Economic Analysis

Are asset prices misaligned from macro fundamentals, and if so, what does that imply?

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When the Covid-19 pandemic emerged in early 2020, a flight to safety resulted in stock and corporate bond prices falling and home prices pausing their otherwise consistently strong rise. At the same time, the prices of risk-free assets (i.e., government bonds) increased. However, quick and massive monetary and fiscal policy responses ensured that the economy did not experience a credit crunch, and despite a large increase in unemployment, personal income remained strong, supporting consumption and business activity under unprecedented conditions. As a result, risk asset prices quickly recovered. The S&P 500 index surpassed its pre-recession high after only five months. For comparison, it took approximately seven and five-and-a-half years following the 2001 and 2008 recessions, respectively. In April of this year, the S&P 500 index stood 26% above its pre-Covid peak, while home prices stood around 14% above their February 2020 level. Given these trends and the fact that asset price bubbles are ubiquitous in economic history, the question about potentially excessive valuations of risk assets looms large. The latest Financial Stability Report, released by the Federal Reserve, states that "prices of risky assets have risen further on the improved economic outlook, and valuations are generally high."[1]

Bubbles are challenging to identify upfront, despite looking obvious in hindsight. If the current valuations prove to be detached from their macroeconomic fundamentals, which tend to exert themselves over the long run, financial instability could ensue, as has been the case historically. While the policy toolbox of modern central banks and governments allows for an effective response, adverse effects nonetheless can materialize, as was the case after the bursting of the subprime mortgage bubble in 2007, which led to the most severe economic downturn in decades. This brief presents estimates of the alignment with macroeconomic fundamentals of valuations of three types of risky assets: equities, corporate bonds, and residential real estate.

The estimation of the degree of potential misalignment is modeled separately for each asset class and is done in several stages, starting with data processing and filtering. The explanatory variables in each case are real GDP as a proxy for economic activity, core PCE price index as a proxy for inflation, 1-year and 10-year nominal treasury rates and reserve bank credit as monetary policy stance proxies, the budget deficit to GDP ratio as a fiscal policy stance proxy, and the nominal trade-weighted dollar index as an international conditions proxy.[2] The models suggest that stock prices are currently above their fundamentals-based benchmark and thus likely face a slower rate of appreciation under current trends, with an increased probability of price correction and higher volatility. Meanwhile, investment-

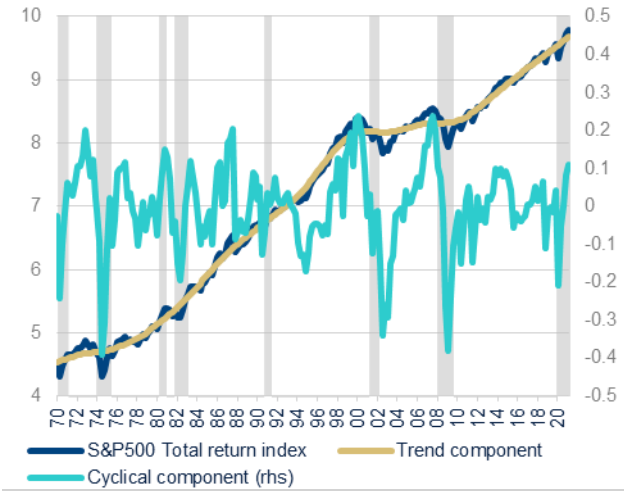
1: Federal Reserve Board. Financial Stability Report. May 2021. https://bit.ly/3hXyOBC
2: More details can be found in the technical appendix.

grade corporate bonds appear to be well in line with macro-fundamentals, while home prices are in the early stages of detaching from the macro fundamentals.

Equities

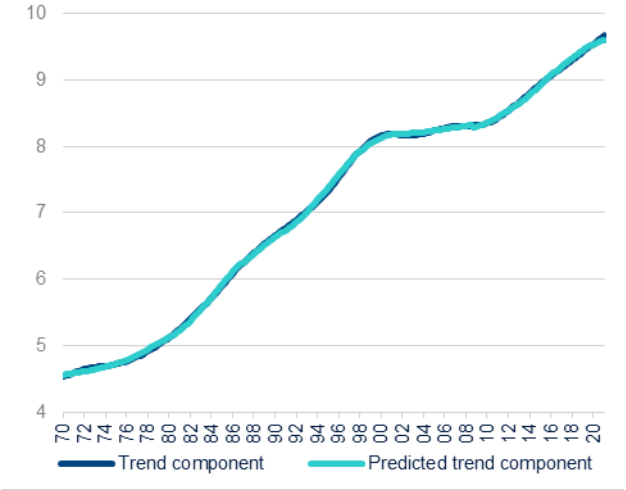
The benchmark for stock valuation in this analysis is the S&P 500 total return stock index. A total return index is preferred to a pure price index since it mostly reflects price changes but also accounts for any changes in dividend payout practices over time. After filtering its time series, we see that the cyclical component swung around its trend a dozen times since 1970, from a maximum upward deviation of 23.7% in 2000 –during the dot-com bubble- to a maximum downward deviation of 39% -during the depth of the Great Recession (Figure 1). Meanwhile, its trend component shows stages of slow growth in the first half of the 1970s and during the 2000s, and stages of strong growth in the 1980s/1990s and 2010s. The results from a regression of the trend component on macroeconomic variable trends[3] (Figure 2) confirm ex-ante expectations from economic theory. The signs of the sensitivities indicate that, over the long run, higher stock valuations are associated with stronger inflation trends, higher short-term rates, lower long-term rates, quantitative easing, larger budget deficits, and a stronger dollar. The serial correlation of the residuals does not invalidate the model's usefulness, which is established based on its out-of-sample forecasting ability and the relative stability of the coefficients in different subsamples. The serial correlation is most likely a reflection of momentum, an effect observed in asset prices that manifests itself in rising (or falling) asset prices continuing to increase (or fall) well after fundamentals no longer validate this outcome. Not surprisingly, the residuals are correlated with the previously extracted cyclical component (Figures 3 and 4), providing further support to this view.

Figure 1. **Stock price index decomposition** (Natural logarithms)



Source: BBVA Research and S&P

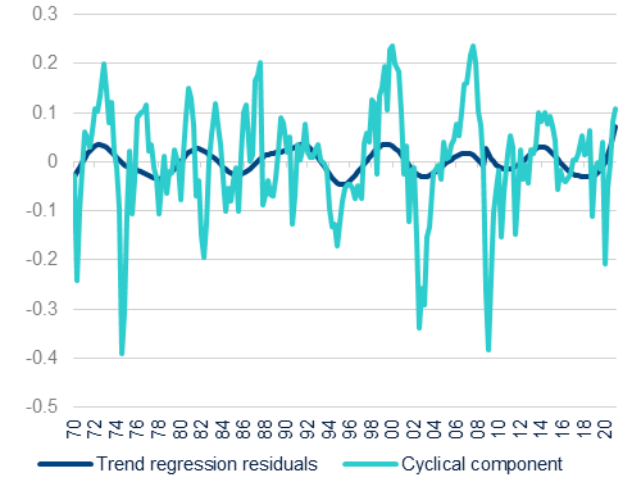
Figure 2. **Stock price index trend, actual and estimated** (Natural logarithms)



Source: BBVA Research

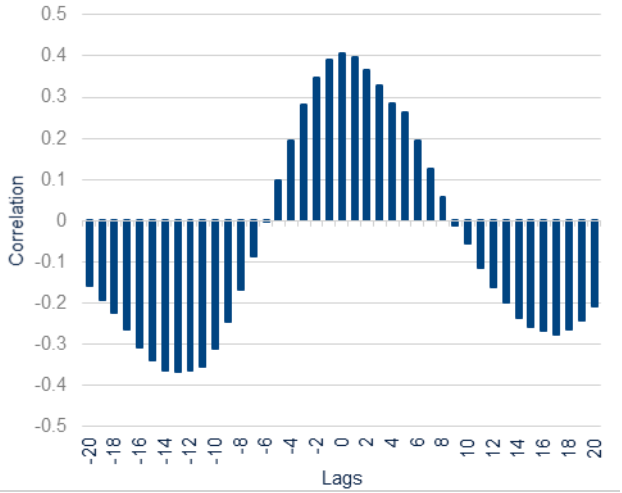
3: The trend regression variables are cointegrated and are regressed in log levels, except in the case of rates and ratios

Figure 3. **Stock index, trend regression residuals and cyclical component** (Natural logarithms)



Source: BBVA Research

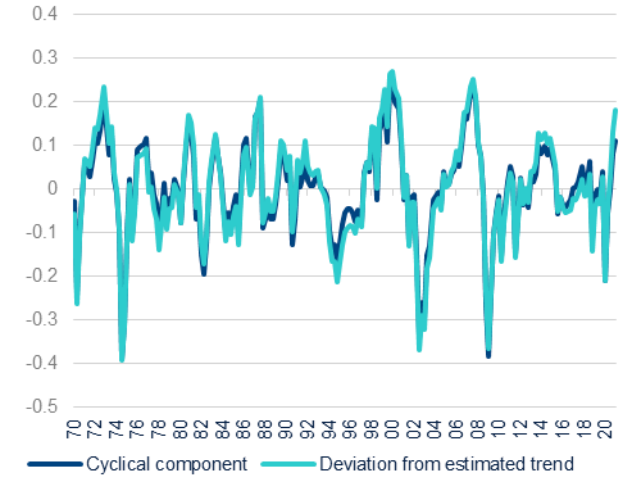
Figure 4. **Cross-correlations, stock index, cyclical component and trend regression residuals**



Source: BBVA Research

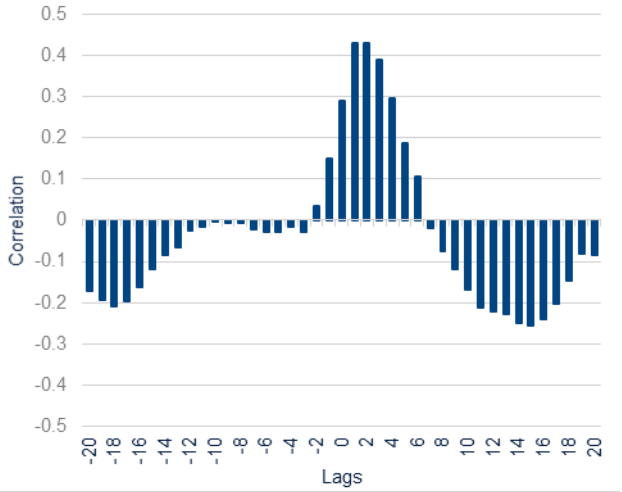
The second stage of the estimation regresses the deviation from the macro-estimated trend (Figure 5) on the cyclical components of the macroeconomic variables. Stock prices are known to anticipate GDP growth over the short-run, which the data confirms (Figure 6). The signs of the sensitivities of the regression again align with ex-ante expectations

Figure 5. **Stock index, cyclical component and deviation from macro-based estimated trend** (Natural logarithms)



Source: BBVA Research

Figure 6. **Cross-correlations, deviation from macro-based estimated trend, S&P500 total return index, and GDP cyclical component**

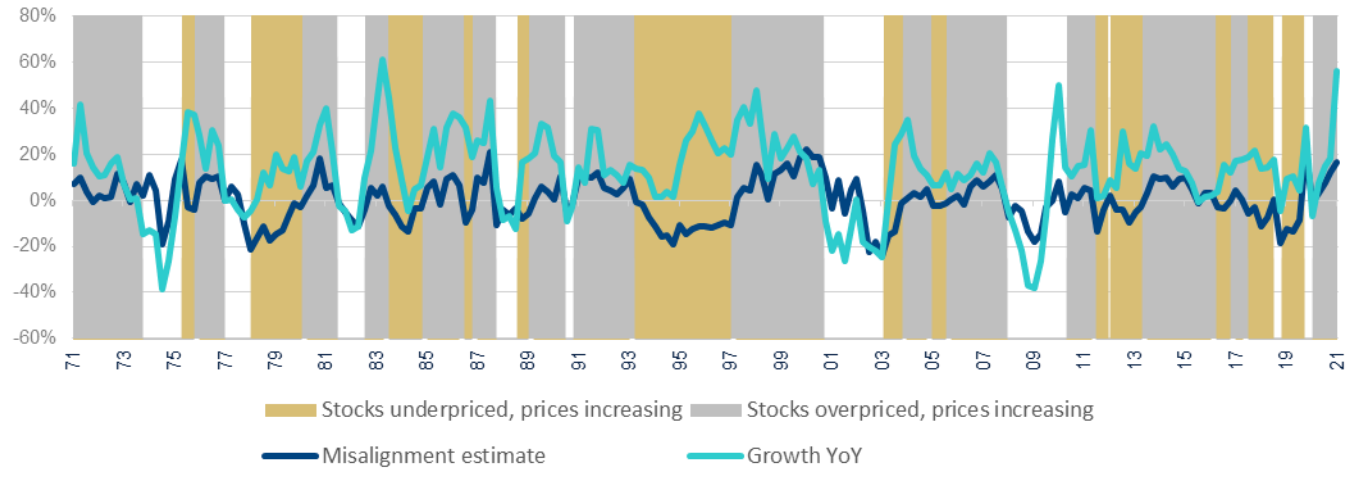


Source: BBVA Research

from economic theory and practice. Short-run overshoots of stock values are associated with future real GDP and past inflation overshoots, higher short-term rates, lower long-term rates, lack of boosts in quantitative easing and budget deficits (associated with recessions), as well as lack of short-term overshoots of the dollar index, which tend to occur in periods of heightened global financial stress.

The macroeconomic variables explain 37% of the stock value variation around the previously estimated macro-based trend. The residuals from the second regression can be viewed as an indicator of price misalignment from the macroeconomic equilibrium at each point in time. The range of misalignment is roughly between -24% and +22%. A deeper dive into the historical performance of this misalignment estimate shows that it is consistent with how stock prices have been performing. Namely, outside of recessions, stocks have tended to increase in value. However, when they were increasing but were undervalued, the rate of price appreciation was sustainable and tended to increase, whereas when they were overvalued, the rate of price appreciation was unsustainable and tended to decrease (Figure 7). Sustained price declines never occurred following periods when stocks were undervalued. The value of the misalignment indicator for 1Q21 suggests that stock valuations are frothy. If history is a guide, this implies slower price appreciation going forward and an increased probability of price declines unless growth remains strong, inflation moderates, long-term rates stay low, and monetary policy remains highly accommodative.

Figure 7. **Stock index, misalignment estimate and rate of growth[4]** (% and %YoY)



Source: BBVA Research

4 The periods are identified based on the values of the two series and their persistence (a period has to last two or more quarters) with some manual adjustment so that single quarter exceptions do not introduce noise that make it difficult to identify the overall patterns

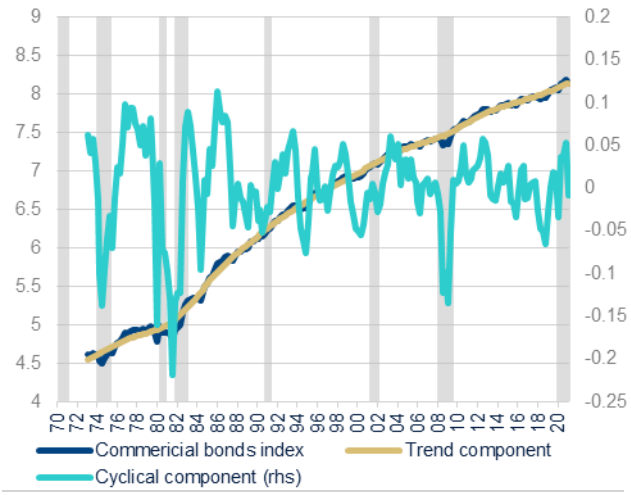
Corporate bonds

The metric for corporate bond valuations is the Bloomberg Barclays Corporate Bond Total Return Index. The filtering of the index's log values produces a cyclical component that is much less volatile than the one extracted from the stock index. The bond index's cycle ranges between a maximum downward deviation of 22% in 3Q82 –the crescendo of the early 1980s Federal Reserve tightening (and the moment of historically highest short-term treasury rates) to a maximum upward deviation of 11% in 1Q86 –the upswing of the junk bonds era (Figure 8).

The regression of the index trend produces a very good fit (Figure 9). The signs of the sensitivities confirm ex-ante expectations from economic theory, as higher corporate bond valuations over the long run are associated with a stronger real GDP trend, inflation trending higher but treasury rates trending lower, quantitative easing, larger budget deficits, and a stronger dollar. Unlike the case with stocks, the residuals are not correlated with the bond index's cyclical component. However, they are correlated with the short-term interest rate cyclical component, implying that the actual trend is above the macro-based estimate when short-term rates are on the rise (Figure 10). This usually occurs when the business and financial cycle upswings are solidifying and growth and inflation prospects are strong. In this sense, unlike in the case of stocks, it is not the prices' cyclical momentum pulling the bond trend above its macro-based estimate. Instead, it is the cyclical strength of the economy, further anchoring bond prices with fundamentals.

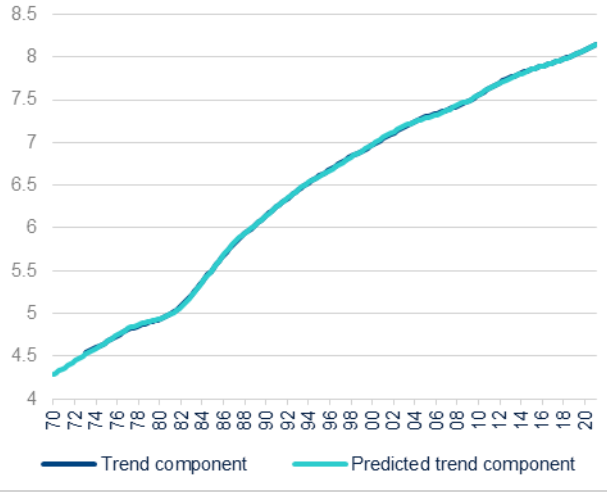
The bond index's deviation (cyclical component plus trend residuals) is associated with future real GDP overshoots, future inflation undershoots, lower short-term and long-term treasury rates, and lack of boosts in quantitative easing, which are associated with recessions. The bond index's deviation is much less correlated with the dollar index cyclical component, suggesting that volatile global conditions have a modest impact on the demand for U.S. corporate bonds. However, the bond index's deviation is sensitive to inflation overshoots and undershoots (Figure 11).

Figure 8. **Bond price index decomposition** (Natural logarithms)



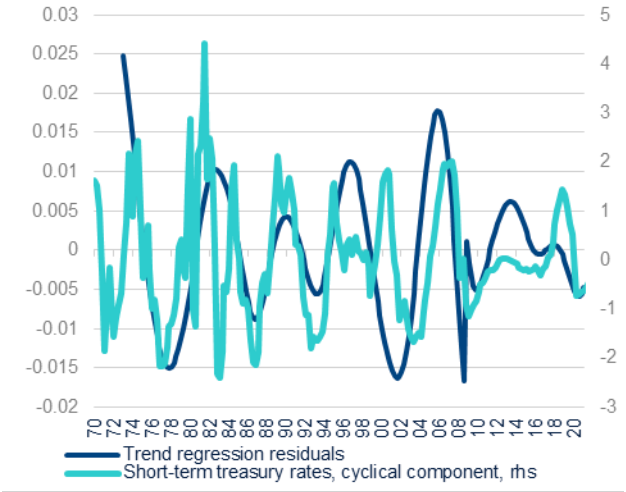
Source: BBVA Research and Bloomberg

Figure 9. **Bond price index trend, actual and estimated** (Natural logarithms)



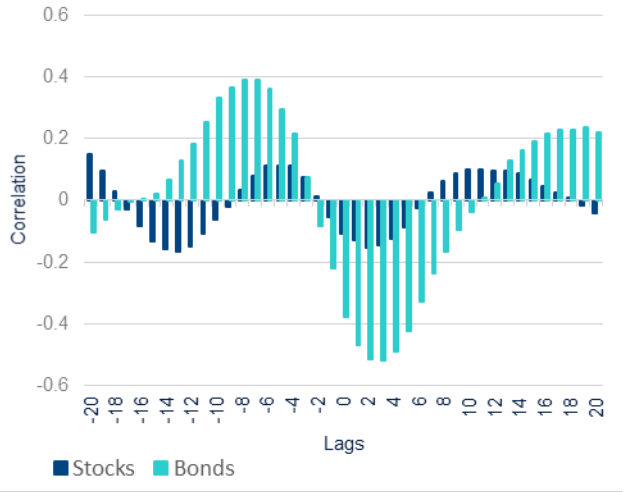
Source: BBVA Research

Figure 10. **Bond index, trend regression residuals and interest rates, cyclical component** (Natural logarithms)



Source: BBVA Research

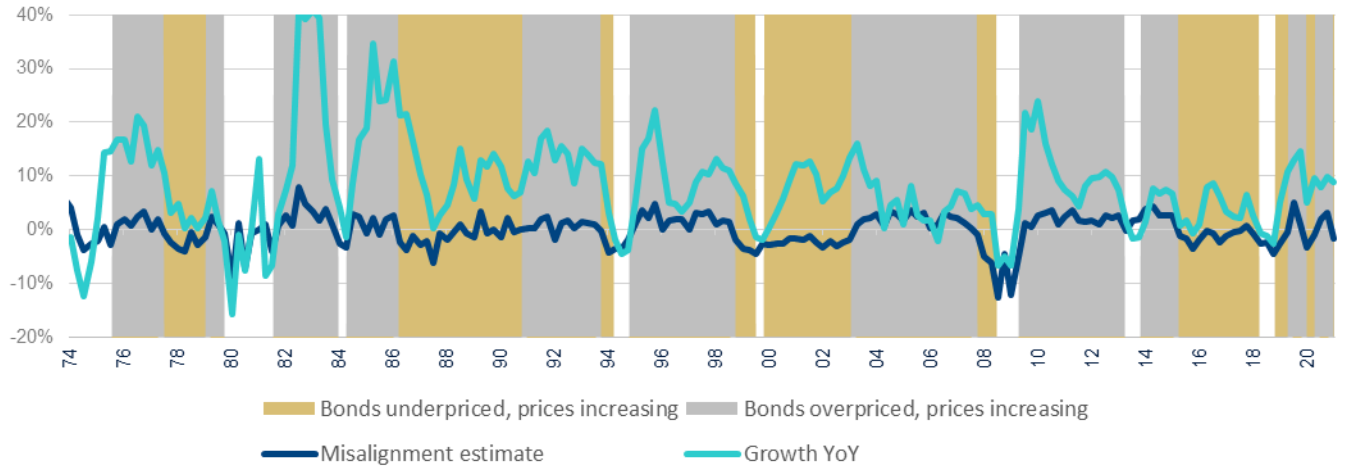
Figure 11. **Cross-correlations, deviation from estimated trend and core PCE inflation cyclical component**



Source: BBVA Research

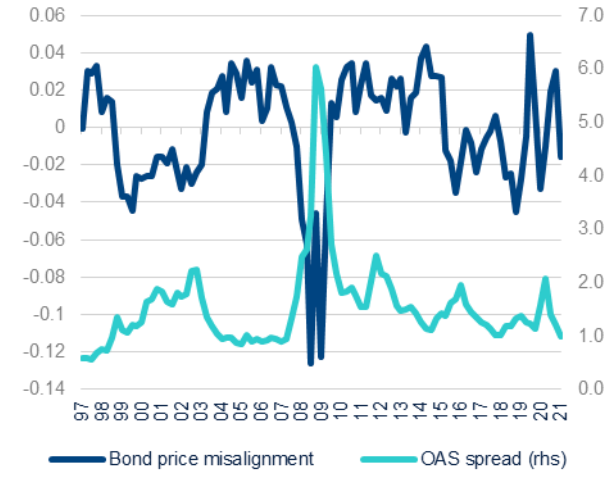
According to the model, macroeconomic variables explain 67% of the bond index's value variation around the previously estimated macro-based trend. Considering the residuals as an indicator of price misalignment from a macroeconomic equilibrium produces a range of misalignment between -12% and +8%. Corporate bond valuations were closely aligned with their fundamentals in periods outside the Great Recession, a particular case when investment-grade credit spreads increased six-fold over eighteen months. The bond price misalignment indicator captures uncertainty, as can be observed from the strong inverse correlation between the misalignment estimate and investment-grade spreads (Figure 13) and the VIX index (Figure 14). The close and consistent alignment of bond prices with fundamentals confirms the adage that while stock valuations are based on narratives, bond valuations are based on mathematics. The latest reading of the misalignment indicator suggests that investment-grade corporate bonds are in line with macroeconomic fundamentals.

Figure 12. **Bond index, misalignment estimate and rate of growth[5]** (% and %YoY)



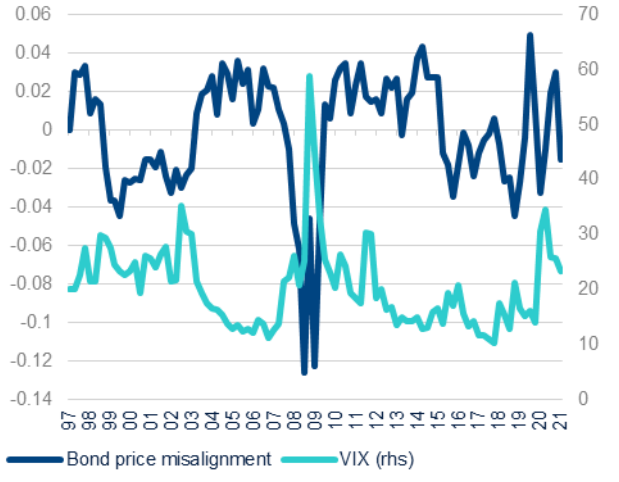
Source: BBVA Research

Figure 13. **Bond price misalignment estimate and investment grade OAS spread** (Natural logarithm and pp)



Source: BBVA Research and ICE BofA

Figure 14. **Bond price misalignment estimate and VIX** (Natural logarithm and Index)



Source: BBVA Research and CBOE

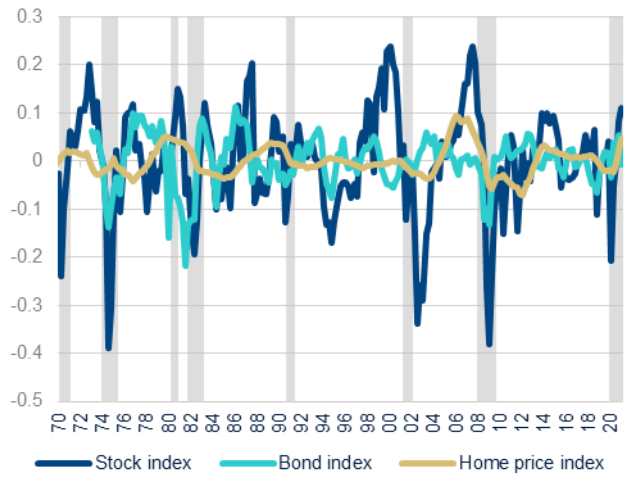
5: The periods are identified based on the values of the two series and their persistence (a period has to last two or more quarters) with some manual adjustment so that single quarter exceptions do not introduce noise that makes it difficult to identify the overall patterns

Residential real estate

Time series filtering of the Case-Schiller home price index's log values produces a cyclical component that is less volatile than both stocks and bonds and exhibits a different pattern, particularly in the period before 1990 (Figure 15). The home price cycle is positively correlated with the cyclical movement of stocks and negatively correlated with the cyclical movement of investment grade bonds. It ranges from a maximum upward deviation of close to 10% in 1Q06 – the peak of the subprime mortgage bubble- to a maximum downward deviation of 7% –the moment when home prices reverted to sustained growth after the Great Recession. The trend component of the home price index does not match the macro-based estimate as closely as in the case of stocks and bonds (Figure 16), which means that the cyclical component captures less of the deviation from macro fundamentals relative to the other two asset classes, and confirms that home prices do not adjust as quickly as stock or bond prices. The signs of the sensitivities obtained from the trend regression are reasonable. Higher home prices over the long run are associated with stronger real GDP and inflation trends, lower short-term and higher long-term treasury rates, quantitative easing, larger budget deficits, and a downward trending value of the U.S. dollar. As in the case of stocks, the residuals are positively correlated with the home price index's cyclical component (Figure 17), suggesting a strong presence of price momentum or inertia.

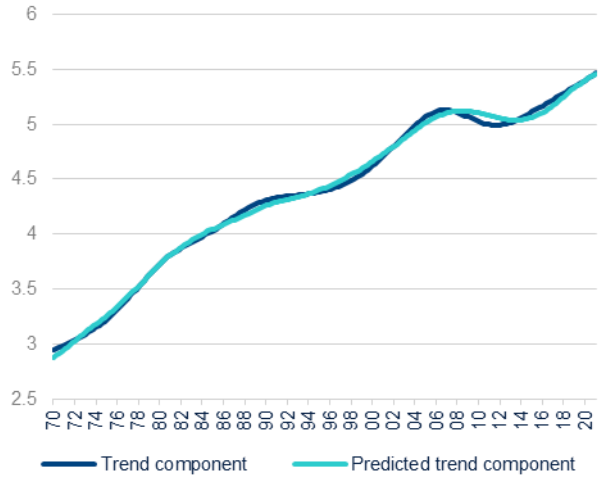
The home price index's deviation from its macro-based estimated trend is modeled similarly to stocks and bonds, with some lag/lead selection adjustments. Short-run overshoots of home prices are associated with future real GDP overshoots, future inflation overshoots, overshoots of short-term and undershoots of long-term treasury rates, lack of boosts in quantitative easing, and undershoots of the dollar index. Based on the model results, unlike in the case of equities, home prices benefit from weaker dollar exchange rates, as this likely attracts investment in residential estate from abroad and boosts domestic investment that could have otherwise gone overseas.

Figure 15. **Cyclical components** (Natural logarithms)



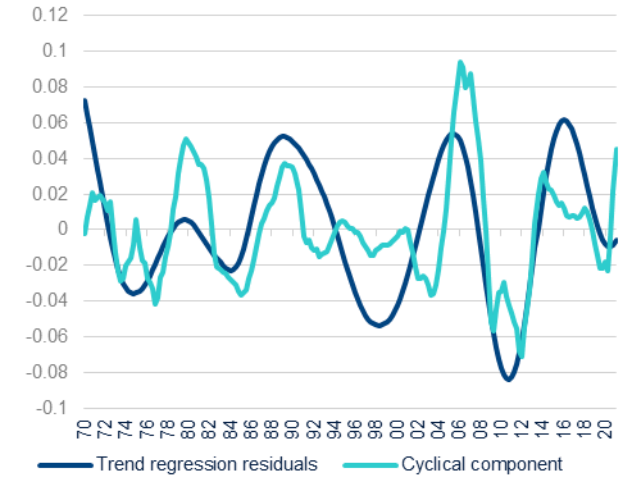
Source: BBVA Research

Figure 16. **Home price index trend, actual and estimated** (Natural logarithms)



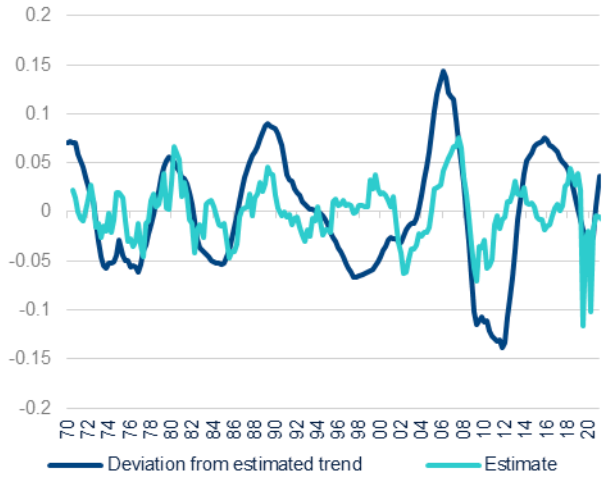
Source: BBVA Research

Figure 17. **Home price index, trend regression residuals and cyclical component** (Natural logarithms)



Source: BBVA Research

Figure 18. **Home price index, deviation from estimated trend and its estimate** (Natural logarithms)

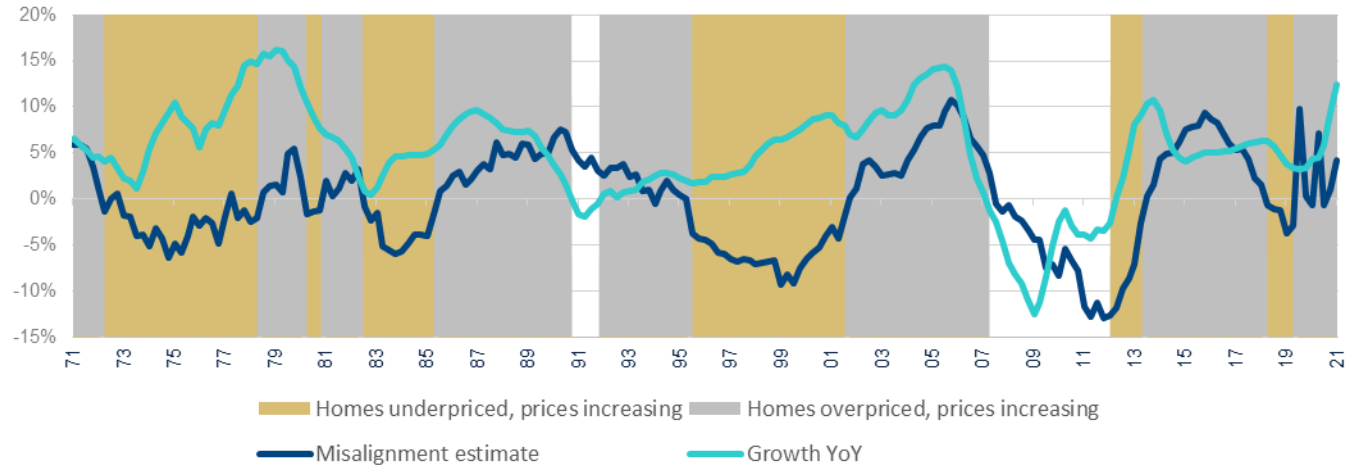


Source: BBVA Research

The macroeconomic variables explain 24% of the home price value variation around the previously estimated long-term trend. The range of misalignment is roughly between -13% and +11%. Over the last fifty years, nominal home prices have tended to consistently increase in value, with only two periods when they did go down –the early 1990s and the period of the Great Recession[6]. When home prices were increasing but were undervalued, which was the case in the mid-1970s and mid-1990s, the rate of price appreciation was sustainable and tended to increase. When they were overvalued, such as in the late 1980s and early 2000s, the rate of price appreciation was unsustainable and tended to decrease and, in some cases, correct to the downside (Figure 19). Sustained price declines never occurred after a period when homes were undervalued. A cross-correlation analysis shows that the misalignment indicator is strongly and inversely correlated with price movements four years into the future. The value of the misalignment indicator for 1Q21 suggests that home prices are above but close to their fundamentals, with a potential to detach more meaningfully if the current high rates of home price appreciation continue.

6: In real terms they did contract over two more periods: 1973-1974 and 1980-1983

Figure 19. **Home price index, misalignment estimate and rate of growth[7]** (% and %YoY)



Source: BBVA Research

Bottom line

The quick and strong increase in asset prices after the Covid-19 shutdown in 2020 has raised concerns about potential bubbles forming in some asset classes. Bubbles occur when prices increase so much that they significantly detach from their fundamentals, and the main way they adjust becomes a price crash, as opposed to a soft landing. This brief compared the historical alignment of equities, investment-grade corporate bonds, and home prices to broad macroeconomic metrics, and found a considerable degree of overvaluation in the equities asset class. While this does not imply an immediate stock price correction, the rate of appreciation is likely to slow considerably unless growth surprises further to the upside and long-term interest rates remain low. Meanwhile, investment-grade corporate bonds are in line with fundamentals, as they tend to be most of the time outside of episodes of heightened uncertainty and financial stress. This makes the risk of a sharp bond price adjustment low as long as there isn't a large and unexpected increase in risk-free interest rates or inflation or a new exogenous shock to the economy such as Covid-19. Finally, home prices are starting to detach from their macroeconomic equilibrium. However, they remain close to it for the time being. If the home price rate of appreciation slows in the coming period, the gap between home prices and fundamentals will narrow, and the price correction risk will remain low.

7: The periods are identified based on the values of the two series and their persistence (a period has to last two or more quarters) with some manual adjustment so that single quarter exceptions do not introduce noise that make it difficult to identify the overall patterns

Technical Appendix: Modeling approach

The first step in processing the data is converting variables with exponential growth trends to log values and filtering all variables using a time series filter. The time series are decomposed into long-term trends and cyclical components using the Hodrick-Prescott filter -a widely used tool for time series decomposition in econometrics. HP is a high-pass filter- meaning that it isolates high-frequency processes, such as short-term asset price fluctuations. The trend and cyclical components are then modeled separately so that the interplay of asset prices and macroeconomic variables could be analyzed in more detail. Different asset classes are modeled independently of each other. While asset prices are also inter-related, this is beyond the scope of this analysis, which only seeks to establish macroeconomic fundamentals-based benchmarks against which to compare independent asset class valuations.

The dependent variables are asset price metrics: S&P500 Total Return Index for stocks, Bloomberg Barclays Corporate Bond Total Return Index for bonds, and the National Case-Schiller Home Price Index, seasonally adjusted, for residential real estate, with data before 1975 taken from Schiller's Irrational Exuberance dataset. The explanatory variables are real GDP as a proxy for economic activity, core PCE inflation index as a proxy for prices, short- and long-term treasury rates (1-year and 10-year) and reserve bank credit as monetary policy stance proxies, the budget deficit rate as a fiscal policy stance proxy, and the nominal trade-weighted dollar index as an international conditions proxy. Additionally, in the trend component models, a dummy variable is added to distinguish the two quantitative easing (QE) regimes before and after the Great Recession, as well as an interaction term.

The trend components are modeled using OLS regressions in log levels (except for interest and budget deficit rates), which is appropriate due to the established cointegration of the variables using a Johansen test for cointegration. Using multiple lagged values of the explanatory variables was considered to address the serial correlation of the residuals, but this causes overfitting and inferior out-of-sample forecasts, which was identified as a challenge. Introducing lagged values of the independent variables (in essence using an ARMA model) was not an option, as this would make the identification of the level of misalignment between asset prices and macro fundamentals more difficult.

Once an asset class valuation macro-based trend is estimated, the residuals are added to the corresponding cyclical component to obtain the total deviation of the actual values from the macro-based estimated trend. The resulting series is regressed against the cyclical components of the macroeconomic variables, in the spirit of many already established macroeconomic factor models used to understand asset price surprises based on macroeconomic surprises. All models are deemed appropriate for the intents and purposes of this assessment, as there is no risk of spurious correlation between the variables due to their established relationship in economic theory and practice. Moreover, out-of-sample forecasts over five-year horizons tested at different points in time (1980, 1990, 2000, and 2010) for both trend and cyclical components for the different asset classes remain satisfactory.

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