

Economic Analysis

Inflation Regime Changes and the Fed's Reaction Function

Probability of inflation regime change is small, but growing supply-side pressures could complicate the Fed's exit strategy if expectations become untethered

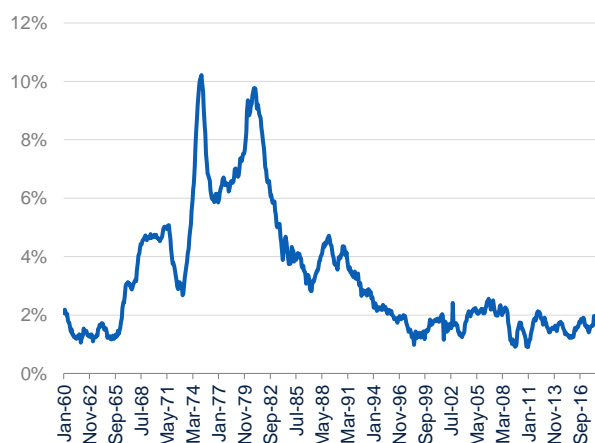
Boyd Nash-Stacey

The recent firming of inflation, an expansionary fiscal agenda, rising debt levels and high-levels of resource utilization all pose upside risks to the near-to-medium term inflation outlook. In addition, the incentives to invest and work should rise in response to the recent tax reform. If the increased in the supply-side pressures fail to translate into nontrivial gains in productivity, there is the potential for inflation to accelerate.

During the high inflationary period in the 1970s-1980s, inflation moved quickly from an average annual rate of 2.8% in 1960-1973 to 6.9% in 1973-1983. In fact, prior to 1965, inflation averaged close to 1.4% per year, similar to the post-crisis period in the U.S. This changed quickly in the following decades, leading to overly responsive monetary policy reaction function and an emphasis on targeting inflation expectations. While today's inflation rate remains well below the high inflation regimes of the 70s-80s, core inflation has begun edging up from August 2017 lows of 1.4% year-over-year to 2.0% in July 2018.

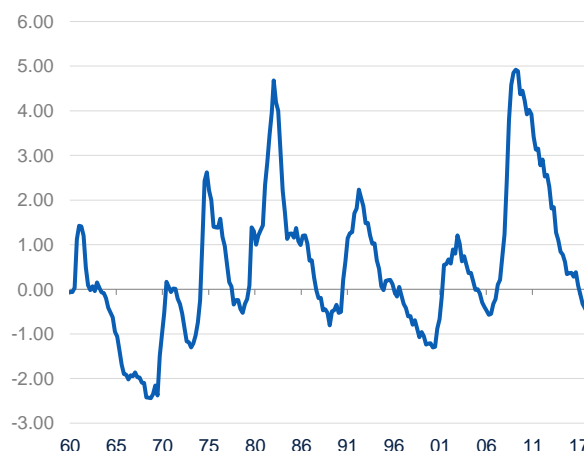
In one sense, the higher inflation rates would be welcome news for those supportive of inflation level targeting, as the persistently higher inflation could neutralize the prolonged undershooting in 2011-2016. In essence, this would bring the level of inflation back in line with its longer-term trend. A back of the envelope calculation suggests that to close this gap by 2022 would require 3% average annual inflation over that period. However, persistently rising inflation combined with the aforementioned factors could engender fears of run-away inflation as in the 1970s and early 1980s, despite the persistent gap. While our baseline continues to assume that inflation will exceed the 2% target over the medium-term, a complimentary analysis on the probability of a regime change also confirms that the probability of entering a high inflation regime remains low, assuming that monetary policy is responsive, wage pressures remain subdued and expectations remain anchored.

Chart 1. Core PCE Price Index, year-over-year %



Source: BBVA Research & BEA

Chart 2. Unemployment rate gap, %



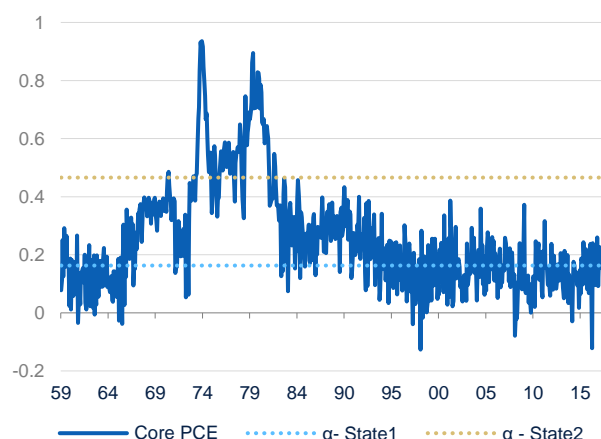
Source: BBVA Research, BLS & CBO

To test the likelihood of entering into a high-inflation regime, we estimate a two state Markov-switching dynamic regression with state dependent covariates. After testing various transformations, we choose to focus on the monthly percent change in core Personal Consumption Expenditures (PCE) because the series has two observable and distinct volatility regimes and, in the event of a persistent rise in inflation, the Fed would look to core PCE to calibrate the appropriate monetary policy response. The sample ranges from January 1961 to July 2018. Chart 5 summarizes the results from the covariate dependent estimation.

Currently the U.S. remains in a low inflationary regime despite the recent increases in actual inflation. However, if the economy shifted into a high inflation state, the likelihood of transitioning back to a low state would be small given the transition probability of less than 2%, meaning that the Fed must carefully monitor any regime pressures to avoid entering a high inflation regime that would be difficult to reverse.

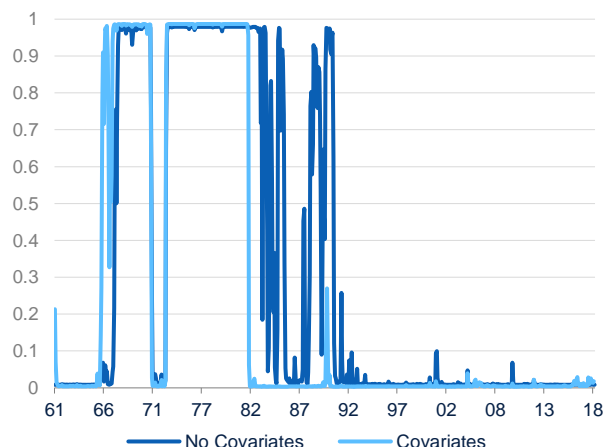
In the estimation that excludes explanatory factors, there are two statistically unique variance regimes, with distinct positive means of 0.17% in the low inflation regime (State 1) and 0.49% in the high inflation regime (State 2). Moreover, the estimated duration of being in State 1 relative to State 2 is about 3:1, meaning that, on average, inflation is about three times more likely to be in the low inflationary regime as inferred by the state probabilities. In terms of the probability of transitioning from the low inflationary regime to the high, the result suggests that there is a less than one percent probability on average of shifting to a high inflation regime.

Chart 3. Core PCE Price Index, month-over-month %



Source: BBVA Research & BEA

Chart 4. Probability of High Inflation Regime, %



Source: BBVA Research

When covariates are included in the state equation the aforementioned conclusions hold: there are two distinct inflationary regimes, the probability of transitioning from a low to high state is low (<1%) and the majority of the sample period is expected to be in a persistent low inflationary environment (2.5:1). However, the inclusion of explanatory determinants of inflation regimes allows for further inference on the factors that could explain and predict a state change.

To allow for the inclusion of the 1970s and 1980s high inflationary environment, covariates were chosen both for their explanatory power and theoretical validity, but also based on sample size as excluding periods prior to the 1980s leads to spurious conclusions. This was not surprising given the significant changes that occurred in the early 1970s such as the oil price shock, the collapse of the Bretton Woods system and the policy mistake of lowering the firewall between fiscal and monetary policy. As such, the state probability equations include ISM Manufacturing Prices Index, the 10-year ex-post term premium and implied deviation from a Taylor-like monetary policy rule.

Four results from the state-dependent equation are noteworthy. First, all three factors have a high degree of significance (Chart 5) in the first state given that these factors are essential to well anchored inflation. Second, the term premium has the largest impact, assuming a one standard deviation shock to the explanatory factors. While also significant, deviation from a monetary policy rule has less explanatory power than the 10-year term premium. Third, the term premium is also the largest contributor to the second state, suggesting that it remains an important explanatory factor in both states. Fourth, the impact that deviation in monetary policy has on the state shifts from being positively related to the state to being negatively associated with it, suggesting that once the economy is in a high inflation environment, an overly accommodative policy will significantly increase the expected mean.

Chart 5. Two-State Markov-Switching Dynamic Regression

Variables	State1	State2	Sigma1	Sigma2	p11	p21
ISM Prices	0.0760*	-0.319*				
	(0.0398)	(0.169)				
Term Premium	0.0352***	0.106***				
	(0.00352)	(0.0119)				
Deviation from Taylor Rule	0.00653***	0.00303				
	(0.00225)	(0.00385)				
Constant	0.139***	0.337***	-2.431***	-1.975***	-5.630***	4.315***
	(0.0102)	(0.0290)	(0.0315)	(0.0552)	(0.720)	(0.656)
Observations	684	684	684	684	684	684

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: BBVA Research

Inflationary pressures building in volatile subcomponents

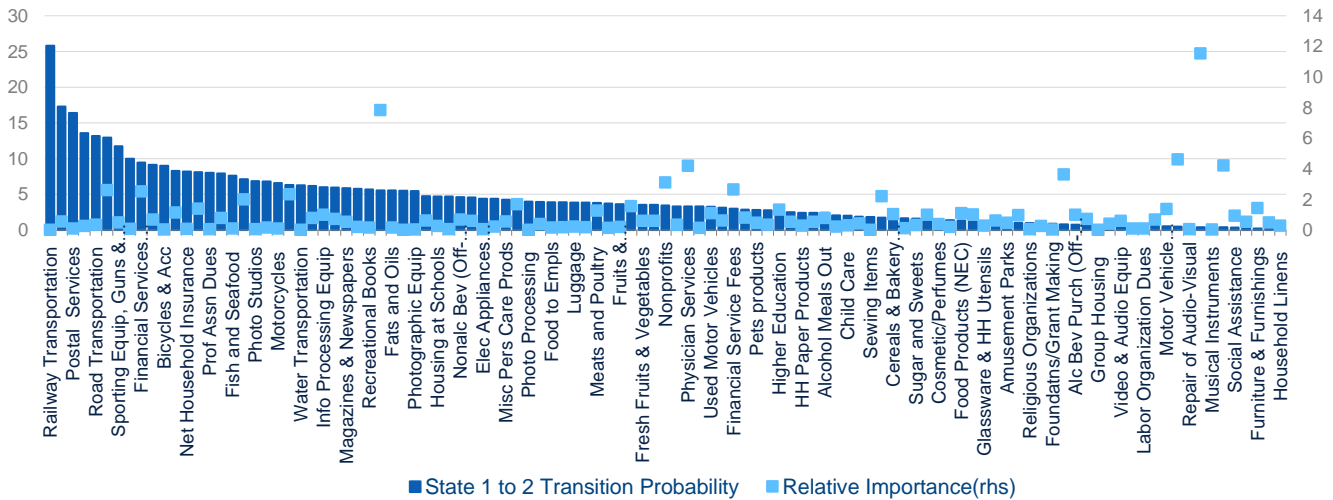
While the previous results suggest that aggregate inflationary conditions remain anchored, there is a possibility that movements in important subcomponents could precede any rise in aggregate inflation, providing an early warning sign of a regime shift. For instance, less than 30% percent of the 109 personal consumption expenditure categories that we examined had a higher than 50% probability of entering a high inflation regime. Although seemingly high given that the overall probability is close to one percent, these categories explain less than 20% of personal consumption expenditures. Household appliances, musical instruments, cosmetics, video media rental and dental services currently have the highest probability of being in a high inflation regime, all with a greater than 95% probability. However, these categories represent less than 2% of overall personal consumption, suggesting no contagion risk of overheating from systemically important inflationary components.

However, the stickiness and probability of transitioning from a stable regime to an unstable one for each component shows that some factors, while stable in low inflation regimes, can become unpredictable and difficult to reign in when unanchored. For example, household appliances are a small share of overall consumption, but are sticky in the sense that once in the high inflation regime their likelihood of transitioning back to the low inflation state is less than one percent. Similar to aforementioned factors rental and housing costs, healthcare costs and financial services prices are extremely sticky in high inflation regime, and these components make up a non-trivial share of consumer prices and thus could pose a greater risks to overall inflation if conditions begin to tilt to the upside.

In fact, all of the five most important contributors to consumer prices are sticky in the high inflation state and account for 32.4% of total personal consumer expenditures: owner equivalent rent (OER), hospital prices, other purchased meals, tenant rent, and physician's services. Currently, after accounting for each categories contribution to the total, the implied probability of shifting to a high inflation regime is less than 2%. However, the top ten most important categories that account for nearly 50% of all personal consumptions suggest that the probability is closer

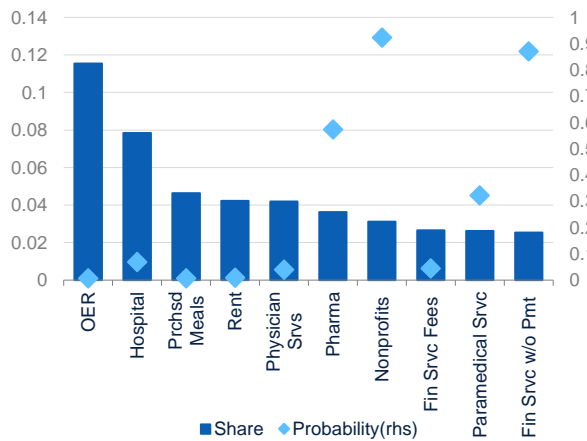
to 20%. The gap in probability relates to elevated price regimes in pharmaceuticals, financial services furnished without payment and nonprofits prices. However, categories such as OER, and tradables such as games, toys, furniture and linens currently have a low probability of entering high inflation state and are less likely to transition from the low to high state, suggesting that in the short-run aggregate prices will remain anchored in low inflation state.

Chart 6. Transition Probability and Relative Importance, %



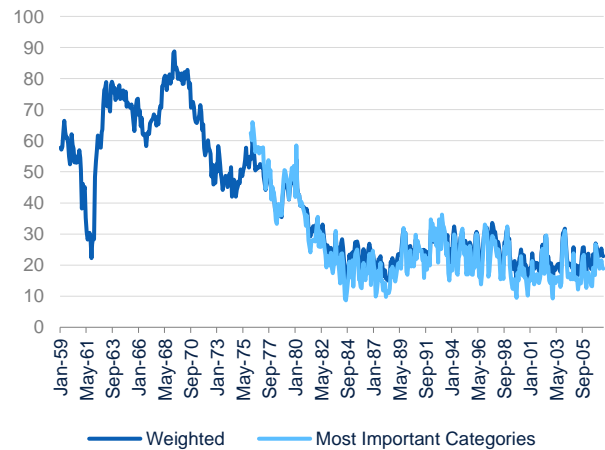
Source: BBVA Research

Chart 7. High Inflation Regime Probability and Relative Importance, %



Source: BBVA Research

Chart 8. High Inflation Regime Diffusion Index*



Source: BBVA Research

* 50+ = Bulk of Components in High Inflation State

Diffusion indexes can help to conceptualize the risks of each distinct inflation regime. For instance, using a standard methodology, we find that all of the diffusion indexes are well below 50, suggesting that there is not a significant co-movement among inflation categories to the upside. For the categories that have the highest relative importance (> than 1%) the diffusion index, is rising, but was 22.5 in June, which is only 10% higher than the average over the past 10 years. The diffusion index with the largest variation from its average was the index that considers factors for which the Fed is more sensitive too; this could underlie the increased scrutiny on inflation. Conversely, the index for which the Fed has the greatest influence on is -2.1% below the average over the past 10 years, suggesting current monetary policy strategy has been successful at keeping these inflationary forces at bay.

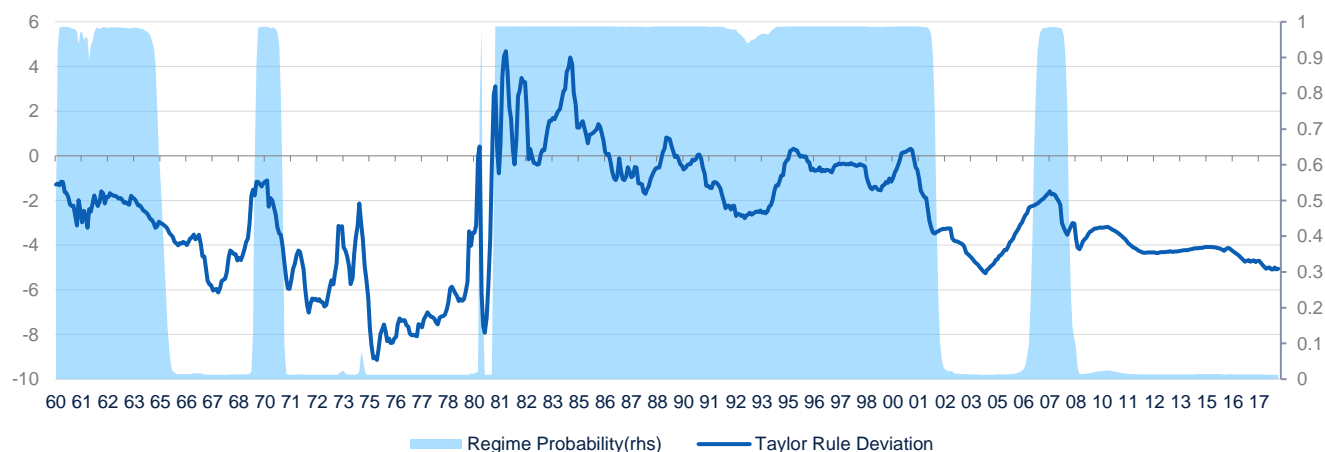
Potential monetary policy responses from inflation regime change

Understanding the Fed’s reaction function with respect to a regime change is vital, as Chairman Powell has suggested:

...the literature on structural uncertainty ... recommends that when you are uncertain about the effects of your actions, you should move conservatively. In other words, when unsure of the potency of a medicine, start with a somewhat smaller dose

In fact, a highly responsive Fed could imply an abrupt increase in the fed funds rate, which would increase the probability of the yield curve inverting and potentially push the economy closer to recession; doing so could send an ominous signal to markets. Conversely, an unresponsive Fed could imply a persistent untethered inflationary regime, which could come at the price of an extreme correction down the road, stagflation, or debt deflation. However, new research from the Federal Reserve Board, which was quoted by Chairman Powell in his Jackson Hole speech, suggests that the tradeoffs from misestimating the stance of monetary policy are small. As such, putting too much emphasis on the current unemployment gap and prevailing Phillips curve could lead to overly tight monetary policy that creates unnecessary headwinds to economic activity.

Chart 9. Monetary Policy Regime Change Probability and Taylor Rule Deviation, % and PP



Source: BBVA Research, Haver Analytics & FRB

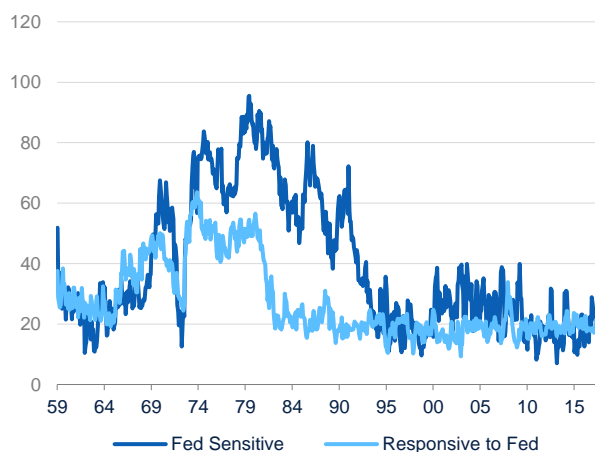
That being said, the influence that regime change probabilities have on the Fed’s reaction function is useful in understanding the potential response of the Fed to changes in certain components. The results from a comprehensive set of univariate regressions suggest that certain categories have the greatest influence on Fed policy decision making. This includes categories such as mass transportation costs, telecommunication services, alcohol, and education and books. The categories that elicit the greatest positive response from the Fed tend to be more likely to shift from a low to high inflation state, have a higher relative importance, exhibit less stickiness in the low inflation state and are not surprisingly in the high inflation state less often. Based on a diffusion index for categories that engender a response from the Fed, inflation conditions are 25% higher than average at 25.0. This implies that the Fed’s focus on inflation will most likely increase, and that further interest rate increases are very likely.

To monitor this development we also developed a Markov switching model to measure the probability of being within distinct Fed monetary policy regimes. We found that historically there have been two statistically different policy regimes: overly accommodative or restrictive. Interestingly, there does not appear to be a statistically third

regime possibly representing a neutral stance, something the committee strives to achieve. Historically, monetary policy has been in the more accommodative regime 20% more often. In addition, the probability of transitioning between states is about 1.5% in both cases, confirming the persistence of monetary policy cycles. However, currently, there is a 98.6% probability that we remain in the accommodative state for the near future.

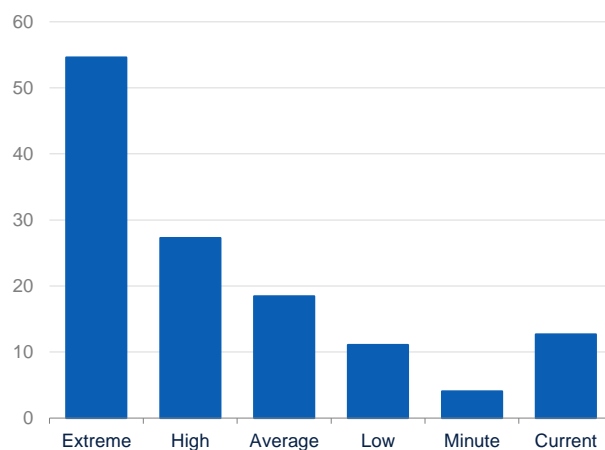
Taken together, according to our model results, we are still in in a low monetary policy regime even though actual and expected inflation have crept up over the last twelve months. Historically the U.S. is more likely to be in a low monetary policy environment; however, if the transition from a low to high state occurs, there is also a high probability of remaining in that state, which has significant implications for future Fed policy. This would suggest that it might make sense for the Fed to err on the hawkish side, even when if there are possible the downside risks to that strategy.

Chart 9. High Inflation Regime Diffusion Index *



Source: BBVA Research
* 50+ = Bulk of Components in High Inflation State

Chart 10. Conditional Probability of Fed Rate Hike*, %



Source: BBVA Research
*Results based on term premium, inflation regime probability & Taylor Rule

Equally important is the Fed's ability to impact categories that could potentially shift into a high inflation state. Without this, the Fed could easily cede control of inflation and expectations, rendering monetary policy ineffective in the medium-run and potentially risking a substantial rise in interest rates. That said, categories including goods with inelastic supplies and/or demand such as pharmaceuticals, therapeutic devices and electricity and gas, and services such as healthcare cost, legal fees, electricity, and gas prices are responsive to Fed Policy. This suggests that the Fed continues to maintain a high degree of control over the state of inflation. In fact, the steady rise in rates over the past 24 months has brought the diffusion index for this category to levels well below the 2016 average. Moreover, this diffusion index is the only one that is currently trending below its 10-year average.

We also estimated a parsimonious model of a probability of a rate hike based on changes in the stance of monetary policy (deviation from Taylor rule), the 10-year term premium, and the probability of entering a high inflationary regime. In fact, at six and twelve months ahead estimations, a 10pp increase in the probability of entering a high inflationary regime increases the probability of a Fed rate hike by seven and five percentage points, respectively. Moreover, going from a low inflationary regime (10th percentile) to a high inflationary regime (90th percentile) increases the probability of a Fed rate hike by 15pp, from 14.5% to 29.4%, all things equal. If we were in fact in an extreme scenario with overly accommodative monetary policy, in a high inflationary regime and with rising or high term premiums, the probability of a rate hike at every meeting would be greater than a coin flip. Such an environment would create unwarranted monetary policy uncertainty, putting the credibility that the Fed has gained over the past four decades in jeopardy.

No time to panic, but careful monitoring warranted

In 2018, a nontrivial change in inflation has justifiably increased fears of a rapid rise in actual and expected inflation. Experiences from the 1970s-80s suggests that things can devolve quickly, and can imprint lasting scars on Fed policy. While actual inflation pressures have risen, the probability of entering a high inflation regime remains extremely low at 0.8%. Household appliances, musical instruments, cosmetics, video media rental and dental services currently have the highest probability of being in a high inflation regime, all with a greater than 95% probability; however, these categories represent less than 2% of overall personal consumption. Component-level tracking with a comprehensive diffusion index also shows conditions remain consistent with a low inflation regime.

A complimentary analysis of monetary policy regimes suggests that we remain in an accommodative state. Our results also show that a shift in inflation regime probabilities or deviating from a traditional monetary policy course would erode the confidence and credibility that Fed has worked to maintain. Ultimately, there remains a high degree of endogeneity between inflation and U.S. monetary policy, as the Fed is likely to respond in kind to any uptick in the probability of an inflation regime shift with the appropriate monetary policy response. As such, our baseline continues to assume that the Fed will raise rates steadily through the next 4-6 quarters.

DISCLAIMER

This document was prepared by Banco Bilbao Vizcaya Argentaria's (BBVA) BBVA Research U.S. on behalf of itself and its affiliated companies (each BBVA Group Company) for distribution in the United States and the rest of the world and is provided for information purposes only. Within the US, BBVA operates primarily through its subsidiary Compass Bank. The information, opinions, estimates and forecasts contained herein refer to the specific date and are subject to changes without notice due to market fluctuations. The information, opinions, estimates and forecasts contained in this document have been gathered or obtained from public sources, believed to be correct by the Company concerning their accuracy, completeness, and/or correctness. This document is not an offer to sell or a solicitation to acquire or dispose of an interest in securities.