Achieving Outcomes in a Bi-modal World

April 2012
The need for new asset allocation and risk management frameworks

- De-leveraging by consumers
- Leveraging by sovereigns
- Policymaker involvement and re-regulation
- Changing demographics

**Investors and clients**
Re-think asset allocation and risk management approaches
If you are a long-term investor: why bother?

*Different versions of the "long run" provide very different answers*

As of 31 December 2011

SOURCE: Bloomberg

* Based on annual returns
** Based on annual returns, from 1945-2011

Refer to Appendix for additional index information.
Asset allocation based on modern portfolio theory

With the publication of his dissertation, “Portfolio Selection”, 59 years ago in the March 1952 edition of the *Journal of Finance*, Harry Markowitz, a doctoral candidate at the University of Chicago, presented the investment world with a new way of allocating capital among risky assets.

Key underlying assumptions:

- Inputs to the model can be predicted or inferred from history
- Standard deviation or volatility defines the risk of a portfolio
- Returns are normally distributed
- Assets class diversification leads to risk diversification
Epochs of asset class returns:
“This time it’s different” versus “triumph of the optimists”

<table>
<thead>
<tr>
<th>Epoch</th>
<th>Real GDP</th>
<th>CPI</th>
<th>DJIA Starting P/E</th>
<th>DJIA return</th>
<th>Gold % return</th>
<th>Oil % Return</th>
<th>Int. Govt. Bond Return</th>
<th>Real Int Bond Return</th>
<th>DJIA and bond correlations</th>
<th>Real Home Prices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epoch 1: 1914-1928</td>
<td>N/A</td>
<td>4.05</td>
<td>14.13</td>
<td>5.30</td>
<td>N/A</td>
<td>4.49</td>
<td>0.34</td>
<td>-3.71</td>
<td>N/A</td>
<td>-1.74</td>
</tr>
<tr>
<td>Epoch 2: 1929-1941</td>
<td>3.25</td>
<td>-1.05</td>
<td>13.32</td>
<td>-6.44</td>
<td>3.87</td>
<td>-4.35</td>
<td>4.24</td>
<td>5.30</td>
<td>0.11</td>
<td>0.06</td>
</tr>
<tr>
<td>Epoch 3: 1942-1960</td>
<td>4.09</td>
<td>3.82</td>
<td>9.49</td>
<td>8.95</td>
<td>0.21</td>
<td>3.99</td>
<td>1.51</td>
<td>-2.31</td>
<td>-0.12</td>
<td>2.15</td>
</tr>
<tr>
<td>Epoch 4: 1961-1980</td>
<td>3.71</td>
<td>5.31</td>
<td>22.43</td>
<td>6.26</td>
<td>15.12</td>
<td>13.50</td>
<td>5.07</td>
<td>-0.25</td>
<td>0.16</td>
<td>0.29</td>
</tr>
<tr>
<td>Epoch 5: 1981-2000</td>
<td>3.28</td>
<td>3.77</td>
<td>7.98</td>
<td>16.74</td>
<td>-3.79</td>
<td>-1.04</td>
<td>9.58</td>
<td>5.81</td>
<td>0.24</td>
<td>0.38</td>
</tr>
<tr>
<td>Epoch 6: 2001-2011</td>
<td>1.52</td>
<td>2.42</td>
<td><strong>30.50</strong></td>
<td>2.51</td>
<td><strong>19.18</strong></td>
<td>4.22</td>
<td>4.79</td>
<td>2.37</td>
<td><strong>-0.31</strong></td>
<td><strong>0.11</strong></td>
</tr>
</tbody>
</table>

As of 31 December 2011
SOURCE: Bloomberg; PIMCO

* Ex-post equity risk premium is defined as difference between DJIA returns and Ibbotson Intermediate Government Bond Index Returns
Oil data is from inflationdata.com. The oil prices are average annual prices of Illinois Crude adjusted by CPI-U. Gold is the month-end spot price. Real Home prices: Robert J. Shiller’s Irrational Exuberance compiled index. The data is from Robert J. Shiller’s Irrational Exuberance. Shiller has compiled and adjusted the dataset from various housing prices series tracking data since 1890. Bonds are represented by the Ibbotson Intermediate Government Bond Series.
Real Intermediate bond returns represented by the Ibbotson Intermediate Government Bond minus annualized CPI.
Refer to Appendix for additional correlation and index information.
Epochs mean revert

<table>
<thead>
<tr>
<th></th>
<th>Triumph of the Optimists</th>
<th>This Time It’s Different</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epochs</td>
<td>1,3,5 (51 years)</td>
<td>2,4,6 (42 years)</td>
</tr>
<tr>
<td>Real average GDP</td>
<td>3.7%</td>
<td>2.8%</td>
</tr>
<tr>
<td>Equity Returns/premia*</td>
<td>10.3%+/+6.5%</td>
<td>0.1%/-4.6%</td>
</tr>
<tr>
<td>Starting Equity Multiple**</td>
<td>10.5 X</td>
<td>22.1 X</td>
</tr>
<tr>
<td>Levering up:</td>
<td>Consumer</td>
<td>Governments</td>
</tr>
<tr>
<td>Demography:</td>
<td>Huge birthrate (3)</td>
<td>Wage-price spirals (4)</td>
</tr>
<tr>
<td></td>
<td>Expanding living standards (1,3,5)</td>
<td>Growing dependency ratios (6)</td>
</tr>
<tr>
<td>Geopolitical:</td>
<td>Won wars and extended peacetime (1,3)</td>
<td>Protectionist pressures, isolationist leanings or worse</td>
</tr>
<tr>
<td></td>
<td>Defeated communism (5)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Increasing democratization (3,5)</td>
<td></td>
</tr>
</tbody>
</table>

SOURCE: Bloomberg, PIMCO.
* Equity returns are based on average annual returns of the S&P 500. Premia is defined as difference between S&P 500 returns and Ibbotson Intermediate Government Bond Index Returns.
** Represents price/earnings ratio of S&P 500 index. Refer to Appendix for additional index information.
An evolution in the academic paradigm

"…in the last 40 years we have learned that discount rates vary dramatically. Most views of the world changed 100%: we thought 100% of the variation in the market dividend yields was due to variation in cash flows; now we know 100% is due to variation in discount rates. We thought 100% of the cross-sectional variation in expected returns came from the CAPM, now we think that's about zero and a zoo of new factors describes the cross section"

- Professor John Cochrane, University of Chicago, 2011
  President of American Finance Association
How should I allocate capital for my clients in this environment?

Working to provide you with the answers first:

- Be forward-looking and tactical
  - to take advantage of or safe-guard against short-term market dislocations

- Consider broadening your investment opportunity set
  - allocate beyond mainstream stocks and bonds
  - address home bias

- Re-think your asset allocation framework
  - Consider focusing on risk diversification instead of asset class diversification

- Consider integrating downside risk management into the asset allocation decision
  - Incorporate explicit downside risk mitigation strategies

Refer to Appendix for additional investment strategy and risk information.
Asset class diversification may not lead to risk diversification

As of 29 February 2012
SOURCE: NCSE, PIMCO.
Hypothetical example for illustrative purposes only.

1 Average Endowment Portfolio information from the 2011 NACUBO-Commonfund Study of Endowments (NCSE). This study is based on information collected as of 30 June 2011.
The asset allocation percentages shown are based on the Average Endowment Portfolio as of 30 June 2011 for endowments >$1 billion.
Refer to Appendix for additional endowment style portfolio index sources, hypothetical example and portfolio analysis information.
Asset class returns are driven by a set of common risk factors

**BREAKDOWN OF TOTAL VOLATILITY BY KEY RISK FACTOR (%)**

- **Equity Factor**
- **Rate Factor**
- **Inflation Factor**
- **Credit Factor**
- **Currency Factor**
- **Other/Idiosyncratic**

**EQUITIES**
- U.S. Equities
- EFA Equities
- EM Equities

**FIXED INCOME**
- Global Bonds
- EM Bonds
- High Yield Bonds

**REAL ASSETS**
- Real Estate
- Commodities
- Gold

Based on returns from 12 Jan '07 to 31 Dec '11

SOURCE: PIMCO, Bloomberg

**Hypothetical example for illustrative purposes only.**

U.S. equities represented by the S&P 500 Index; EFA equities is represented by the MSCI Daily TR Net EAFE Index; EM equities is represented by the MSCI Daily TR Net Emerging Markets Index; U.S. Bonds represented by the Barclays Capital U.S. Aggregate TR Index; Global Bonds represented by the BarCap Global Aggregate Total Return Index; Global High Yield represented by the BarCap Global High Yield Total Return Index; EM External Bonds represented by JPMorgan Emerging Markets Bond Index; EM Bonds represented by JPMorgan GBI-EM Global Diversified Composite Unhedged Index; EM Corporate Bonds represented by JPM Corporate EMBI Diversified Composite Index; REITs represented by Dow Jones U.S. Real Estate Index; Commodities represented by Dow Jones-UBS Commodity TR Index; Gold represented by Philadelphia Gold and Silver Index; Oil represented by the current front month crude contract.

1 Other factors include: Idiosyncratic (specific), Country, Industry, Sector, and “Style” factors such as Value, Size, Momentum, Liquidity, and Leverage.

2 We employed a block bootstrap methodology to calculate volatilities. We start by computing historical factor returns that underlie each asset class proxy from January 1997 through the present date. We then draw a set of 12 monthly returns within the dataset to come up with an annual return number. This process is repeated 15,000 times to have a return series with 15,000 annualized returns. The standard deviation of these annual returns is used to model the volatility for each factor. We then use the same return series for each factor to compute covariance between factors. Finally, volatility of each asset class proxy is calculated as the sum of variances and covariance of factors that underlie that particular proxy.

Refer to Appendix for additional hypothetical example and index information.
We recommend inventors reverse the asset allocation decision process

TRADITIONAL APPROACH

Asset Classes

Typically static policy portfolio

Risk factors

Potentially concentrated

Investment Views

Misaligned

RECOMMENDED APPROACH

Investment Views

Forward-looking

Risk factors

Targeted

Asset Classes

Selected based on relative value

Refer to Appendix for additional investment strategy and risk information.
Asset allocation using risk factors

Example: Adding high yield bonds to a portfolio

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>Exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broad equity market</td>
<td>+</td>
</tr>
<tr>
<td>Interest rate duration</td>
<td>++</td>
</tr>
<tr>
<td>Yield curve duration</td>
<td>++</td>
</tr>
<tr>
<td>Credit spread duration</td>
<td>+++</td>
</tr>
<tr>
<td>Industrial commodities</td>
<td>0</td>
</tr>
<tr>
<td>Illiquidity</td>
<td>++</td>
</tr>
<tr>
<td>Currency</td>
<td>+</td>
</tr>
<tr>
<td>Gold</td>
<td>0</td>
</tr>
<tr>
<td>Momentum</td>
<td>+</td>
</tr>
</tbody>
</table>

Refer to Appendix for additional investment strategy and risk information.
Risk management ought to be an integral part of asset allocation instead of an afterthought.
Return distribution of U.S. equities is not normal and has fat tails

SOURCE: Bloomberg, PIMCO
Hypothetical example for illustrative purposes only. Not indicative of the past or future performance of any PIMCO product.
Major asset class return distributions are not only fat-tailed, but also bi-modal.
Bi-modality has huge implications on portfolio construction and asset selection

- Focus was on managing the belly of the distribution
- Being a seller of volatility and liquidity paid
- Higher beta assets did well

**BI-MODAL WORLD (2001 - ?)**
- Focus on managing the “tails” of the distribution
- Being a buyer of cheap volatility and liquidity pays
- Assets that provide disproportionate upside/downside capture typically do well

*Sample for illustrative purposes only. Refer to Appendix for additional outlook information.*
A new risk management framework for the bi-modal world

Just-in-time

Pay for the accident

Just-in-case

Plan for the accident

Refer to Appendix for additional investment strategy and risk information.
Best of both worlds: Tail risk hedging can be defense and offense

**OFFENSIVE ASPECTS**
- Tilt aggressively
- Designed to provide explosive “non-linear” liquidity when you can use it
- Rebalance optimally

**DEFENSIVE ASPECTS**
- Designed to reduce drawdown
- Designed to guard against panic and other behavioral biases
- Helps reduce uncertainty

Refer to Appendix for additional investment strategy and risk information.
Offensive risk management: Can tail risk hedging be profitable?

COMPARISON OF PORTFOLIO RETURN DISTRIBUTIONS

<table>
<thead>
<tr>
<th>STATISTIC</th>
<th>60/40 PORTFOLIO 1</th>
<th>OFFENSIVE/TAIL RISK HEDGED PORTFOLIO (MODEL) 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expected return</td>
<td>6%</td>
<td>7%</td>
</tr>
<tr>
<td>Volatility</td>
<td>12%</td>
<td>16%</td>
</tr>
<tr>
<td>Downside volatility</td>
<td>8%</td>
<td>5%</td>
</tr>
<tr>
<td>Upside volatility</td>
<td>8%</td>
<td>12%</td>
</tr>
</tbody>
</table>

SOURCE: PIMCO ("Offensive Risk Management: Can Tail Risk Hedging Be Profitable?" April 2010 by Vineer Bhansali and Joshua M. Davis)

Hypothetical example for illustrative purposes only.
(1 January 1990-1 March 2010)

The objective of the illustration is to show the mechanics of tail risk hedging during all periods of severe market stress, often referred to as “tail events.” Periods of market stress would be characterized by 1) a substantial decline in the equity markets, 2) a substantial widening in credit spreads, and 3) a substantial increase in market volatility. Note: This portfolio analysis is based on the paper sourced above. The 60/40 Portfolio shown differs from the “Traditional” 60/40 Portfolio referenced throughout this material. Bonds in this portfolio are represented by short maturity T-Bills rather than intermediate investment grade bonds in the “Traditional” portfolio. Different indexes would have different results.

1 The first distribution (blue line) is based on an allocation of 60% equities (S&P 500) and 40% Treasuries (Citigroup 3-Month T-Bill), with a risk premium on equities of 5% per year.
2 The second distribution (the yellow line) is derived based on an iterative optimization (varying increases of equity allocation above 60% and different strikes on an S&P put option hedge) to match estimated value of losses greater than 5% in the first portfolio (blue line). Estimated value of losses is defined as the probability of losses greater than 5%, multiplied by the magnitude of those returns.
3 While the median return of the second portfolio (yellow line) is lower, its estimated return (probability multiplied by magnitude of returns) is higher, with a fatter right tail compensating for the shift of the median to the left.
4 Offensive/Tail Risk Hedged Portfolio (Model). Fees and/or expenses are not included in the annual return. Refer to Appendix for additional hypothetical example, index and risk information.
Hedging the “tails”

1. **Quantify portfolio risks**
   Type and magnitude

2. **Identify offsetting hedges**
   Direct and indirect hedges

3. **Optimize hedging portfolio**
   Based on maximum loss objective

4. **Monetize hedges during crisis**
   Capture gains and consider re-investing

Refer to appendix for additional investment strategy and risk information.
PIMCO’s approach for multi-asset portfolio construction

1. Build the beta
   - Targeted Allocation to global risk factors
     - Equity
     - Credit
     - Rate
     - Inflation
     - FX Management

2. Add the alpha
   - Relative value and tactical opportunities
     - Macro
     - Arbitrage
     - Structural
     - Security selection

3. Hedge the tails
   - Systematic tail hedging
     - Put options
     - Option-like securities
     - Flight to quality assets
     - Momentum strategies

Refer to Appendix for additional investment strategy and risk information.
PIMCO’s current asset allocation views

GLOBAL EQUITIES
- Favor Emerging Markets (EM) given stronger secular growth dynamics
- Within Developed Markets (DM) equities, favor multinationals, high dividend payers

GLOBAL FIXED INCOME
- Plan to favor "safe spread" sectors as potential return generators
  - EM Debt, select investment grade corporates
- Hold "cleanest dirty shirt" sovereigns for defense with higher yield
  - Australia, Canada, Mexico, Brazil

TAIL HEDGES
- Maintain exposure to a broad basket of systemic hedges, especially now that volatility has temporarily subsided
- Emphasize US dollar as a hedge against deleveraging

REAL ASSETS
- Favor gold as a hedge against paper currency debasement
- Tactically hold oil to hedge rising Middle East risk premium
- Growth-linked commodities and TIPS are cyclically less attractive

As of 31 December 2011
All investments contain risk and may lose value.
Refer to Appendix for additional investment strategy, outlook and risk information.
Questions?
Past performance is not a guarantee or a reliable indicator of future results.

**CORRELATION**
The correlation of various indices or securities against one another or against inflation is based upon data over a certain time period. These correlations may vary substantially in the future or over different time periods that can result in greater volatility.

**ENDOWMENT STYLE PORTFOLIO INDEX SOURCES**
Domestic Equities: S&P 500; Global Equities: MSCI EAFE Net Dividend Index in USD; EM Equities: MSCI Emerging Markets Index; Domestic (IG/HY) Bonds (IG bonds, HY bonds): 6.75% Investment Grade Bonds - Barclays Capital US Aggregate Index, 0.9% High Yield Bonds - Barclays Capital US High Yield Index; Global Bonds: Barclays Capital Global Aggregate Index; EM Bonds: JP Morgan EMBI Global Index; Real Estate: NCREIF Property Index; Hedge Funds: HFRI Fund Weighted Composite Index; Private Equity: Cambridge Associates LLC U.S. Private Equity Index®; Venture Capital: Cambridge Associates LLC U.S. Venture Capital Index®; Energy and Natural Resources (Energy, Timber, Commodities, Managed Futures): 3.6% Energy - Dow Jones UBS Commodity Energy Index, 1.8% Timber - NCREIF Timberland Index, 1.8% Commodities - Dow Jones UBS Commodity Index, 1.8% Managed Futures: DJICS Managed Futures Index; Distressed Debt: HFRI ED: Distressed/Restructuring Index; Cash: Citigroup 3 Month US T-Bill Index.

**HYPOTHETICAL EXAMPLE**
No representation is being made that any account, product, or strategy will or is likely to achieve profits, losses, or results similar to those shown. Hypothetical or simulated performance results have several inherent limitations. Unlike an actual performance record, simulated results do not represent actual performance and are generally prepared with the benefit of hindsight. There are frequently sharp differences between simulated performance results and the actual results subsequently achieved by any particular account, product, or strategy. In addition, since trades have not actually been executed, simulated results cannot account for the impact of certain market risks such as lack of liquidity. There are numerous other factors related to the markets in general or the implementation of any specific investment strategy, which cannot be fully accounted for in the preparation of simulated results and all of which can adversely affect actual results.

**INVESTMENT STRATEGY**
There is no guarantee that these investment strategies will work under all market conditions or are suitable for all investors and each investor should evaluate their ability to invest for the long-term, especially during periods of downturn in the market.

**OUTLOOK**
Statements concerning financial market trends are based on current market conditions, which will fluctuate. There is no guarantee that these investment strategies will work under all market conditions, and each investor should evaluate their ability to invest for the long-term, especially during periods of downturn in the market. Outlook and strategies are subject to change without notice.

**PORTFOLIO ANALYSIS**
The portfolio analysis is based on the NACUBO average endowment model portfolio and representative accounts. No representation is being made that the structure of the average portfolio or any account will remain the same or that similar returns will be achieved. Results shown may not be attained and should not be construed as the only possibilities that exist. Different weightings in the asset allocation illustration will produce different results. Actual results will vary and are subject to change with market conditions. There is no guarantee that results will be achieved. No fees or expenses were included in the estimated results and distribution. The scenarios assume a set of assumptions that may, individually or collectively, not develop over time. The analysis reflected in this information is based upon data at time of analysis. Forecasts, estimates, and certain information contained herein are based upon proprietary research and should not be considered as investment advice or a recommendation of any particular security, strategy or investment product.

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**RISK**
Investing in the bond market is subject to certain risks including market, interest-rate, issuer, credit, and inflation risk. Equities may decline in value due to both real and perceived general market, economic, and industry conditions. Investing in foreign-denominated and/or domiciled securities may involve heightened risk due to currency fluctuations, and economic and political risks, which may be enhanced in emerging markets. Tail risk hedging may involve entering into financial derivatives that are expected to increase in value during the occurrence of tail events. Investing in a tail event instrument could lose all or a portion of its value even in a period of severe market stress. A tail event is unpredictable; therefore, investments in instruments tied to the occurrence of a tail event are speculative. Derivatives may involve certain costs and risks such as liquidity, interest rate, market, credit, management and the risk that a position could not be closed when most advantageous. Investing in derivatives could lose more than the amount invested.
It is not possible to invest directly in an unmanaged index.

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