PIMCO

Your Global Investment Authority

Viewpoint

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Asset Allocation: Does Macro Matter? Part II

Asset allocators often focus on valuation levels to determine which asset class is "cheap" or "overvalued" without consideration for impending macroeconomic regime shifts. While careful assessment of valuation levels is important, there is more to getting your portfolio mix right.

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Our previous PIMCO Viewpoint, titled "Asset Allocation: Does Macro Matter?," revealed a significant historical relationship between the relative performance of different risk factors – such as equity risk, interest risk, credit risk and commodity risk – and changes in macroeconomic conditions. Given the now-emerged evidence that risk factors are key drivers of portfolio outcomes, the conclusion we draw is that macroeconomic shifts matter a great deal in asset allocation.

If investors have the ability to produce superior macroeconomic forecasts, they may be able to outperform their peers, or add value beyond their strategic benchmark allocation. Careful top-down macroeconomic analysis is at the core of PIMCO's forward-looking investment philosophy. Of course it's impossible to invest in real GDP growth and inflation directly. Therefore, to express a macroeconomic view, investors should assess the impact that changes in GDP growth and inflation have on a set of market-based, investable risk factors.

To do so, we'd like to present a simple econometric model that describes the linkages between macroeconomic activity and market risk factors. The model we present here leverages recent work done in PIMCO's Analytics and Solutions groups to empirically measure risk factor return sensitivities to GDP and inflation scenarios.

PIMCO's investment professionals constantly formulate, debate and revise not only the firm's macroeconomic scenarios, but also the impact of these scenarios on risk factor returns. Hence, this simple model is not meant to be a substitute for a forward-looking investment process. Rather, it is meant to establish an intuitive benchmark for scenario analysis and motivate the importance of macroeconomic regime shifts on asset allocation decisions, which should be augmented by judgment, experience, risk-factor-specific variables and a view on current events.

The model presented here incorporates the following two key features:

- **Incorporating market expectations:** Asset pricing theory would suggest that market risk factors change in anticipation of macroeconomic data, and current asset prices reflect market participants' information and expectations. For example, strong economic growth may not translate into higher future equity returns if valuations already have priced in higher earnings growth. For this reason it is important to distinguish between anticipated changes in macroeconomic variables and unanticipated changes. Therefore, the model controls for current macroeconomic expectations, which is designed to improve the accuracy of the scenario analysis.[1]

- **Allowing flexible scenario definitions:** Instead of providing return estimates for scenarios defined by broad categories of growth and inflation (such as "low", "stable" and "high") or specific historical episodes or business cycle phases, the model accommodates any combination of GDP and inflation views. In other words, it directly translates point estimates of GDP growth and inflation into risk factor returns.

Empirical model

Consider a simple model that focuses on the following set of core risk factors: equity risk, credit risk, interest rate risk and commodity risk. These risk factors collectively account for a large fraction of the return variation in most diversified portfolios.

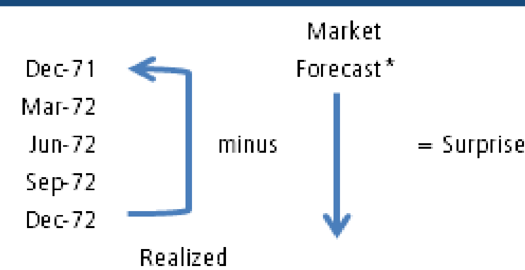
To estimate the performance of a portfolio in different macroeconomic regimes, the model measures the linkages between factor returns and macro surprises, as follows:

$$\text{Factor Return} = \alpha + \beta_{\text{GDP}} \cdot \text{GDP}_{\text{Surprise}} + \beta_{\text{INFL}} \cdot \text{INFL}_{\text{Surprise}} + \beta_{\text{INT}} \cdot \text{GDP}_{\text{Surprise}} \cdot \text{INFL}_{\text{Surprise}} + \varepsilon$$

The interaction term measures the complementarity effect between growth and inflation. The impact of an inflation surprise on yields may be more pronounced if it is accompanied by a positive shock to GDP growth, since it may signal a more permanent increase in the path for future inflation.

Figure 1 provides a stylized illustration of the model. Surprises are defined as one-year realized growth (or inflation) minus what was forecasted at the beginning of the year.

Figure 1: Stylized illustration of the model



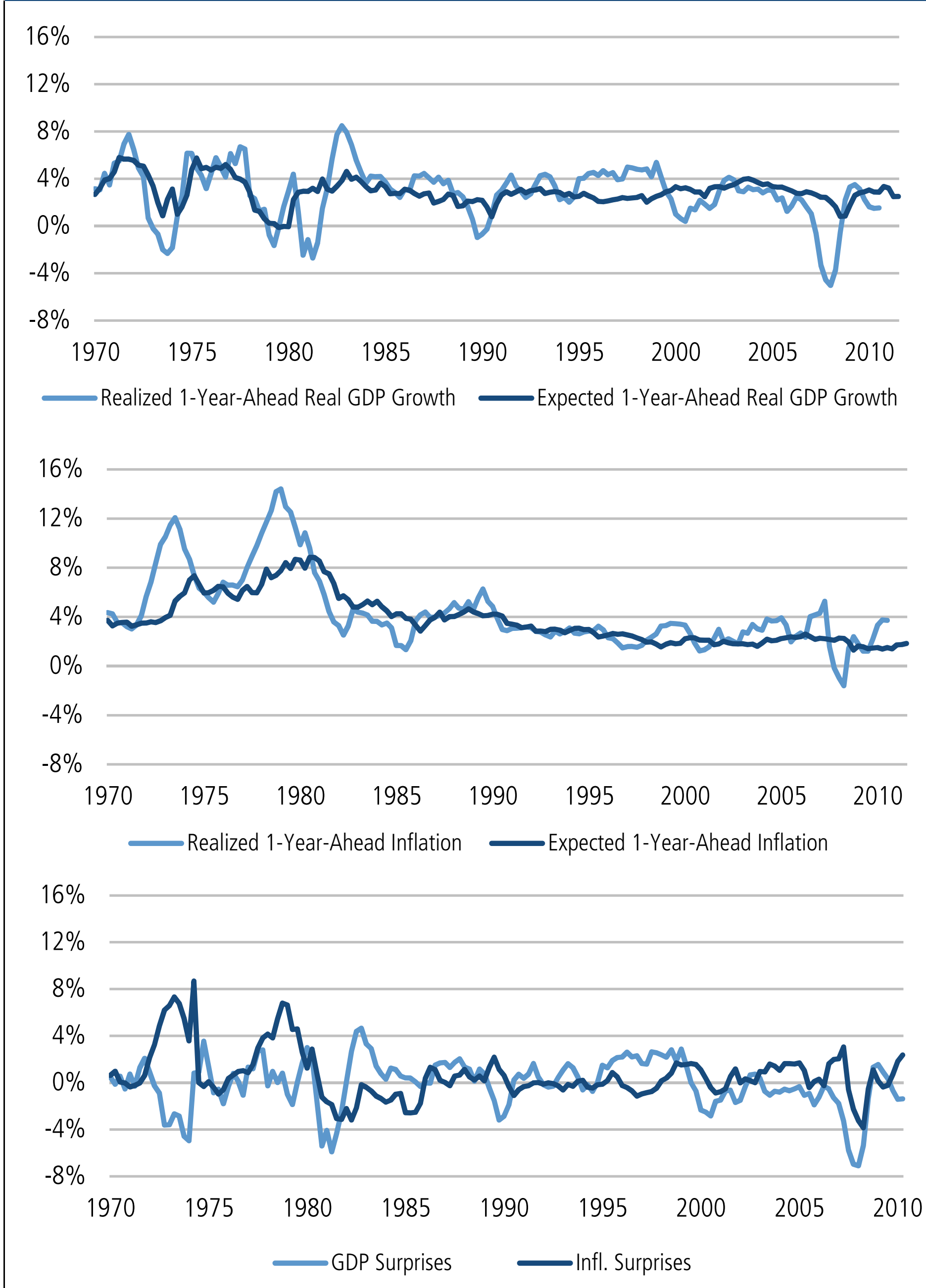
*Market forecast from the Survey of Professional Forecasters

Source: PIMCO

The model updates these surprises quarterly and regresses them against risk factor returns. A one-year horizon for the data is chosen to focus on medium-term tactical implications for asset allocation, rather than high frequency events. Actual market expectations are, strictly speaking, unobservable, but the Survey of Professional Forecasters provides a reasonable proxy. Figure 2 plots the time series of realized, expected and surprise real GDP growth and inflation.

[1] To compare the explanatory power of real GDP growth and inflation expectations, realizations and surprises, we regressed risk factor returns on each of these three sets of measures. We found evidence that surprises outperform both expectations and realizations for all the key risk factors.

Figure 2: Time series of realized, expected and surprise real GDP growth and inflation



Hypothetical example for illustrative purposes.

Source: Haver Analytics, Survey of Professional Forecasters (conducted by Federal Reserve Bank of Philadelphia). Expected GDP growth and inflation are measured using the forecasted values from the Survey of Professional Forecasters. Surprises are defined as expected minus realized.

Figure 3 shows the estimated betas for each of the key risk factors. A beta of –0.2 on GDP surprises for the credit spread means that if at the end of the year, realized GDP growth is 1% higher than consensus expectation was at the beginning of the year, the credit spread would drop by 1% x 0.2 = 0.2% in expectation. Figure 3 also shows the standard deviation of historical GDP and inflation surprises, which helps interpret the results. For a one standard deviation positive GDP surprise, the credit spread would drop by 2.1% x 0.2 = 0.4% in expectation.

Figure 3: Regressions

	Constant	GDP Surprise	Inflation Surprise	Interaction	R^2
Short Rate		0.5	0.7	12.2	50%
		(5.8)	(7.4)	(4.0)	
10y Yield		0.2	0.4	4.6	31%
		(3.4)	(5.2)	(1.8)	
10/30 Slope		-0.1	0.0	-1.5	20%
		(-4.9)	(-2.6)	(-3.2)	
Credit Spreads (Baa)		-0.2	0.0		22%
		(-4.2)	(1.3)		
Equities	7.1%	3.9	-2.2		29%
	(3.7)	(4.1)	(-2.7)		
Commodities	3.1%	2.7	6.3		30%
	(1.1)	(2.4)	(4.1)		
Historical Standard Deviation:		**2.1%**	**2.0%**		

SOURCE: PIMCO, Haver Analytics, the Survey of Professional Forecasters.
Hypothetical example for illustrative purposes only.
Newey-West t-stat in parentheses. See appendix for list of indexes used. Regressions for equities and commodities use excess returns which are total returns net of one-year Treasury bill yields. Sample period: 1970–2011 subject to data availability. The constant terms for rates, slope and spread, as well as the interaction terms for equities and commodities, were not included in the final regressions as they were insignificant. The Newey-West heteroskedasticity and autocorrelation consistent standard errors are used for hypothesis testing and model selection. As a robustness check, we also run each model with four sets of non-overlapping data (differing in the starting quarter), and the estimation results are consistent with those using the overlapping data. The models focus on conditional estimated risk factor returns given GDP growth and inflation surprises; they do not address the conditional volatilities of the returns given surprises.

Overall, results are intuitive:

- Yields rise with both GDP growth and inflation surprises;
- Credit spreads increase with negative growth surprises but have little sensitivity to inflation surprises;
- When negative GDP surprises occur, the curve tends to steepen;
- Equities react positively to GDP growth surprises and negatively to inflation surprises;
- Commodities react positively to GDP growth surprises and positively to higher inflation surprises (inflation hedge).

To interpret these results, investors should consider a few caveats:

- The sensitivities of the 10/30 slope risk factor to GDP growth and inflation surprises are statistically significant but small, since 10-year and 30-year yields usually move together with the surprises.
- The betas for GDP and inflation surprises in the 10-year yield regression are lower than 1.0 because the model focuses on one-year shocks, which often don't represent permanent or complete shocks.

- Realized values for GDP and inflation may include revisions. Pre-revision numbers would produce better model fits, as they would better represent the information that was available to market participants at the time risk factor returns were calculated. Indeed, if part of the surprise was actually realized in a subsequent period, then current period risk factor returns can't fully reflect that surprise.
- However, in an analysis which includes lags (not reported here) previous surprises do not significantly impact scenario estimates and model fit. (Commodities did show modest mean-reversion in the impact of inflation surprises.)
- The explanatory power of the model changes depends on the time period, which reinforces the need to use the model in conjunction with qualitative inputs. For example, during the 1970s, the link between inflation surprises and rates was quite strong, while for credit spread, the most recent 20 years show a stronger link with GDP growth than during the earlier part of the sample.
- The model uses overlapping observations. However, as a robustness check, analyses with four sets of non-overlapping data (differing in the starting quarter) show consistent results.
- The 7.1% risk premium over cash for equities is a historical estimate for the full sample from 1970 to 2011. It may seem high in the current environment and could be adjusted downward for the purposes of scenario analysis.

Scenario analysis

This model accommodates any combination of GDP and inflation views. Hence, as mentioned earlier, instead of providing results for broad categories like "low-stable-high" growth, the model directly translates point estimates of GDP growth and inflation into risk factor returns.

For scenario analysis, the model multiplies sensitivities (betas) by expected surprises, which are defined as the differences between the GDP and inflation scenario and current consensus expectations (summarized by the survey of professional forecasters). In this context, only if the investor's macro view differs from current expectations will the estimated returns be affected. If the scenario is identical to current market expectations, the realized surprise will be zero, and estimated excess returns will be measured as follows:

- For equities and commodities they will simply be equal to the long-term risk premia as measured by the intercepts of the regression.
- The expected change in credit spreads and interest rates will be zero in this case.
- For the fixed income assets, the estimated excess return will simply be approximated by the current carry over cash rates. Carry is a first order approximation of returns that relies on the assumption that conditions don't change over the time horizon.

As an illustration of macro scenario analysis, Figures 4, 5 and 6 show heat maps of scenario returns for equities, bonds and a simple 60/40 portfolio.

Figure 4 shows equities are extremely sensitive to growth surprises.

For bonds, three effects compete:

1. The "risk off" diversification effect from duration,
2. The inflation risk from duration, and
3. The "risk on" effect from spread.

Hence Figure 5 shows under all scenarios which of these effects dominate in this specific example.

Lastly, because the 60/40 portfolio is dominated by equity risk, Figure 6 shows that its overall sensitivity to macro shocks is similar to equities. The magnitudes are muted, however, by a diversification effect with interest risk (duration).

Figure 4: Heat map of scenario returns for equities

Equities		Real GDP Growth Surprise						
		-4%	-2%	-1%	0%	1%	2%	4%
		-2σ	-σ	-σ/2		σ/2	σ	2σ
Inflation Surprise 4%	2σ	-17%	-9%	-6%	-2%	2%	6%	14%
2%	σ	-13%	-5%	-1%	3%	7%	11%	19%
1%	σ/2	-11%	-3%	1%	5%	9%	13%	21%
0%		-9%	-1%	3%	7%	11%	15%	23%
-1%	-σ/2	-6%	2%	5%	9%	13%	17%	25%
-2%	-σ	-4%	4%	8%	12%	16%	20%	27%
-4%	-2σ	0%	8%	12%	16%	20%	24%	32%

Source: PIMCO, Haver Analytics, the Survey of Professional Forecasters. Equities are proxied by the S&P 500.
Hypothetical example for illustrative purposes only. Surprises are defined as the differences between scenarios and the market expectations from the Survey of Professional Forecasters at the beginning of the year. Sample period: 1970–2011 subject to data availability. The risk-free rate is assumed to be 0.1%. σ represents the estimated standard deviation of the respective surprise. Risk factor returns are assumed to be linear functions of surprises in the regression for simplicity, while other nonlinear relationships could be present. For example, although low inflation surprises have positive implications on equity returns in general, extremely low inflation/deflation surprises could be correlated with low equity returns.

Figure 5: Heat map of scenario returns for bonds

Bonds		Real GDP Growth Surprise						
		-4%	-2%	-1%	0%	1%	2%	4%
		-2σ	-σ	-σ/2		σ/2	σ	2σ
Inflation Surprise 4%	2σ	1%	-2%	-3%	-5%	-6%	-8%	-11%
2%	σ	3%	1%	0%	-1%	-2%	-3%	-5%
1%	σ/2	4%	3%	2%	1%	0%	-1%	-2%
0%		5%	4%	4%	3%	2%	2%	1%
-1%	-σ/2	6%	6%	5%	5%	5%	4%	4%
-2%	-σ	7%	7%	7%	7%	7%	7%	7%
-4%	-2σ	9%	10%	11%	11%	11%	12%	12%

Source: PIMCO, Haver Analytics, the Survey of Professional Forecasters.
Hypothetical example for illustrative purposes only. The bond portfolio is assumed to have a duration of five years and a credit spread duration of three years. Surprises are defined as the differences between scenarios and the market expectations from the Survey of Professional Forecasters at the beginning of the year. Sample period: 1970–2011 subject to data availability. Carry of the bond portfolio is assumed to be 3%. σ represents the estimated standard deviation of the respective surprise. Risk factor returns are assumed to be linear functions of surprises in the regression for simplicity, while other nonlinear relationships could be present. For example, although low inflation surprises have positive implications on equity returns in general, extremely low inflation/deflation surprises could be correlated with low equity returns.
Calculation example: For the scenario with GDP surprise = –2% and inflation surprise = 1%, the estimated return for the hypothetical bond portfolio is 3%, which is a combination of: 2% "risk off" diversification effect from duration, –2% inflation effect from duration, –1% "risk off" effect from spread, and 4% other effects, including interaction effect of GDP and inflation surprises and carry

Figure 6: Heat map of scenario returns for a simple 60/40 portfolio

60/40			Real GDP Growth Surprise						
			-4%	-2%	-1%	0%	1%	2%	4%
			-2σ	-σ	-σ/2		σ/2	σ	2σ
Inflation Surprise	4%	2σ	-10%	-6%	-5%	-3%	-1%	1%	4%
	2%	σ	-7%	-3%	-1%	1%	3%	5%	9%
	1%	σ/2	-5%	-1%	1%	3%	5%	8%	12%
	0%		-3%	1%	3%	6%	8%	10%	14%
	-1%	-σ/2	-1%	3%	5%	8%	10%	12%	17%
	-2%	-σ	0%	5%	7%	10%	12%	14%	19%
	-4%	-2σ	4%	9%	11%	14%	17%	19%	24%

Source: PIMCO, Haver Analytics, the Survey of Professional Forecasters.
Hypothetical example for illustrative purposes only. The simple portfolio is composed of 60% of the equities and 40% of the bond portfolio shown in Figure 4 and Figure 5, respectively. Surprises are defined as the differences between scenarios and the market expectations from the Survey of Professional Forecasters at the beginning of the year. Sample period: 1970–2011 subject to data availability. The risk-free rate is assumed to be 0.1%. Carry of the bond portfolio is assumed to be 3%. σ represents the estimated standard deviation of the respective surprise. Risk factor returns are assumed to be linear functions of surprises in the regression for simplicity, while other nonlinear relationships could be present. For example, although low inflation surprises have positive implications on equity returns in general, extremely low inflation/deflation surprises could be correlated with low equity returns

Overall, the power of this approach lies in estimating the deltas from general market consensus, which drive the sensitivities of risk factor returns to macroeconomic surprise. To estimate levels, current conditions matter. While the approach carefully accounts for current expectations, starting valuation, yield, and spread levels may influence the entire set of scenarios up or down. For example, in the absence of macroeconomic surprises, a 6% estimated return in excess of cash may be optimistic for the 60/40 portfolio, since zero-bound interest rates make it difficult to squeeze more valuation increases out of most asset classes.

Conclusions

The conventional, valuation-based approach to asset allocation might work in normal markets, but we see such an approach as akin to looking in the rearview mirror, which may lead to suboptimal investment outcomes when important macroeconomic shifts take place.

Macro variables are important drivers of investable risk factors' returns, which in turn are the underlying components of asset class returns. We believe an econometric framework to assess the impact of shocks to GDP growth and inflation provides the missing link between macroeconomic forecasts and portfolio performance. The framework recognizes that asset prices reflect expectations about future macro scenarios. In other words, what matters in a given scenario is what will unfold relative to these current market expectations.

Overall, asset allocators should recognize asset prices react significantly to macroeconomic news and changes in regimes. To the extent that investors can produce more accurate macroeconomic forecasts, they may therefore be able to outperform their peers and benchmarks and gain a competitive edge.

Finally, sophisticated investors should constantly complement, review and revise qualitative and quantitative macroeconomic analyses with judgment, experience and a view on current events.

Reference:

Indexes used to compute risk factor returns:

- Short rate: short-term U.S. interest rate (from OECD Outlook)
- 10-year yield: 10-year U.S. Treasury note yield at constant maturity
- 30-year yield: 30-year U.S. Treasury note yield at constant maturity
- Credit spread (Baa): Moody's Seasoned Baa Corporate Bond Yield minus 10-Year U.S. Treasury note yield at constant maturity
- Equity: stock price index: S&P 500 total return: monthly dividend reinvestment 1970–1988, then daily, and one-year U.S. Treasury bill yield at constant maturity
- Commodity: The S&P GSCI Commodity Total Return Index, and one-year Treasury bill yield at constant maturity

Source: Haver Analytics

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