in Industrial Production Index (2007 - 2019)



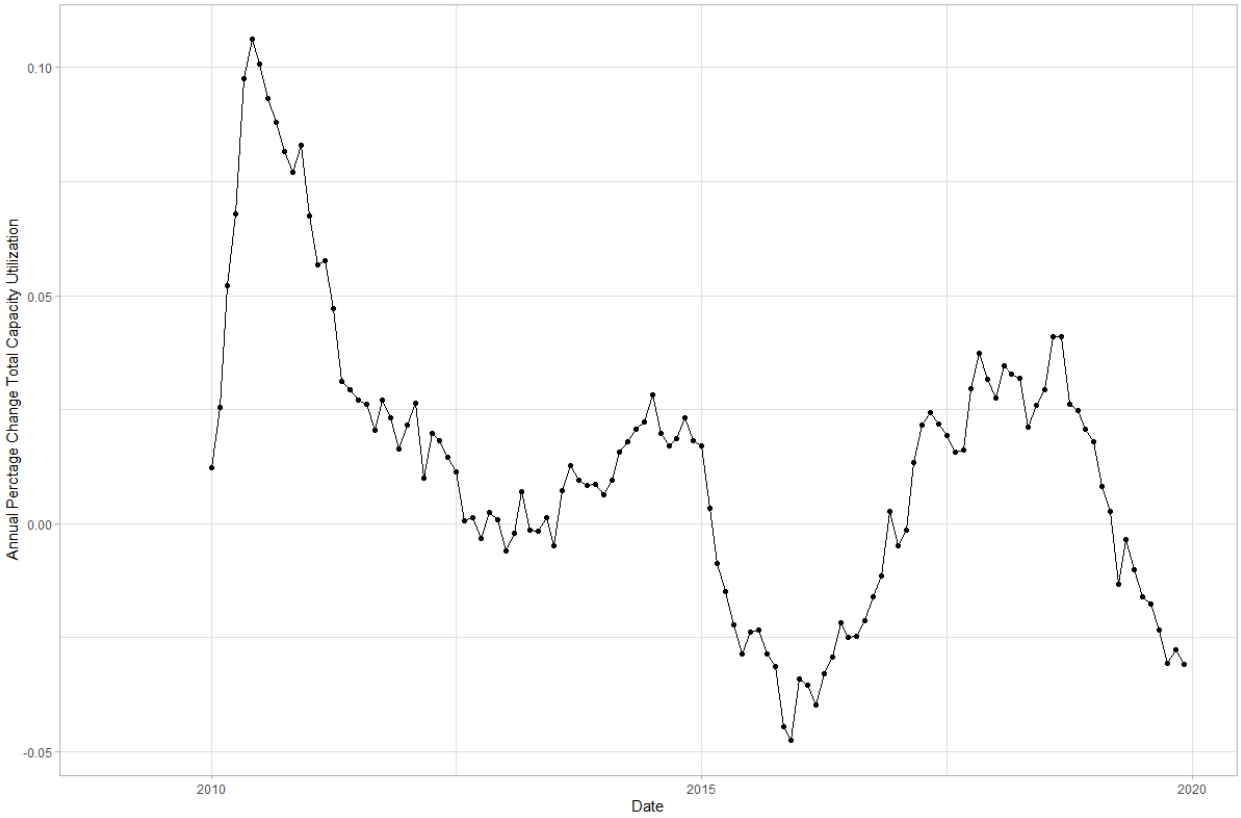
Source: https://fred.stlouisfed.org/series/INDPRO

Figure 7: Total Capacity Utilization: All Industries (2009 - 2019)



Source: https://fred.stlouisfed.org/series/TCU

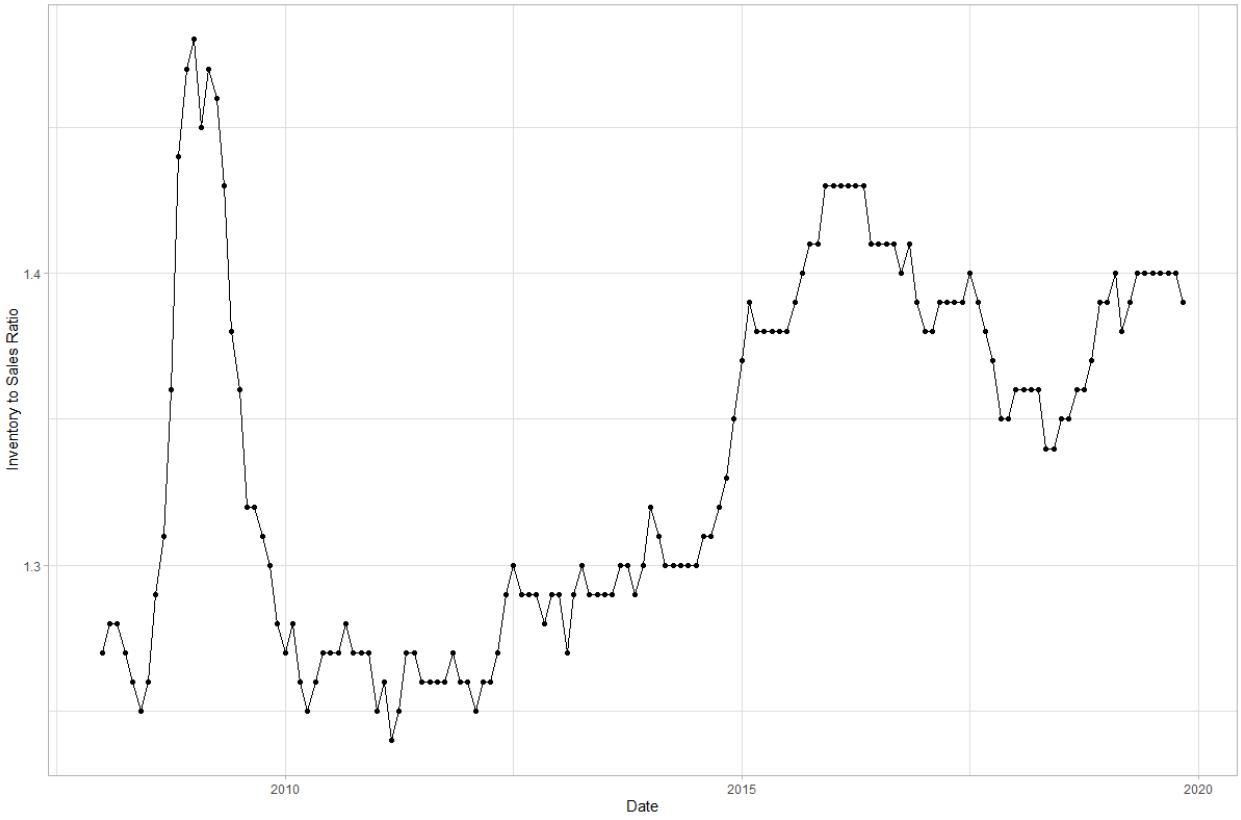
Figure 8: Annual Percent Change in Total Capacity Utilization (2009 - 2019)



Source: https://fred.stlouisfed.org/series/TCU

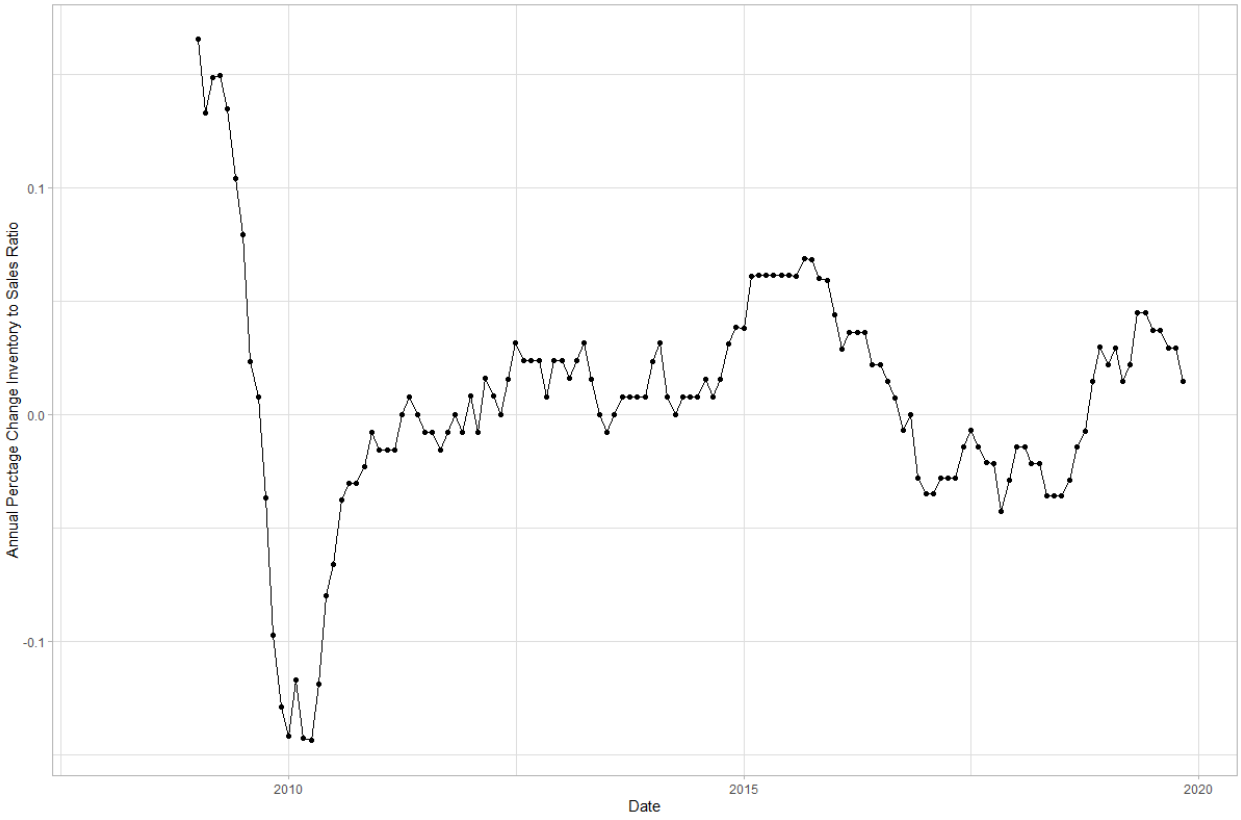
The trend in the total capacity utilization ("TCU"; see Figure 7) and year-over-year change in total capacity utilization (per Figure 8) are concerning. The TCU has been trending downwards for the last 14 months. For the last 8 months, the TCU has seen a negative year-over-year change. Not only is TCU falling, but capacity utilization for the last three quarters of 2019 were below that of the last three quarters of 2018.

Figure 9: Inventory to Sales Ratio (2008-2019)



Source: https://fred.stlouisfed.org/series/ISRATIO

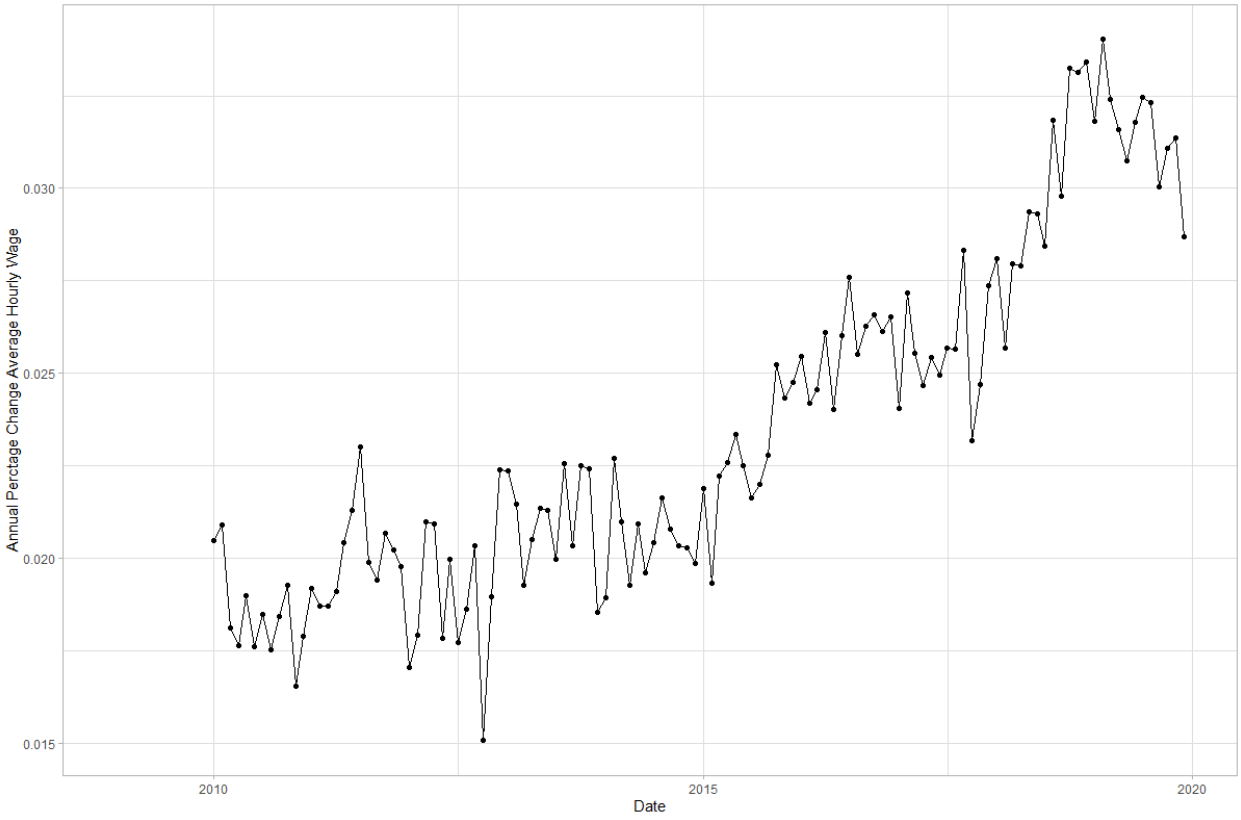
Figure 10: Year-over-Year Change in Inventory to Sales Ratio (2010 - 2019)



Source: https://fred.stlouisfed.org/series/ISRATIO

The inventory to sales ratio was increasing for much of the first half of 2019, and then plateaued in the last half of 2019. The year-over-year change in the inventory to sales ratio also showed a promise the last half of 2019. Although companies are not accumulating inventory relative to sales, the inventory adjustment always comes at a cost. Most firms, when making inventory adjustments, reduce output, decrease productivity and decrease their workforce.

Figure 11: Annual Percentage Change in Average Hourly Wage (2010 - 2019)



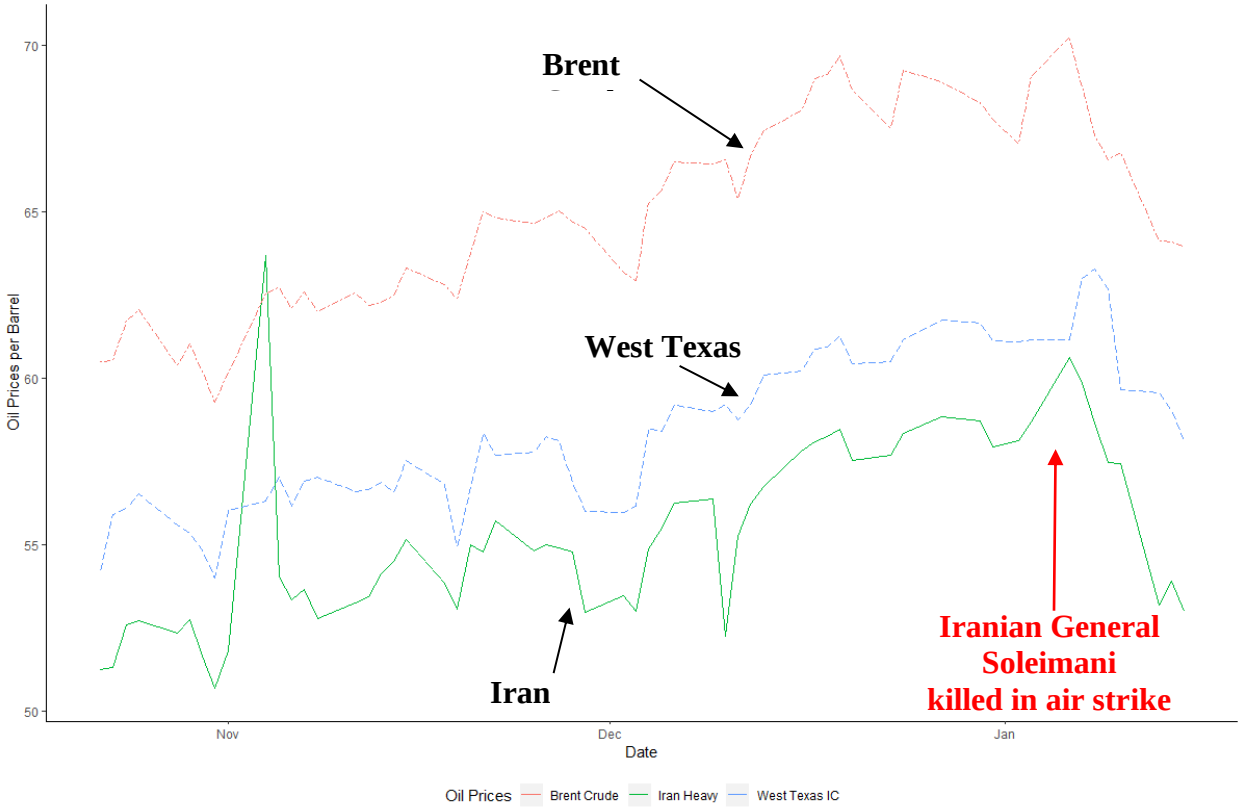
Source: https://fred.stlouisfed.org/series/CES0500000003

The year-over-year growth in wages (December 2018 – December 2019) was 2.9%, below a prevailing forecast of 3.1 – 3.2% growth in wages[8]. The unemployment rate is stable at 3.5%, but the number of jobs added in December[9] (145,000) was low relative to expectations and the number of jobs the economy added were revised down by approximately 14,000 for October and November 2019. A downward revision in the number of new jobs created, a downward trend in capacity utilization and lower-than-expected wage growth all suggest a softening of the economy.

A more recent development has caused some additional concerns regarding the state of the economy. The death of Iranian General Soleimani in early January 2020[10] pushed oil prices up in over-night trading[11]. Although the oil prices did drop to pre-December levels within a few days, the hyper-sensitivity surrounding the tension in Iran points to the general nervousness surrounding global events. A recent "near-miss" of a recession in Germany[12] had added to the pessimism about the global economy. The US will have a very difficult time staying out of a recession if the global economy weakens and becomes less predictable.

[8] https://www.cnbc.com/2020/01/10/us-nonfarm-payrolls-december-2019.html
[9] https://www.bls.gov/news.release/empsit.nr0.htm
[10] https://www.cnn.com/middleeast/live-news/us-iran-soleimani-tensions-live-intl-01-05-20/index.html
[11] https://www.cnn.com/2020/01/02/investing/oil-prices-iran-commander-baghdad/index.html
[12] https://www.bbc.com/news/business-50419127

Figure 12: Price Per Barrel of Oil: Brent Crude, West Texas and Iranian Heavy (Oct - Dec 2019)



Source: https://fred.stlouisfed.org/series/DCOILWTICO; https://fred.stlouisfed.org/series/DCOILBRENTEU; oilprice.com

Short and Long-Run Expectations

Every economic recession occurs as a result of an economic shock. The following table identifies a chronology of the last six recessions, their peak and trough months and the corresponding economic shocks. The recessions of 1975 and 1980 were motivated by energy policies and oil prices. The recession in 1991 was caused by consumer pessimism surrounding the Iraq war and massive failures within the savings and loan industry. The 2001 recession was caused by a burst of the dot.com bubble and the loss in consumer confidence caused by failures by Enron, WorldCom and the 9-11 terrorist strikes to the US. The Great Recession in 2008 was caused by a collapse of the housing market and the sub-prime loan market. The last four recessions were the result of decreases of consumer spending.

The movement of several economic indicators suggest that we are headed towards another consumer driven economic recession.

Table 2: Recession Chronology and Corresponding Shocks

Peak Month	Trough Month	Economic Shock
November 1973	March 1975	Oil Embargo
January 1980	July 1980	Fall of the Shah of Iran/Energy Crisis/Volker Interest Rates
July 1981	November 1982	Volker Interest Rate Hike
July 1990	March 1991	Iraq War/ Savings and Loan Crisis
March 2001	November 2001	Dot.com Bubble/ Enron & WorldCom/ 9-11 Terrorist Strike
December 2007	June 2009	Housing Crisis
May 2020 - Jan 2021	?	Tariff Crisis/ Farming Failures / White House Crisis

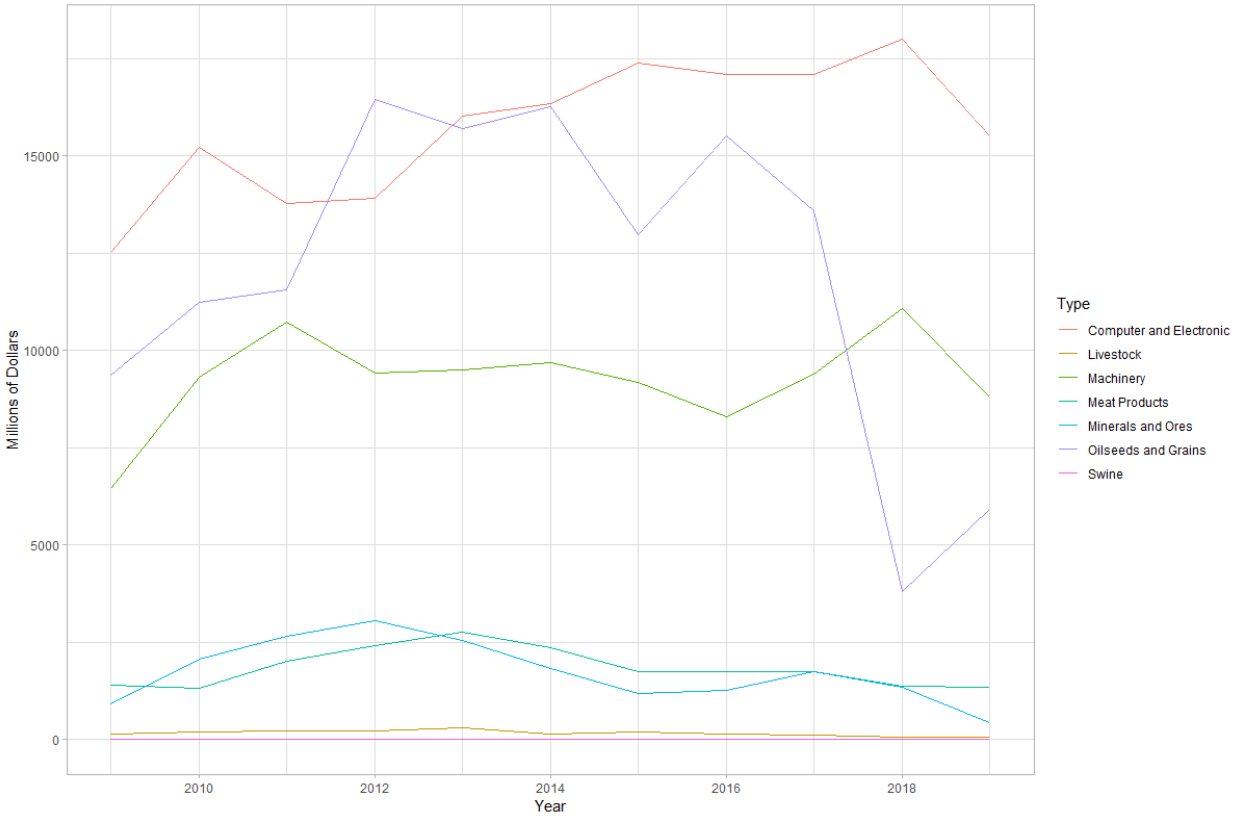
Source: NBER.org

The on-going trade war between the US and China has driven soybean and other agricultural exports between the US and China to significantly low levels: during the 2018-19 season, China purchased 14.3 million tonnes of soy, the lowest purchase amount by China in more than 10 years[13]. As a result, soy stockpiles have increased by more 1.8 billion bushels and are pushing domestic soy prices down[14]. Although soy future prices[15] have started to increase with renewed trade talks, the damage has already taken hold. The value of agricultural exports have been trending considerably lower (see Figure 9) and year-over-year changes have hit negative levels in the last 12 months. Lower exports and lower domestic prices (and corresponding lower domestic revenue) have driven down farm profits. The net-cash income of soy farmers has decreased from $130,000 per farm in 2016 to $65,100 in 2018[16]. It is not surprising to see farm loan delinquency rates increase to the highest levels since 2012 (see Figure 10).

Soy farmers are not the only groups negatively impacted by the trade-war[17]. Exports of computers and electronics, livestock, machinery, minerals and ores as well as other oilseeds and grains are all down in either 2018 or 2019. Exporters of meat products (including swine) experienced small upticks in 2018 but saw a softening of the market so far in 2019. The outbreak of the swine flu in China[18] has had a small positive impact on the exports for swine from the US.

[13] https://www.reuters.com/article/us-usa-trade-china-agriculture/us-soybean-exports-to-china-rise-but-big-purchases-remain-elusive-idUSKCN1UO1ZL
[14] ibid
[15] https://www.wsj.com/articles/soybean-futures-bounce-back-after-china-restarts-purchases-11570127899
[16] https://data.ers.usda.gov/reports.aspx?ID=17840
[17] Recent reports of a new deal have become available - https://www.cnbc.com/2019/10/14/phase-one-us-china-trade-deal-not-enough-to-boost-trumps-2020-odds.html, however, Secretary Mnuchin has indicated that new tariffs are still scheduled to go into effect until the deal is signed - https://www.cnbc.com/2019/10/14/mnuchin-says-he-expects-tariffs-to-go-up-in-december-if-there-is-no-china-deal-in-place.html
[18] https://www.cnn.com/2019/09/04/business/china-pork-swine-fever-pigs/index.html

Figure 13: Value of Exports (in Millions) by Type of Goods (2009-2019)19

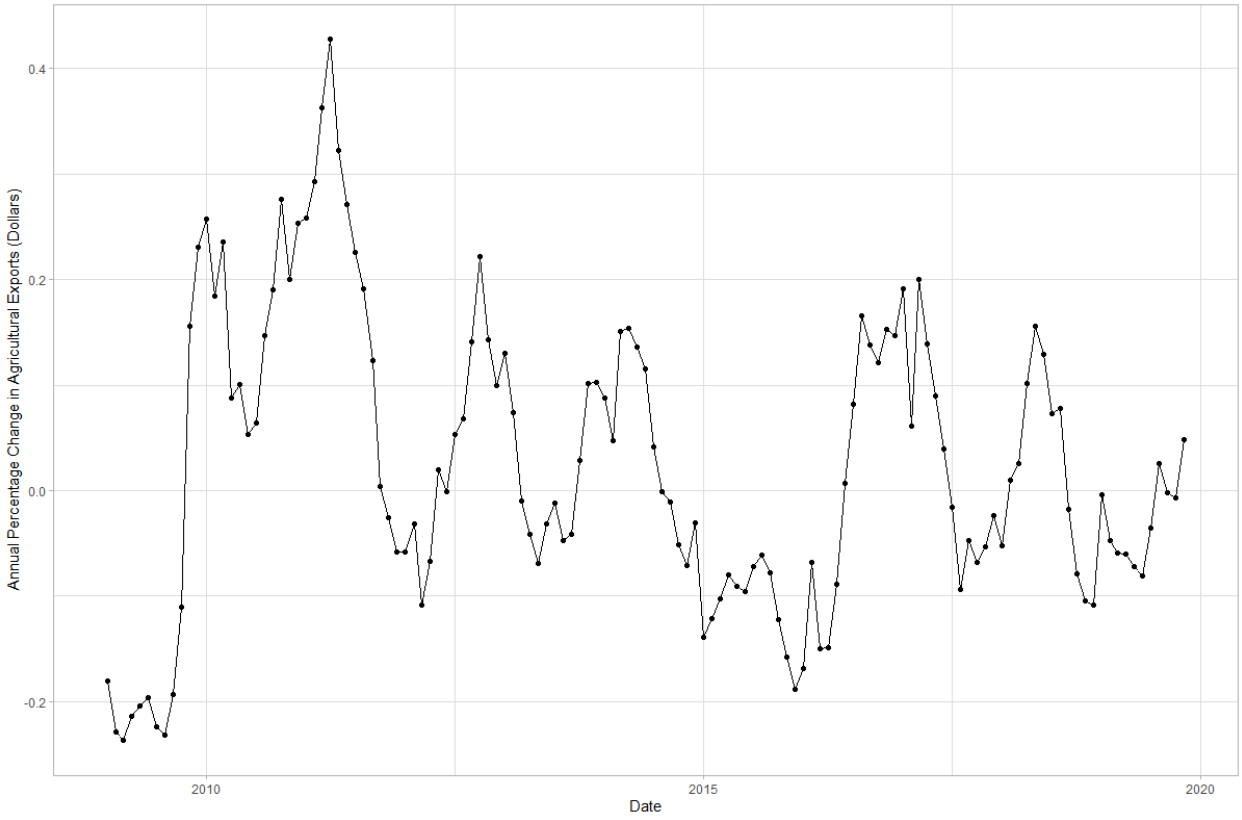


Source: http://usatrade.census.gov

Although the tariffs (and retaliatory tariffs) are impacting farmers directly, they will start impacting consumers more directly in the next few months. Price increases as a result of these tariffs could cost consumers between $300 and $900 per year[20]. This is likely to translate into a drop in consumer confidence and could easily spin into a mild consumer-driven recession.

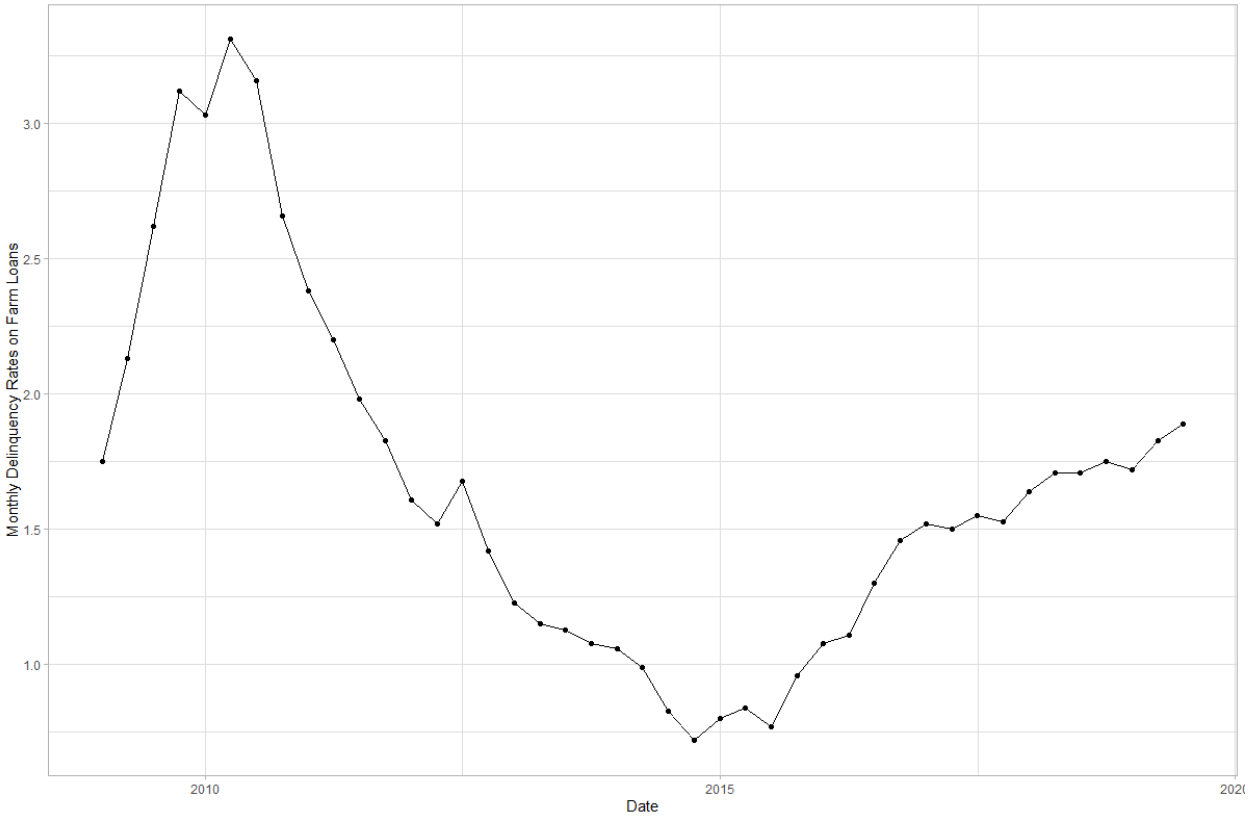
[19] Data for exports was available through August 2019; the values for 2019 are based on released numbers through August and then forecast values through the rest of 2019.
[20] https://www.nytimes.com/interactive/2019/business/economy/trade-war-costs.html

Figure 14: Year-Over-Year Change in Value of Agricultural Exports (2009-2019)



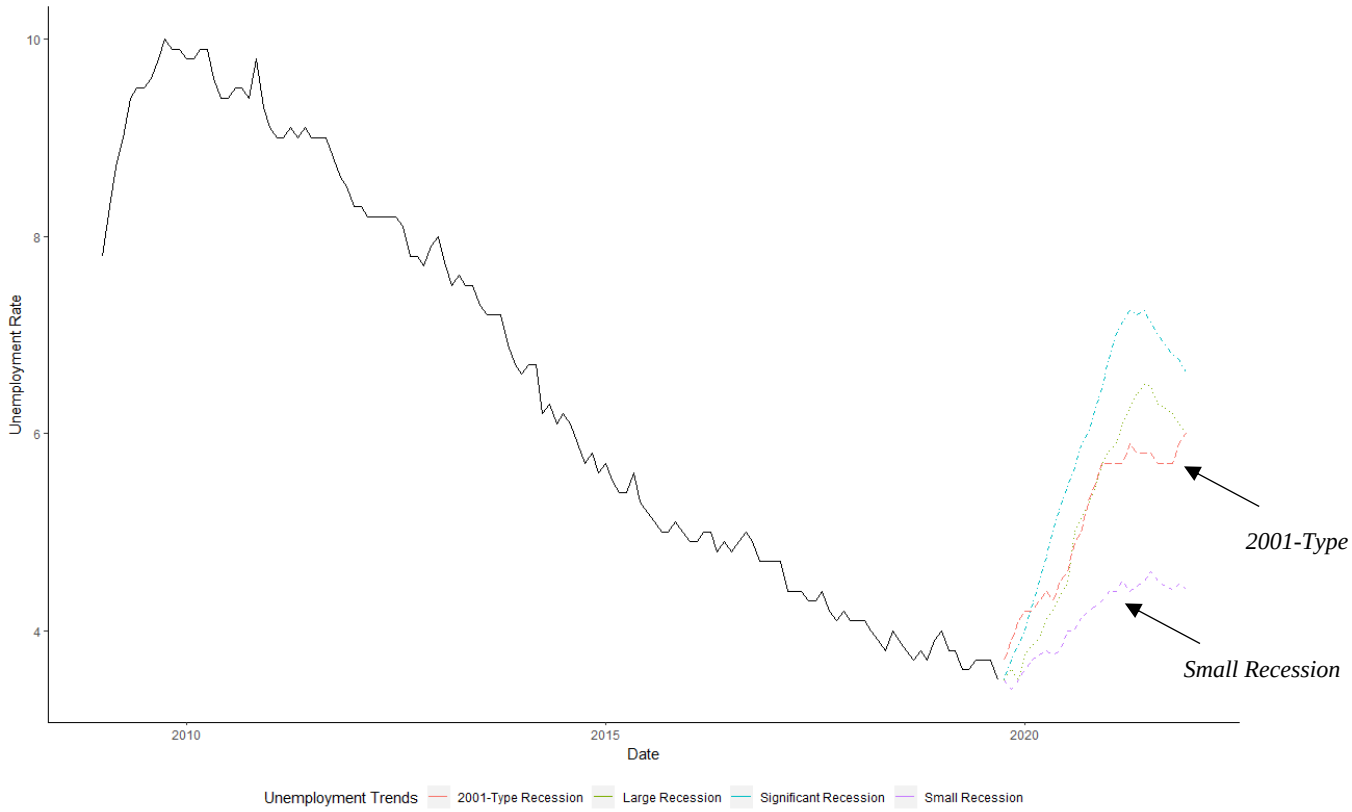
Source: https://www.ers.usda.gov/data-products/foreign-agricultural-trade-of-the-united-states-fatus/us-agricultural-trade-data-update

Figure 15: Bank Loans for Agricultural Production: Delinquency Rates (2008 - 2019)



Source: https://fred.stlouisfed.org/series/DRFAPGACBS

Figure 16: Unemployment Trend with Forecasts

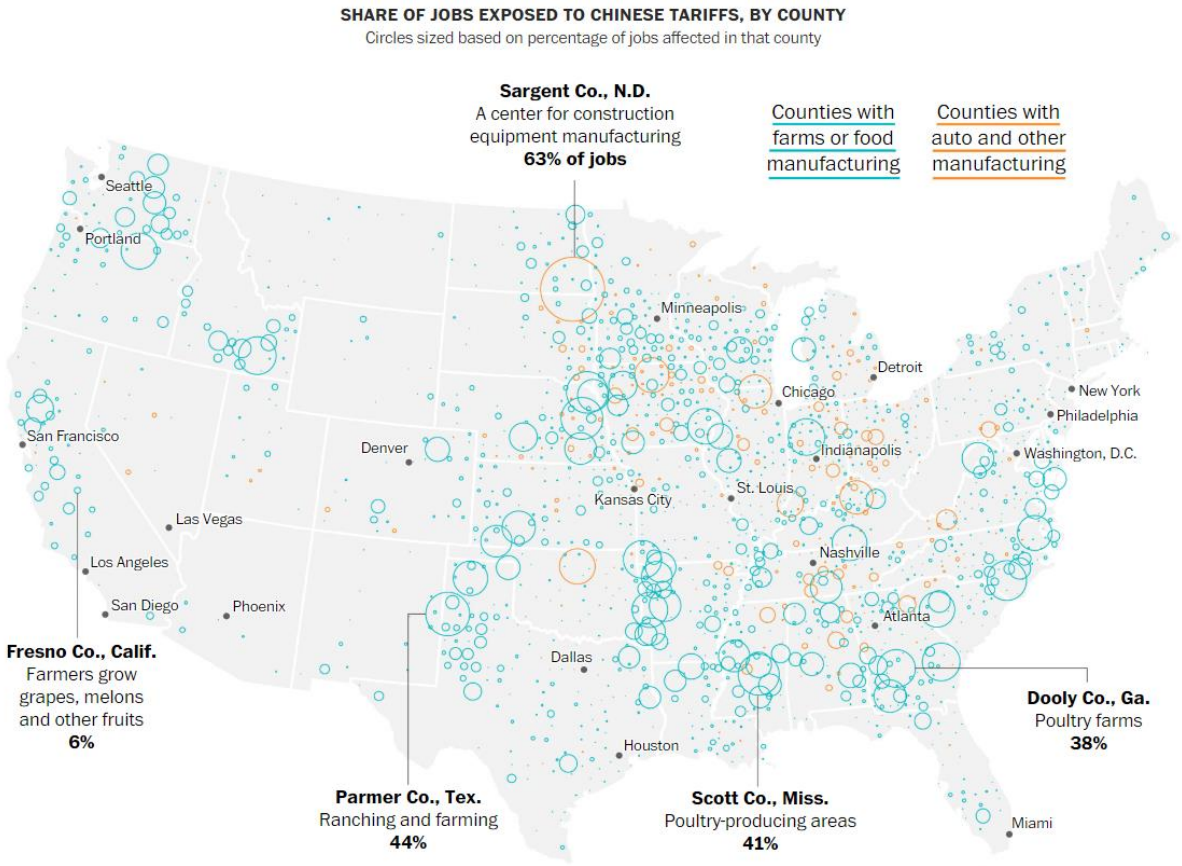


Given the current trends in macroeconomic indicators, it is likely the economy will experience a recession in the next 12-18 months. The depth of the recession is likely to be something similar to the 2001 recession (6-9 months) with peak unemployment between 5.5% and 6.5%. The graph above shows the trends in the unemployment rates given the severity of the economic shock and the depth of the economic recession. Given the attention that the Federal Reserve Bank is placing on the current economic climate, it is possible (although slightly less likely) that the economy would bounce into a small recession with unemployment rates topping off around 5%. The Fed would have to make significant changes (50-75 basis point) reductions to the federal funds rate target within the next two meetings to stave a more significant recession. Given the pressure that the current administration is putting on the Federal Reserve Bank[21], it is not an unreasonable course of action for the Fed to engage in significant expansionary policy. If the timing is right, aggressive Fed moves might act as a safety net for a falling economy.

[21] https://www.bloomberg.com/news/articles/2019-08-22/key-trump-quotes-on-powell-as-fed-remains-in-the-firing-line

Impact on Election

Figure 17: State Exposure to Trade War: Food and Manufacturing Sectors



Source: https://www.washingtonpost.com/graphics/2018/business/china-tariff-jobs/

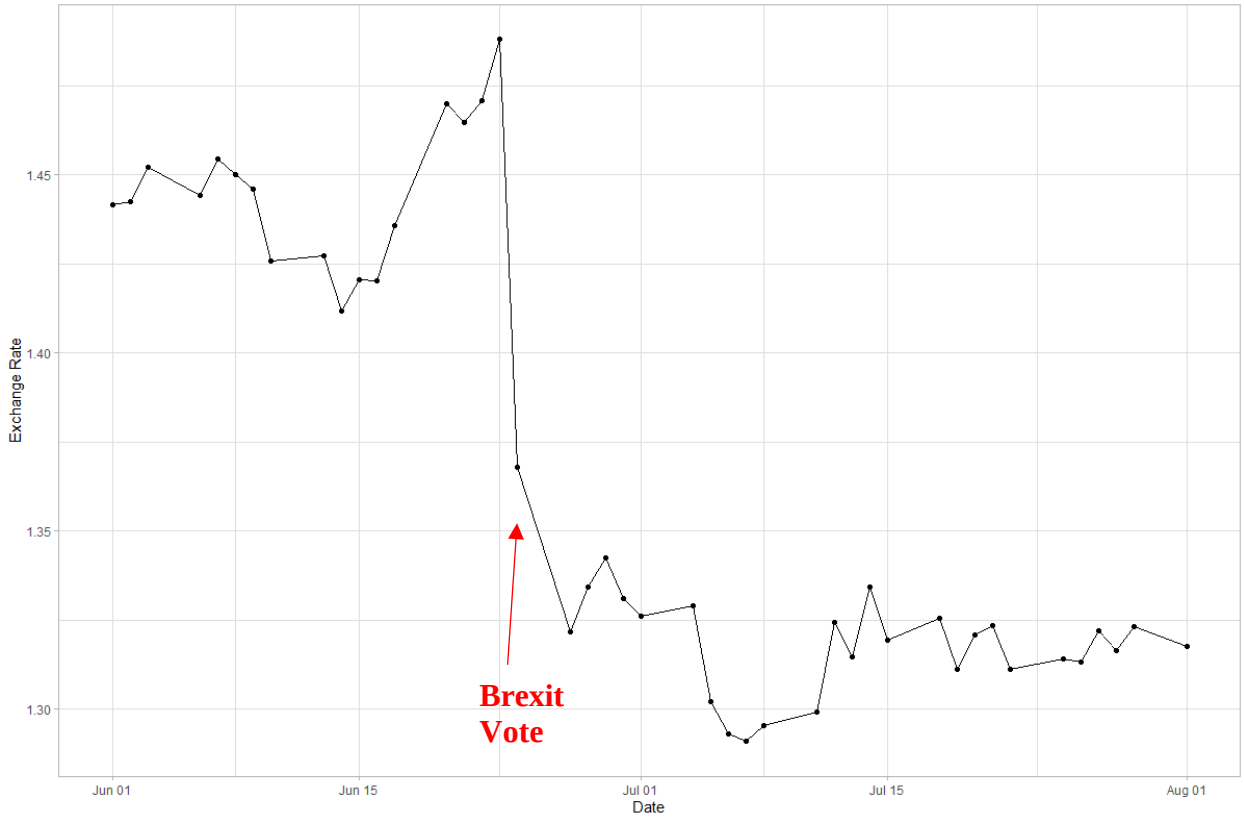
The impact of the escalation in tariffs has not been felt evenly across the US. China has targeted very specific goods in their retaliatory tariffs. We can see that states in the Midwest—Illinois, Wisconsin, Minnesota, and Ohio -- have experienced a much harder hit than western plains states such as Colorado, Utah and North Dakota.

The drop in exports in the Midwest could cause an uptick in unemployment rates in these states. This could be very damaging to the re-election chances for President Trump. Changes in unemployment (for the negative) can be a mobilizing event[22] - creating an urgency for voters to voice their opinions at the polls. Additionally, higher unemployment rates and lower GDP growth have been associated with voters turning against the incumbent party in presidential and midterm elections[23]. A change in the economy trajectory from growth to economic recession could turn voters away from Trump in Wisconsin and Ohio. Given that Trump narrowly won these states, even small changes in voter sentiment could flip these states back to the democratic candidate.

[22] See, for example, https://scholar.princeton.edu/sites/default/files/mincanta/files/incantalupo_turnout_0.pdf
[23] https://www.theatlantic.com/business/archive/2010/11/the-most-important-economic-indicator-in-midterm-elections/65505/

Brexit and Exchange Rates

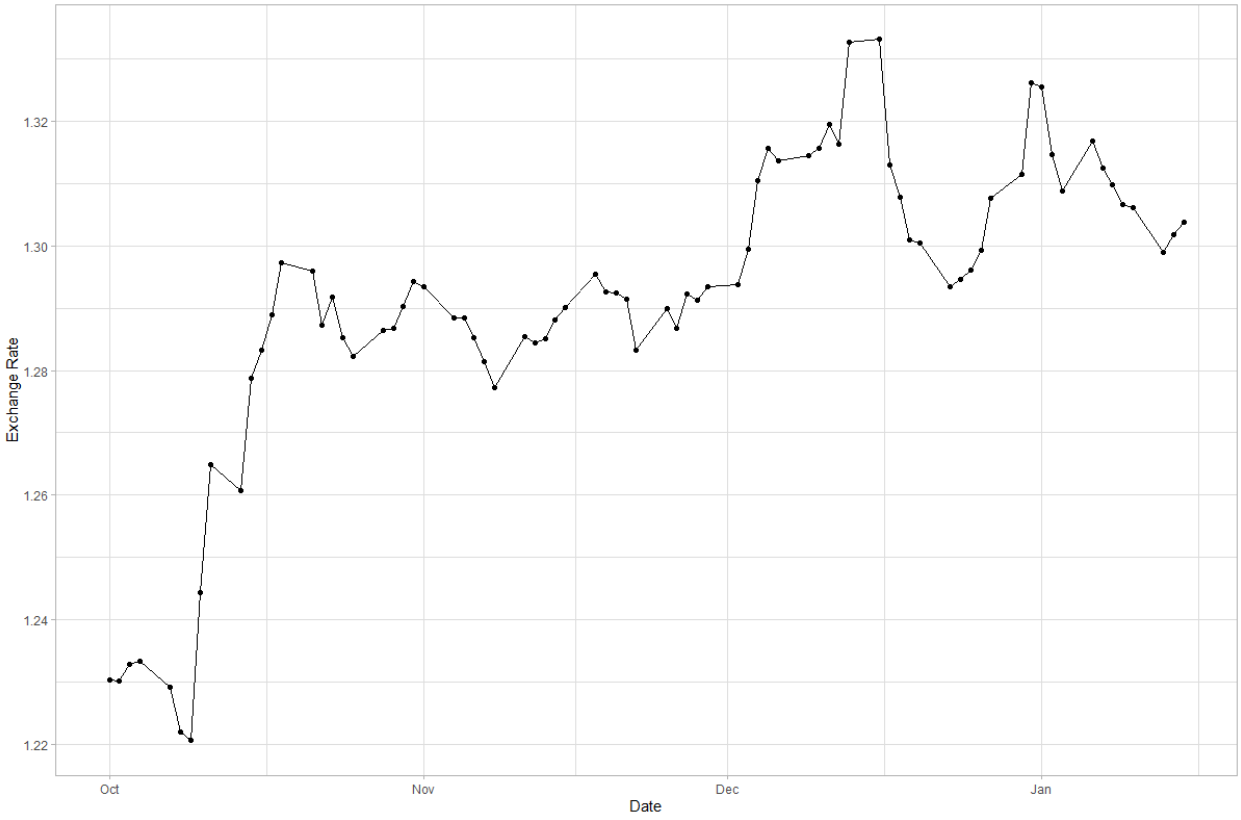
Figure 18: Dollar Price of GBP: Exchange Rate June - August (2016)



Source: https://www.investing.com/currencies/gbp-usd-historical-data

Exchange rates between currencies are determined by the supply and demand of the one currency relative to the second currency. The demand for a currency, the Great British pound for example, is determined in part by the belief in the country the currency represents. The vote for Brexit on June 23, 2016 significantly disincentivized investors to purchase pounds. We can see this big drop in the dollar price of a pound on June 24, 2016 as a result of the decreased demand for owning the pound. Although a strengthening dollar (as is shown as the large drop in the dollar price of a pound on June 24, 1016) makes foreign goods less expensive for US consumers, it also makes US products more expensive for foreign consumers. When the dollar price of a pound decreased, the pound price of a dollar increased, making US exports more expensive for British consumers.

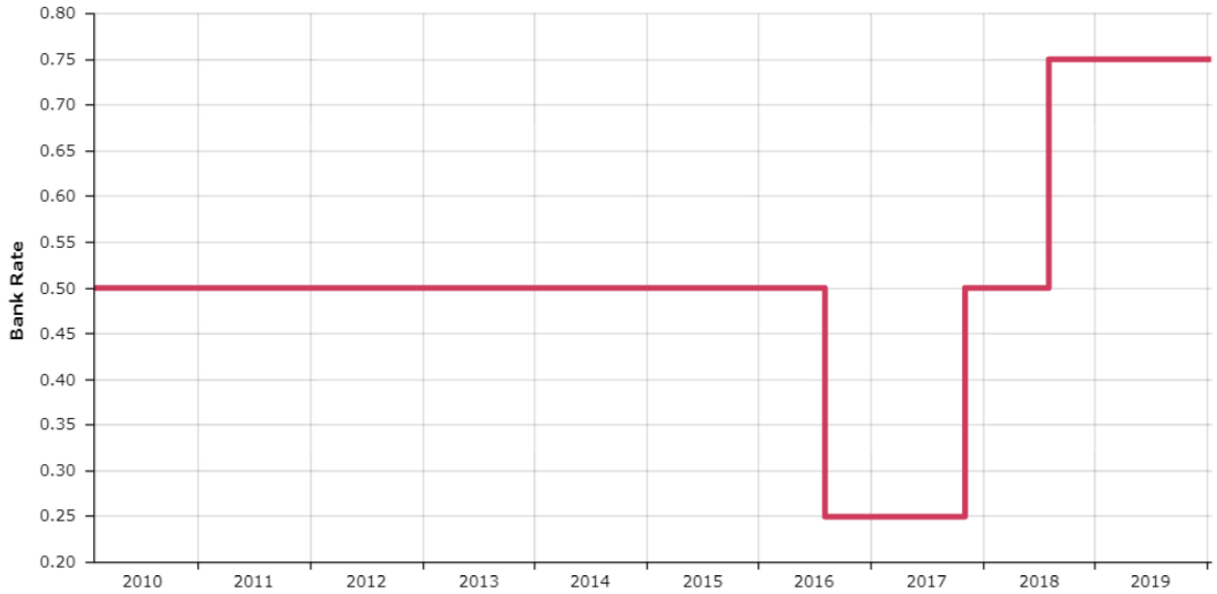
Figure 19: Dollar Price of GB Pound (Oct 2019 - Jan 2020)



Source: https://www.investing.com/currencies/gbp-usd-historical-data

Recently, however, the tide has shifted with respect to the pound. Although Brexit remains unpopular with British citizens, the snap-election and re-election of Boris Johnson has almost certainly guaranteed that Brexit will happen within the first quarter of 2020. This certainty has solidified the demand for the pound. The UK will need trading partners and the US is in a position to create a bilateral trade agreement. The higher dollar-price of the pound makes US exports less expensive – this could drive exports to the UK and alleviate some of the pressure US exports have felt in response to the trade war with China.

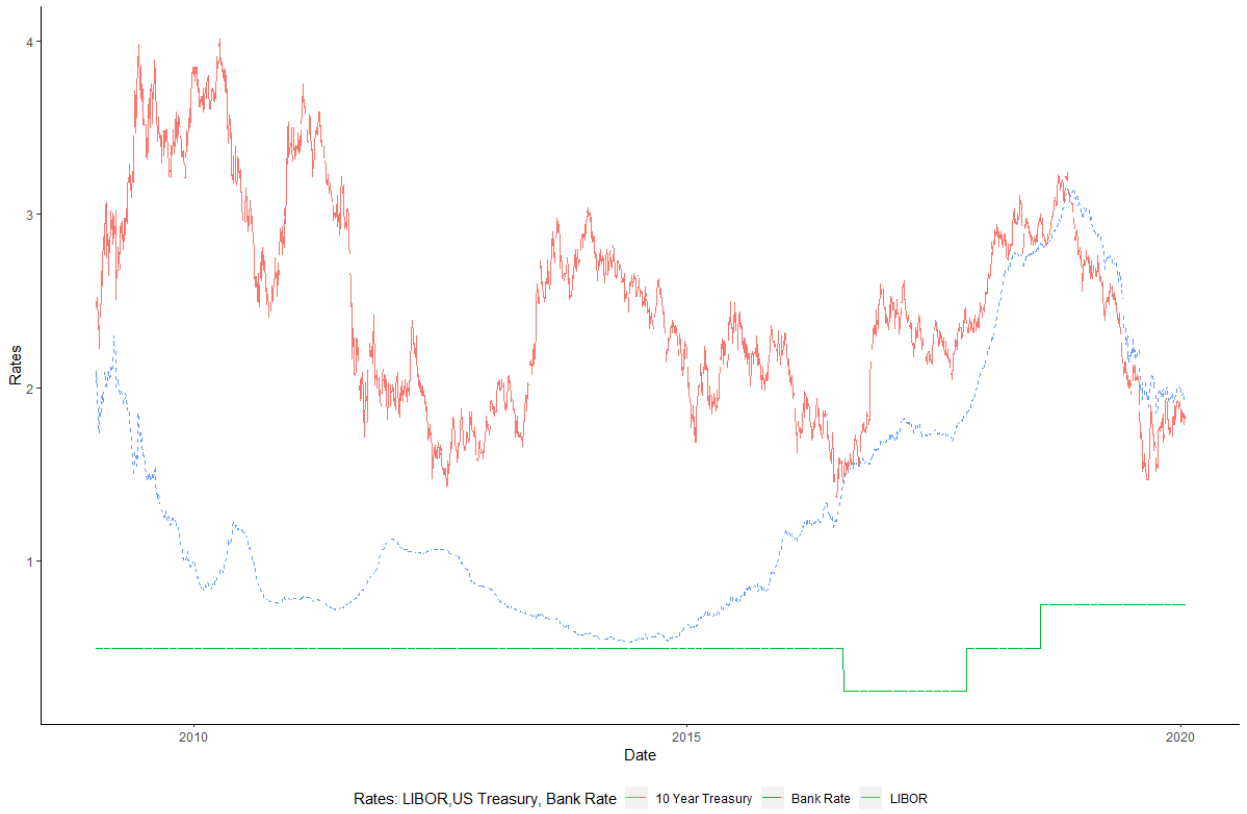
Figure 20: Bank Rate Set by Bank of England (2010 - 2019)



Source: https://www.bankofengland.co.uk/monetary-policy/the-interest-rate-bank-rate

Although Britain has been going through the Brexit crisis for more than two years, the Bank of England has been fairly stable with its monetary policy. The Bank of England acts in a similar fashion to the Central Bank of the US, setting the foundation interest rate upon which other interest rates are stacked. The Bank of England dropped the Bank Rate by 25 basis points approximately 1 month after the Brexit vote in 2016 and then increased the rates at the end of August 2017 and again in 2018. The Bank of England's policy have been mirrored by changes in the LIBOR starting in mid 2016. The 10-year US Treasury rate has moved in concert with the LIBOR since mid 2016.

Figure 21: Bank Rate, LIBOR and 10-Year Treasury Rates (2009 - 2019)



Source: https://fred.stlouisfed.org/series/USD12MD156N#0; https://www.bankofengland.co.uk/monetary-policy/the-interest-rate-bank-rate

The LIBOR represents the average rate at which banks in England lend to each other and has been moving in steps similar to the rates established by the Bank of England. The 10-year US Treasure rate is not dependent on the LIBOR or the Bank Rate, but is determined by the market for mid-term risk-free assets. Because government securities in both of these countries are considered risk-free, any differences in the rates between these assets will be off-set by exchange rates and transaction costs. As such, differences in the prevailing interest rates in these two countries highlight the alternative risk aversion of consumers within those native markets. Between 2016 and mid 2018, investors in the US and Britain moved towards the equities market and moved away from fixed income. However, as the certainty of Brexit takes hold (particularly with the re-election of Boris Johnson), risk-averse investors are moving towards fixed income. An increase in the bond market has increased the price of bonds and decreased the prevailing interest rates. The downward movement in both the 10-year Treasury and the LIBOR starting in mid 2018 signals a bit of a push toward security and a move away from risk for institutional investors.

Data Analysis

As part of the Dodd-Frank Act, larger banking institutions in the United States are required to use government specified variables, and approved proprietary processes, to determine if they are adequately prepared for unexpected “systemic failures”. Some banking institutions are also

incorporating portions or components of their forecasting processes to estimate future profitability; in order to do so, however, realistic forecasts (as opposed to extremes) are required.

While arguments could be made about the variables included in this study, as stated in Jiang, et al., "… a conclusion that can be made for … US data is that there is little to no improvement in forecast accuracy when the number of predictors is expanded beyond 20-40 variables."

Capitalytics provides the results of a rigorous analysis of every variable that is included in our quarterly macroeconomic study. These variables include the following[24]:

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)

Our procedure is as follows:

1. Data is collected per the information in Appendix A, "Data sources".

[24] 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.

2. Correlations between variables are identified to determine which variables are may be considered as "dependent" (upon other variables, i.e., highly correlated with other variables as part of their nature).

3. Multiple forecast analyses are performed per the procedure in Section I of Appendix B for all variables, with the results of corresponding forecasts aggregated.

4. Regressions are performed per the procedure in Section III of Appendix B for all variables.

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

Correlations

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

In Appendix C of this document, we document the 141 pairs of variables that showed absolute correlation values greater than or equal to 0.6. As part of this portion of the study, Capitalytics identified the following sets of strong dependencies (correlations with magnitudes greater than 0.95) between variables that were subsequently validated as significant, long-term, recurring correlations as part of the nature of the variables; these pairings of variables are viewed as extremely significant based on the respective definitions of the variables and will be leveraged as discussed in Section I of Appendix B.

Regression (Dependent) Variable	**… depends on …**	**Independent Variable**[25]
6-month Treasury yield		3-year Treasury yield*
Prime rate		3-month Treasury yield
1-month Treasury yield		1-year Treasury yield
3-year Treasury yield		1-year Treasury yield
7-year Treasury yield		3-year Treasury yield*
10-year Treasury yield		5-year Treasury yield
20-year Treasury yield		7-year Treasury yield*
30-year Mortgage rate		20-year Treasury yield*
Moody's AAA Rate		7-year Treasury yield*
30-year Treasury yield		20-year Treasury yield*
S&P 500 Stock Price Index		Commercial Real Estate Price index
US Residential Home Price Index		Commercial Real Estate Price index
Primary Credit rate		3-year Treasury yield*

Analysis of Variables

[25] 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

The slowing of US GDP growth continued through 3Q2019 at approximately 0.5%, and Capitalytics' quantitative analysis expects it to very slowly rebound, first to 1.0% by mid-2020 and then to 1.5% by early or mid-2021. Nominal GDP growth is projected to reach about 2.4% by early to mid-2021 before again retreating. Real disposable income growth surprisingly grew to over 3% in Q3, but is expected to slip until 4Q2021 and remain between 2% and 3% for the foreseeable future. Nominal disposable income may reach 3% by the end of 2021, and then remain below 4% through 2024.

While the Fed' attempts to drive inflation to a target of 2% by adjusting interest rates on Treasury bonds, rates for Q1 & Q2 were both around 0.2%, with rates in Q3 dropping to 0.13%, resulting in a significant dampening of forecasted values to a level under 0.3% for the foreseeable future. Pragmatically speaking, this seems extremely unlikely to be actually play out, due to a number of factors, not the least of which is the impending US Presidential election.

Other Commentary

- Kiplinger reports that it believes overall inflation rate will level at 2.2% during 2020, with the core rate standing at 2.3% (see https://www.kiplinger.com/article/business/T019-C000-S010-inflation-rate-forecast.html; Jan 15, 2020)
- Per the WSJ, "In early 2018, the Trump administration was taking a victory lap after achieving its goal of growing the economy by 3% a year, or more. In February of that year, the White House forecast that the economy would continue growing over 3% a year in 2018 and 2019, and that the economy would be so strong the Federal Reserve would continue raising interest rates … as the trade war wore on, the administration began imploring the Fed to slash interest rates to bolster the economy. The Fed cut rates three times. Even so, the economy has cooled toward 2%." (see https://www.wsj.com/articles/trade-war-with-china-took-toll-on-u-s-but-not-big-one-11578832381; Jan. 12, 2020)
- "Consumer spending was still the mainstay of economic growth in the third quarter." (see https://www.kiplinger.com/article/business/T019-C000-S010-gdp-growth-rate-and-forecast.html; Nov. 27, 2019)
- Per the WSJ, "Private-sector economists surveyed in recent days expect U.S. gross domestic product to expand an inflation-adjusted 2.2% this year on average, measured from the fourth quarter a year earlier. Forecasters expect economic growth will slow to 1.7% in 2020 and will be 1.9% in 2021." (see https://www.wsj.com/articles/economists-dont-see-path-to-3-growth-in-2019-11568296800; Sept 12, 2019)

Unemployment Rate

Analysis

Unemployment shows no sign of breaking from its historic sub-4% low levels in the foreseeable future (currently 3.6%), staying between 3.5% and 3% through 2024 (depending on national elections and other comparable factors). 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 will become increasingly stringent as time continues. There is a growing concern regarding the finite-ness of the workforce population, and the fact that job growth has been slowing over the past few years: even with tax cuts and economic stimulus plans, the concerns of high-level trade talks have already started to impact blue collar jobs, and there is a growing belief that the historic labor rates cannot continue indefinitely.

Other Commentary

- "The number of women on nonfarm payrolls exceeded men in December for the first time since mid-2010, the Labor Department said Friday. Women held 50.04% of jobs last month, surpassing men on payrolls by 109,000." (per https://www.wsj.com/articles/december-jobs-report-11578657600; Jan. 10, 2020)
- Monthly job growth has slowed from 223,000 in September 2018 to an expected average of 150,000 during 2020. Kiplinger reports "… that is because there are fewer available workers to hire, given the low unemployment rate. But the smaller gains also signal that the economy is slowing down to a more moderate growth rate. The tax cut couldn't boost growth forever, and the trade war with China is keeping exporters and commodities-oriented industries from expanding." (see https://www.kiplinger.com/article/business/T019-C000-S010-unemployment-rate-forecast.html; Jan. 10, 2020)
- "The unemployment rate will average 3.6% in 2019. It will increase slightly to 3.7% in 2020 and 3.8% in 2021. That's lower than the Fed's 6.7% target. But former Federal Reserve Chair Janet Yellen noted a lot of workers are part-time and would prefer full-time work. Also, most job growth is in low-paying retail and food service industries." per The Balance (see https://www.thebalance.com/us-economic-outlook-3305669; Aug 27, 2019)

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

Analysis

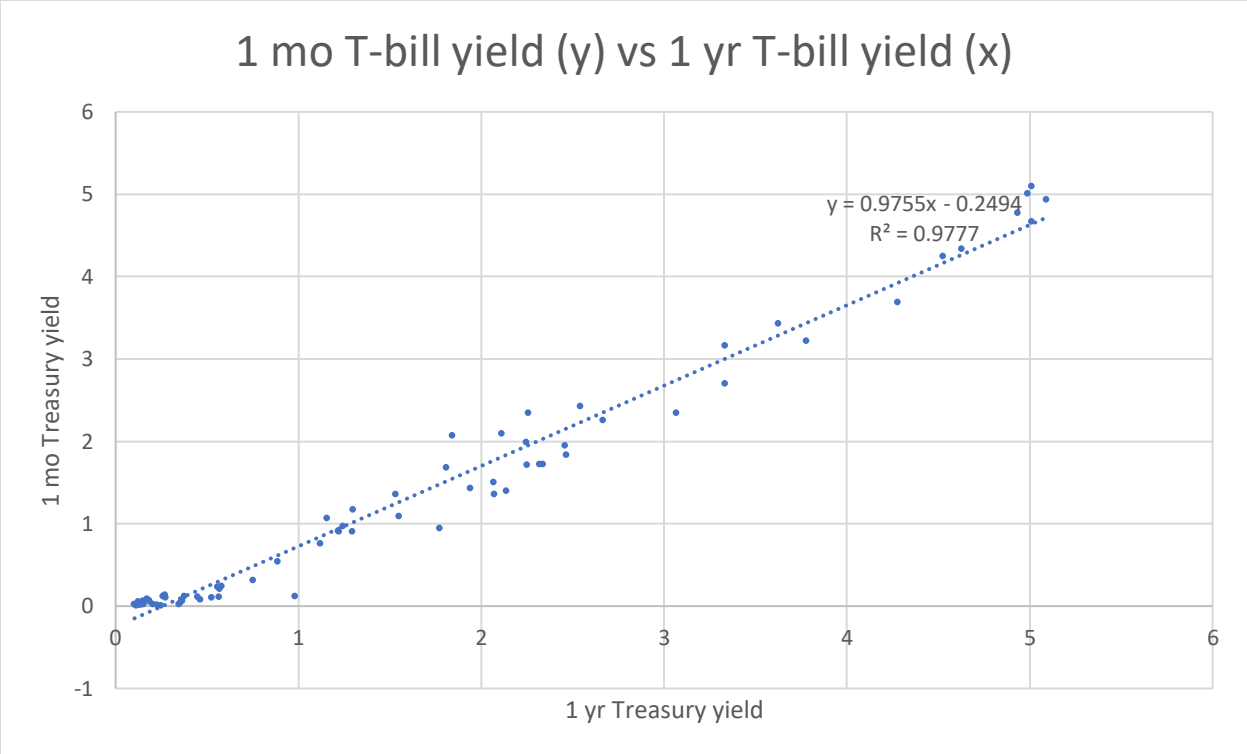
For the past several months, the US' yield rates toyed with long-term rates dropping below short-term rates, i.e., a "yield curve inversion". Now, with the yield curve having "inverted" as it did in, e.g., 2007, the concnern is whether this inversion is a precursor for a recession.

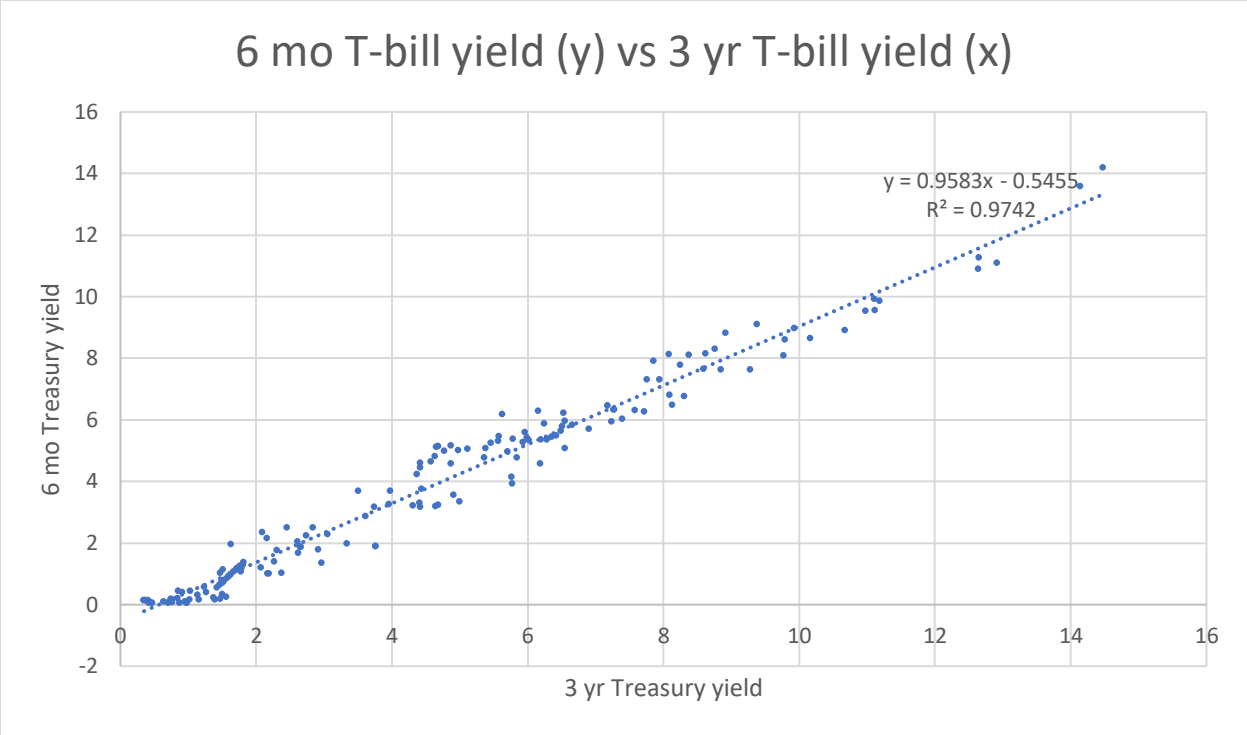
Capitalytics' analysis shows that the 3-month Treasury yield to steadily climb by a few basis points per quarter to a level of 2.15% by the end of 2021 or early 2022, assuming that there are minimal changes to US fiscal policy. We believe that 5-year Treasury yield rates to slowly fall to around 1.5% over the next several years, and the 10-year Treasury yield rates to rise to 2.1% by early 2021 before retreating, reversing the currently "warped" yield curve. Recession is still a

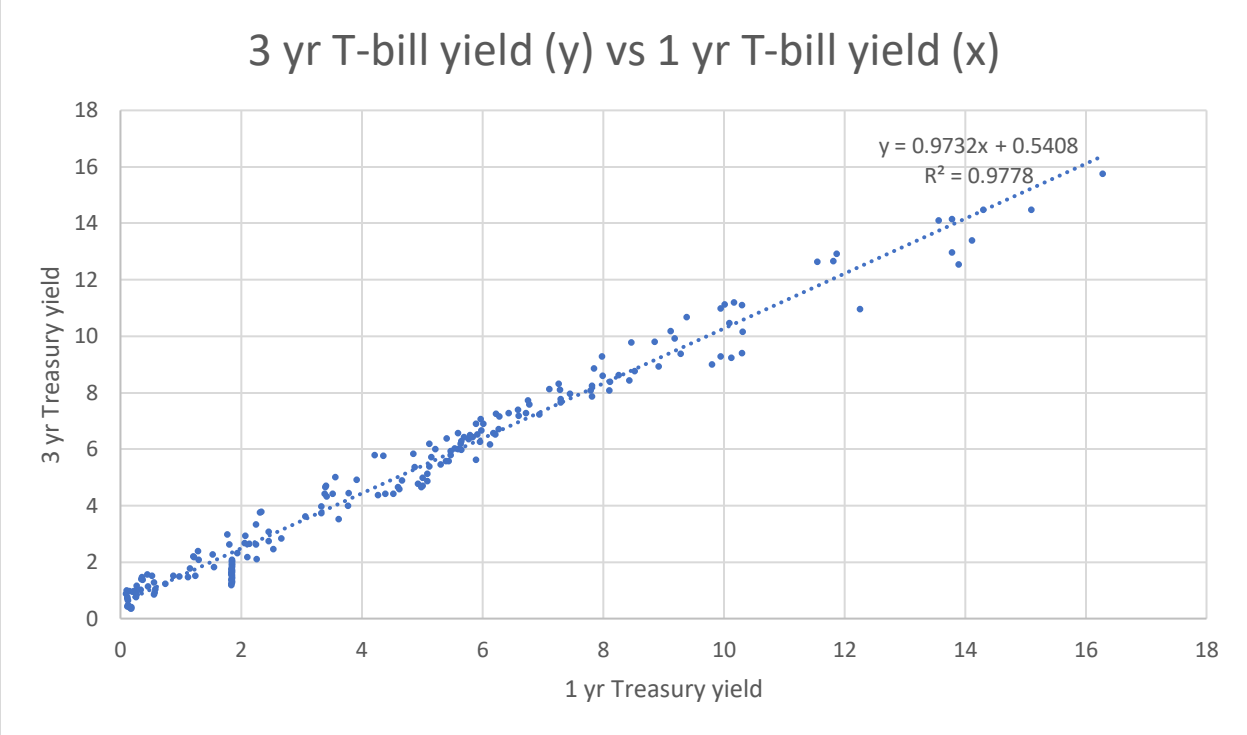
realistic possibility for occurring during 2020 and 2021, as we have stated previously, we expect it to be a very mild recession, and may not be even realized as such until after its resolution.

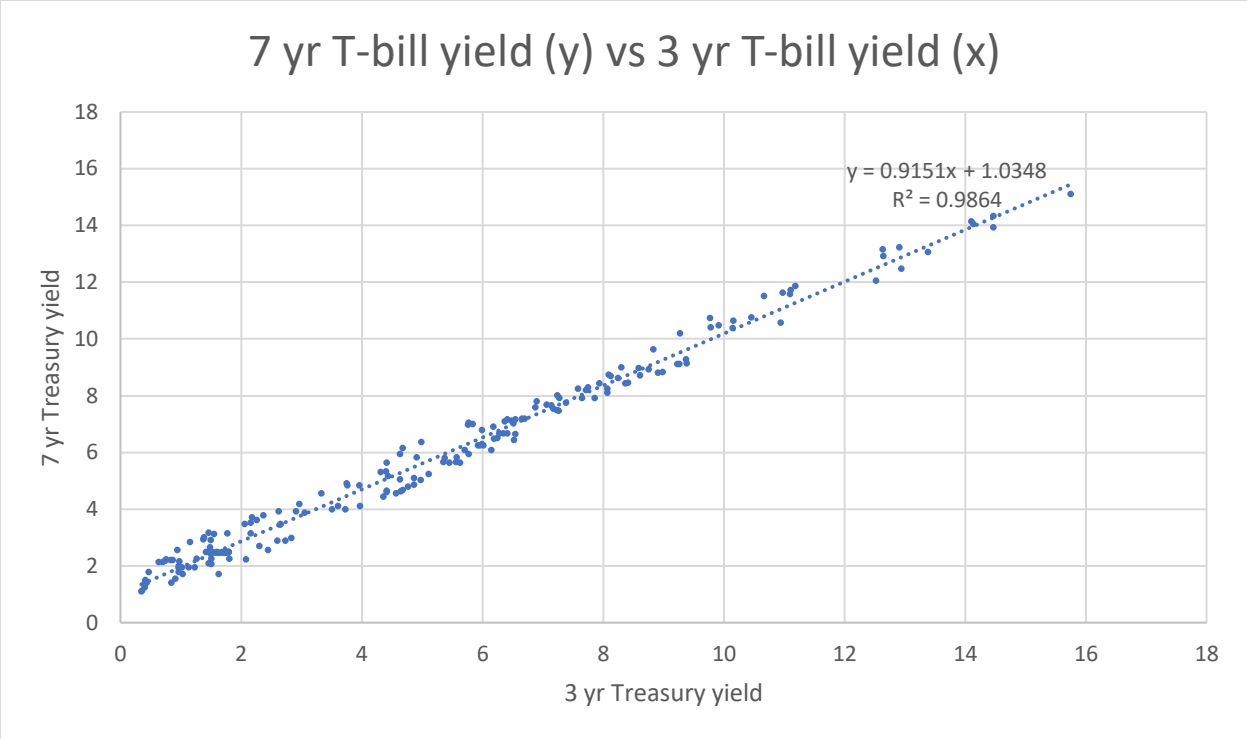
Other Commentary

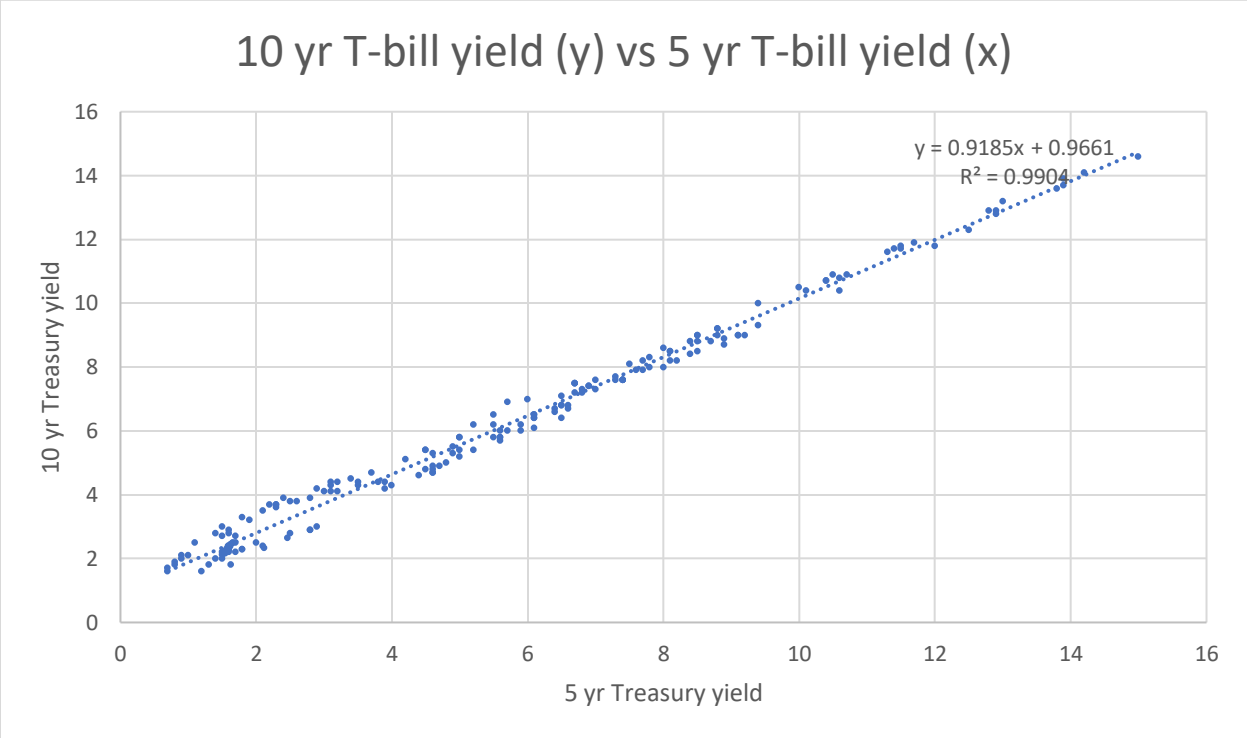
- "The Fed signaled in December that it doesn't expect to change rates this year. Officials who have spoken over recent days have reiterated they see no imminent need to change rates, to either higher or lower levels." (https://www.wsj.com/articles/fed-s-george-it-s-appropriate-to-hold-rates-steady-for-now-11579026000; Jan. 14, 2020)
- "Economists say broad structural changes to the economy such as an aging population or technological advances will hold down interest rates for the foreseeable future." (see https://www.wsj.com/articles/fed-has-many-tools-to-deter-recession-former-chairman-bernanke-says-11578184800; Jan. 5, 2020)
- Kiplinger asserts that interest rates will remain essentially "as is" through much of 2020, but the Fed' will return to its agenda of raising rates in 2021, albeit very cautiously, and as a function of the trade "skirmish" with China. (https://www.kiplinger.com/article/business/T019-C000-S010-interest-rate-forecast.html; Dec. 11, 2019)
- "[Robert Shiller] chalks it up to analysts "data-mining" to find any indicator that holds up. While the yield curve has preceded each of the seven recessions since the 1950s, with only one false positive, it's a fairly small data set to be really conclusive." (https://www.cnbc.com/2019/08/22/robert-shiller-says-recession-fears-may-make-it-a-reality.html; Aug 22, 2019)

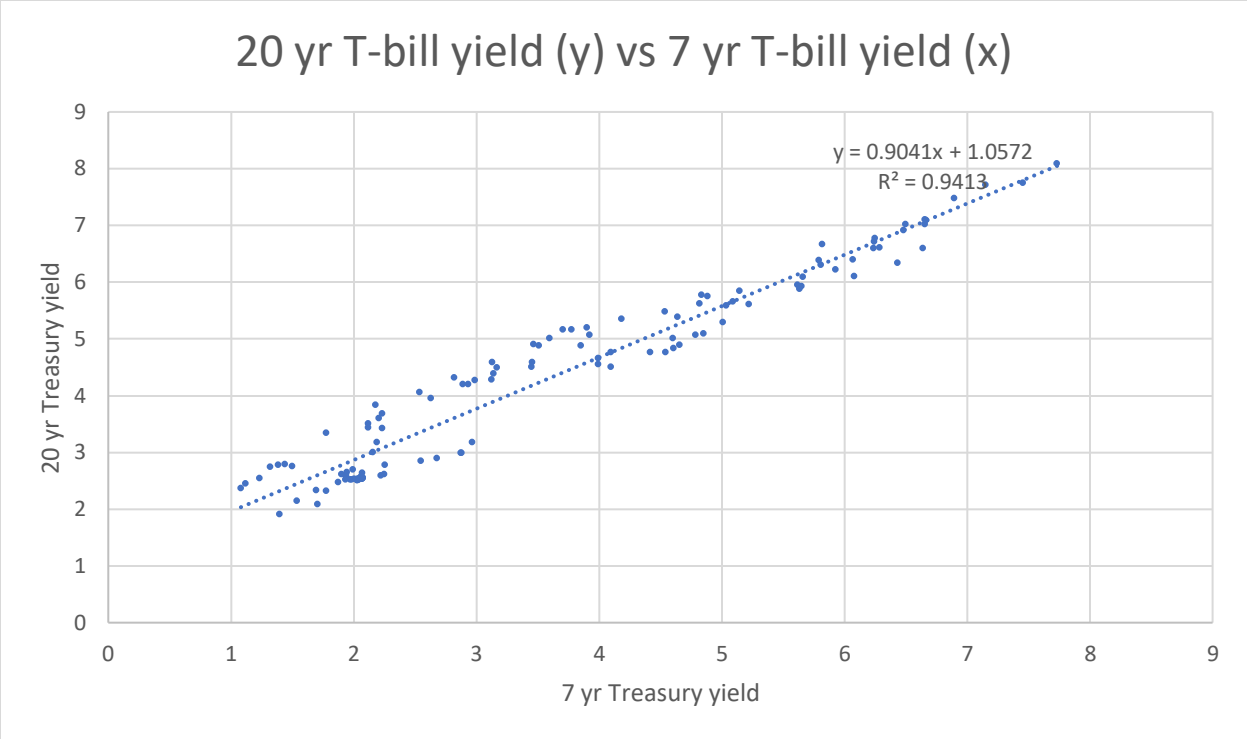


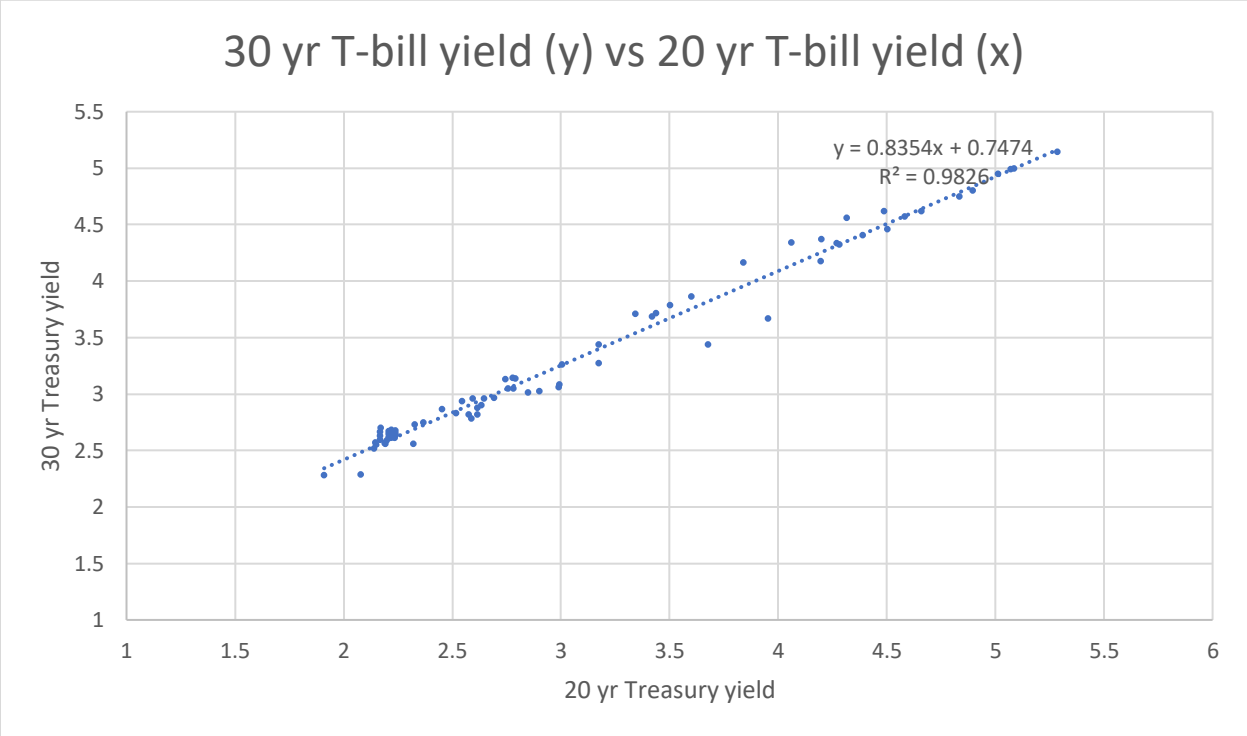












30-year Mortgage Rate

Analysis

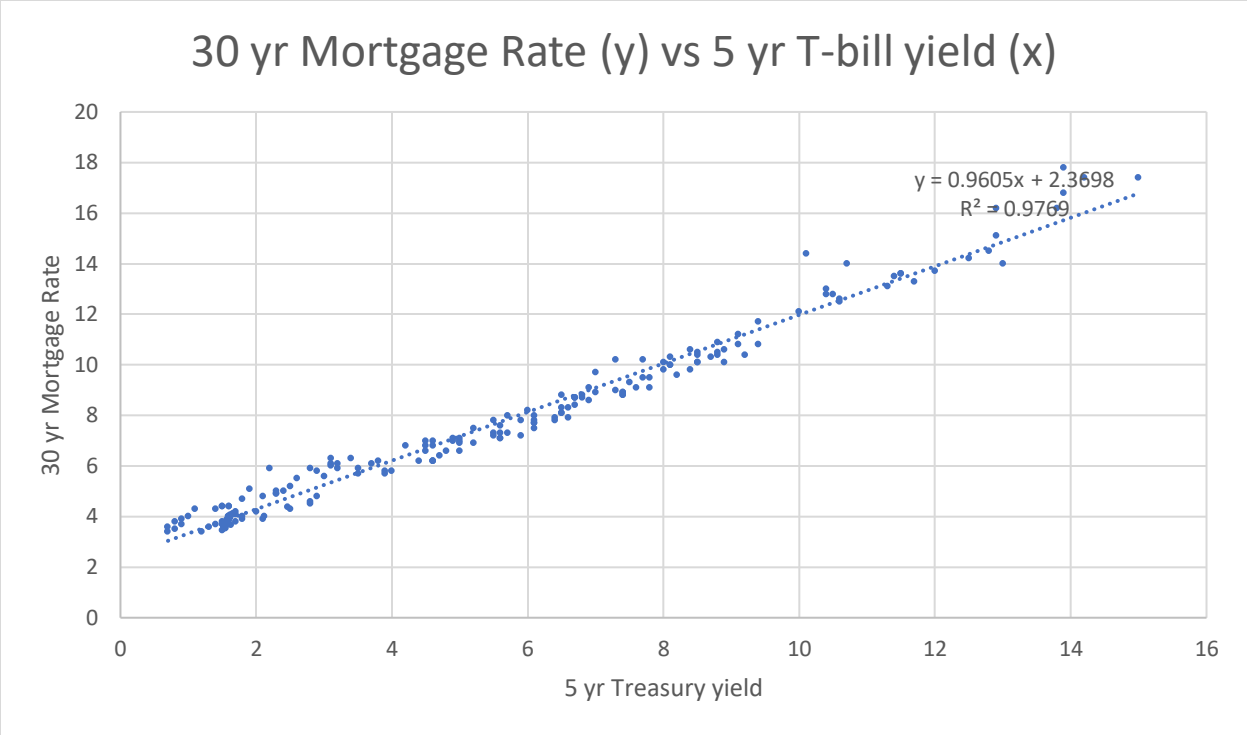
Over the past year, an anticipated economic slowdown and reduction in the housing market has been continuously rumored as being "right around the corner". At this point, our models reflect essentially stabilizing between 3.6% and 3.85% for the foreseeable future.

We are concerned about the current White House administration's continued attempts to directly influence interest rates (which are closely tied to the mortgage rate), and the expectation that this influence will continue for the next 12-18 months. Along these lines, the current "trade war" with China that is occur in the venues of certain commodities will also impact previously discussed rates, eventually including mortgage rates.

The following chart serves to illustrate the strong connection between mortgage rates and the 5-year T-bill.

Other Commentary

- Kiplinger states that the Fed' will keep interest rates roughly fixed for 2020, and then will cautiously restart increasing them in 2021 depending on the US' trade war with China, and other factors. (https://www.kiplinger.com/article/business/T019-C000-S010-interest-rate-forecast.html; Dec. 11, 2019)
- "The average rate on a 30-year mortgage, after peaking at 4.87% in November, fell more than one percentage point to 3.75% in June. … The S&P CoreLogic Case-Shiller National Home Price Index rose 3.4% in May from a year ago, down from 3.5% growth in the previous month. Home-price growth has declined on a year-to-year basis for 14 consecutive months. Double-digit price gains have vanished across the nation, after being the norm in many coastal cities just a couple of years ago." (see https://www.kiplinger.com/article/business/T019-C000-S003-housing-market-forecast-housing-starts-home-sales.html; Aug 1, 2019)



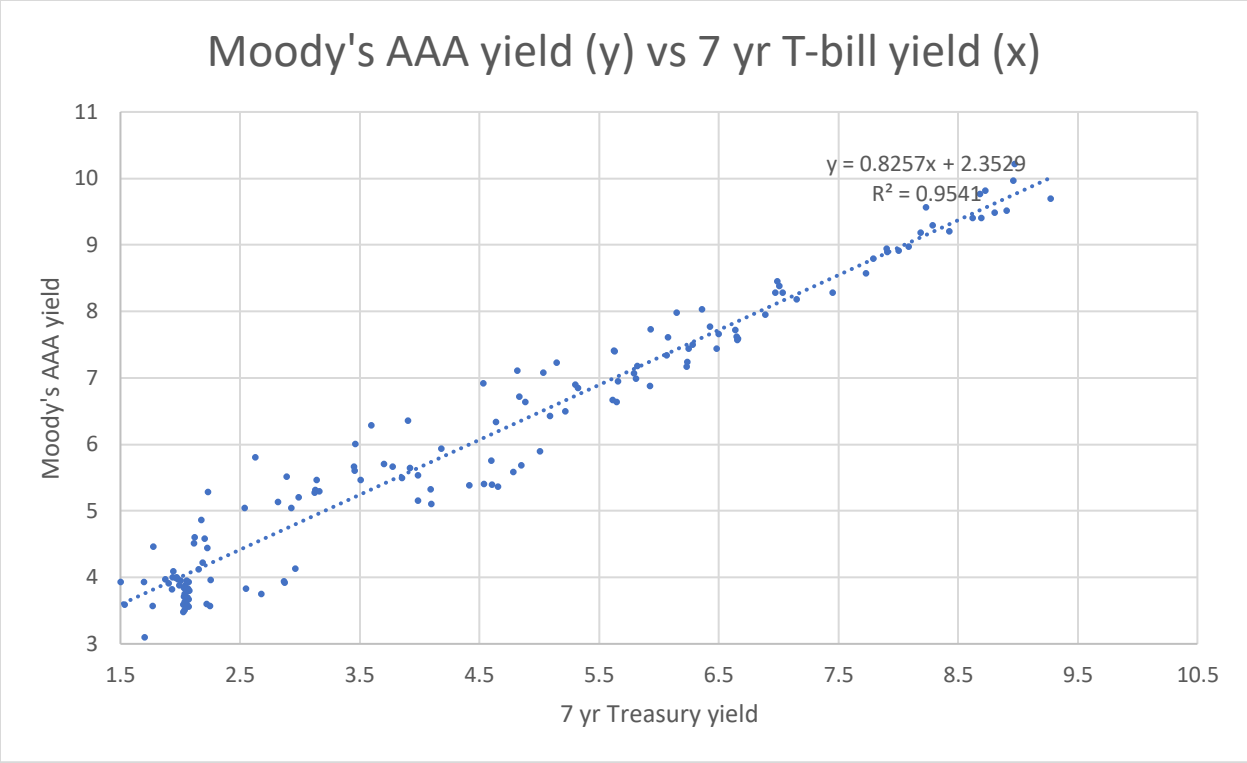
Moody's AAA & BAA Rates

Analysis

Moody's AAA bond rates tend to track in conjunction with mid-duration T-bill. Moody's BAA rates tend to be higher, and more volatile, than AAA rates.

Capitalytics' quantitative models sees AAA rates being relatively stable over the next several years (through 2024) at between 3.2% and 3.45% yields, though slightly lower than our previous models suggested; given the projected climate, and the connection between these bonds and the mid-duration Treasury yields, these values are not surprising. BAA rates will fluctuate between 3.8% and 4.0% for the foreseeable future.

The following chart illustrates the relationship between Moody's AAA rate and the 7-year T-bill yield which has emerged in our analysis.



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.

Given the recent turn in returns, Capitalytics sees returns on BBB investments stabilizing to between 3.15% and 3.4% through 2024. We note that these returns are lower than we predicted in our previous reports based on the trend that we are now observing in the market.

Other Commentary

- "A surprise rally in riskier corporate bonds is providing much-needed help to some energy companies with lower credit ratings, allowing them to issue new bonds to push back looming repayment dates." (see https://www.wsj.com/articles/energy-companies-seize-the-day-with-bond-refinancings-11579006807; Jan. 14, 2020)
- "Investors have either made peace with the risk of mass downgrades when the credit cycle turns, or they've just decided to ignore it and reach for yield when the Federal

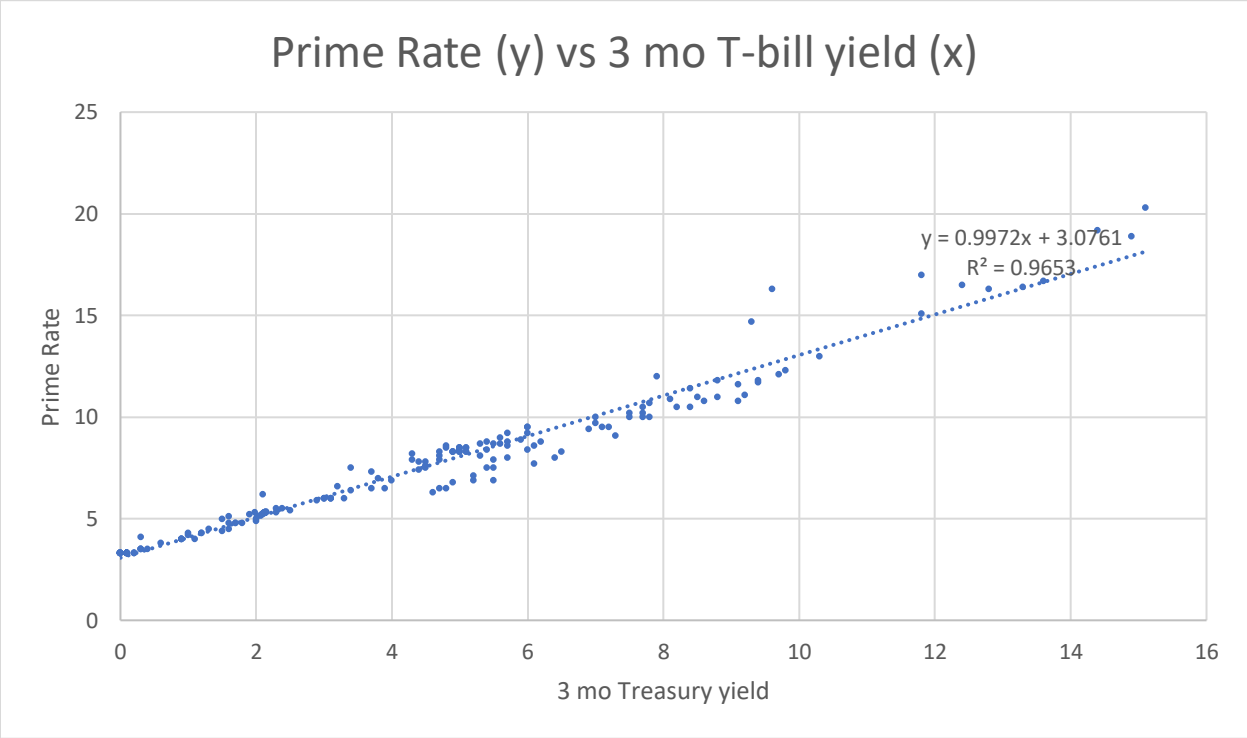
> Reserve is cutting interest rates. Neither seems to be sustainable. … But perhaps the most telltale sign of just how little investors seem to mind the 'ratings cliff' between investment- and speculative-grade is how they're gobbling up double-B bonds just as voraciously as triple-Bs. In fact, on Oct. 28, the spread between the two dropped to 43 basis points, a new low, according to Bloomberg Barclays data. At the start of 2019, it was as high as 172 basis points. Even though triple-B corporate bonds are having their best year in a decade, double-B debt isn't far behind." (see https://www.bloomberg.com/opinion/articles/2019-11-04/alarms-still-blare-on-triple-b-bonds-but-no-one-cares; Nov. 4, 2019)

Prime Rate

Analysis

The Prime Rate is historically very tightly coupled to very short-term Treasury Bills (specifically, 3-month yields). Capitalytics models show the Prime Rate rising in the next few years from its current level of 5.3% to 5.55% by mid- to late-2022, and then fluctuating consistently above 5.4% through 2024.

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



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. For the foreseeable future, and depending on the geo-political stability of the Middle East and other OPEC nations, gasoline prices are expected to drop slightly from 2019 levels, but increase by a few pennies per gallon per year through 2024.

Other Commentary

- Kiplinger reports "… the national average gas price may hit $3 sometime this spring or summer, a level it hasn't reached since 2014. Diesel, now averaging $3.01 per gallon, is also little changed from a week ago and will probably hold steady this winter." (see https://www.kiplinger.com/article/business/T019-C000-S010-energy-price-forecast.html; Jan. 13, 2019)
- Per The Balance, "[The U.S. Energy Information Administration] predicts [Brent global] crude oil prices will average $64/barrel in the second half of 2019 … West Texas Crude will average around $6.60/barrel less. … Since oil contracts are priced in dollars, a strong dollar depresses oil prices. Oil companies are laying off workers. Some may default on their debt. High yield bond funds haven't done well as a result. … The oil market is still responding to the impact of U.S. shale oil production. That reduced oil prices by 25% in 2014 and 2015. … That raised profit margins. It also gave consumers more disposable income to spend. The slight slowdown is because both companies and families are saving instead of spending." (see https://www.thebalance.com/us-economic-outlook-3305669; Aug 27, 2019)

Cost of Federal Funds (Primary Credit Rate)

Analysis

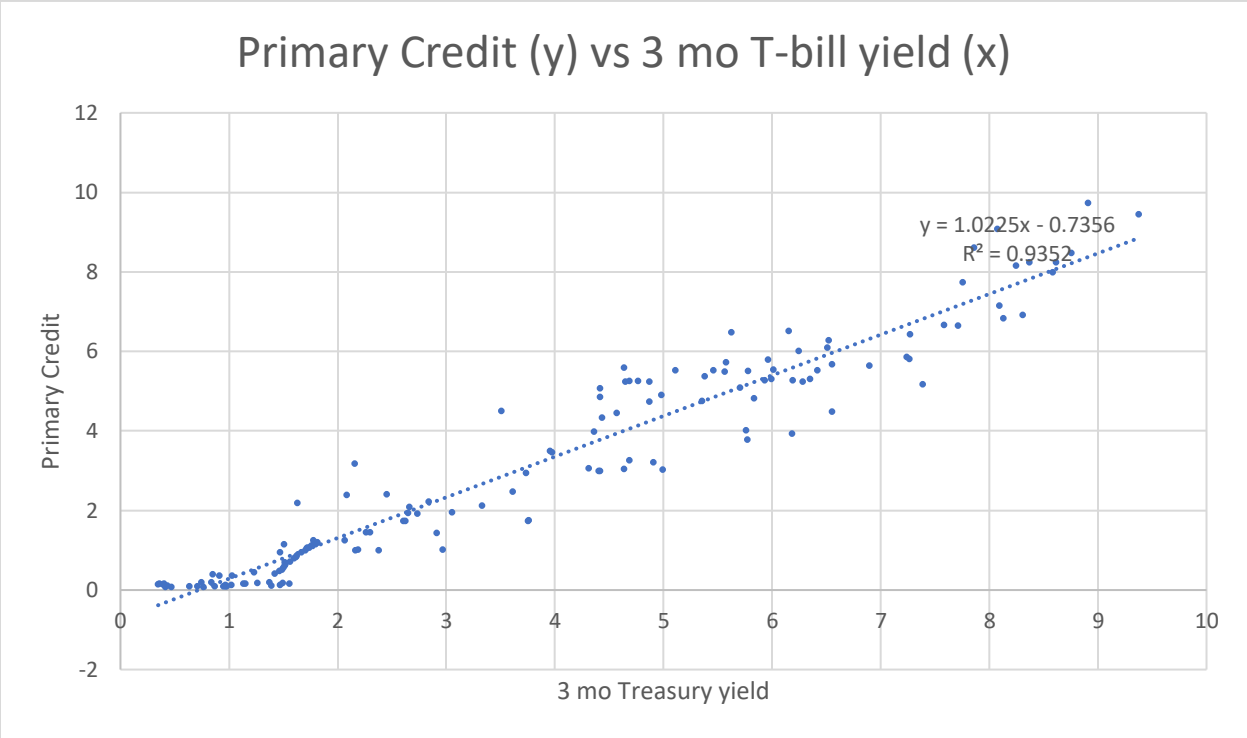
When a depository institution has a shortfall and need for liquidity, it may borrow funds on a short-term basis from the Federal Reserve. The "discount rate" is the interest rate charged to commercial banks and other depository institutions on loans they receive from their regional Federal Reserve Bank's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

The Primary Credit rate for 3Q2019 is 2.2%, and Capitalytics is projecting it to fall to around 1.5% by the end of 2020. Our quantitative models continue that drop to below 1.0% by 2024, but we find that outcome to be unlikely for several reasons, with a realistic floor remaining around 1.0-1.2%.

The accompanying chart serves to illustrate the relationship between the Primary Credit rate and the 3-month T-bill yield.

Other Commentary

- "The Fed has been adding large amounts of short-term liquidity to financial markets since September, when short-term interest rates surged unexpectedly. Then, big banks that normally lend cash short term to other financial companies pulled back, causing money-market rates to go up. Most notably, the federal-funds rate, a key focus of central-bank policy, moved above its range." (see https://www.wsj.com/articles/new-york-fed-adds-60-7-billion-to-financial-markets-11578929190; Jan. 13, 2020)

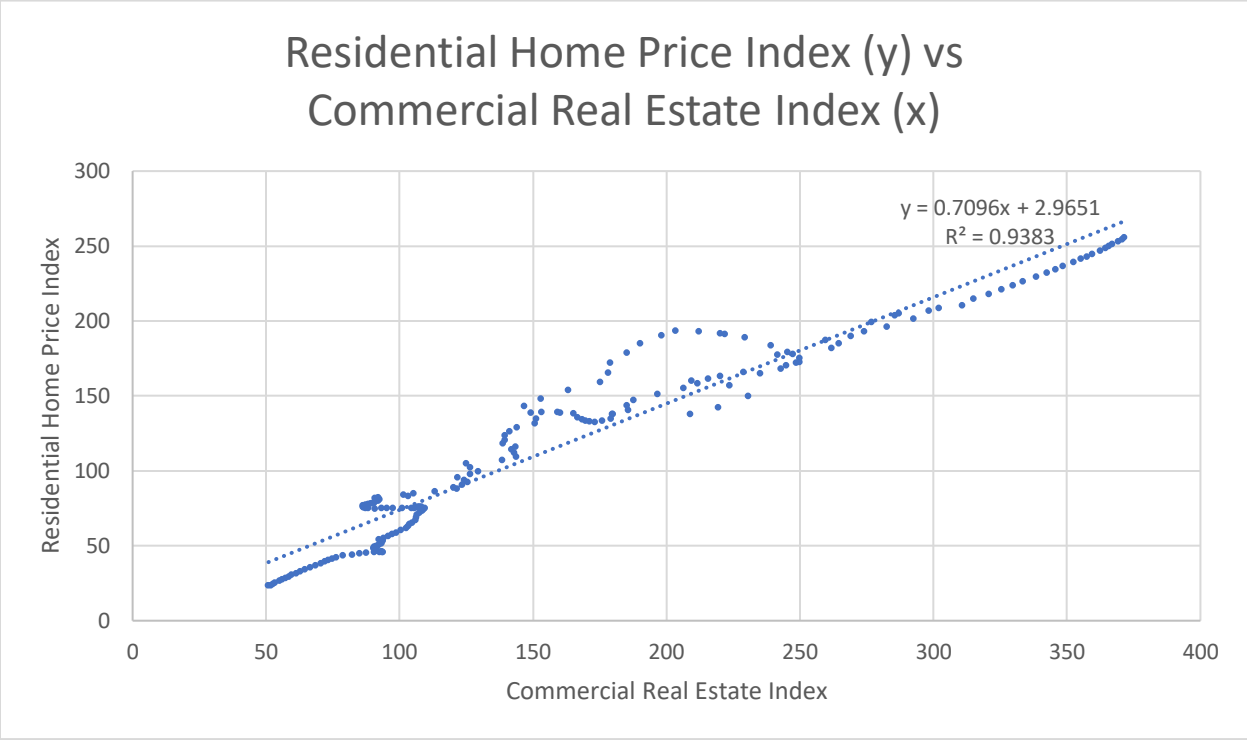


House and Commercial Real Estate Price Indexes

Analysis

New home-construction and home sales (both new- and existing-home sales) have dropped dramatically since the end of 2018. These trends will be reflected in the Home Real Estate Price Index as it may grow by as much as 1% per quarter nationally over the next several quarters (from 210 in 3Q2019, to 222 at YE2020, to 243 at YE2023), while still being driven by the aforementioned trends.

The Commercial Real Estate Price index is currently projected to grow at between 0.4% and 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 approximately 1%-2% per quarter over the next 60 months (from 311 in 3Q2019, to 334 at YE2020, to 367 at YE2023).



Other Commentary

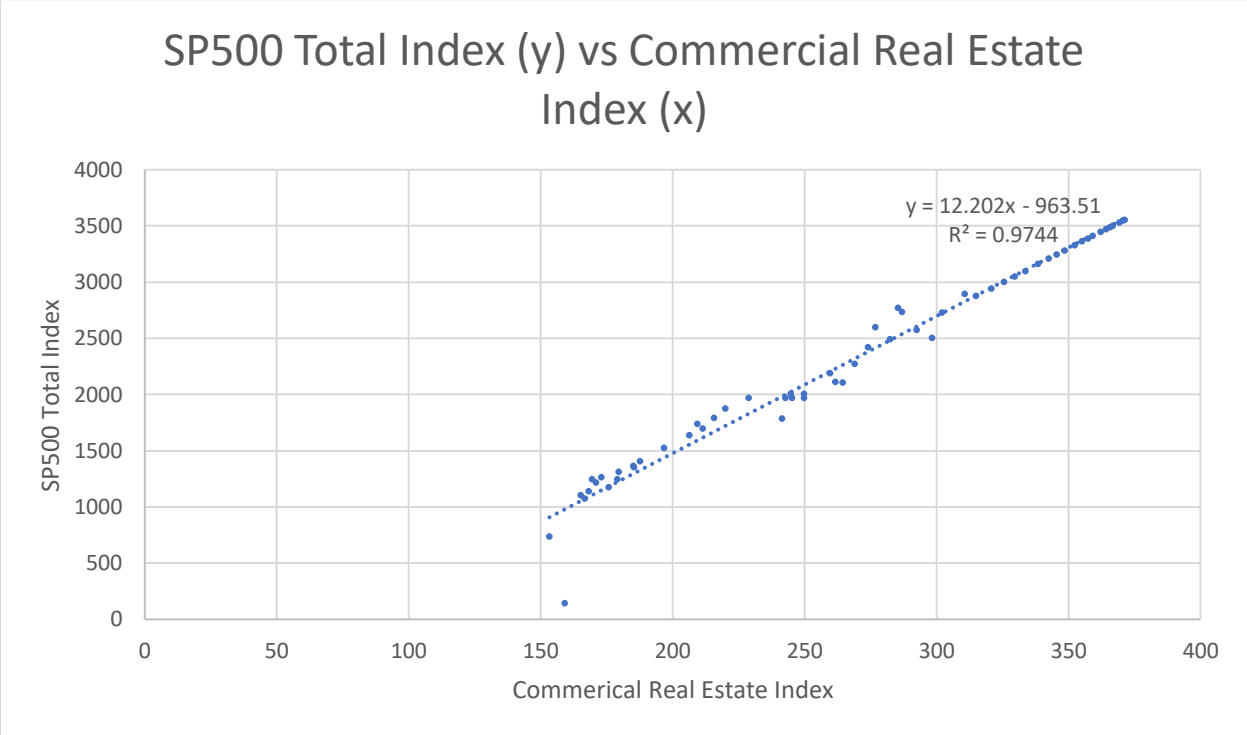
- Per the National Association of Realtors, "… numerous experts have lowered their housing market predictions for the next 5 years for home prices and appreciation rates. According to Zillow's Home Price Expectations Survey (which surveyed a panel of over 100 real estate and economic experts), experts forecast that home prices will rise only 2.8% in 2020 nationally." (see https://www.mashvisor.com/blog/us-housing-market-predictions-2020/; Sept 7, 2019)
- The S&P CoreLogic Case-Shiller National Home Price Index rose 3.4% in May from a year ago, down from 3.5% growth in the previous month. Home-price growth has declined on a year-to-year basis for 14 consecutive months. Double-digit price gains have vanished across the nation, after being the norm in many coastal cities just a couple of years ago. (see https://www.kiplinger.com/article/business/T019-C000-S003-housing-market-forecast-housing-starts-home-sales.html; Aug 1, 2019)

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

Analysis

Given the business- and investor-friendly administration that is currently installed in the United States, we expect growth (albeit decreasing) occurring steadily in 2020 in concert with the next round of legislative elections.

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. While our quantitative analysis presents the Dow metric as crossing 31,000 in mid-2020, we believe that a more realistic timeframe for this outcome will be mid-2021 (again, assuming that the Republican controlled White House remains intact). Our quantitative analysis also sees a strong relationship between the S&P 500 and the previously discussed Commercial Real Estate Index, and presents that it pass its 3,000 point milestone in 2Q2020, and grow by another 10% by the end of 2023.



Other Commentary

- "The DOW reached record levels this summer and if Trump were to give China a big, big break in a new bilateral trade deal, the DOW would move upward. It could reach 30,000 by next May if China gets its way. Yet President Trump is tough on dealing, and won't be giving China freebies. He trashes them frequently on Twitter and his disdain for them is obvious. And the Democrats wouldn't give China major freebies either if they won the

2020 election. Dems or Trump, there's no going back to the past — a key fact for the DJIA." (from https://gordcollins.com/stock-market/dow-jones-forecast/; Sept 2, 2019)

Market Volatility Index

Analysis

Capitalytics is calling for the Market Volatility Index to fluctuate between 14 and 16 over the next five years. We again caveat the statement as we did last quarter, saying that we find "stability" to be fairly unlikely for next few years, and would caution our clients in relying on this information. It should 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

- "As the market has gotten more volatile, there's been a pickup in the VIX – the CBOE Volatility Index –which reflects action on options of S&P 500 component stocks maturing in about a month. … VIX close of 18.47 means that a month from now, the options market is predicting the S&P will be either 5.3% higher or 5.3% lower [sic, the latter being more likely] … Such a downward move will bring the S&P more in line with the broader indexes which are already showing the market in a bearish stance." (from https://www.forbes.com/sites/brendancoffey/2019/08/18/the-vix-projects-the-sp-going-bearish/#19ea44c769df; Aug 18, 2019)

Regression Analyses

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

Regression for Real GDP growth

	Dependent variable (+/- SE):
	Real GDP growth
Constant	1.476 (+/- 0.748)
	p = 0.056*
5-year Treasury Yield	0.434 (+/- 0.422)
	p = 0.310
Observations	40
R^2	0.027
Adjusted R^2	0.002
Residual Std. Error	1.546 (df = 38)
F Statistic	1.062 (df = 1; 38)
Note:	*p<0.1; **p<0.05; ***p<0.01

Regression for Nominal GDP growth

	Dependent variable (+/- SE):
	Nominal GDP growth
Constant	3.956 (+/- 2.822)
	p = 0.171
US Fed Reserve O-N Loan Rate	-1.328 (+/- 0.580)
	p = 0.029**
Moody's BAA Curve	-2.919 (+/- 1.065)
	p = 0.010***
Real disposable income growth	-0.676 (+/- 0.241)
	p = 0.009***
Nominal disposable income growth	0.556 (+/- 0.232)
	p = 0.023**
30-year Mortgage Rate	3.632 (+/- 1.352)
	p = 0.012**
Observations	40
R^2	0.344
Adjusted R^2	0.248
Residual Std. Error	1.701 (df = 34)
F Statistic	3.566** (df = 5; 34)
Note:	*p<0.1; **p<0.05; ***p<0.01

Regression for Real disposable income growth

	Dependent variable (+/- SE):
	Real disposable income growth
Constant	0.898 (+/- 2.678)
	p = 0.740
10-year Treasury Yield	0.622 (+/- 1.048)
	p = 0.557
Observations	40
R^2	0.009
Adjusted R^2	-0.017
Residual Std. Error	3.812 (df = 38)
F Statistic	0.352 (df = 1; 38)
Note:	*p<0.1; **p<0.05; ***p<0.01

Regression for Nominal disposable income growth

	Dependent variable (+/- SE):
	Nominal disposable income growth
Constant	0.377 (+/- 2.795)
	p = 0.894
10-year Treasury Yield	1.416 (+/- 1.094)
	p = 0.204
Observations	40
R^2	0.042
Adjusted R^2	0.017
Residual Std. Error	3.977 (df = 38)
F Statistic	1.677 (df = 1; 38)
Note:	*p<0.1; **p<0.05; ***p<0.01

Regression for CPI Inflation Rate

	Dependent variable (+/- SE):
	CPI Inflation Rate
Constant	-46.562 (+/- 10.650)
	p = 0.0002***
US Fed Reserve O-N Loan Rate	-2.924 (+/- 0.816)
	p = 0.002***
Real disposable income growth	-1.270 (+/- 0.088)
	p = 0.000***
Nominal disposable income growth	1.258 (+/- 0.085)
	p = 0.000***
Unemployment Rate	1.665 (+/- 0.423)
	p = 0.001***
30-year Mortgage Rate	2.446 (+/- 1.073)
	p = 0.031**
Dow Total Stock Market Index	0.0004 (+/- 0.0001)
	p = 0.001***
Home Price Index	0.117 (+/- 0.034)
	p = 0.002***
Market Volatility Index	0.047 (+/- 0.016)
	p = 0.008***
30-year Treasury Yield	2.960 (+/- 0.993)
	p = 0.007***
10-year Treasury Yield	-2.174 (+/- 0.888)
	p = 0.022**
7-year Treasury Yield	-4.628 (+/- 1.647)
	p = 0.010***
3-year Treasury Yield	2.833 (+/- 1.200)
	p = 0.026**
Observations	40
R^2	0.918
Adjusted R^2	0.881
Residual Std. Error	0.508 (df = 27)
F Statistic	25.133*** (df = 12; 27)
Note:	*p<0.1; **p<0.05; ***p<0.01

Unemployment Rate

Regression for Unemployment Rate

	Dependent variable (+/- SE):
	Unemployment Rate
Constant	17.993 (+/- 0.888)
	p = 0.000***
Real disposable income growth	0.179 (+/- 0.057)
	p = 0.004***
Nominal disposable income growth	-0.183 (+/- 0.055)
	p = 0.003***
CPI Inflation Rate	0.116 (+/- 0.046)
	p = 0.017**
Dow Total Stock Market Index	-0.0002 (+/- 0.00003)
	p = 0.000***
Home Price Index	-0.039 (+/- 0.006)
	p = 0.00000***
Market Volatility Index	-0.021 (+/- 0.004)
	p = 0.0001***
30-year Treasury Yield	-2.828 (+/- 0.615)
	p = 0.0001***
20-year Treasury Yield	2.799 (+/- 0.557)
	p = 0.00003***
10-year Treasury Yield	0.697 (+/- 0.197)
	p = 0.002***
3-month Treasury Yield	0.626 (+/- 0.068)
	p = 0.000***
5-year Treasury Yield	-0.562 (+/- 0.217)
	p = 0.016**
Observations	40
R^2	0.996
Adjusted R^2	0.995
Residual Std. Error	0.155 (df = 28)
F Statistic	655.769*** (df = 11; 28)
Note:	*p<0.1; **p<0.05; ***p<0.01

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

Regression for 1-month Treasury Yield

	Dependent variable (+/- SE):
	1-month Treasury Yield
Constant	1.480 (+/- 0.521)
	p = 0.008***
Moody's AAA Curve	-0.306 (+/- 0.089)
	p = 0.002***
Real disposable income growth	-0.027 (+/- 0.011)
	p = 0.021**
Nominal disposable income growth	0.023 (+/- 0.010)
	p = 0.036**
Unemployment Rate	-0.034 (+/- 0.010)
	p = 0.002***
30-year Mortgage Rate	0.430 (+/- 0.096)
	p = 0.0001***
Prime Rate	-0.527 (+/- 0.153)
	p = 0.002***
3-month Treasury Yield	1.320 (+/- 0.145)
	p = 0.000***
Observations	40
R^2	0.993
Adjusted R^2	0.992
Residual Std. Error	0.071 (df = 32)
F Statistic	677.710*** (df = 7; 32)
Note:	*p<0.1; **p<0.05; ***p<0.01

Regression for 3-month Treasury Yield

	Dependent variable (+/- SE):
	3-month Treasury Yield
Constant	-3.109 (+/- 0.727)
	p = 0.0002***
SP500 Stock Price Index	0.0003 (+/- 0.0001)
	p = 0.017**
Moody's AAA Curve	-0.262 (+/- 0.064)
	p = 0.0003***
Moody's BAA Curve	0.206 (+/- 0.072)
	p = 0.008***
Unemployment Rate	0.162 (+/- 0.037)
	p = 0.0002***
Home Price Index	0.010 (+/- 0.003)
	p = 0.002***
1-month Treasury Yield	1.465 (+/- 0.137)
	p = 0.000***
6-month Treasury Yield	-0.639 (+/- 0.124)
	p = 0.00002***
Observations	40
R^2	0.994
Adjusted R^2	0.993
Residual Std. Error	0.065 (df = 32)
F Statistic	783.942*** (df = 7; 32)
Note:	*p<0.1; **p<0.05; ***p<0.01

Regression for 6-month Treasury Yield

	Dependent variable (+/- SE):
	6-month Treasury Yield
Constant	2.703 (+/- 0.835)
	p = 0.003***
Real disposable income growth	-0.059 (+/- 0.018)
	p = 0.003***
Nominal disposable income growth	0.057 (+/- 0.017)
	p = 0.003***
Prime Rate	-0.757 (+/- 0.253)
	p = 0.006***
10-year Treasury Yield	-0.421 (+/- 0.067)
	p = 0.00000***
3-month Treasury Yield	1.474 (+/- 0.244)
	p = 0.00000***
5-year Treasury Yield	0.576 (+/- 0.086)
	p = 0.00000***
Observations	40
R^2	0.983
Adjusted R^2	0.980
Residual Std. Error	0.116 (df = 33)
F Statistic	318.950*** (df = 6; 33)
Note:	*p<0.1; **p<0.05; ***p<0.01

Regression for 1-year Treasury Yield

	Dependent variable (+/- SE):
	1-year Treasury Yield
Constant	3.725 (+/- 1.037)
	p = 0.002***
Real disposable income growth	-0.069 (+/- 0.022)
	p = 0.004***
Nominal disposable income growth	0.066 (+/- 0.021)
	p = 0.004***
Prime Rate	-1.032 (+/- 0.314)
	p = 0.003***
10-year Treasury Yield	-0.567 (+/- 0.084)
	p = 0.00000***
3-month Treasury Yield	1.601 (+/- 0.303)
	p = 0.00001***
5-year Treasury Yield	0.802 (+/- 0.107)
	p = 0.000***
Observations	40
R^2	0.974
Adjusted R^2	0.969
Residual Std. Error	0.144 (df = 33)
F Statistic	205.191*** (df = 6; 33)
Note:	*p<0.1; **p<0.05; ***p<0.01

Regression for 3-year Treasury Yield

	Dependent variable (+/- SE):
	3-year Treasury Yield
Constant	1.486 (+/- 1.562)
	p = 0.349
Nominal GDP growth	0.037 (+/- 0.016)
	p = 0.030**
Prime Rate	-1.159 (+/- 0.418)
	p = 0.010***
Dow Total Stock Market Index	0.0001 (+/- 0.00001)
	p = 0.00000***
Market Volatility Index	0.012 (+/- 0.005)
	p = 0.015**
US Avg Retail Gasoline Price ($-gal; all grades, all formulations)	-0.232 (+/- 0.075)
	p = 0.004***
30-year Treasury Yield	0.540 (+/- 0.074)
	p = 0.00000***
3-month Treasury Yield	1.374 (+/- 0.389)
	p = 0.002***
Observations	40
R^2	0.938
Adjusted R^2	0.925
Residual Std. Error	0.189 (df = 32)
F Statistic	69.601*** (df = 7; 32)
Note:	*p<0.1; **p<0.05; ***p<0.01

Regression for 5-year Treasury Yield

	Dependent variable (+/- SE):
	5-year Treasury Yield
Constant	-2.201 (+/- 1.193)
	p = 0.076*
US Fed Reserve O-N Loan Rate	0.299 (+/- 0.091)
	p = 0.003***
Moody's BAA Curve	0.523 (+/- 0.124)
	p = 0.0003***
Nominal GDP growth	0.047 (+/- 0.016)
	p = 0.008***
Nominal disposable income growth	0.017 (+/- 0.008)
	p = 0.043**
Dow Total Stock Market Index	0.0002 (+/- 0.00004)
	p = 0.0002***
Commercial Real Estate Price Index	-0.013 (+/- 0.005)
	p = 0.021**
Market Volatility Index	0.013 (+/- 0.005)
	p = 0.019**
US Avg Retail Gasoline Price ($-gal; all grades, all formulations)	-0.343 (+/- 0.100)
	p = 0.002***
30-year Treasury Yield	0.321 (+/- 0.098)
	p = 0.003***
Observations	40
R^2	0.918
Adjusted R^2	0.893
Residual Std. Error	0.192 (df = 30)
F Statistic	37.211*** (df = 9; 30)
Note:	*p<0.1; **p<0.05; ***p<0.01

Regression for 7-year Treasury Yield

	Dependent variable (+/- SE):
	7-year Treasury Yield
Constant	-1.042 (+/- 2.162)
	p = 0.633
SP500 Stock Price Index	0.002 (+/- 0.001)
	p = 0.011**
Unemployment Rate	0.321 (+/- 0.134)
	p = 0.023**
BBB corporate yield	0.479 (+/- 0.138)
	p = 0.002***
Prime Rate	-1.282 (+/- 0.451)
	p = 0.008***
1-month Treasury Yield	1.203 (+/- 0.398)
	p = 0.005***
Observations	40
R^2	0.566
Adjusted R^2	0.502
Residual Std. Error	0.380 (df = 34)
F Statistic	8.876*** (df = 5; 34)
Note:	*p<0.1; **p<0.05; ***p<0.01

Regression for 10-year Treasury Yield

	Dependent variable (+/- SE):
	10-year Treasury Yield
Constant	-2.240 (+/- 0.601)
	p = 0.001***
Dow Total Stock Market Index	0.0001 (+/- 0.00001)
	p = 0.0002***
Market Volatility Index	0.021 (+/- 0.006)
	p = 0.003***
30-year Treasury Yield	0.989 (+/- 0.110)
	p = 0.000***
Observations	40
R^2	0.723
Adjusted R^2	0.700
Residual Std. Error	0.319 (df = 36)
F Statistic	31.351*** (df = 3; 36)
Note:	*p<0.1; **p<0.05; ***p<0.01

Regression for 20-year Treasury Yield

	Dependent variable (+/- SE):
	20-year Treasury Yield
Constant	-0.747 (+/- 1.910)
	p = 0.699
SP500 Stock Price Index	0.002 (+/- 0.001)
	p = 0.002***
US Fed Reserve O-N Loan Rate	-4.412 (+/- 1.642)
	p = 0.012**
Real GDP growth	0.335 (+/- 0.130)
	p = 0.016**
Nominal GDP growth	-0.322 (+/- 0.117)
	p = 0.011**
Real disposable income growth	-0.275 (+/- 0.087)
	p = 0.004***
Nominal disposable income growth	0.277 (+/- 0.085)
	p = 0.003***
Unemployment Rate	0.782 (+/- 0.159)
	p = 0.00004***
Prime Rate	-1.106 (+/- 0.482)
	p = 0.030**
US Avg Retail Gasoline Price ($-gal; all grades, all formulations)	-0.513 (+/- 0.172)
	p = 0.006***
1-month Treasury Yield	5.063 (+/- 1.528)
	p = 0.003***
Observations	40
R^2	0.769
Adjusted R^2	0.689
Residual Std. Error	0.349 (df = 29)
F Statistic	9.646*** (df = 10; 29)
Note:	*p<0.1; **p<0.05; ***p<0.01

Regression for 30-year Treasury Yield

	Dependent variable (+/- SE):
	30-year Treasury Yield
Constant	0.909 (+/- 0.178)
	p = 0.00002***
10-year Treasury Yield	1.725 (+/- 0.140)
	p = 0.000***
5-year Treasury Yield	-1.691 (+/- 0.247)
	p = 0.00000***
3-year Treasury Yield	0.694 (+/- 0.158)
	p = 0.0001***
Observations	40
R^2	0.862
Adjusted R^2	0.851
Residual Std. Error	0.233 (df = 36)
F Statistic	74.999*** (df = 3; 36)
Note:	*p<0.1; **p<0.05; ***p<0.01

30-year Mortgage Rate

Regression for 30-year Mortgage Rate

	Dependent variable (+/- SE):
	30-year Mortgage Rate
Constant	1.888 (+/- 0.255)
	$p = 0.000^{***}$
Market Volatility Index	0.012 (+/- 0.005)
	$p = 0.012^{**}$
30-year Treasury Yield	0.560 (+/- 0.073)
	$p = 0.000^{***}$
1-month Treasury Yield	0.266 (+/- 0.055)
	$p = 0.00003^{***}$
Observations	40
R^2	0.687
Adjusted R^2	0.661
Residual Std. Error	0.253 (df = 36)
F Statistic	26.390^{***} (df = 3; 36)
Note:	$^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Moody's AAA & BAA Rates

Regression for Moody's AAA Curve

	Dependent variable (+/- SE):
	Moody's AAA Curve
Constant	1.372 (+/- 0.332)
	p = 0.0002***
Unemployment Rate	0.068 (+/- 0.031)
	p = 0.034**
BBB corporate yield	0.510 (+/- 0.096)
	p = 0.00001***
Observations	40
R^2	0.712
Adjusted R^2	0.697
Residual Std. Error	0.297 (df = 37)
F Statistic	45.764*** (df = 2; 37)
Note:	*p<0.1; **p<0.05; ***p<0.01

Regression for Moody's BAA Curve

	Dependent variable (+/- SE):
	Moody's BAA Curve
Constant	4.838 (+/- 0.538)
	p = 0.000***
SP500 Stock Price Index	-0.001 (+/- 0.0001)
	p = 0.00001***
Nominal GDP growth	-0.042 (+/- 0.017)
	p = 0.019**
BBB corporate yield	0.229 (+/- 0.096)
	p = 0.023**
5-year Treasury Yield	0.548 (+/- 0.103)
	p = 0.00001***
6-month Treasury Yield	1.057 (+/- 0.445)
	p = 0.024**
1-year Treasury Yield	-1.125 (+/- 0.460)
	p = 0.020**
Observations	40
R^2	0.909
Adjusted R^2	0.892
Residual Std. Error	0.192 (df = 33)
F Statistic	54.786*** (df = 6; 33)
Note:	*p<0.1; **p<0.05; ***p<0.01

BBB Corporate Yield

Regression for BBB corporate yield

	Dependent variable (+/- SE):
	BBB corporate yield
Constant	-0.692 (+/- 0.521)
	p = 0.193
Moody's BAA Curve	0.942 (+/- 0.097)
	p = 0.000***
Nominal GDP growth	0.059 (+/- 0.027)
	p = 0.039**
6-month Treasury Yield	-1.918 (+/- 0.704)
	p = 0.010***
1-year Treasury Yield	1.895 (+/- 0.703)
	p = 0.011**
Observations	40
R^2	0.799
Adjusted R^2	0.776
Residual Std. Error	0.319 (df = 35)
F Statistic	34.776*** (df = 4; 35)
Note:	*p<0.1; **p<0.05; ***p<0.01

Prime Rate

Regression for Prime Rate

	Dependent variable (+/- SE):
	Prime Rate
Constant	-0.119 (+/- 0.923)
	p = 0.899
SP500 Stock Price Index	0.0003 (+/- 0.0001)
	p = 0.039**
Unemployment Rate	0.200 (+/- 0.054)
	p = 0.001***
Home Price Index	0.013 (+/- 0.004)
	p = 0.003***
30-year Treasury Yield	-0.147 (+/- 0.045)
	p = 0.003***
1-month Treasury Yield	1.681 (+/- 0.187)
	p = 0.000***
6-month Treasury Yield	-0.960 (+/- 0.177)
	p = 0.00001***
Observations	40
R^2	0.987
Adjusted R^2	0.984
Residual Std. Error	0.090 (df = 33)
F Statistic	411.032*** (df = 6; 33)
Note:	*p<0.1; **p<0.05; ***p<0.01

US Average Retail Gasoline Price

Regression for US Avg Retail Gasoline Price (-gal; all grades, all formulations)

	Dependent variable (+/- SE):
	US Avg Retail Gasoline Price ($-gal; all grades, all formulations)
Constant	19.023 (+/- 2.610) p = 0.00000***
Moody's BAA Curve	-0.521 (+/- 0.115) p = 0.0001***
Real disposable income growth	-0.097 (+/- 0.038) p = 0.016**
Nominal disposable income growth	0.091 (+/- 0.037) p = 0.020**
Unemployment Rate	-0.555 (+/- 0.141) p = 0.0005***
Home Price Index	-0.070 (+/- 0.012) p = 0.00001***
20-year Treasury Yield	0.529 (+/- 0.125) p = 0.0002***
3-month Treasury Yield	1.382 (+/- 0.194) p = 0.00000***
1-year Treasury Yield	-0.728 (+/- 0.195) p = 0.001***
Observations	40
R^2	0.851
Adjusted R^2	0.812
Residual Std. Error	0.230 (df = 31)
F Statistic	22.116*** (df = 8; 31)
Note:	*p<0.1; **p<0.05; ***p<0.01

Cost of Federal Funds (Primary Credit Rate)

Regression for US Fed Reserve O-N Loan Rate

	Dependent variable (+/- SE):
	US Fed Reserve O-N Loan Rate
Constant	0.185 (+/- 0.058)
	p = 0.004***
Real disposable income growth	-0.038 (+/- 0.012)
	p = 0.003***
Nominal disposable income growth	0.036 (+/- 0.011)
	p = 0.003***
10-year Treasury Yield	-0.267 (+/- 0.046)
	p = 0.00001***
3-month Treasury Yield	0.821 (+/- 0.032)
	p = 0.000***
5-year Treasury Yield	0.366 (+/- 0.058)
	p = 0.00000***
Observations	40
R^2	0.991
Adjusted R^2	0.989
Residual Std. Error	0.080 (df = 34)
F Statistic	714.024*** (df = 5; 34)
Note:	*p<0.1; **p<0.05; ***p<0.01

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

Regression for Dow Total Stock Market Index

	Dependent variable (+/- SE):
	Dow Total Stock Market Index
Constant	16,898.720 (+/- 3,097.556) p = 0.00001***
Unemployment Rate	-2,175.296 (+/- 94.779) p = 0.000***
Prime Rate	4,009.335 (+/- 805.099) p = 0.00002***
Market Volatility Index	-70.270 (+/- 13.516) p = 0.00002***
US Avg Retail Gasoline Price ($-gal; all grades, all formulations)	970.995 (+/- 286.464) p = 0.002***
1-month Treasury Yield	-3,049.204 (+/- 936.451) p = 0.003***
3-year Treasury Yield	2,131.667 (+/- 403.472) p = 0.00001***
Observations	40
R^2	0.991
Adjusted R^2	0.989
Residual Std. Error	628.151 (df = 33)
F Statistic	590.104*** (df = 6; 33)
Note:	*p<0.1; **p<0.05; ***p<0.01

Regression for SP500 Stock Price Index

	Dependent variable (+/- SE):
	SP500 Stock Price Index
Constant	1,247.343 (+/- 381.667)
	p = 0.003***
Moody's AAA Curve	571.937 (+/- 118.065)
	p = 0.00004***
Moody's BAA Curve	-799.387 (+/- 99.032)
	p = 0.000***
Real disposable income growth	45.930 (+/- 16.009)
	p = 0.008***
Nominal disposable income growth	-45.990 (+/- 15.339)
	p = 0.006***
Prime Rate	443.756 (+/- 44.991)
	p = 0.000***
30-year Treasury Yield	2,644.640 (+/- 537.049)
	p = 0.00003***
20-year Treasury Yield	-3,205.892 (+/- 530.748)
	p = 0.00001***
7-year Treasury Yield	821.401 (+/- 84.982)
	p = 0.000***
Observations	40
R^2	0.976
Adjusted R^2	0.970
Residual Std. Error	102.397 (df = 31)
F Statistic	157.017*** (df = 8; 31)
Note:	*p<0.1; **p<0.05; ***p<0.01

House and Commercial Real Estate Price Indexes

Regression for Home Price Index

	Dependent variable (+/- SE):
	Home Price Index
Constant	222.663 (+/- 3.649)
	p = 0.000***
Unemployment Rate	-8.502 (+/- 0.337)
	p = 0.000***
US Avg Retail Gasoline Price ($-gal; all grades, all formulations)	-4.784 (+/- 1.082)
	p = 0.0002***
1-month Treasury Yield	-30.476 (+/- 13.140)
	p = 0.027**
3-month Treasury Yield	20.273 (+/- 5.092)
	p = 0.0004***
6-month Treasury Yield	53.583 (+/- 23.858)
	p = 0.032**
3-year Treasury Yield	12.786 (+/- 2.372)
	p = 0.00001***
1-year Treasury Yield	-43.175 (+/- 16.201)
	p = 0.012**
Observations	40
R^2	0.993
Adjusted R^2	0.991
Residual Std. Error	2.474 (df = 32)
F Statistic	618.109*** (df = 7; 32)
Note:	*p<0.1; **p<0.05; ***p<0.01

Regression for Commercial Real Estate Price Index

	Dependent variable (+/- SE):
	Commercial Real Estate Price Index
Constant	304.682 (+/- 9.780) p = 0.000***
Real disposable income growth	3.902 (+/- 1.890) p = 0.047**
Nominal disposable income growth	-3.798 (+/- 1.834) p = 0.047**
Unemployment Rate	-17.871 (+/- 0.712) p = 0.000***
CPI Inflation Rate	3.411 (+/- 1.541) p = 0.034**
Prime Rate	13.968 (+/- 1.749) p = 0.000***
US Avg Retail Gasoline Price ($-gal; all grades, all formulations)	-5.625 (+/- 2.215) p = 0.016**
Observations	40
R^2	0.989
Adjusted R^2	0.987
Residual Std. Error	5.489 (df = 33)
F Statistic	486.215*** (df = 6; 33)
Note:	*p<0.1; **p<0.05; ***p<0.01

Market Volatility Index

Regression for Market Volatility Index

	Dependent variable (+/- SE):
	Market Volatility Index
Constant	254.922 (+/- 36.216)
	p = 0.00000***
Unemployment Rate	-11.798 (+/- 2.407)
	p = 0.00003***
Dow Total Stock Market Index	-0.006 (+/- 0.001)
	p = 0.00000***
30-year Treasury Yield	-66.855 (+/- 20.613)
	p = 0.003***
20-year Treasury Yield	62.525 (+/- 18.734)
	p = 0.003***
3-month Treasury Yield	9.736 (+/- 2.319)
	p = 0.0002***
Observations	40
R^2	0.666
Adjusted R^2	0.617
Residual Std. Error	5.566 (df = 34)
F Statistic	13.573*** (df = 5; 34)
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 "2019 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/newsevents/pressreleases/files/bcreg20190213a1.pdf) are listed. Please note that shaded attributes are not discussed within this report.

Attribute	Referenced Source[26]
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

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

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).[27]
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.

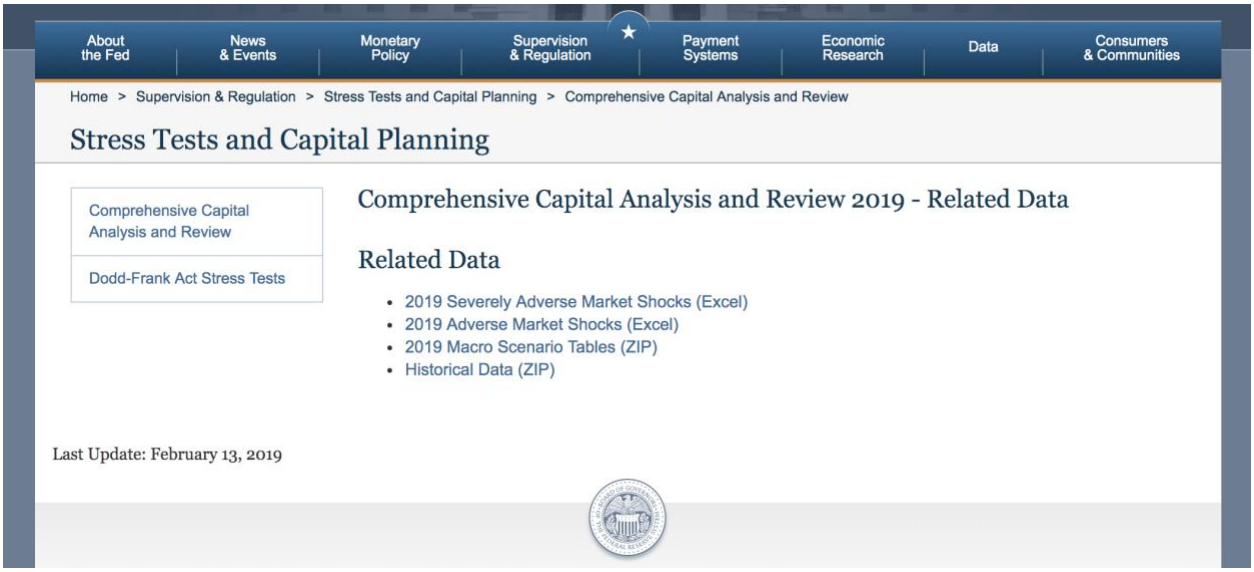
[27] The Merrill Lynch 10-year BBB corporate bond rate is being discontinued from future Z.1 releases as of April 30, 2019 due to licensing restrictions.

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 June 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[28].

[28] 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) 3Q2019.

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/supervisoryreg/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) 3Q2019.

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.

Section I: General Forecasting Methodology

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

For each metric, four distinct forecasts are produced.

1. The first forecast uses the full quarterly history of the metric as an input to an additive exponential smoothing representation. The process that is executed is that provided by R's[29] "forecast" package[30]; specifically, the "ets" function (see p.39 of https://cran.r-project.org/web/packages/forecast/forecast.pdf)[31] 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)[32], 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

[29] As of this writing, v.3.6.2of the "R" language is available at https://cran.r-project.org/.
[30] As of this writing, v.8.10 of the forecast package is available at https://CRAN.R-project.org/package=forecast.
[31] 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.
[32] 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)[33].

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

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

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

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

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

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

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

   - the slope of the "best fitting" line (based on minimizing the total absolute error) using the immediately preceding 2 years of values[34];
   - the same slope using the immediately preceding 4 years of values; and,
   - the same slope using the immediately preceding 8 years of values.

[33] It bears noting that a lower value for the "score" indicates better accuracy of an algorithm.
[34] 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.

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[35].

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

[35] See the SP500 metric's analysis.

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.

Section III: Regression Construction

Capitalytics also generates a regression to estimate future values of the variables that we track in terms of current-day values. By using R's "lm" function, we estimate the next quarter's values for each variable in terms of the preceding set of variables' values. These regressions are built using the immediately preceding 40 sets of variables' values.

Each output variable is considered in turn as the response variable, with all other variables as possibilities for the control (independent) variables *excluding* any variables that have an 80% correlation with the response variable. Successive linear regressions are built; if any of the control variables' p-values exceed 5%, or if the model's p-value exceeds 5% and the number of considered control variables is greater than one, the most offensive control variable is dropped, and the regression is re-run.

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

Appendix C: Variable Correlations

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

Variable 1	Variable 2	Correlation
BBB Corporate Yield	US Average Retail Gasoline Price	0.690333
BBB Corporate Yield	20-year Treasury yield	-0.801413
BBB Corporate Yield	30-year Treasury yield	-0.641119
BBB Corporate Yield	3-year Treasury yield	-0.667981
BBB Corporate Yield	7-year Treasury yield	-0.746257
Commercial Real Estate Price Index	6-month Treasury yield	0.671452
Commercial Real Estate Price Index	US Average Retail Gasoline Price	-0.667148
Commercial Real Estate Price Index	1-year Treasury yield	0.68864
Commercial Real Estate Price Index	20-year Treasury yield	0.885671
Commercial Real Estate Price Index	30-year Treasury yield	0.752295
Commercial Real Estate Price Index	3-year Treasury yield	0.774735
Commercial Real Estate Price Index	7-year Treasury yield	0.858345
Primary Credit	Commercial Real Estate Price Index	0.658106
Primary Credit	**1-month Treasury yield**	**0.992901**
Primary Credit	3-month Treasury yield	-0.754762
Primary Credit	**6-month Treasury yield**	**0.993951**
Primary Credit	Moody's AAA Rate	0.801846
Primary Credit	Moody's BAA Rate	0.733779
Primary Credit	House Price Index	0.605853
Primary Credit	Prime Rate	-0.75632
Primary Credit	US Average Retail Gasoline Price	-0.628429
Primary Credit	10-year Treasury yield	-0.730931
Primary Credit	**1-year Treasury yield**	**0.987197**
Primary Credit	20-year Treasury yield	0.791279
Primary Credit	30-year Mortgage Rate	-0.713834
Primary Credit	**3-year Treasury yield**	**0.95464**
Primary Credit	5-year Treasury yield	-0.769461
Primary Credit	7-year Treasury yield	0.892872
Dow Jones Total Stock Market Index	6-month Treasury yield	0.603015
Dow Jones Total Stock Market Index	US Average Retail Gasoline Price	-0.620798
Dow Jones Total Stock Market Index	1-year Treasury yield	0.624077
Dow Jones Total Stock Market Index	20-year Treasury yield	0.836895
Dow Jones Total Stock Market Index	30-year Treasury yield	0.87531
Dow Jones Total Stock Market Index	3-year Treasury yield	0.719359
Dow Jones Total Stock Market Index	7-year Treasury yield	0.823068
1-month Treasury yield	**6-month Treasury yield**	**0.995362**
1-month Treasury yield	**1-year Treasury yield**	**0.988774**
1-month Treasury yield	3-year Treasury yield	0.932833
1-month Treasury yield	7-year Treasury yield	0.777184
3-month Treasury yield	6-month Treasury yield	-0.768908
3-month Treasury yield	1-year Treasury yield	-0.777445
3-month Treasury yield	3-year Treasury yield	-0.788218
6-month Treasury yield	**1-year Treasury yield**	**0.99804**
6-month Treasury yield	**3-year Treasury yield**	**0.973268**

Moody's AAA Rate	BBB Corporate Yield	-0.770879
Moody's AAA Rate	Commercial Real Estate Price Index	0.911045
Moody's AAA Rate	Dow Jones Total Stock Market Index	0.883415
Moody's AAA Rate	3-month Treasury yield	-0.708353
Moody's AAA Rate	6-month Treasury yield	0.815353
Moody's AAA Rate	**Moody's BAA Rate**	**0.973734**
Moody's AAA Rate	House Price Index	0.850678
Moody's AAA Rate	Prime Rate	-0.676747
Moody's AAA Rate	US Average Retail Gasoline Price	-0.779528
Moody's AAA Rate	10-year Treasury yield	-0.888995
Moody's AAA Rate	1-year Treasury yield	0.832519
Moody's AAA Rate	**20-year Treasury yield**	**0.981312**
Moody's AAA Rate	30-year Mortgage Rate	-0.871908
Moody's AAA Rate	30-year Treasury yield	0.942872
Moody's AAA Rate	3-year Treasury yield	0.902986
Moody's AAA Rate	5-year Treasury yield	-0.845236
Moody's AAA Rate	**7-year Treasury yield**	**0.964827**
Moody's BAA Rate	BBB Corporate Yield	-0.718448
Moody's BAA Rate	Commercial Real Estate Price Index	0.894697
Moody's BAA Rate	Dow Jones Total Stock Market Index	0.887234
Moody's BAA Rate	3-month Treasury yield	-0.606449
Moody's BAA Rate	6-month Treasury yield	0.74526
Moody's BAA Rate	House Price Index	0.833847
Moody's BAA Rate	US Average Retail Gasoline Price	-0.733121
Moody's BAA Rate	10-year Treasury yield	-0.833706
Moody's BAA Rate	1-year Treasury yield	0.762719
Moody's BAA Rate	20-year Treasury yield	0.917059
Moody's BAA Rate	30-year Mortgage Rate	-0.80821
Moody's BAA Rate	30-year Treasury yield	0.740428
Moody's BAA Rate	3-year Treasury yield	0.836457
Moody's BAA Rate	5-year Treasury yield	-0.773596
Moody's BAA Rate	7-year Treasury yield	0.907391
House Price Index	6-month Treasury yield	0.621222
House Price Index	1-year Treasury yield	0.639454
House Price Index	20-year Treasury yield	0.84826
House Price Index	30-year Treasury yield	0.644228
House Price Index	3-year Treasury yield	0.723422
House Price Index	7-year Treasury yield	0.806381
Prime Rate	6-month Treasury yield	-0.772703
Prime Rate	US Average Retail Gasoline Price	0.690022
Prime Rate	1-year Treasury yield	-0.780438
Prime Rate	20-year Treasury yield	-0.698171
Prime Rate	3-year Treasury yield	-0.786409
Prime Rate	7-year Treasury yield	-0.754148
US Average Retail Gasoline Price	3-month Treasury yield	0.70146
US Average Retail Gasoline Price	6-month Treasury yield	-0.652099
US Average Retail Gasoline Price	10-year Treasury yield	0.7749
US Average Retail Gasoline Price	1-year Treasury yield	-0.676024
US Average Retail Gasoline Price	20-year Treasury yield	-0.754679
US Average Retail Gasoline Price	3-year Treasury yield	-0.747043
US Average Retail Gasoline Price	5-year Treasury yield	0.764319
US Average Retail Gasoline Price	7-year Treasury yield	-0.783751
S&P 500 Stock Price Index	BBB Corporate Yield	0.716986

S&P 500 Stock Price Index	**Commercial Real Estate Price Index**	**-0.957246**
S&P 500 Stock Price Index	Primary Credit	0.770622
S&P 500 Stock Price Index	Dow Jones Total Stock Market Index	-0.942646
S&P 500 Stock Price Index	1-month Treasury yield	0.754788
S&P 500 Stock Price Index	3-month Treasury yield	-0.75295
S&P 500 Stock Price Index	6-month Treasury yield	0.769877
S&P 500 Stock Price Index	Moody's AAA Rate	-0.671695
S&P 500 Stock Price Index	Moody's BAA Rate	-0.763059
S&P 500 Stock Price Index	House Price Index	-0.945136
S&P 500 Stock Price Index	Prime Rate	-0.77142
S&P 500 Stock Price Index	Unemployment Rate	0.945507
S&P 500 Stock Price Index	1-year Treasury yield	0.764746
S&P 500 Stock Price Index	30-year Treasury yield	-0.666513
S&P 500 Stock Price Index	3-year Treasury yield	0.652893
Unemployment Rate	30-year Treasury yield	-0.612901
10-year Treasury yield	6-month Treasury yield	-0.746819
10-year Treasury yield	1-year Treasury yield	-0.763822
10-year Treasury yield	3-year Treasury yield	-0.819945
10-year Treasury yield	7-year Treasury yield	-0.868833
20-year Treasury yield	3-month Treasury yield	-0.697827
20-year Treasury yield	6-month Treasury yield	0.811387
20-year Treasury yield	10-year Treasury yield	-0.87434
20-year Treasury yield	1-year Treasury yield	0.834532
20-year Treasury yield	3-year Treasury yield	0.901149
20-year Treasury yield	5-year Treasury yield	-0.818451
20-year Treasury yield	**7-year Treasury yield**	**0.969222**
30-year Mortgage Rate	6-month Treasury yield	-0.7326
30-year Mortgage Rate	US Average Retail Gasoline Price	0.794607
30-year Mortgage Rate	1-year Treasury yield	-0.750816
30-year Mortgage Rate	20-year Treasury yield	-0.875051
30-year Mortgage Rate	3-year Treasury yield	-0.808666
30-year Mortgage Rate	7-year Treasury yield	-0.857466
30-year Treasury yield	**20-year Treasury yield**	**0.989173**
30-year Treasury yield	3-year Treasury yield	0.613962
30-year Treasury yield	7-year Treasury yield	0.841413
3-year Treasury yield	**1-year Treasury yield**	**0.983487**
5-year Treasury yield	6-month Treasury yield	-0.782279
5-year Treasury yield	1-year Treasury yield	-0.79532
5-year Treasury yield	3-year Treasury yield	-0.830905
7-year Treasury yield	3-month Treasury yield	-0.765994
7-year Treasury yield	6-month Treasury yield	0.913122
7-year Treasury yield	1-year Treasury yield	0.928828
7-year Treasury yield	**3-year Treasury yield**	**0.977722**
7-year Treasury yield	5-year Treasury yield	-0.85077

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