

Long-term Asset Values in the U.S. Market:
Analysis on the Main Drivers and Their Future Implications

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Summary of Key Findings

- It is possible that we are standing at a historical turning point where the upward asset price momentum for the past three decades might come to an end.
- Counter-intuitively, the inverse relationship between the long-term asset values and long-term interest rates is not valid in all developed economies. However, it holds true for the U.S. market due to the unique nature of the country's financial sector.
- Similarly, inflation is not a universal driver for interest rates in all developed countries. The close relationship between the two factors within the U.S. is conditional upon the prominent role that inflation plays in the Fed's decision-making process.
- Inflation trends are driven by a wealth of long-term and short-term factors, but for the U.S., the country's widening non-energy trade deficit is not only the main cause for its prolonged downward inflation trend for the past decades, but also one of the deciding factors for its future inflation trends.
- Given the strong linkages among the asset values, interest rates, and inflation rates in the U.S. market, it is possible to construct a framework that utilizes numerous factors to predict the country's short-to-medium term inflation trends and the corresponding changes in asset values.

Introduction

The secret to investing success is there is no secret. It is true that even for investors who do not master the tactical skills for picking up the best stock out of the market, having a correct view for the long-term market trends can still generate stunning returns over the years. Take the inflation adjusted S&P 500 index for example¹, the index demonstrates a general downward trend before 1982 but shifts toward an upward trend thereafter. If an investor had taken short positions starting 1971 and long positions on the same index after 1982, his annualized return would have been nearly 6% after inflation adjustments. As of today, the recent interest rate hikes in the U.S. have gradually brought the rates back to 2.25% from the nearly zero level, and the S&P 500 almost ended its record-long bull market last December by falling nearly 20% from its all-time high. In fact, the possibility that we are standing at a historical turning point of the upward asset price momentum for the past three decades urges the necessity for a thorough re-examination of the underlying drivers that resulted in the two different long-term trends in asset values historically.

The report mainly focuses on the U.S. market and contains three parts. Part 1 tests the two widely recognized assumptions through past 50 years' historical data: the inverse relationship between asset prices and interest rate, and the strong correlation between interest rate and inflation. It then investigates into the necessary political and economic conditions that make these assumptions applicable for the U.S. market. Although exceptions exist for other developed markets, for the U.S. market specifically, it is concluded that by knowing the future direction of inflation rates, one can also theoretically predict the future trends in asset values.

Part 2 focuses on inflation and further analyzes the fundamental drivers that resulted in the two separate long-term inflation trends in the U.S.: the upward trend before 1980s and the downward trend after 1980s. Among all the factors, it is found that the country's widening non-energy trade deficit acts as a primary cause for its prolonged downward inflation trend. Moreover, given the on-going trade negotiations between the U.S. and its major trading partners, the possible outcomes of these negotiations would have a substantial impact on the country's non-energy trade balance, therefore making it a deciding factor for both the short-term and long-term trends in future inflation.

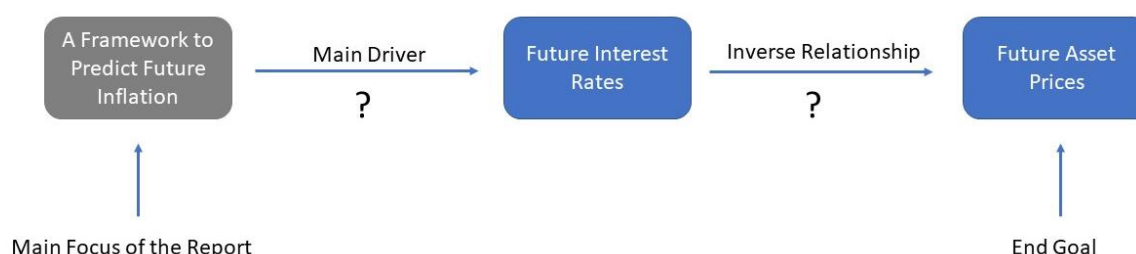
Different trade negotiation outcomes will result in different level of non-energy trade balance. In order to further quantify these impacts, Part 3 aims to construct a multi-variate model to predict the country's core inflation using non-energy trade balance as one of the explanatory variables. Ultimately, by adjusting the input levels for non-energy trade balance, one can stress test how the country's inflation, interest rate environment and different asset values would respond to these possible scenarios.

¹ See appendix for detailed calculation for inflation adjusted indices

Part 1: Important Assumptions Underlying the Inflation vs. Asset Value Model

As illustrated in the following figure, the report's approach to develop a feasible framework to make predictions for future inflation rates in the U.S. market and use that to predict future asset value trends lays its foundation in two assumptions. In order to ensure the effectiveness of these assumptions in the context of the U.S. and other developed markets, it is necessary to have a thorough understanding of their underlying conditions and limitations.

Figure 1: Overall Framework of the Report



1.1 Interest Rate vs. Asset Values Relationship Revisited

The inverse relationship between long-term interest rate and asset values has been widely recognized by the industry, but we cannot simply take such assumption for granted. Take the U.S. and Japan for example, although past 40 year's historical data for both the U.S. equity and the bond markets have demonstrated strong negative correlations with its 10-year treasury yields (as show in Table 1), the stock market in Japan was far less impacted by the changes in the long-term interest rates under a similar time frame. As shown in Table 2 and Figure 2, the inflation adjusted Nikkei 225 and Japanese 9-year government bond yields demonstrated little to no correlation.

Table 1: U.S. Interest Rate vs. Asset Prices Correlation Matrix

Correlation (1973 – 2018 Monthly Data ²)	S&P 500	Long Treasury	US Corp Credit
10-Year Treasury Yield	-0.79	-0.89	-0.90

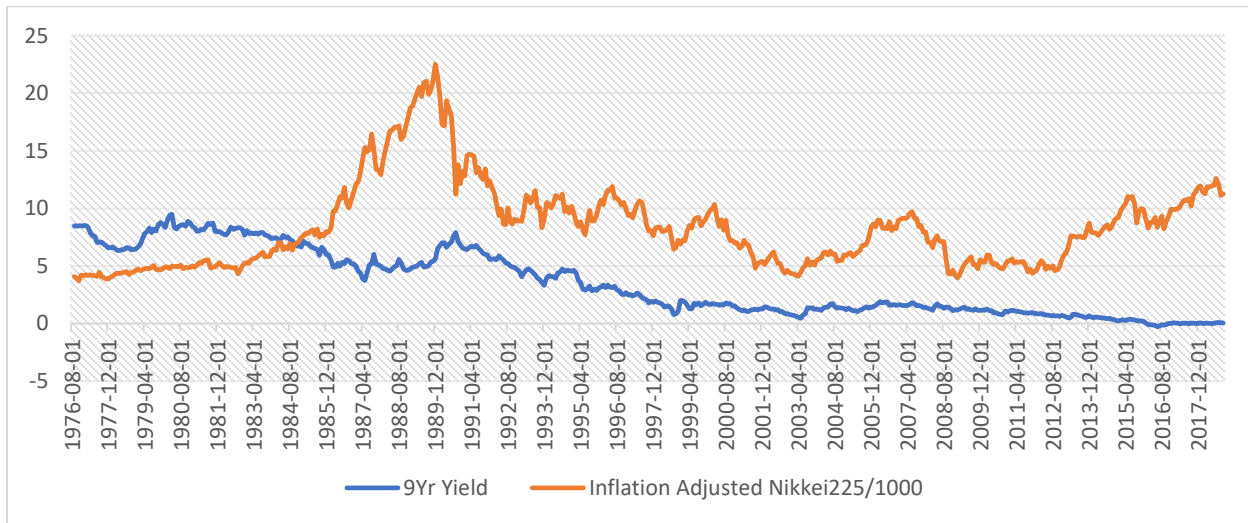
Table 2: Japan Interest Rate vs. Stock Market Correlation Matrix

Correlation (1976 – 2018 Monthly Data ³)	Nikkei 225
9-Year Government Bond Yield	0.025

² Data source: Bloomberg, Investing.com; Index levels are inflation adjusted using YoY core inflation

³ Data source for Table 2 and Figure 2: www.macrotrends.net, Bank of Japan; Index levels are inflation adjusted using YoY core inflation

Figure 2: Japan Interest Rate vs. Stock Market



To find out the possible causes for such difference, one must first examine why such relationship exists in the U.S market. Theoretically, the increase in interest rate corresponds to the increase in opportunity costs to invest in risky assets, thus these assets will naturally become less attractive to investors during rate hikes. Moreover, as the primary mandate of the country's financial institutions is to act in the best interests of their shareholders, the strict debt covenants applied to the private sector companies would greatly constrain their financing capacity when the interest rate increases. Therefore, both the higher financing costs and the limitations to further expand will put pressure on the companies' earnings and growth expectations, resulting in poorer equity market performance in upward rate cycles, and vice versa.

However, in Japan, the companies' earnings do not necessarily experience downward pressure when higher interest rates weigh on their financing costs. Instead, as cross holding is a long-standing tradition among the leading corporations and financial institutions in Japan, during rate hikes, these financial institutions barely have the incentives to limit the companies' capacity to expand. As a result, the extra revenue resulted from business expansion can often offset the negative impacts from both the greater opportunity costs and higher borrowing costs.

Therefore, it can be concluded that the inverse relationship between interest rate and asset values only holds true in the U.S. market given the high independency level of the country's financial institutions, while it can be dangerous to apply it directly to another country or market without considering the unique nature or characteristics of its financial sector.

1.2 Inflation as the Main Driver of Interest Rate – Why it Holds True for the U.S.

Since long-term interest rates can be understood as the geometric mean of the expected future short-term rates, the report will first put emphasis on the formation process of the short-term interest rates. While inflation should play an important role in every central bank's decision-making process, due to each central bank's unique focus, not all developed economies across all periods have exhibited high linkages between inflation rates and their monetary policies. For

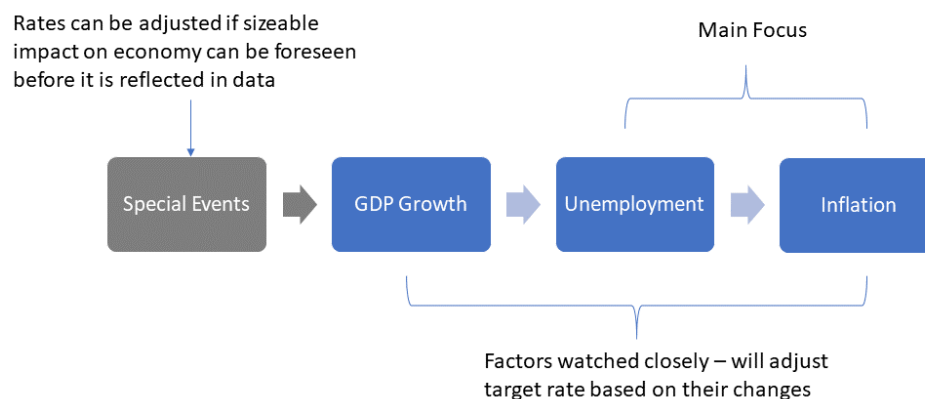
example, both the U.S. and Japan experienced a long-term upward inflation trend followed by a downward inflation trend historically. While the interest rates in the U.S. followed closely with inflation across both the upward and downward inflation periods, interest rates in Japan barely kept up with the its inflation during its upward inflation period from 1960 to 1972, as shown in the following comparison table. Therefore, its is necessary to re-examine why such relationship holds for the U.S. and whether it will continue to hold in the future.

Table 3: Inflation vs. Interest Rate Correlations by Trend Period (U.S. and Japan)⁴

	<i>Upward Inflation</i>	<i>Downward Inflation</i>
<i>US Core Inflation vs. Effective Fed Fund Rate Correlation</i>	0.75 (Data: 1962 – 1981)	0.84 (Data: 1981 – 2018)
<i>Japan Core Inflation vs. Basic Lending Rate Correlation</i>	0.22 (Data: 1960 – 1974)	0.81 (Data: 1974 – 2018)

The following figure is a simplified demonstration on how the Fed decides on their policy rates. Since its establishment in 1913, the primary mandate of the Federal Reserve has been protecting the reliability of the nation’s currency through ensuring stable inflation, but the Full Employment and Balanced Growth Act of 1977 also emphasizes its secondary mandate of achieving full employment⁵. Not only that, the Fed also watches closely at the factors that can potentially impact these two mandates in the future. These include unemployment itself as a main driving force for inflation, the county’s economic growth such as GDP, and any special events such as stock market crash or political tensions.

Figure 3: The Fed’s Standard Decision-Making Process



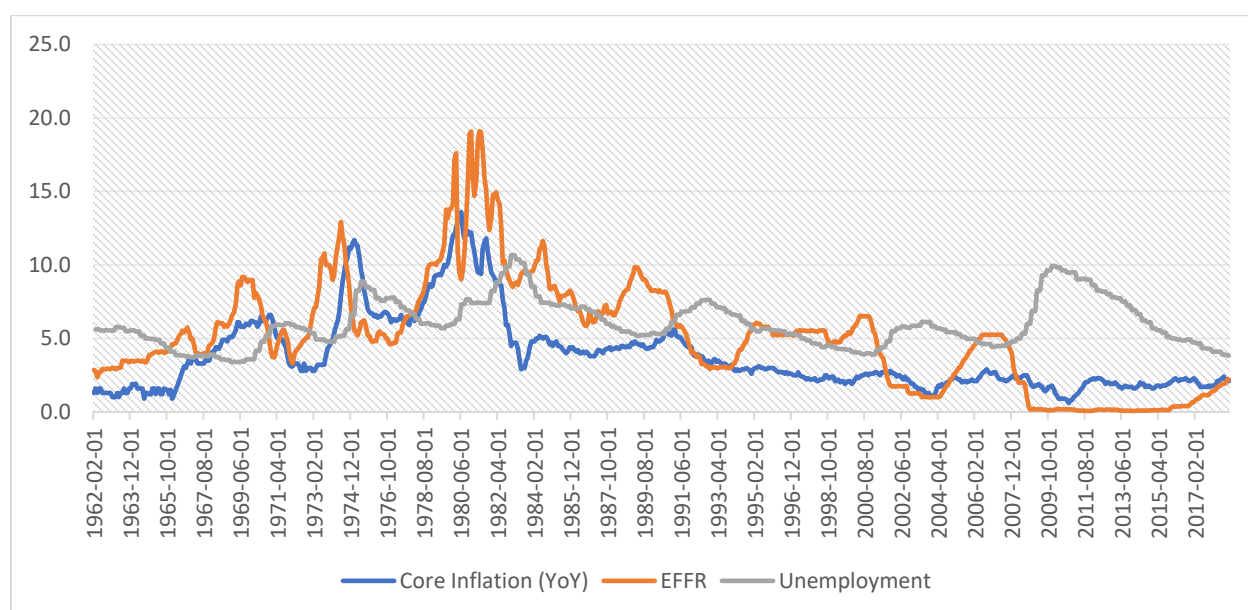
In order to verify such “standard process” and whether the Fed has been consistent about its mandate in the past decades, the appendix: Interest Rate Breakpoints and Major Events summarizes each major shift in the Fed’s target rate since 1960s and the corresponding reasons

⁴ Data Source: Bloomberg, BOJ, Federal Reserve Bank of St. Louis (Monthly)

⁵ (FEDERAL RESERVE BANK OF SAN FRANCISCO, n.d.)

that justify the Fed's decision. Note that for most of the time the signals given by employment and inflation are complementary to each other, and when the inflation number seems controllable, the Fed usually takes great considerations to lower their rates to combat high unemployment. Yet, the best period to testify which of these two mandates remains as the primary focus of the Fed is the stagflation period from 1979 to early 1980s, when both inflation and unemployment peaked at 7.6% and 6% respectively. As shown in the following figure, in April 1980 the Fed first lowered rates, but as the core inflation rate continued to escalate and reached 13% in August, the Fed was forced to raise back the interest rates despite the period's high unemployment. Such example, along with the high correlation between inflation and the EFFR historically (as high as 0.77 from 1962 to 2018), demonstrates the prominent role that inflation plays in the Fed's decision-making process, and this inevitably results in the close relationship between inflation and long-term interest rate trends as well, as shown in Figure 4 and the following correlation matrix between historical 10-year treasury yields and core inflation.

Figure 4: Effective Federal Funds Rate and Economic Indicators⁶



⁶ Data Source: Bloomberg

Figure 5: Long-term Interest Rates and Core Inflation⁷

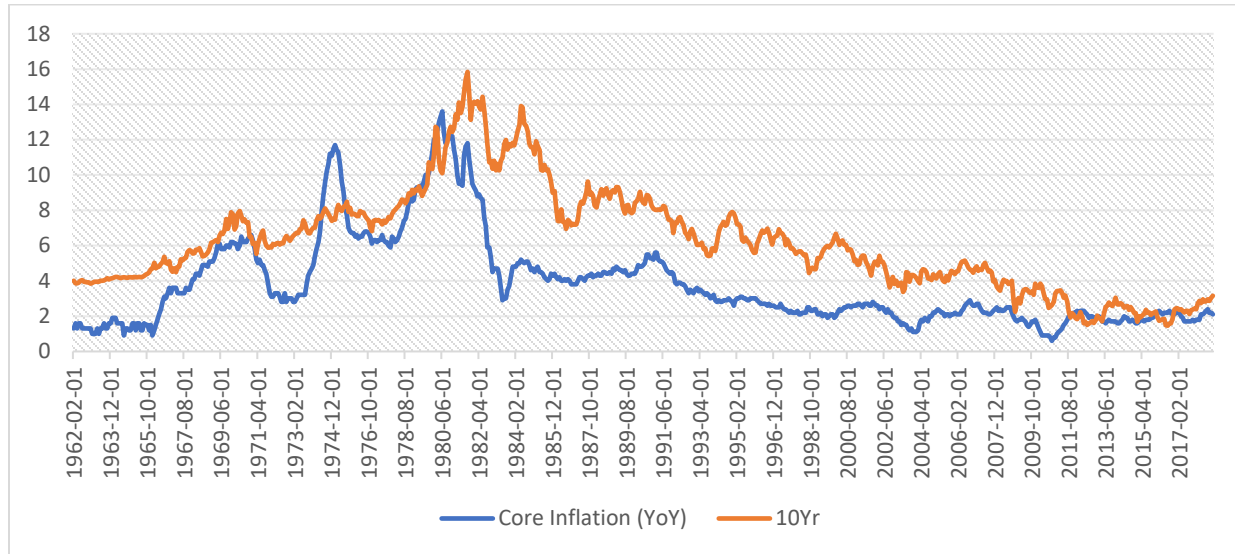


Table 4: U.S. Long-term Interest Rate vs. Core Inflation Correlation⁸

Correlation (1962 – 2018 Monthly Data)	U.S. Core Inflation
10 Yr Treasury Yield	0.76

Therefore, the close relation between long-term interest rates and inflation in the U.S. market is in fact a result from the prominent role that inflation plays in the Fed's decision-making process, and most importantly, the consistency of such mandate along its history. Combining with the results in the previous section 1.1, it is concluded that although the same assumptions might not be applicable to other developed economies such as Japan, the unique political and economic conditions in the U.S. market have resulted in strong linkages among its asset values, interest rates and inflation rates, thus through studying both the long-term and short term drivers for inflation rates, one can theoretically use the predictions for future inflation to predict future asset values.

⁷ Data Source: Bloomberg

⁸ Data Source: Bloomberg

Part 2: Long-term Inflation Drivers in the U.S.

2.1 Overview

As shown in the Figure 6, despite short-term cycles and fluctuations, the country's historical core inflation can be separated into two main periods: the long-term upward trend from 1960s to early 1980s, and the long-term downward trend from 1980s to present. The primary focus of this section is to investigate the long-term drivers that resulted in these two distinct inflation trends historically and to find out which of these factors are subject to immediate changes in the near future. In theory, inflation can be understood as a result of supply shortage in relation to demand. Therefore, the key to understanding the country's inflation trend is to find out the structural forces that drives its demand and supply power.

On the demand side, although the inflationary effect of the increase in population and household income is self-evident, the impacts from these factors can be greatly distorted by the structural changes in other demographic characteristics. In the U.S. market, the growing population age and increasing income inequality, which is a result of the country's shifting industry structure in the recent decades, have greatly contributed to the inaccuracy of predicting its demand power using wage growth and unemployment alone in recent decades.

On the supply side, except for the country's high dependency on energy imports in the past, for consumer goods, inflation can also be greatly driven by the prolonged process for the domestic companies to adjust their supply capacity to meet the expanded demand. However, as globalization opened the access to the production capacity in other developing economies with much cheaper costs, both the duration and intensity of the inflation hikes would be greatly reduced as these temporary supply gaps were immediately filled by increased imports, as shown in the country's international trade balance.

The following analysis further examines the historical trends in the country's population age, industry structure, and international trade balance in detail and how these factors have resulted in the two different inflation trends before and after 1980s.

Figure 6: Historical Trends in Core Inflation⁹



2.2 Root Causes for Long-Term Inflation Trends: Before and After 1980s Comparison

Population Age

The distribution of the country's population in different age groups is a crucial factor for its long-term inflation trend, as an expanding young population lays the foundation for strong domestic demand, and vice versa.

Before 1980s

Following the ending of WWII, the U.S. experienced a “spike” in population growth during the years from 1946 to 1964¹⁰, as shown in the Figure 7. As these Baby Boomers grew up and became young adults 20 years later, their strong demand for consumer goods created a great upward pressure for inflation from 1960s to 1980s.

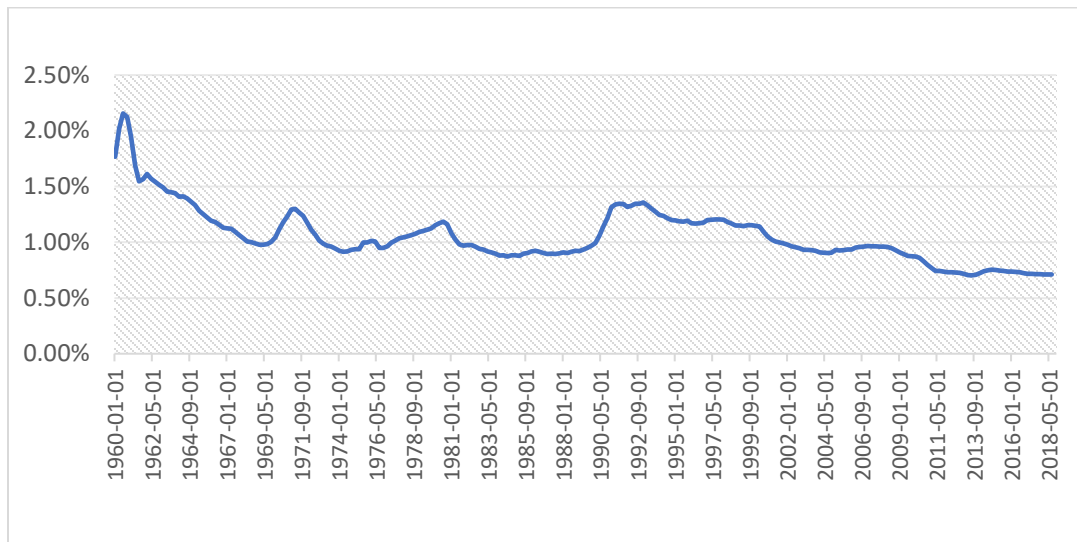
After 1980s

After 1964, however, the moderately decreasing population growth rate implies the shrinking of the young working-age population 20 years later. In other words, given the elders' tendency to save more than spend in contrast to the younger population, this resulted in a decrease in the overall demand after early 1980s.

⁹ Data Source: Bloomberg

¹⁰ (The Gale Group Inc., n.d.)

Figure 7: YoY Population Growth¹¹



Shifting Industry Structure and Income Inequality

Another demand side factor that could have a substantial impact on the country's inflation trend is the increasing income inequality as a result of shifting industry structure and workforce within the U.S. economy, as the country outsourced a significant amount of its manufacturing capacity in the light of globalization.

Before 1980s

Figure 8 shows that, before early 1980s the number of people employed in the manufacturing industry in the U.S. made up more than 25% of the country's total employment. In fact, the country's booming manufacturing industry laid the foundation of the growing "middle-class" households, whose increase in income serves as the main driving force for the country's consumption power in this period.

After 1980s

After 1980s, however, the employment in manufacturing decreased drastically along with substantial increases in both higher and lower paid occupations, resulting in the "diminishing middle class". As the U.S. transitioned toward to a more service-oriented economy, shares of higher paid occupations in industries such as financial services, scientific and technical services, and information technology have become much bigger¹². Although similar increase exhibits in lower paid industries such as food and drink services to accommodate the needs for the growing high-income group, the income growth for the top 5% earners completely outpaced the rest of

¹¹ Data Source: Bloomberg

¹² Data Source: US Census Bureau

the income groups after 1984, as shown in the Figure 9. This means despite the strong labor market conditions, their impact on the inflation would be less significant as the overall income growth is primarily driven by the increasing wages earned by the top 5% households, who would likely use their extra earnings for investments rather than consumption.

Figure 8: Percent of Employment in Manufacturing¹³

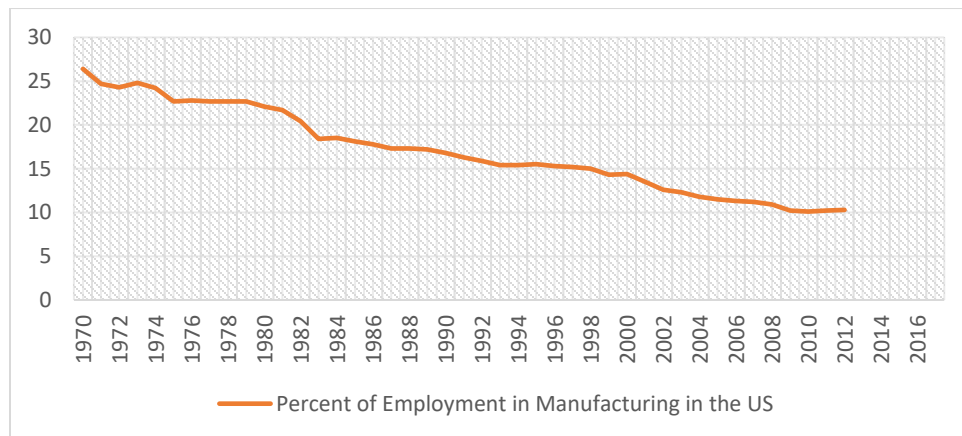
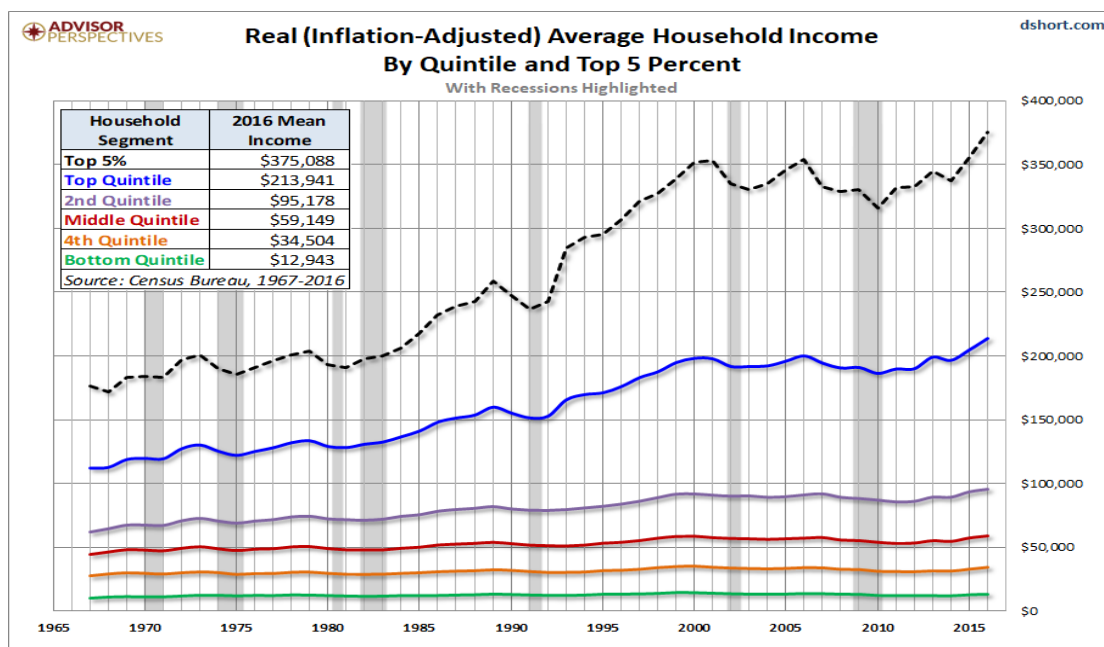


Figure 9: Figure: Real Household Income by Quintile¹⁴



¹³ Data Source: Federal Reserve Bank of St. Louis

¹⁴ Figure from FinancialSense.com

International Trade Balance

In theory, an expanding trade deficit would be a strong deflationary force due to the increase of additional supply, but it is important to distinguish between the energy and non-energy trade balance due to the different effects they may have on the country's inflation. In fact, the significant turning point in December 1982 when the U.S. became a non-energy goods importer from a net exporter can be a main contributor to the “downward” inflation trend after 1980s.

Before 1980s

As illustrated in the Figure 10, before 1983, the U.S. was a net exporter in non-energy goods and was one of the largest oil importers with nearly 40% of its oil consumption produced overseas¹⁵. Moreover, the country's total trade balance was around 0% of its GDP during this period. This implies that while the U.S. consumers and factories experienced a series of oil price rallies as a result of the OAPE embargo and the political instabilities in the Middle East during 1970s, in order to maintain a trade balance close to zero, the country's exports of non-energy products also need to significantly increase. As a result, the reduced aggregate supply within the country further magnified the intensity of the inflation hikes during this period.

After 1980s

Beginning in 1983, the status quo has drastically changed as the U.S became a net importer in non-energy goods. Not only that, the country's trade deficit in non-energy goods has largely widened over the last three decades. As globalization became a more and more dominant theme and China became part of the WTO, the U.S. has outsourced a significant amount of its manufacturing capacity to emerging market countries where production costs are much cheaper. As the deficit continued to widen, the fluctuations in energy prices can be largely absorbed by the much cheaper production costs overseas. This caused the country's inflation to be less sensitive to energy prices, and, as mentioned in the previous Industry Structure and Income Inequality section, less responsive to the labour market conditions due to the shrinking demand for domestic manufacturing labour. This also explains why the country's core inflation remained low at around 2% even when the oil prices peaked at \$128/barrel in 2007 and when unemployment rate has dropped to 49-year low at 3.7% in 2018, as demonstrated in Figure 11.

Note that a widening non-energy deficit not only created downward pressure for inflation, which is a key indicator for short-term interest rates, it also had direct impacts on the country's long-term interest rates. For the countries who run a trade surplus with the U.S., since their foreign reserves would increase along with their exports, these countries would likely use the excess amount of foreign reserves to increase their holdings in U.S. treasuries in exchange for higher long-term returns. As a result, the long-term treasury yields within were also lowered due to higher purchasing demand from these countries.

¹⁵ Data source: EIA

Figure 10: U.S Non-Energy and Energy Trade Balance vs. Inflation¹⁶

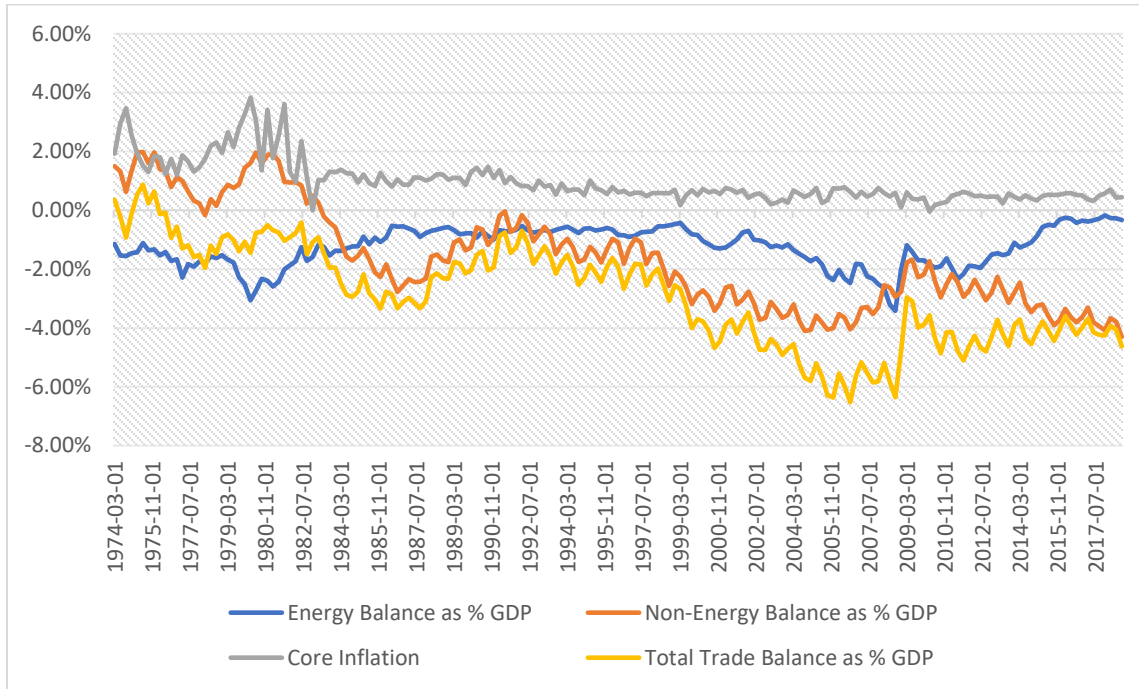
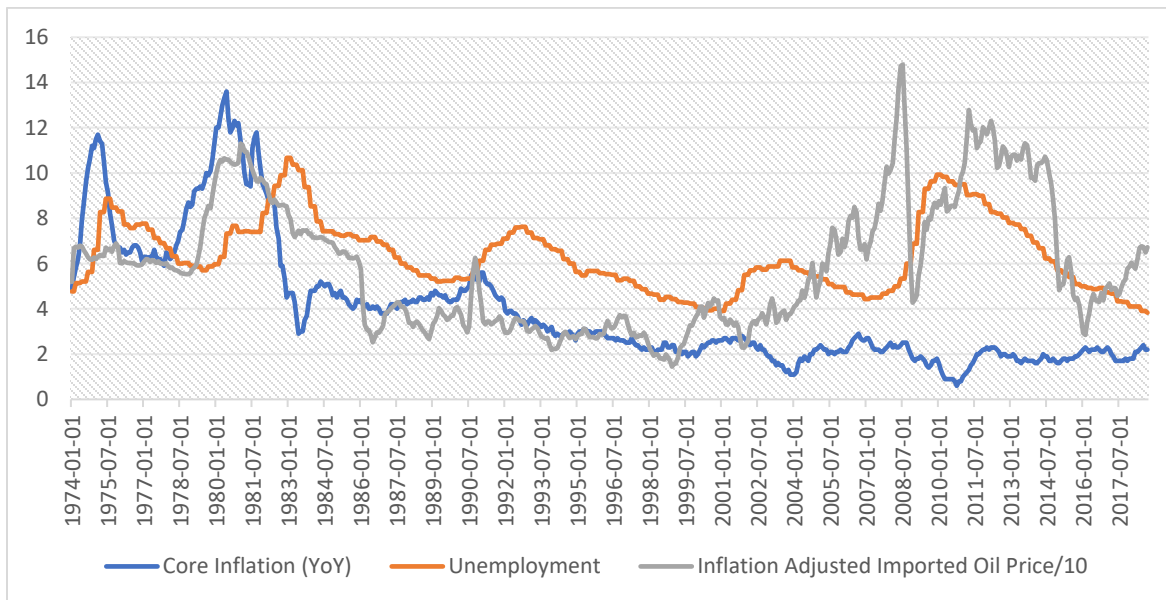


Figure 11: Inflation, Unemployment Rate and Inflation-adjusted Oil Prices¹⁷



¹⁶ Data Source: US Census Bureau, Bloomberg

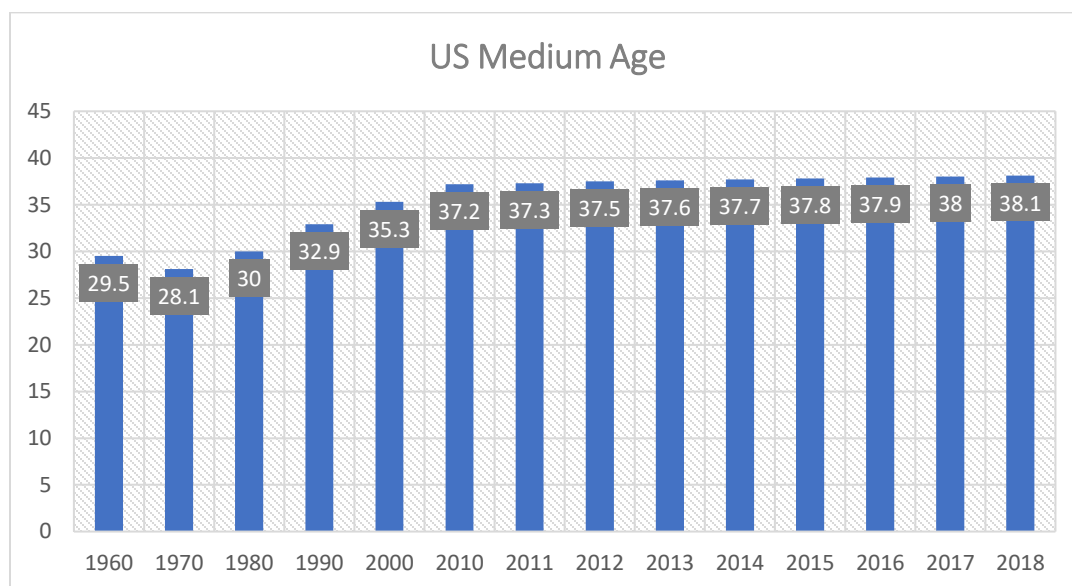
¹⁷ Data Source: EIA, Bloomberg

2.3 Medium-Term Implications of Long-Term Inflation Root Causes

1. Impacts of the aging population can be limited

It is shown that changes in the three economic fundamentals within the U.S: the widening non-energy goods trade balance, the aging population, and the shifting industry structure have greatly contributed to the different inflation trends in the two periods before and after 1980s. Among them, the shifting trend in population age remains the most predictable. According to Figure 12, the medium age of the U.S. population is currently growing at a pace of 0.1 years annually, which is much slower compare to the period from 1970 to 1990. Looking forward, the trend will likely remain stable.

Figure 12: US Medium Age¹⁸



2. The shifting industry structure is a prolonged process

Similarly, although the country's shifting industry structure towards a more service and technology oriented economy has profound influence on the population's income distribution and demand power over the past decades, structural changes is not likely to happen in the short run. In the medium-to-long term, however, its impact will be directly reflected in the changes in the country's non-energy trade balance, as a continuing reversing trend in the non-energy trade balance would likely indicate returning manufacturing jobs and the income growth acceleration for the middle-class families.

¹⁸ Data Source: Statista.com

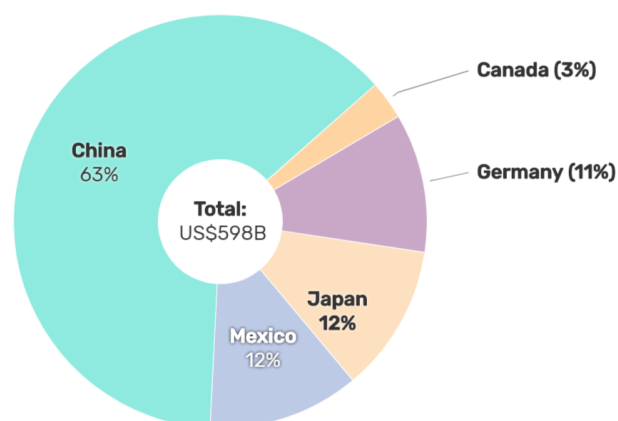
3. Uncertainties in the U.S. trade relations to be watched closely

As the ongoing trade negotiations between the U.S. and its major trading partners may cause an immediate turning point of its widening trade deficit going forward, the main factor that could have a substantial impact on the country's future inflation is its non-energy trade balance, which, as discussed in the previous section, is both the root cause for the deflationary effect of the imported goods as well as an indicator of the shifting trends in the country's industry structure.

According to the data shown in the following chart, as in 2017, China, Canada, Mexico, Germany, and Japan are the five countries with which the U.S. runs the largest trade deficit. Despite its \$ 32 billion surplus with the rest of the countries during the same year, the U.S. ran a total of \$ 598 billion trade deficit with these five economies, making them the main contributors to the negative trade balance of the U.S. in the recent decade¹⁹. To better understand the future implications of the trade negotiations between the U.S. and these five countries, the following table summarizes the current progress as well as the possible outcomes of these on-going trade talks.

If the U.S. fails to make any effective progress in these negotiations, the country's current deficit will likely continue to widen, and its current "downward trend" in inflation would likely persist. However, in the case where President Trump can push through all his plans, the country's non-energy deficit will likely shrink significantly. This can directly result in immediate price increases in imported goods due to higher tariffs, and at the same time, an increase in demand for domestically produced products due to reduced imports. Nevertheless, it will lead to an immediate inflation hike in the short run, and in the long run, as discussed previously, a continuing reversing trend in non-energy trade balance would likely indicate structural changes in the country's industry structure and income distribution, which would further lead to higher long-term inflation.

Figure 13: US Major Trading Partners by Trade Deficit²⁰



¹⁹ (Dash, 2019)

²⁰ (Dash, 2019)

Table 5: Current Progress & Possible Outcomes of the On-going Trade Negotiations

	Ongoing Progress	Possible Outcomes
<i>China</i>	On December 1 st , 2018, the U.S. and China agreed to a 90-day truce, in which both countries would begin negotiations on structural changes with respect to forced technology transfer, intellectual property protection, non-tariff barriers, etc. If the parties are unable to reach an agreement by March 1st, the current 10% tariffs will be raised to 25%. However, the deadline got postponed while two countries trying to reach a deal soon. ²¹	A. An agreement is successfully reached, and the current 10% tariff is lifted; However, within the agreement there is no specifications about penalties, or the U.S. judiciary does not hold the power of adjudication and enforcement of the penalties in the event of non-compliance B. The negotiation gets postponed and the tariffs are kept at current 10% C. The parties fail to reach agreement and the 25% tariffs is imposed D. An agreement is successfully reached with proclaimed penalties for non-compliance. Furthermore, should there be any breach of the agreement, the U.S. judiciary holds the power of adjudication and enforcement of the penalties
<i>Mexico & Canada</i>	In November 2018, the U.S., Mexico, and Canada agreed to sign on the new USMCA, which was designed to replace the existing NAFTA to secure a stronger trade deal for the U.S. industries, particularly for the auto and agriculture sectors. ²² The agreement is currently waiting to be approved by the parliaments of the three nations. ²³	E. The new USMCA is turned down by the Congress F. The agreement is passed by parliaments in all three nations
<i>Japan & Germany</i>	Both countries are potentially subject to significantly higher trade tariffs on foreign cars and car parts imposed by the U.S. on the basis of protecting national security. In July 2018, the U.S. and EU issued a joint statement announcing the formation of a working group to seek to reduce barriers to trade, while Trump agreed not to impose higher or extra tariffs during the period of negotiation. ²⁴ Similarly, in September 2018 Japan also agreed to new trade negotiations for a bilateral “Trade Agreement on Goods” (TAG) to avoid threat of high tariffs on Japanese auto imports. ²⁵	G. Parties fail to make effective progress in the negotiations and the status quo continues H. Deals are successfully reached and will likely reduce the country’s trade deficit with both EU and Japan

²¹ (the White House, 2018)

²² (the White House, 2018)

²³ (BNN Bloomberg, 2019)

²⁴ (Office of the United States Trade Representative, n.d.)

²⁵ (lawder & Shepardson, 2019)

Part 3: Short-to-Medium Term Inflation Modeling and Forecasting

3.1 Model Overview

While both aging population and increasing income inequality in the U.S. have greatly contributed to its downward inflation trend, the current absence of signals suggests they will likely remain stable in the near future. However, given the on-going trade negotiations and the potential tariffs the U.S. would impose on other countries, the country's widening non-energy trade deficit is most subject to immediate structural changes, making it a crucial factor to be considered in shorter-term inflation prediction. This part of the report aims to further quantify the impacts of different non-energy trade balance resulted from various possible negotiation outcomes. In particular, a multivariate model is first constructed to predict short-to-medium term inflation trends by using non-energy trade balance as one of the explanatory variables, and then the inflation results of the model can be translated into the corresponding changes in interest rates and the potential price movements in major asset classes.

Although the short-to-medium term inflation trends can be a result of the combined impact of multiple factors, including unemployment rate, energy prices, and the non-energy trade balance as mentioned previously, different main drivers can be identified for each distinct period within the history. Thus, separate inflation models can be built for each of these periods to determine how exactly inflation would respond to each individual factor. As demonstrated in Table 6, the model is first separated into two periods before and after 1982, when the non-energy trade balance for the U.S. remained mostly positive before but became negative thereafter. The first part of the model runs the inflation, unemployment and energy prices data before 1982 to determine how inflation would respond to unemployment and changes in energy price alone. The second part would use the previous model to forecast inflation after 1982 and use the differences between the predicted and actual inflation values to determine the additional deflationary impact contributed by changes in the non-energy trade deficit.

Table 6: Model Overview

	<i>Data Period</i>	<i>Response Variable</i>	<i>Explanatory Variables</i>
<i>Part 1</i> ²⁶	1962 - 1982	Core Inflation	Unemployment Rate, Crude Oil Price Inflation
<i>Part 2</i> ²⁷	1982 - 2018	Difference between Actual Core Inflation and Predicted Core Inflation by Part 1	Non-Energy Trade Deficit as % GDP

²⁶ Data source: Bloomberg, EIA; Monthly data otherwise specified

²⁷ Data source: Bloomberg, EIA, US Census Bureau; Monthly data otherwise specified

3.2 Inflation Modeling without Trade Deficit

The first part of the model aims to measure how core inflation responds to unemployment rate and oil price inflation. However, as shown in the following figure, the impact of energy prices before 1972 can be considered minimal. Therefore, part 1 of the model can be further broken down into two periods (before and after 1972) to determine impacts of the two factors separately, as demonstrated in Table 7. Since core inflation excludes the direct changes in energy and food prices, the oil price input is lagged for 4 months to better capture the postponed effect of energy prices on production costs. After running the data, the weightings of the explanatory variables are calculated as following:

$$\text{Core Inflation Rate} = 6.86 - 0.75 * \text{Unemployment Rate} + 0.16 * \text{Crude Oil Price Inflation}^{28}$$

Figure 14: Historical Crude Oil First Purchase Price²⁹

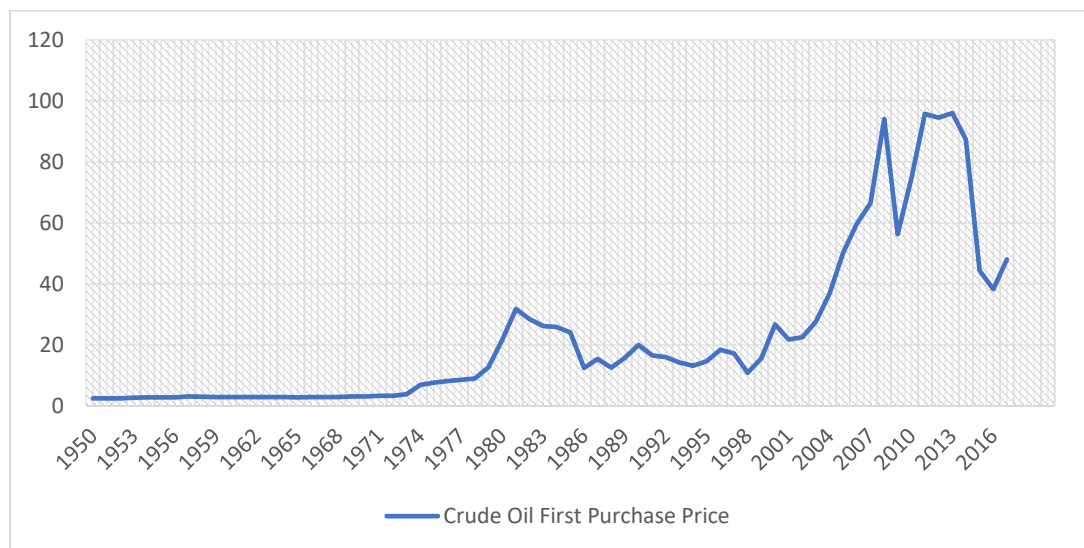


Table 7: Part 1 Model Breakdown

	<i>Data Period</i>	<i>Response Variable</i>	<i>Explanatory Variable</i>
<i>Part 1</i>	1962 - 1972	Core Inflation	Unemployment Rate
	1962 - 1982 ³⁰	Difference between Actual Core Inflation and Predicted Core Inflation using Unemployment Rate	4-month Lagged Crude Oil Price Inflation YoY

²⁸ Detailed model results are included in the Appendix

²⁹ Data Source: EIA

³⁰ Note that since the average core inflation during 1972 – 1982 was significantly higher than the ones in any other period, the data prior to 1972 are also used in the model to prevent overestimation of the constant variable; due to the data limitation of historical oil prices, yearly data are used prior to 1975

3.3 Inflation Modeling with Trade Deficit

Building upon the results from the first part of the model, the second part aims to solve the weighting of the deflationary impact of the widening non-energy trade deficit using the data from 1982 to 2017. However, the increasing trade deficit and the manufacturing outsourcing in the wake of globalization after the 1980s can significantly reduce the sensitivity of consumer goods prices to the changes in energy prices, as the latter will likely be absorbed by the much cheaper production costs in emerging economies. Whether energy prices still play a huge role in the country's inflation rate as it did before remains unclear. Therefore, both models with and without oil prices as an explanatory variable are tested, and their equations are listed as follow:

$$(1) \text{ Core Inflation} = 6.86 - 0.75 * \text{Unemployment Rate} + 0.16 * \text{Crude Oil Price Inflation} +$$

$$x * \text{Non-Energy Trade Balance as \% of GDP} + y$$

$$(2) \text{ Core Inflation} = 6.86 - 0.75 * \text{Unemployment Rate} +$$

$$x * \text{Non-Energy Trade Balance as \% of GDP} + y$$

Where x and y are the new weighting and the intercept to be solved

The following figures 14 and 15 demonstrate predicted vs. actual inflation from both models. Along with the model results shown in the Appendix, the accuracy of model (2) without energy prices significantly outperforms model (1) with a R-squared close to 0.53, while the R-squared for the model (1) is only 0.12. Such results confirm that the impact of energy prices on inflation for the period after 1982 can be much less significant compare to the one before 1982.

Moreover, Figure 15 and 16 show that the inflation trends are much better captured in Figure 15 where non-energy trade balance is added in comparison to Figure 16, where unemployment is used alone. This further confirms the significant impact of non-energy trade balance to the country's inflation trends after 1980s. After running the historical data as demonstrated in Table 6, the following model would be used for future predictions in short-to-medium term inflation:

$$\text{Core Inflation} = 10.25 - 0.75 * \text{Unemployment Rate}$$

$$+ 1.17 * \text{Non-Energy Trade Balance as \% of GDP}$$

Or equivalently,

$$\Delta \text{Core Inflation} = -0.75 * \Delta \text{Unemployment Rate}$$

$$+ 1.17 * \Delta \text{Non-Energy Trade Balance as \% of GDP}$$

Figure 15: Predicted vs. Actual Inflation (Unemployment, Non-Energy Trade Balance, Energy Prices)³¹

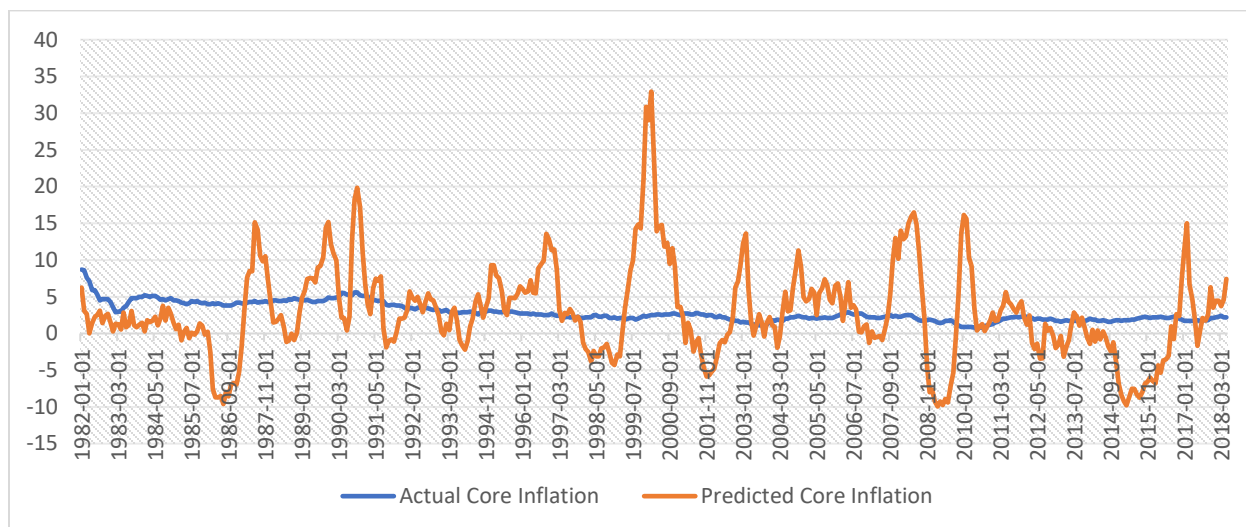
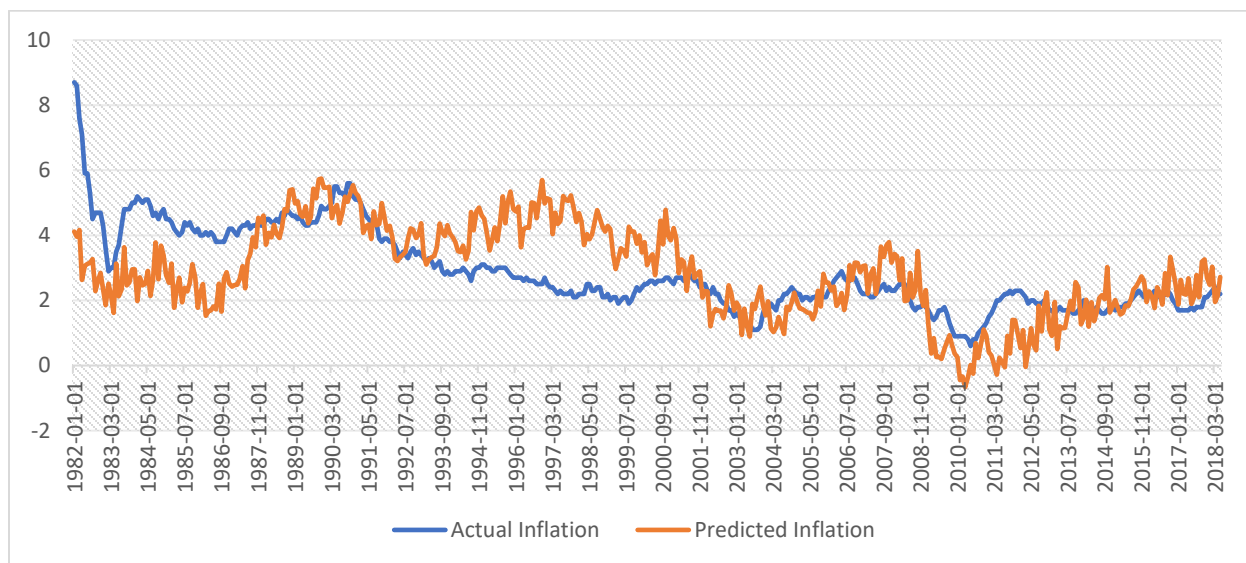
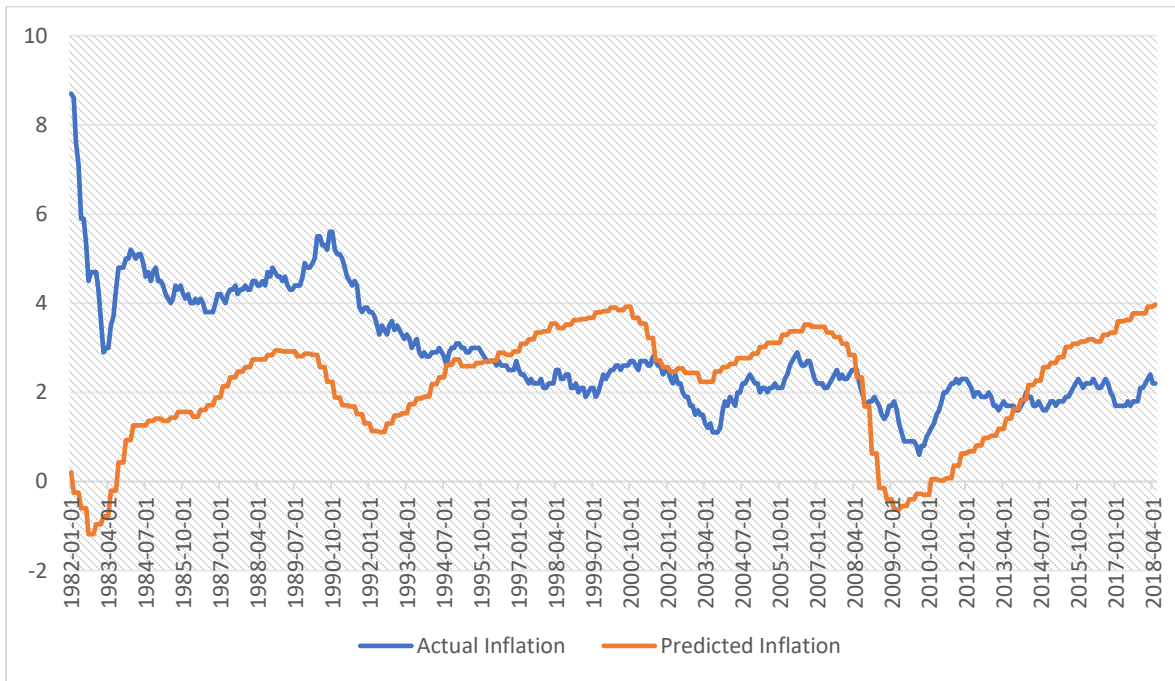


Figure 16: Predicted vs. Actual Inflation (Unemployment, Non-Energy Trade Balance)



³¹ Data source for Figure 15-17: EIA, Bloomberg, US Census Bureau

Figure 17: Predicted vs. Actual Inflation (Unemployment)



3.4 Scenario Analysis³²

The model mentioned above can be very useful in measuring the potential impact of any change in the country's non-energy trade balance and unemployment on its current inflation level. Depending on the progress and outcomes of the on-going trade negotiations between the U.S. and its major trading partners, assuming unemployment holds constant at its current level, this part of the report gives estimates of future inflation trends in the next 2 years under four possible scenarios

1. Non-energy trade balance continues to grow at current pace

Although the initial intention of the trade negotiations is to resolve the country's widening deficit with other countries, they do not necessarily result in ideal outcomes. If the negotiations with China, EU, and Japan all get postponed and the new USMCA is turned down by the parliaments, or even if a deal with China is successfully made but it is in absence of the necessary terms to ensure China's compliance, as indicated as scenario A in Table 5, the country's non-energy trade balance will likely continue to grow at the current pace. In this case, the average monthly decrease in non-energy trade balance as % GDP since 1981 is calculated and used to forecast the future trade gap. According to the model, the core inflation will decrease at a pace of 0.16% annually. This implies that the country's core inflation, which is currently at the level of 2.2%, will soon be below 2% two years from now.

³² Current levels in this section refers to data as of February 2019

Table 8: Future Deficit and Core Inflation Current Trend Projection³³

<i>Date</i>	<i>Non-Energy Trade Balance/GDP (%)</i>	<i>Inflation (%)</i>
<i>Sep 2018</i>	-3.98	2.20
<i>Mar 2019</i>	-4.04	2.13
<i>Sep 2019</i>	-4.11	2.06
<i>Mar 2020</i>	-4.16	1.99
<i>Sep 2020</i>	-4.23	1.91

2. *Non-energy trade balance remains at current level*

Another possible scenario is that the on-going trade talks do not result in dramatic changes in the trade relations between the U.S. and its major trading partners, but some effective progress is made. For example, even there is no or little progress being made with EU and Japan, if the USMCA is successfully passed by the congress and the country's trade tariffs with China maintains at the current level, in the next two years the non-energy trade balance will likely remain at the current level at around -4% of GDP instead of continuing to expand. In this case, the core inflation would maintain at its current level of 2.2%.

3. *Current non-energy trade deficit reduces by half*

Another possible result following the trade talks is that effective actions are implemented to greatly reduce the country's trade deficit. For example, given that the USMCA is successfully passed by the Congress, and at the same time, either the 25% tariffs are imposed on Chinese goods or a new bilateral trade agreement is in place between the U.S. and China with necessary penalty terms included, as indicated as scenario D in Table 5, the U.S. non-energy trade deficit will likely be greatly reduced in the next two years. In this case assume the U.S. non-energy trade deficit would be cut off by half to -2% of GDP, then according to the weightings of the model, the core inflation rate can rise by 2.34% and reach at 4.54%, a significant hike compare to the current 2.2% level. Similarly, although it is possible that the negotiation with China will get postponed without extra or higher trade tariffs, significant progresses in the country's negotiations with EU and Japan might also yield similar outcomes.

4. *Non-energy trade balance reduces to zero*

In some extreme cases, if Trump is able to push through all of his plans and reduce deficits significantly with all of the country's five biggest trading partners, a situation similar to the period before 1980s, when the U.S. ran a zero or positive non-energy trade balance, might be resulted. In this case, assume the current deficit would reduce to zero in the next two years, the potential core inflation calculated by the model can increase to 6.88%, which is almost comparable to the period during early 1980s, when the country's core inflation mostly maintained between 7% to 10%.

³³ Data source: US Census Bureau, Bloomberg

3.5 Implications of Scenario Analysis

Among the four possible outcomes from the scenario analysis, the most extreme case happens when the U.S. non-energy trade deficit reduces to zero level and the core inflation can potentially rise to 6.88%. Despite the chances being relatively small, it is necessary to stress test how interest rates and different asset values would respond to the significantly higher inflation number. Given the strong correlations among the country's inflation, long-term interest rates and asset prices, the most straight-forward way is to apply linear regressions to quantify these relationships separately. The following table summarizes the potential changes in interest rates and equity/bond market prices given the scenario where core inflation equals to 6.88%. It is shown that, the 10-year Treasury Yield may increase to 6.9%, and correspondingly, both stock prices and bond values in the country can drop by about 30% comparing to their current levels.

Table 9: Scenario Analysis under Extreme Inflation³⁴

<i>Response Variable</i>	<i>Explanatory Variable</i>	<i>Current Level³⁵</i>	<i>Weighting</i>	<i>Predicted Level</i>	<i>% Change</i>
10 Yr Treasury Yield	Core Inflation YoY	2.66%	0.84	6.59%	159.40%
SP500 (Inflation Adjusted)	10 Yr Treasury Yield	414.25	-26.86	308.66	-25.49%
Long Treasury Total Return (Inflation Adjusted)	10 Yr Treasury Yield	622.21	-52.89	414.29	-33.42%
US Credit (Inflation Adjusted)	10 Yr Treasury Yield	494.38	-40.73	334.26	-32.39%

³⁴ Detailed model results included in the Appendix; Data Source: Bloomberg, investing.com

³⁵ As of February 2019

Conclusion

According to the previous analysis, the unique nature of the U.S. financial sector and the Fed's consistent focus on inflation lay the foundation for the two important assumptions of the report: the long-term asset values in the U.S. market share a prominent inverse relationship with long-term interest rates, and the long-term interest rate itself is primarily driven by long-term inflation trends. Furthermore, it can be shown that three long-term economic factors, the aging population, the increasing income inequality, and the widening non-energy trade deficit greatly contributed to the country's prolonged low inflation trends for the past three decades. Among them, the non-energy trade deficit is most subjective to structural changes in the near future, making it a crucial factor to be considered when predicting short-to-medium term inflation trends.

For the U.S. market specifically, the greatest uncertainty laying ahead is the potential outcomes of the ongoing trade negotiations between the U.S. and its major trading partners. By utilizing the inflation - interest rate - asset prices framework discussed by the report earlier, investors need to watch closely at the development of these events in order to keep informed about their corresponding impacts on the country's future trends in trade deficit, inflation, interest rates, and asset values respectively.

References

- BNN Bloomberg. (2019, Jan 29). *Democrats, Republicans alike won't support USMCA with tariffs in place: Trade rep.* Retrieved from bnnbloomberg.ca: <https://www.bnnbloomberg.ca/democrats-republicans-alike-won-t-support-usmca-with-tariffs-in-place-trade-rep-1.1205871>
- Dash. (2019, March 15). *Fed Funds Rate History with Its Highs, Lows and Chart.* Retrieved from the balance: <https://www.thebalance.com/fed-funds-rate-history-highs-lows-3306135>
- Dash. (2019, Mar 19). *US Trade Deficit by Country, With Current Statistics and Issues.* Retrieved from the Balance: <https://www.thebalance.com/trade-deficit-by-county-3306264>
- FEDERAL RESERVE BANK OF SAN FRANCISCO. (n.d.). *What is The Fed: History.* Retrieved from frbsf.org: <https://www.frbsf.org/education/teacher-resources/what-is-the-fed/history/>
- Federal Reserve History. (n.d.). *Savings and Loans Crisis.*
- lawder, D., & Shepardson, D. (2019, Feb 15). *Automakers brace for U.S. government report on import tariffs.* Retrieved from REUTERS.com: <https://www.reuters.com/article/us-usa-trade-autos/automakers-brace-for-u-s-government-report-on-import-tariffs-idUSKCN1Q503G>
- Office of the United States Trade Representative. (n.d.). *U.S.-EU Trade Agreement Negotiations.* Retrieved from ustr.gov: <https://ustr.gov/countries-regions/europe-middle-east/europe/european-union/us-eu-trade-agreement-negotiations>
- The Gale Group Inc. (n.d.). *Baby Boomers.* Retrieved from Encyclopedia: <https://www.encyclopedia.com/social-sciences-and-law/sociology-and-social-reform/sociology-general-terms-and-concepts/baby-boom-generation>
- the White House. (2018, December 1). *Statement from the Press Secretary Regarding the President's Working Dinner with China.* Retrieved from whitehouse.gov: <https://www.whitehouse.gov/briefings-statements/statement-press-secretary-regarding-presidents-working-dinner-china/>
- the White House. (2018, Nov 30). *The United States Signs a Stronger Trade Agreement with Mexico and Canada.* Retrieved from whitehouse.gov: <https://www.whitehouse.gov/briefings-statements/united-states-signs-stronger-trade-agreement-mexico-canada/>

Appendix: Inflation Adjusted Index Calculation

The calculation for any inflation adjusted index can be described as follow:

$$\text{Index}'_T = \text{Index}'_{T-12} (\text{Index}_T / \text{Index}_{T-12} - \text{Core CPI YoY}_T / 100)$$

Where Index'_T is the inflation adjusted monthly index level at time T,

Index_T is the monthly index level at time T,

Core CPI YoY_T is the inflation reading at time T

Figure 18: Inflation Adjusted Bond Market Indices³⁶

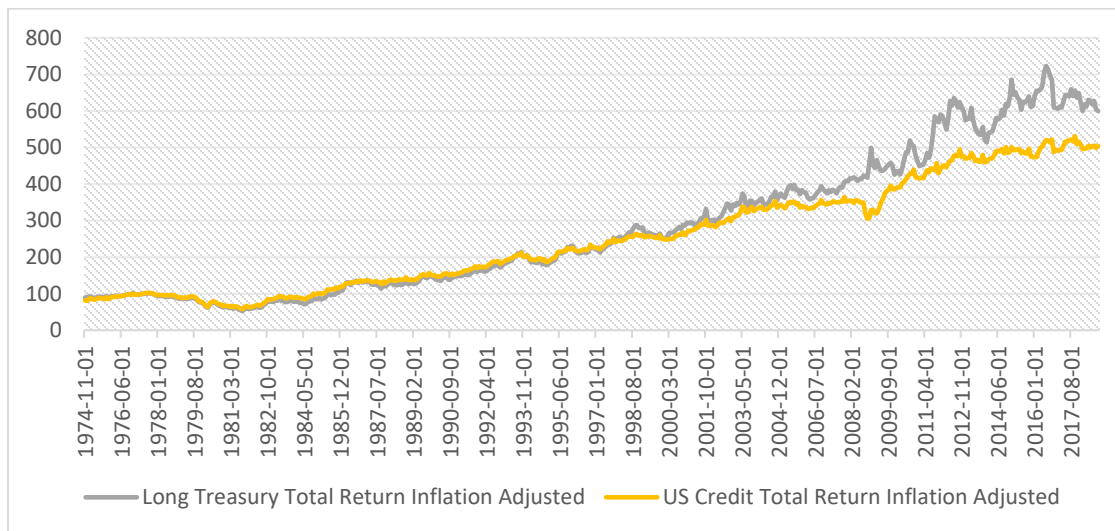
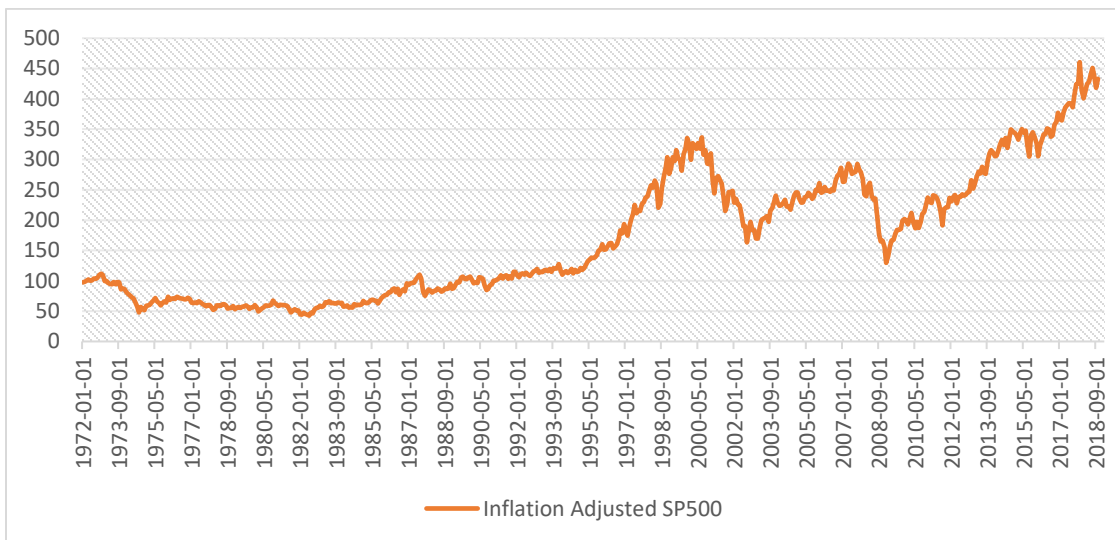


Figure 19: Inflation Adjusted SP500³⁷



³⁶ Data Source: Bloomberg

³⁷ Data Source: Bloomberg

Appendix: Interest Rate Cycle Breakpoints and Major Events³⁸

Breakpoint	Trend	Event
Dec 1972	Increase	Nixon devalued dollar, creating inflation; Fed raised rate from 5.5% to 5.75% in order to combat 3% YOY core inflation
Nov 1974	Decrease	Unemployment rate rose sharply from 4.8% earlier in the year to 5.6%; Fed lowered rates to 9.25% (comparing to July's 13%) to end recession despite 12% YOY inflation
Aug 1977	Increase	Inflation rose to 7% in April; Unemployment rate dropped from January's 7.8% to 7.1%; In response the Fed raised rates to 6% (comparing to 4.75% from last year)
Apr 1980	Decrease	Unemployment rate rose from 6% to 6.3%; Lowered rates two times in April and May to 11.5% from 20% in March, despite 13% YOY core inflation
Aug 1980	Increase	YOY core inflation hit 13.6% in June; Gradually raised rates back up to 20% from 10% to combat Inflation despite high unemployment at 7.3%
June 1981	Decrease	YoY core Inflation cooled down from January's 11.4% to 9.5%; Recession began in July: real GDP struggled at negative growth rate for 2 nd and 4 th quarter Gradually lowered rates over 6 months starting June from 20% to 12%
Jan 1983	Increase	Quarterly real GDP growth rate stabilized from 1982 third quarter's -0.38% and increased to 2% in 1983's third quarter; Gradually raised rates over 5 months from 8.5% to 9.63%
Oct 1984	Decrease	Quarterly real GDP growth rate dropped from 2 nd quarter's 2% to 3 rd quarter's 0.96%; Began lowering again from September's 11.75% to 10%
Dec 1986	Increase	Unemployment rate moderately decreased from 7.2% to 7% over previous months; Raised rates to 6% (comparing to 5.66% in August)
Oct 1987	Temporary Decrease and raised back shortly	Black Monday stock market crash; Lowered rates from 7.55% to 6.88%; Raised back and continue to increase as unemployment rate kept decreasing from 6% to 5.2%

³⁸ (Dash, 2019)

Jul 1989	Decrease	Following the breakout of S&L crisis ³⁹ Fed lowered rates from 9.75% to 9.25% and continued to decrease as crisis worsened
Feb 1994	Increase	Unemployment rate moderately dropped from last year's 7.1% to 6.6%; Fed raised rates from 3% to 3.25% to keep growth and inflation in a healthy range
Jan 2001	Decrease	2001 4 th quarter GDP growth rate lowered to 0.62% compare to 2001 4 th quarter's 1.7% Lowered rates from 6.5% to 6%; Rates continued to decrease to 1% in 2003 as Dot-com Crisis broke out later in the year
Jun 2004	Increase	YOY inflation increased sharply from April's 2.3% to 3.3%; Raised back rates from 1% to 1.25%
Sep 2007	Decrease	Home sales significantly fell and leading economic indicators shew signs of recession; Lowered rates from 5.25% to 4.75% and continued to decrease to 0.25% as financial crisis broke out and economy worsened
Dec 2015	Increase	Growth stabilized; Unemployment rate hit historical low at 5%; Raised rates from 0.25% to 0.5%

³⁹ (Federal Reserve History, n.d.)

Appendix: Part 1 Inflation Model (without Deficit) Regression Results

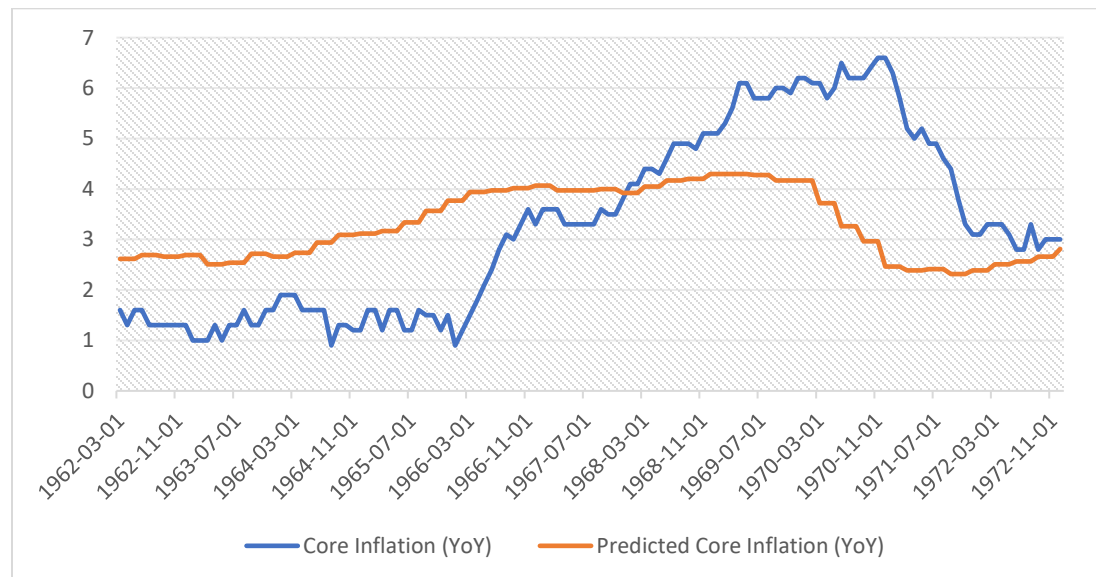
Period 1962 – 1972 (Employment Only)

Response Variable: Core Inflation

Explanatory Variable: Unemployment Rate

Regression Statistics	
Multiple R	0.382435983
R Square	0.146257281
Adjusted R Square	0.139587416
Standard Error	1.685969082
Observations	130

	Coefficients	Standard Error	t Stat	P-value
Intercept	6.860225931	0.775016528	8.851715647	6.0094E-15
Unemployment	-0.753791294	0.160972204	-4.682741956	7.11456E-06



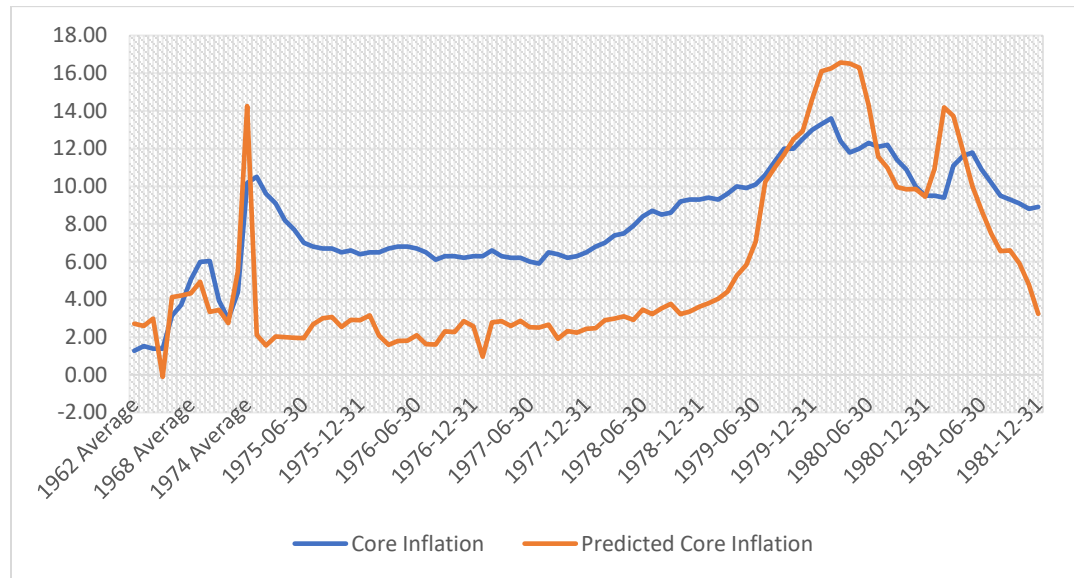
Period 1962 – 1982 (Employment and Energy Prices)

Response Variable: Core Inflation – Predicted Inflation using Unemployment Rate

Explanatory Variable: Oil Price Inflation YoY

Regression Statistics	
Multiple R	0.838838
R Square	0.703649
Adjusted R Square	0.693233
Standard Error	3.908485

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	0	#N/A	#N/A	#N/A
Oil Price Inflation	0.157586	0.010438	15.0977	4.27E-27



Appendix: Part 2 Inflation Model (with Deficit) Regression Results

Model (1) - With Energy Prices

Period: 1982 – Present

Response Variable: Non-Energy Trade Deficit as % of GDP

Explanatory Variable: Core Inflation - Core Inflation Predicted by Unemployment and Energy Prices

<i>Regression Statistics</i>	
Multiple R	0.355924
R Square	0.126682
Adjusted R Square	0.124674
Standard Error	6.252308
Observations	437

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	4.046583	0.650618	6.219596	1.17E-09
4-Month Lagged Non-Energy Balance as % GDP	1.985116	0.249903	7.943562	1.7E-14

Model (2) - Without Energy Prices

Period: 1982 – Present

Response Variable: Non-Energy Trade Deficit as % of GDP

Explanatory Variable: Core Inflation - Core Inflation Predicted by Unemployment

<i>Regression Statistics</i>	
Multiple R	0.729694
R Square	0.532454
Adjusted R Square	0.531379
Standard Error	1.311285
Observations	437

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	3.388963	0.136453	24.83613	1.98E-85
4-Month Lagged Non-Energy Balance as % GDP	1.166542	0.052412	22.25734	8.04E-74

Appendix: Implications of Scenario Analysis Regression Results

SP500 vs. 10 Yr Treasury Yields

Period: 1972 – Present

Response Variable: Inflation Adjusted SP500

Explanatory Variable: 10 Yr Treasury Yields

<i>Regression Statistics</i>	
Multiple R	0.8006
R Square	0.6409
Adjusted R Square	0.6402
Standard Error	62.353
Observations	562

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	342.57	6.0405	56.713	3E-234
Inflation Adjusted SP500	-26.859	0.8496	-31.613	1E-126

Long Treasury vs. 10 Yr Treasury Yields

Period: 1974 – Present

Response Variable: Inflation Adjusted Long Treasury Total Return

Explanatory Variable: 10 Yr Treasury Yields

<i>Regression Statistics</i>	
Multiple R	0.8951
R Square	0.8012
Adjusted R Square	0.8009
Standard Error	84.135
Observations	528

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	615.95	8.1823	75.278	8E-284
Long Treasury Total Return Inflation Adjusted	-52.885	1.1485	-46.046	1E-186

US Credit vs. 10 Yr Treasury Yields

Period: 1974 – Present

Response Variable: Inflation Adjusted US Credit Total Return

Explanatory Variable: 10 Yr Treasury Yields

<i>Regression Statistics</i>	
Multiple R	0.9095
R Square	0.8272
Adjusted R Square	0.8268
Standard Error	59.465
Observations	528

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	509.69	5.7831	88.134	0
US Credit Total Return Inflation Adjusted	-40.727	0.8118	-50.171	1E-202

10 Yr Treasury Yields vs. Core CPI

Period: 1972 – Present

Response Variable: 10 Yr Treasury Yields

Explanatory Variable: Core CPI

<i>Regression Statistics</i>	
Multiple R	0.7547695
R Square	0.569677
Adjusted R Square	0.5690432
Standard Error	1.8975076
Observations	681

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	2.9689647	0.13	22.842	4E-86
Core CPI YoY	0.8443325	0.0282	29.981	2E-126