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U.S. Inflation Chart Book

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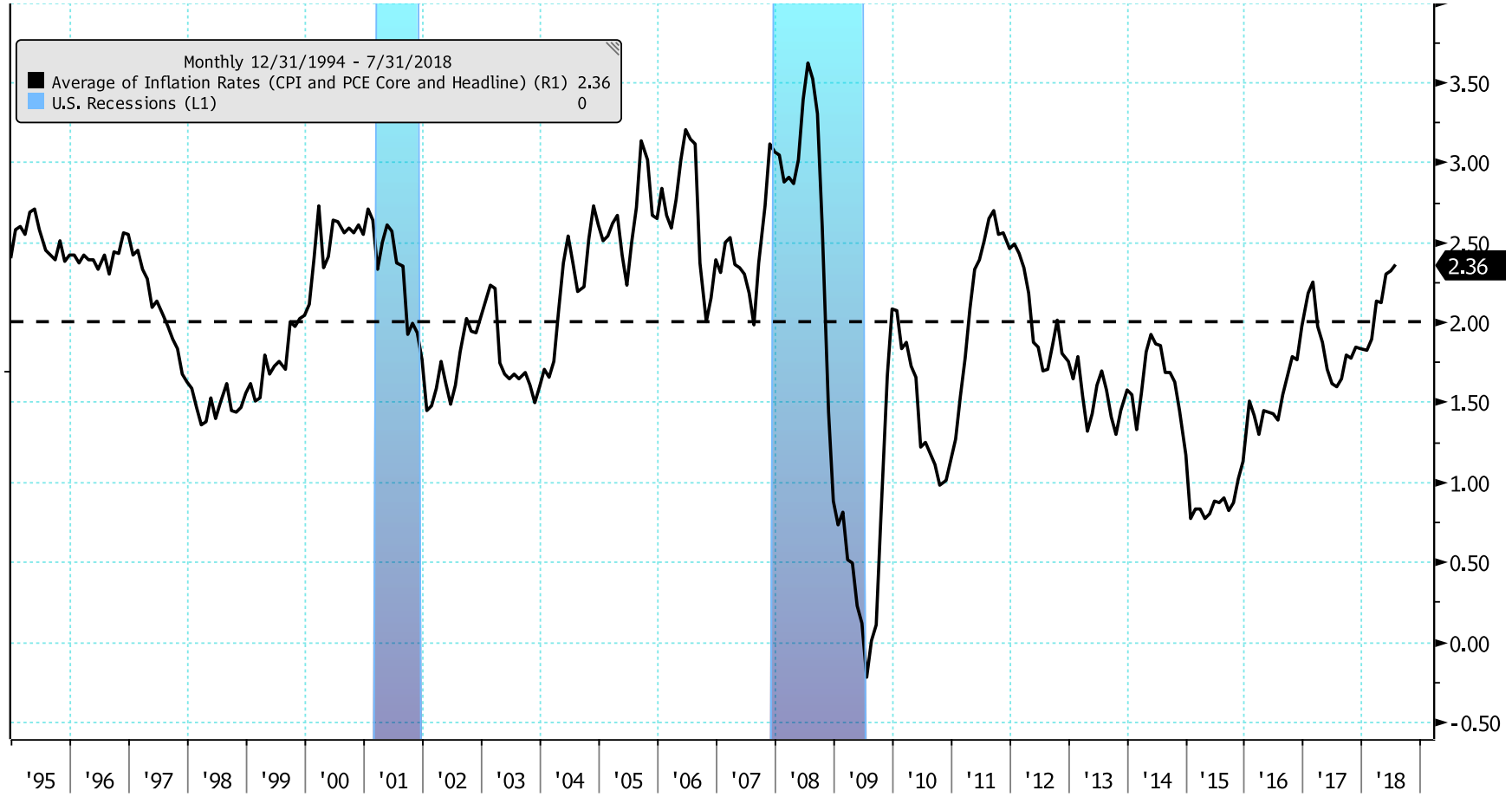
Nick Reece, CFA
Senior Financial Analyst, Merk Investments LLC

Average U.S. Inflation Measure

Average of Core and Headline Rates YoY of Personal Consumption Expenditures (PCE) Index and Consumer Price Index (CPI)



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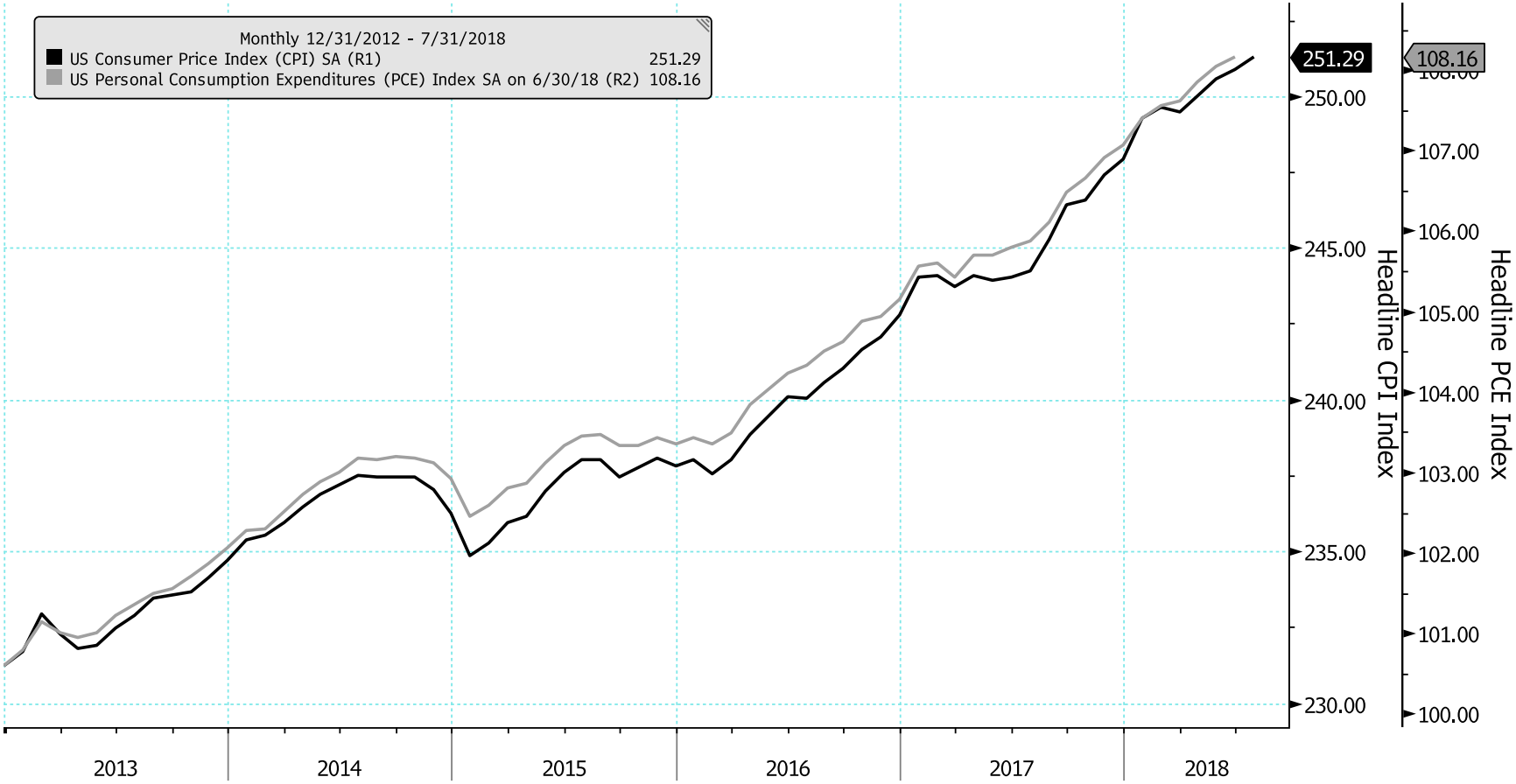
Analysis: One reason inflation is potentially relevant is that it is typically rising and/or at a relatively high level going into a recession, and therefore relates to thinking about the business cycle. On this chart, going back to the mid 1990s, the inflation average was above 2.5% YoY when recessions started. Inflation tends to decline during recessionary periods: from about 2.5% to 1.5% in 2001 and from about 3% to 0% in 2008-2009 (the oil price hit a high of $145/barrel in July 2008). The average of the four measures is now back above the 2% Fed inflation target. Powell has described the target as symmetric, meaning he is seeking to prevent persistent deviations from the 2% target in either direction. Part of the recent rise in annual inflation readings is due to "base-effects," which are effects based on kinks in the data series from the "base" data point used to calculate the YoY rate of change.

Headline CPI and PCE Index

Looking out for base effects in the benchmark CPI and PCE headline indexes



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Analysis: In addition to tracking the YoY inflation readings, it is helpful to look at the underlying index levels because base effects can be a factor, for example the indexes moved sideways into the summer last year which suggests a lower than normal baseline from which to measure YoY readings. Currently, headline YoY readings are likely to be somewhat higher than they otherwise would be as a result. Base effect refers to the effect that a known change in the denominator has on YoY calculations, e.g., the downtick from April 2017 to May 2017 in the CPI Index (black) might contribute to a higher than normal YoY reading for May 2018 because of the dip down in the denominator for the calculation, which is known in advance of the actual May 2018 YoY reading. Base effects are important to monitor as they tend to be short lived and can provide misleading inferences regarding overall trends.

Oil "Base-effects"

The cumulative percentage change in the oil price over the past year

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Analysis: the oil price can be a major factor in determining base effects in the indexes. The price of oil is about 40% higher than this time a year ago. As you can see from the chart, oil made a recent peak in June 2018, which suggests there might be some negative base effects come the June 2019 YoY inflation reading.

Inflation Expectations and Oil

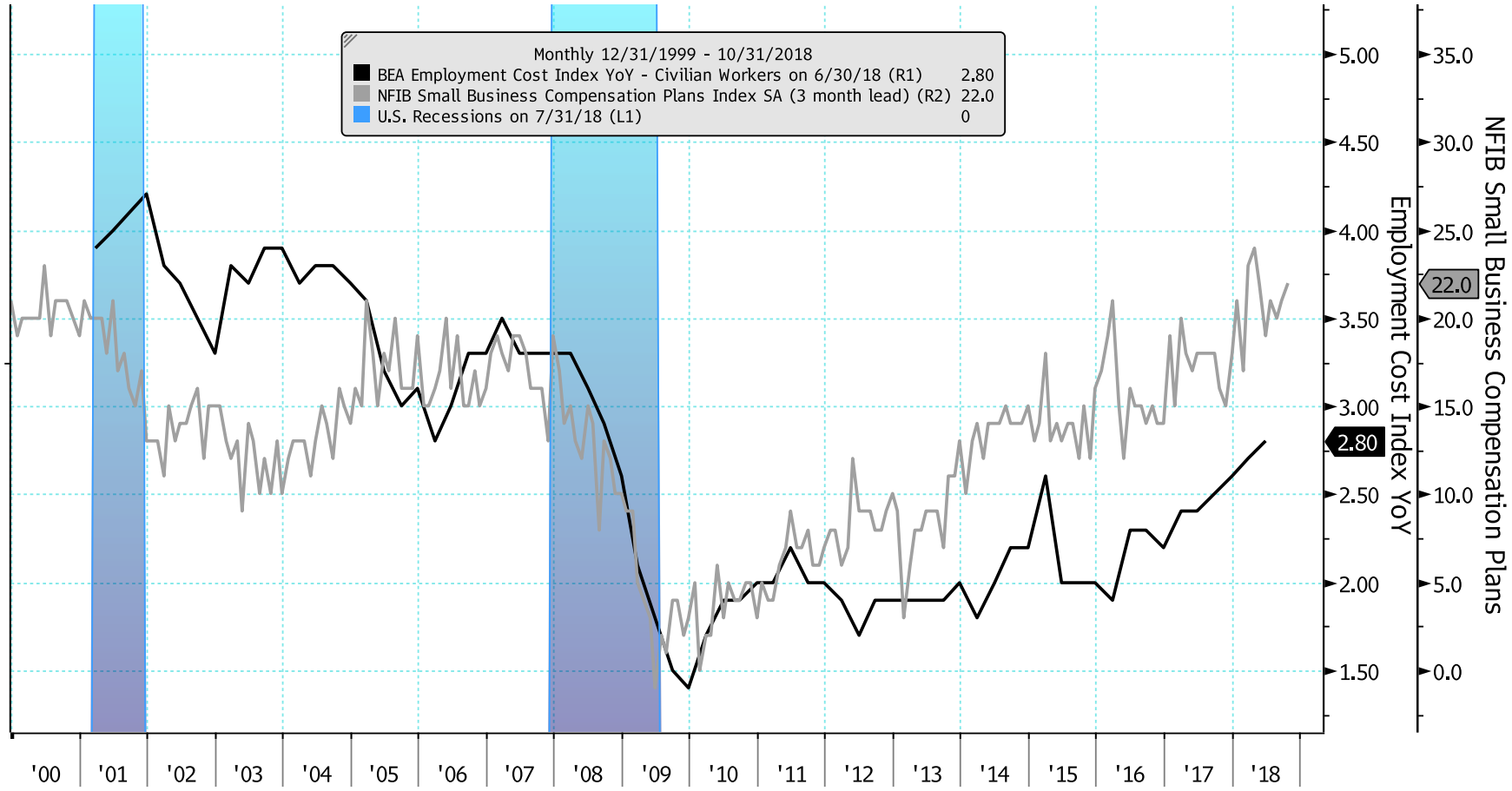
West Texas Intermediate (WTI) Oil Spot Price and the 5-year forward CPI annualized inflation expectation

Source: Bloomberg, © Merk Investments LLC www.merkinvestments.com/research

*Analysis: it seems that annualized inflation expectations (over the subsequent 5 years) are closely related to the level of the oil price. This may relate to the idea of "cost-push" inflation- in other words, the idea that higher input costs such as energy will eventually be passed onto consumers. However energy is also a direct consumer good and appears to show up in CPI readings without a lag. I personally question whether it makes sense that the market expects a higher rate of inflation going forward based on a higher oil price today. Specifically, it seems plausible that a higher oil price today would actually create future negative base effects for annual inflation readings. In any case, inflation expectations are important for Fed rate hike expectations and for bond yields further out the curve, as they contain an inflation premium. *The 5yr CPI annualized inflation expectation is determined by market pricing in a derivative contract based on the CPI index.**

Labor Costs

Employment Cost Index and Small Business Compensation Plans (3-month lead)



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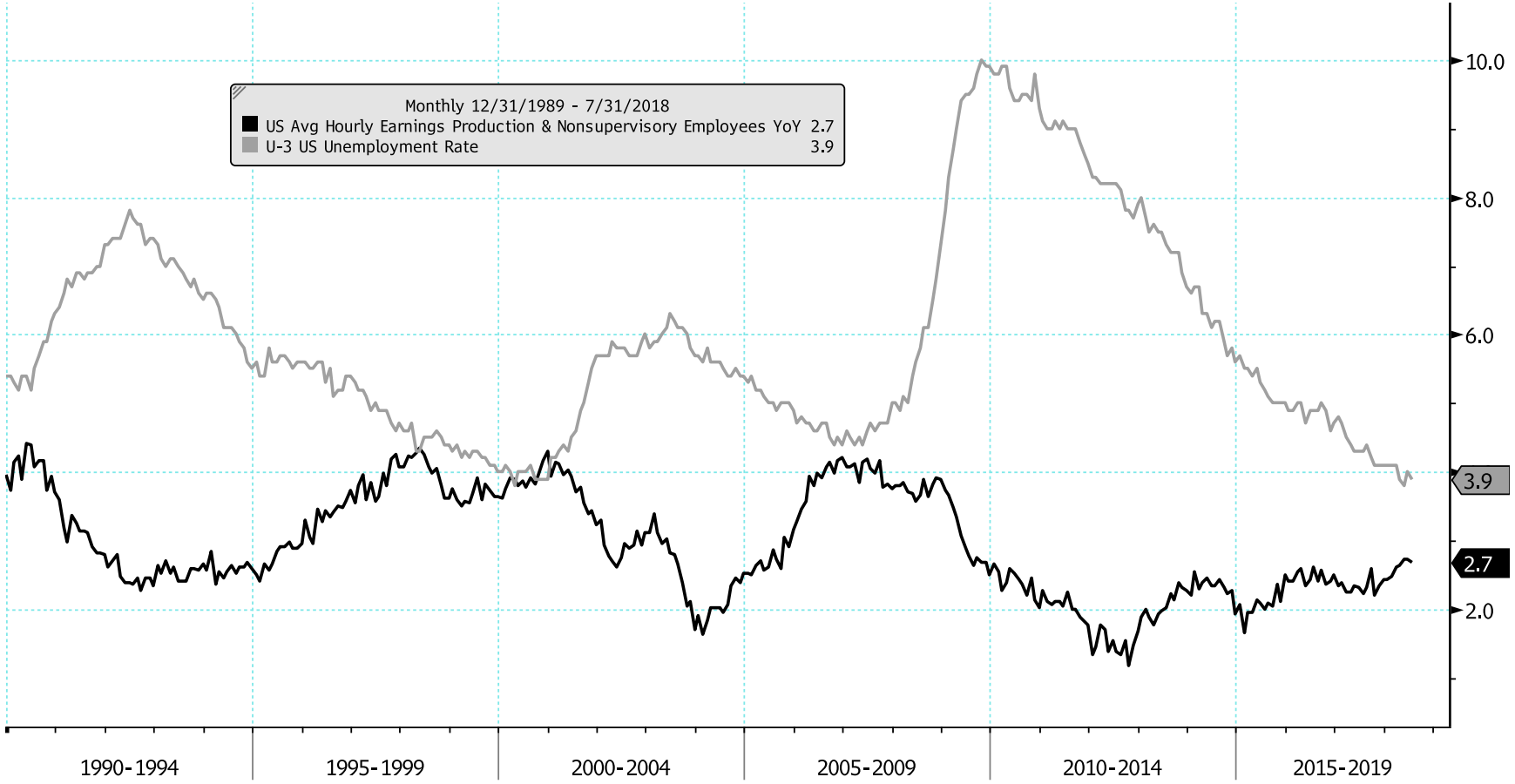
Analysis: The employment cost index (ECI), which many economists believe to be a better labor market inflation gauge than average hourly earnings, shows an uptrend that is supported by the rise in the NFIB Small Business Compensation Plans, which appears to be somewhat of a leading indicator for the ECI. The idea that an increase in wages or employment costs might lead to overall inflation readings relates to the idea of "cost-push" inflation.

On this chart the grey series is shifted forward on the horizontal axis to show the potential fit as a leading indicator

Unemployment Rate and Wages

The relationship between the unemployment rate and wages is referred to as the "Phillips Curve"



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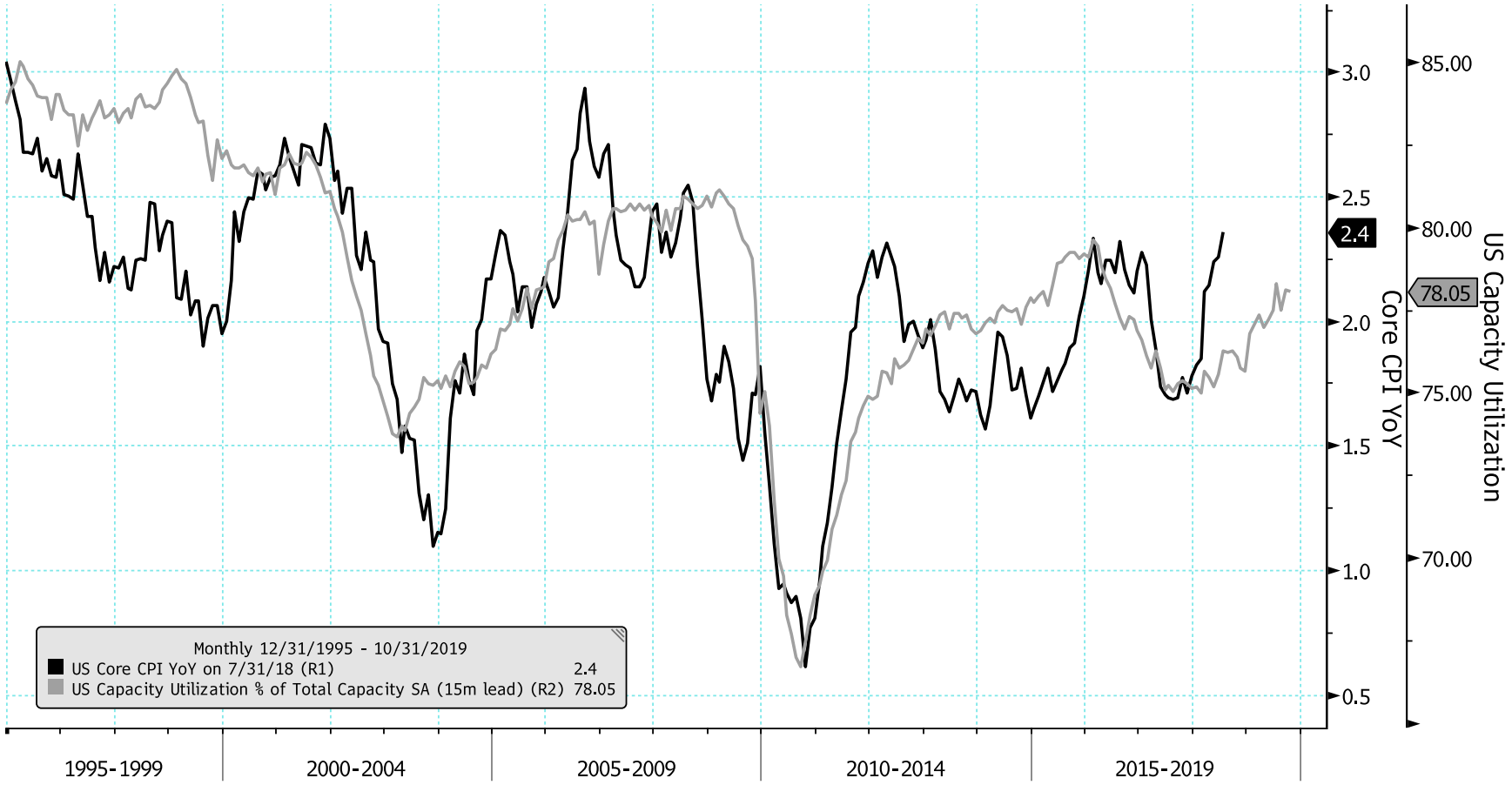
Analysis: This chart shows the relationship between the unemployment rate and wage inflation. The general thinking among most economists is that a lower unemployment rate is associated with a higher rate of wage inflation. This business cycle has so far shown relatively low wage inflation given how much the unemployment rate has declined. This chart is also included in the Fed Chart Book. A number of commentators are suggesting that wage inflation is finally starting to come through…

Capacity Utilization and Inflation

Capacity Utilization Rate (lead by 15 months) and Core CPI YoY



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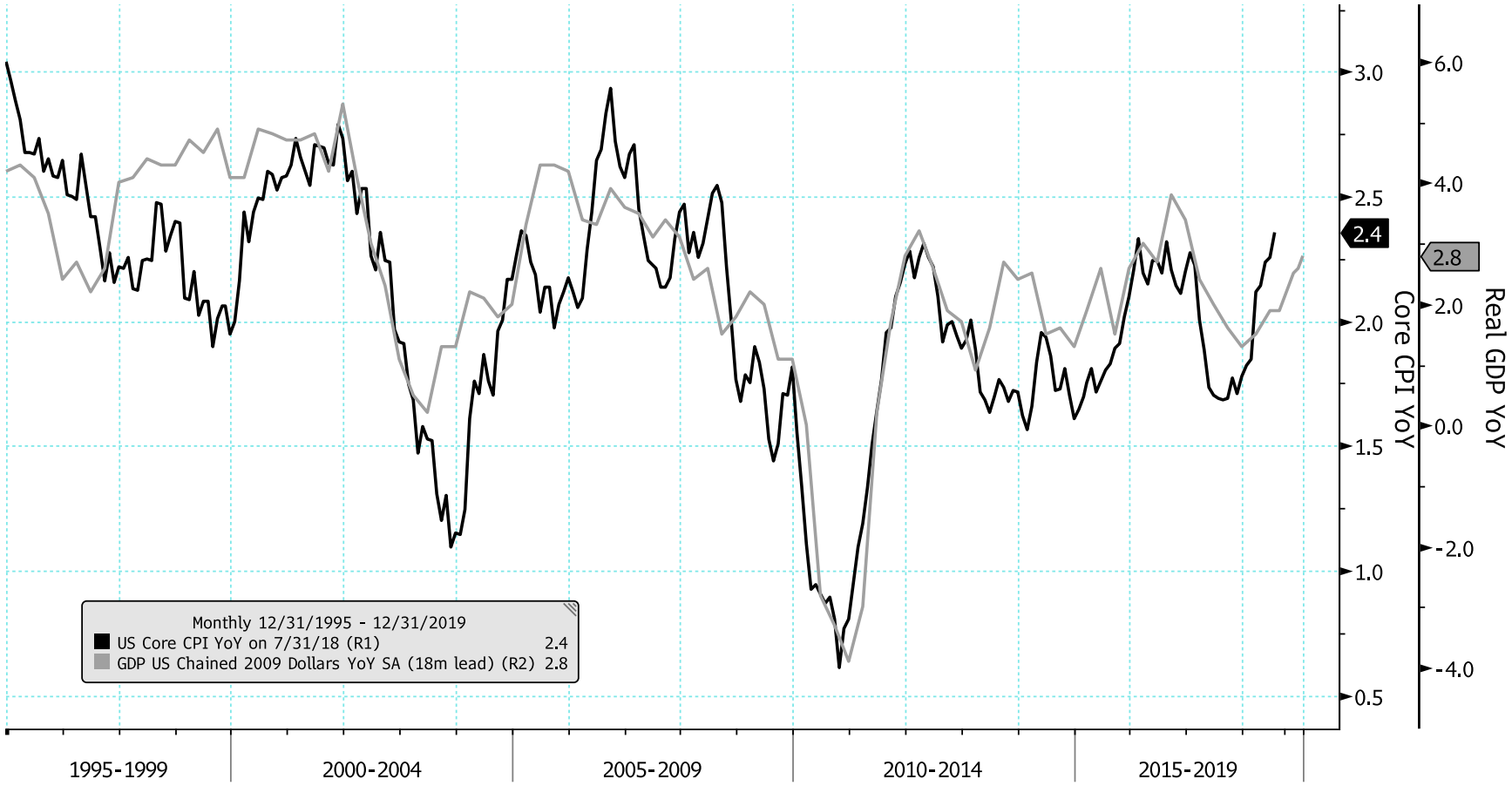
Analysis: the relationship between capacity utilization and inflation relates to the idea that a reduction in economic slack is inflationary as producers compete with each other for fixed capital and labor inputs needed for production- similar to the concept on the previous "Phillips Curve" chart. This chart suggests there is a potential leading indicator quality to the capacity utilization rate.

On this chart the grey series is shifted forward on the horizontal axis to show the potential fit as a leading indicator

GDP Growth and Inflation

Real GDP YoY (lead by 18 months) and Core CPI YoY



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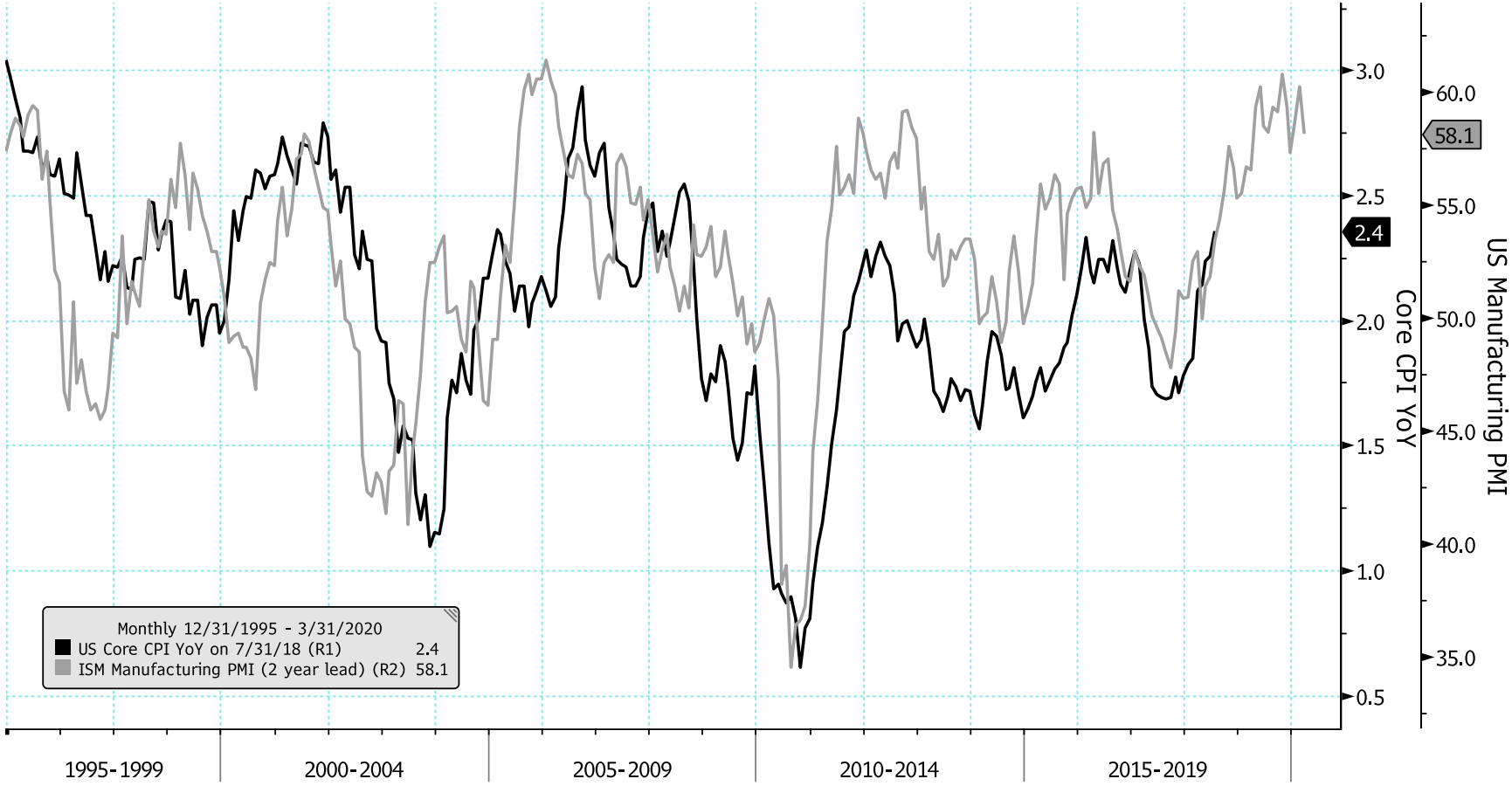
Analysis: This chart suggest that real GDP growth might be a leading indicator to inflation.

On this chart the grey series is shifted forward on the horizontal axis to show the potential fit as a leading indicator

US Manufacturing PMI and Inflation

US Manufacturing Purchasing Managers Index (PMI) (lead by 24 months) and Core CPI YoY



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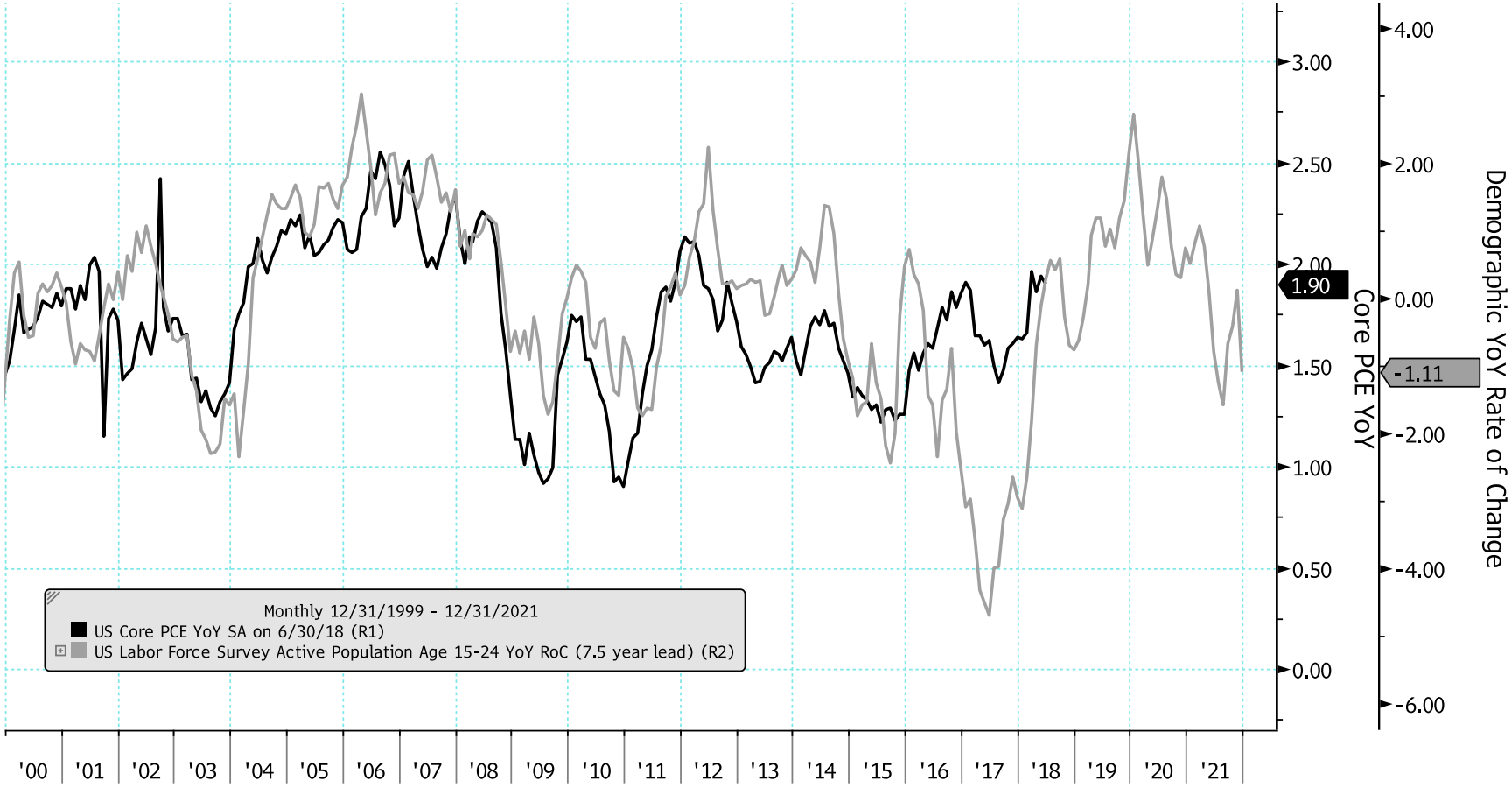
Analysis: Consistent with the previous chart, here the Manufacturing ISM (which is an economic growth leading indicator) appears to be a longer leading indicator for inflation than the previous GDP chart. It potentially suggests that inflation might peak late next year.

On this chart the grey series is shifted forward on the horizontal axis to show the potential fit as a leading indicator

U.S. Demographics and Inflation

Short to Medium Term Outlook (Annual Rate of Change in the 15-24 year old labor force (lead by 7.5 years) vs Core PCE YoY)



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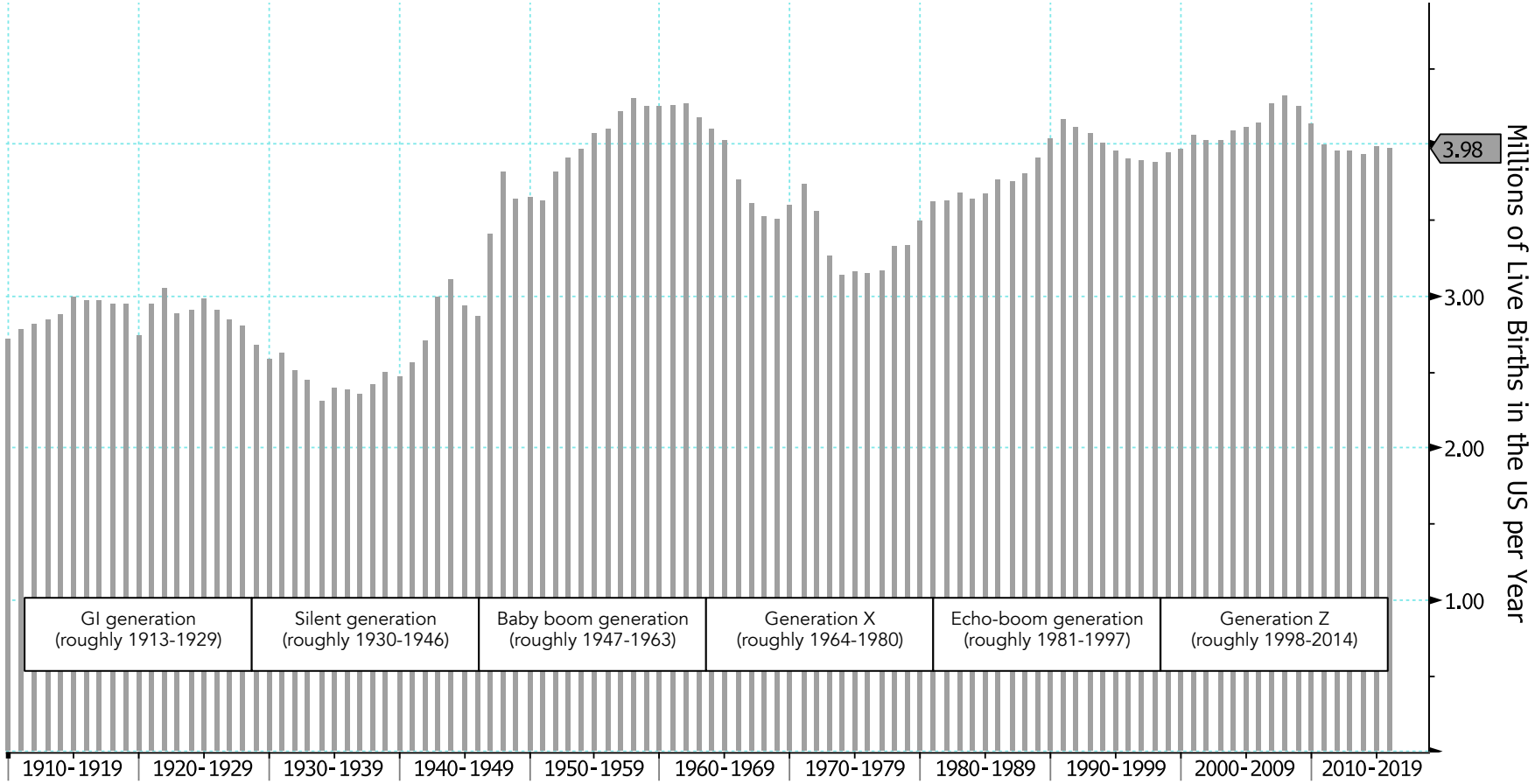
*Analysis: This chart is a curiosity to me as there appears to be a fit between a demographic metric and the inflation reading. Consistent with the above PMI chart it suggests there might be inflationary pressure through 2019. In the context of the following chart, it might be that the next couple of years are inflationary as the echo-boomers (peak birth year 1990, and with number of births rising each year from 1983 to 1990) move into their peak borrowing years (e.g., take out first-time mortgages, and spend money on household/family formation) inflation might move higher. This chart is somewhat experimental, the apparent relationship here might be mostly coincidental. However, the logic makes a certain amount of sense to me and adding some credibility to this framework is that it has been tracking pretty well since it was created in Oct 2017 when the Core PCE YoY was 1.3%. *On this chart the grey series is shifted forward on the horizontal axis to show the potential fit as a leading indicator**

U.S. Live Births per Year

Millions of live births per year in the U.S. from 1905 to 2015 with generation groupings



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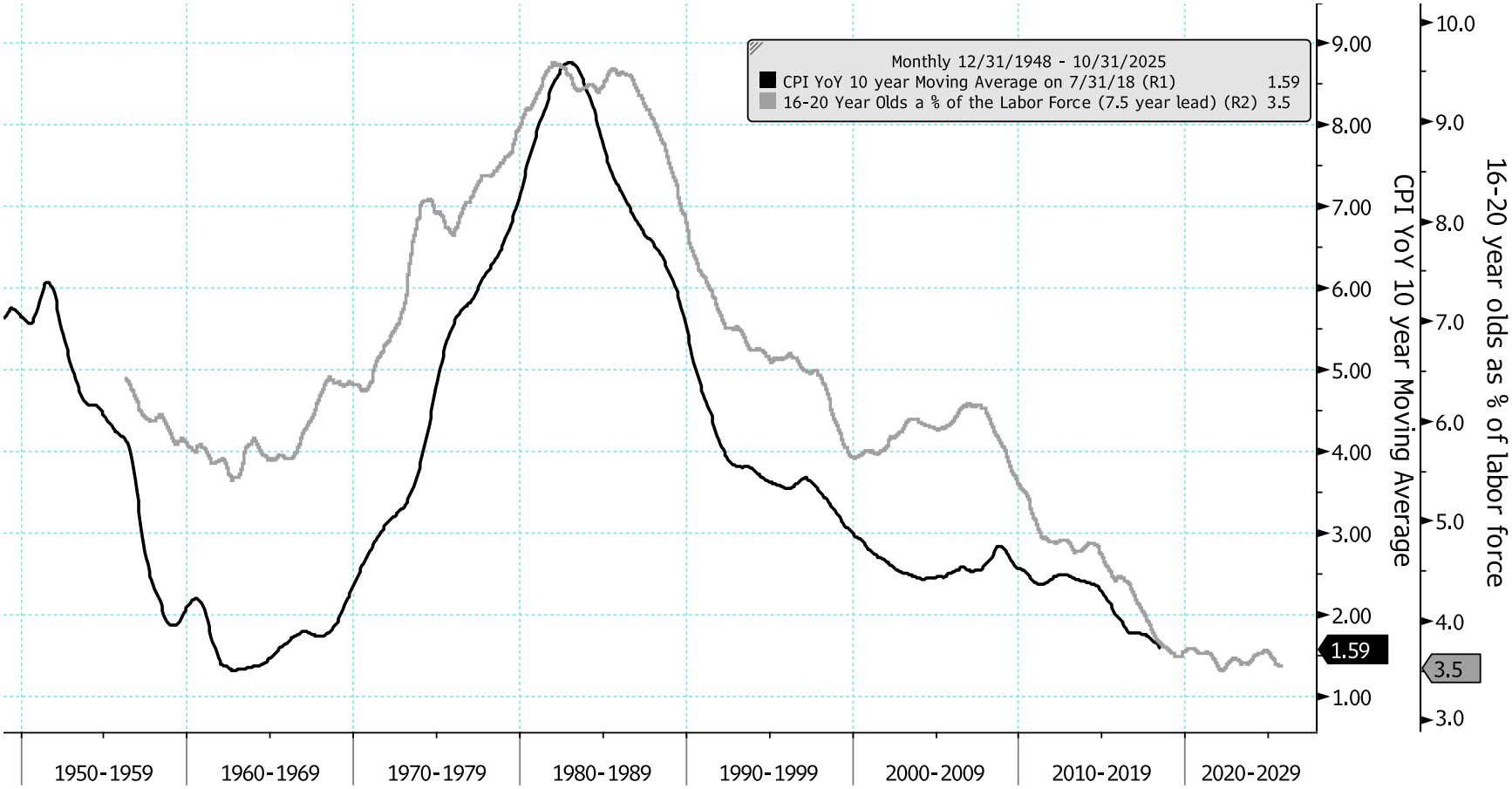
Analysis: demographic analysis is somewhat unique in that we can be reasonably certain what the future will look like. E.g., babies born in 1990 will turn 28 this year, etc. 1990 was a large birth year, so whatever 28 year olds normally do, that should be booming this year. Conversely, 1973 was the smallest birth year in recent generations, so whatever 45 year olds normally do might be somewhat depressed this year. Each grouping covers 17 calendar years, here are the total births in millions: GI: 49.0m, Silent: 44.9m, Baby-boom: 68.4m, Gen X: 58.9m, Echo-boom: 65.9, Gen Z: 69.1m. Some notable years: 1957 was the peak baby boom year with 4.3m, 1973 was the min Gen X year with 3.1m, 1990 was the peak Echo-boomer year with 4.2m.

U.S. Demographics and Inflation

16-20 year olds as % of the labor force (lead by 7.5 years) and 10 year trend inflation rate (CPI YoY 10yr MA)



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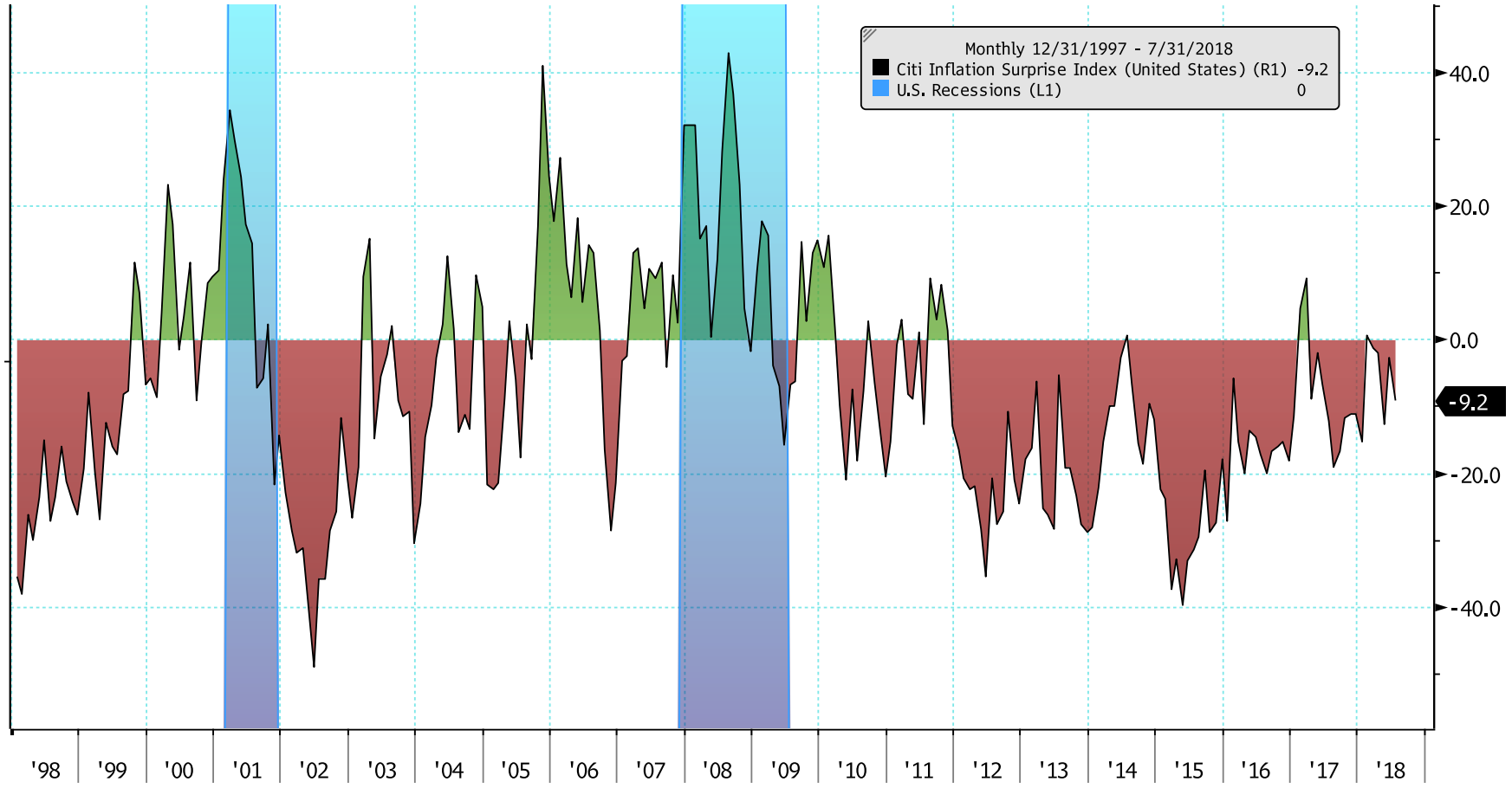
*Analysis: For similar reasons discussed in the previous slides, inflation seems to show a relationship to demographics over a longer time horizon. Possible theory: as young people enter the labor force they have a future income to borrow against. Credit creation drives borrowing and spending without an immediate offset of real production. As for an aging society being deflationary, anecdotally recent retirees from the baby boom generation are finding ways to reduce their consumption spending. It is important to note that my research on this is a work in progress. Economists hold a range of views with respect to demographics: some think an aging society is inflationary, some deflationary, some think it shouldn't/doesn't matter for inflation. To the extent that the above chart represents a genuine relationship, demographics look generally disinflationary over the coming years. *On this chart the grey series is shifted forward on the horizontal axis to show the potential fit as a leading indicator**

Citi U.S. Inflation Surprise Index

The Citi U.S. Inflation Surprise Index measures price surprises relative to market expectations



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Analysis: In my view late stages of the business cycle are characterized by inflation coming out higher than expected. As a side note: it seems to me that (unexpected) inflation is a tightening of real world business/consumer conditions, therefore it seems pro-cyclical that the Fed tightens financial conditions at the same time business/consumer conditions are tightening via higher than expected inflation – it is of course in pursuit of their price stability mandate. In any case, it is not surprising to me that the combination of higher than expected inflation and tightening financial conditions is followed by a recession. This chart ties in with the first chart in the series and relates to both inflation and to the business cycle.

Conclusion/Thoughts

Having confidence about inflation dynamics is nearly impossible, the Fed readily admits that they do not have a reliable framework for anticipating developments. My charts, framework, and thoughts are a work in progress and my views below, which are informed by the charts and framework, are presented on a best guess basis.

Recent months have seen an uptick in inflation in large part due to base effects, which may temper over the Q3 and Q4 periods. More medium term, over the next 18 months or so, I would not be surprised to see inflation readings in the mid to upper 2%-3% range for both headline and core readings. A number of indicators suggest that inflation should be trending higher through 2019. If so that might have implications for market pricing around the expected path of the federal funds rate.

While there are other factors that play a role (e.g., reduction of labor market slack), I tend to emphasize demographics when it comes to the inflation outlook. In keeping with the scenario outlined above, my demographic analysis suggests that inflation should trend higher over the next 18 months or so and then begin to soften. The longer run demographic trend looks disinflationary to me- although there is disagreement among economists about whether aging societies are more inflationary or deflationary. Based on the experience of Japan my current thinking favors the idea that an aging society is more likely to be disinflationary rather than inflationary.

As a final point- in keeping with the first chart and the final chart- a recession, whenever that arrives, might add an additional damper to inflation in my view.

To reiterate the first point above, there are many cross currents going on with respect to inflation dynamics so any outlook should be taken with caution.

-Nick Reece, CFA

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Disclosure

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