

Equity in Central Bank Portfolios

Static and Dynamic Allocation

May 2015

Jay Hyman

+972 3 623 8745

jay.hyman@barclays.com

Barclays, UK

Albert Desclée

+44 20 777 33382

albert.desclee@barclays.com

Barclays, UK

Anando Maitra

+44 20 313 40091

anando.maitra@barclays.com

Barclays, UK

Simon Polbennikov

+44 20 313 40752

simon.polbennikov@barclays.com

Barclays, UK

Outline

- Introduction: do equities make sense within a CB portfolio?
- Static allocation to equities, within a simple risk/reward framework
- Dynamic allocation to equities based on valuation ratios – a long-term historical study based on a “no view” optimization framework

Introduction: Equity in Central Bank Portfolios?

- **“Classic” investment goals for Central Bank reserves portfolios:**
 - Capital preservation – minimize risk of losses
 - Maximize liquidity – make sure funds can be available immediately when needed
 - Grow the national wealth – but only as a secondary goal, subject to the first two
 - Avoid “headline risk”
- **To include equity in a Central Bank portfolio, we would need to conclude either:**
 - that a (small?) allocation to equity can be perfectly consistent with these goals
 - that the above guidelines do not fully reflect the current set of priorities
- **Factors that could help motivate an allocation to equity:**
 - Increase in size of reserve portfolio could increase the priority of asset growth relative to the other return goals stated above
 - Concern about cost of holding reserves: low interest rates, FX exposure, inflation
 - Negative correlation between equity and fixed income could make equity a good hedge against rising rates

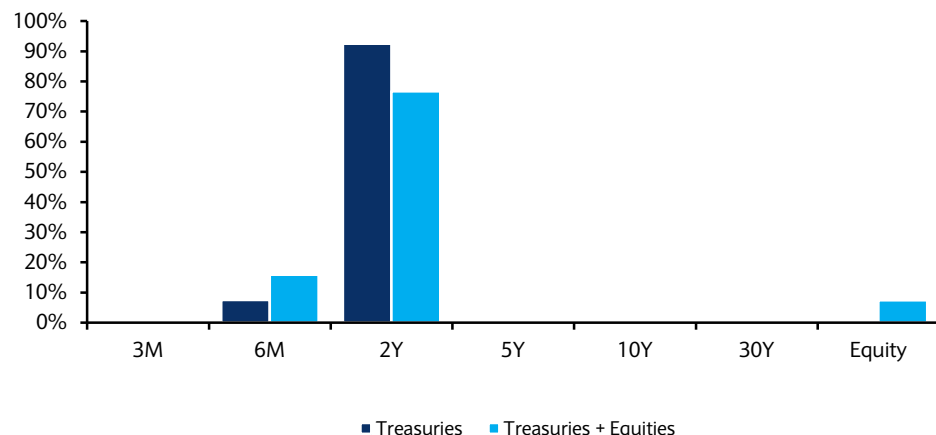
Risk vs. Reward: A Simple Historical Case Study

- **We consider an asset allocation problem for Central Banks using a purely historical approach based on limiting worst-case performance**
- **The optimization criterion: maximize average return, subject to a constraint on worst-case loss in a given review period**
- **Example of worst-case loss constraints: what static asset allocation would have produced the highest average return such that:**
 - cumulative returns over any 6-month period $\geq -50\text{bp}$
 - cumulative returns over any 12-month period ≥ 0
 - worst portfolio drawdown observed from high-water mark $\geq -100\text{bp}$
- **We carry out each such analysis twice:**
 - Using asset classes defined by six on-the-run Treasuries of different maturities: 3mo, 6mo, 2yr, 5yr, 10yr, 30yr
 - Using the above Treasury asset classes plus an equity asset class represented by a broad market total return index of US equities (MSCI Total Return Index)

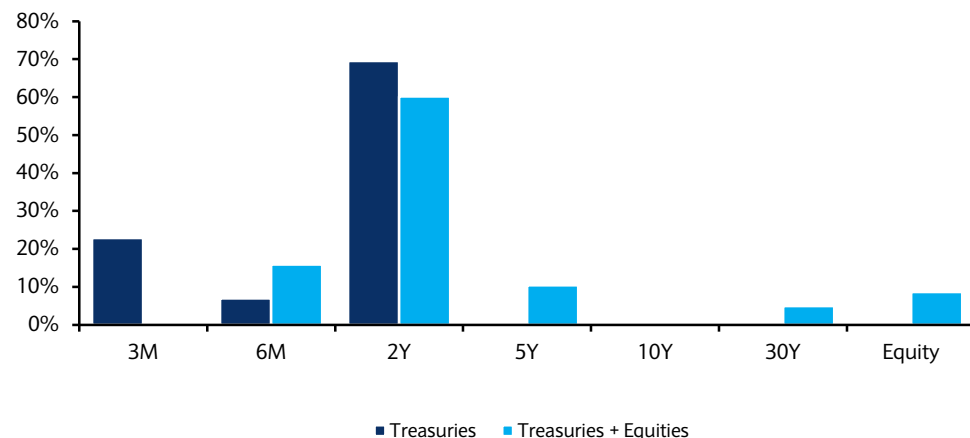
Static Allocation: Historical Case Study Results

In-sample Optimization based on asset return data from Jan 1981 – Feb 2015

Optimal Portfolio w Worst Case 6mo Return $\geq -50bp$



Optimal Portfolio w Worst Case 12mo Return ≥ 0



- We compare the optimal static portfolios using two different formulations of our in-sample optimization, based on worst case returns over horizons of 6 and 12 months
- When using the longer 12-month horizon, including equity makes a bigger difference:
 - the Treasury-only portfolio gets more conservative, shifting to the 3-month
 - with equity, a more diversified portfolio is obtained, with a greater allocation to risky assets (long bonds and equities)
- Due to the negative correlation between bond and equity returns over this period, adding equity does not necessarily require shortening duration

Source: Barclays Research

Static Allocation Results (continued)

In-sample Optimization based on asset return data from Jan 1981 – Feb 2015

Portfolio	Avg Tsy Duration	Equity Allocation	Long Bond Allocation	Worst 6mo Return	Worst 12mo Return	Max. Drawdown	Sharpe Ratio
Opt.(Tsy Only, 6mo>-50bp)	1.77	0.0%	0.0%	-0.5%	-0.6%	-1.46%	0.61
Opt. (w Equity, 6mo>-50bp)	1.51	7.4%	0.0%	-0.5%	-0.3%	-1.59%	0.76
Tsy 2y	1.87	0.0%	0.0%	-0.7%	-0.7%	-1.62%	0.61
Opt. (Tsy Only, 12mo>0)	1.48	0.0%	0.7%	-0.2%	0.0%	-1.01%	0.61
Opt. (w Equity, 12mo>0)	2.32	8.6%	4.9%	-1.5%	0.0%	-2.61%	0.73

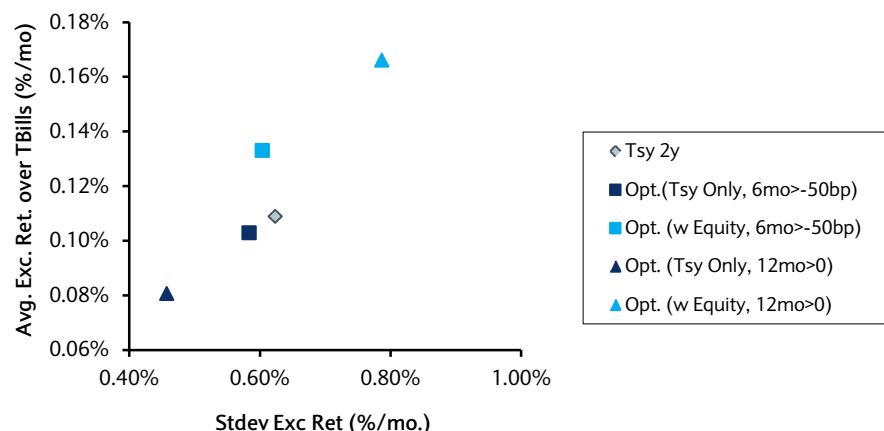
- Note that the 2-Year Treasury benchmark has achieved worst-case returns below our targeted levels of -50bp over 6 months and 0bp over 12 months
- Including equity assets under either optimization criterion improves the realized Sharpe ratio of the optimal portfolio, from about 0.6 to over 0.7
- However, the addition of equity can degrade the maximum drawdown in the optimal portfolio relative to that of the Treasury-only optimal portfolio

Source: Barclays Research

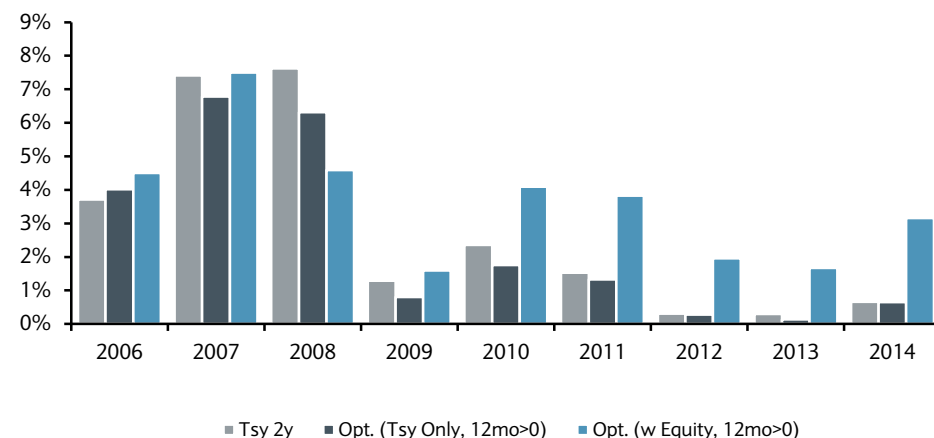
Static Allocation Results (continued)

In-sample Optimization based on asset return data from Jan 1981 – Feb 2015

Risk vs. Return Tradeoff by Optimization Rules



Performance Comparison in recent Calendar Years



- Adding equity improves the risk/return tradeoff (Sharpe Ratio)
- To meet the 12-month no-loss constraint with only Treasuries requires a very conservative portfolio; with equities we take more risk and earn more return
- The optimal Treasury-only portfolio based on the 12mo horizon underperformed the 2yr over the past several years; with equity, it underperformed the 2yr in 2008 and outperformed in the 6 years since then.

Source: Barclays Research

Dynamic Asset Allocation Based on “No View” Optimization

Portfolio allocation for Performance – “No-view” Portfolio Optimization

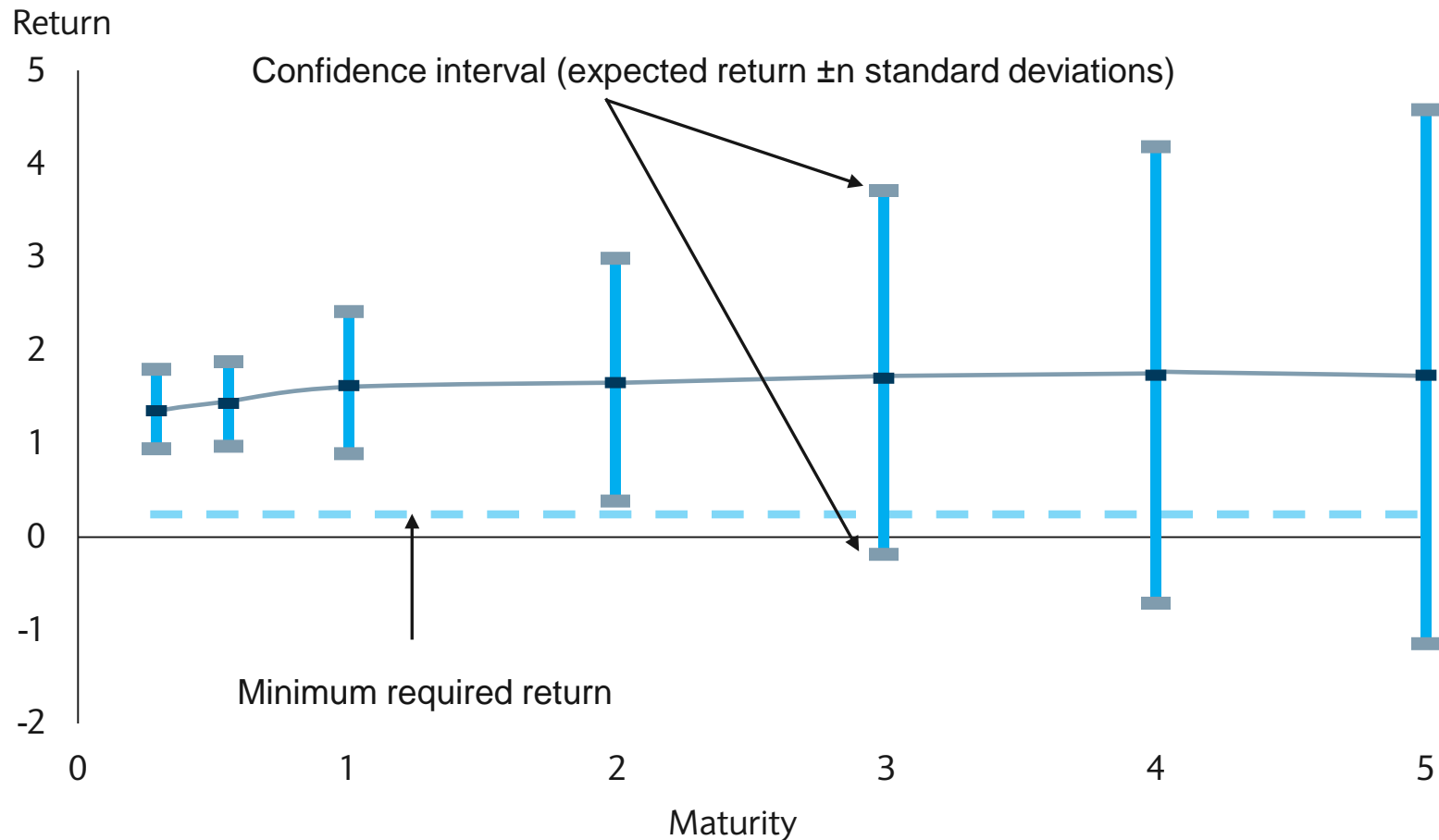
- Use a “no-view” statistical optimization to maximize expected return subject to a constraint on worst-case return
- Focus on capital preservation while obtaining moderate outperformance
- Choose only highly liquid investment assets
- Use historical data to project asset return volatility
- Use current yield curve as the basis for expected asset returns

Risk-return Tradeoff in the Strategy Formulation

- Expected return for each asset is based on its carry
 - For bonds we assume an unchanged yield curve, so expected return includes:
 - carry return proportional to the yield of the bond
 - plus adjustments for rolldown and convexity
 - For equities, we use the Shiller earnings-to-price ratio
 - Uses current price divided by 10-year rolling inflation-adjusted earnings
 - Measure of the long-term return potential for equities
- Return volatility is estimated based on historical returns
- Worst case return constrains the risk we put into the strategy, expressed as either:
 - A fixed lower bound on returns (e.g., 0% total monthly return)
 - A floating lower bound on returns : n standard deviations below expected benchmark returns

“No-view” Optimization

“No-view” statistical optimization



Source: Barclays Research

Optimization Procedure

- The objective is to find the portfolio with positive weights that solve

$$\begin{aligned} \max \quad & \sum_i w_i r_i \\ \text{s.t.} \quad & \sum_i w_i (r_i - n \sigma_i) \geq r_{\min} \end{aligned}$$

- This formulation assumes perfectly correlated losses in all assets in the worst case. We use an alternate version that relies on historical asset covariances.
- The choice of n determines the level of confidence that the minimum return threshold will not be violated.

Number of Standard Deviations	Confidence Level
1.0	84.1%
1.5	93.3%
2.0	97.7%

Source: Barclays Research

Strategy Parameters

- Horizon over which the minimum return constraint is imposed
 - A shorter horizon reduces the risk-taking ability of the strategy
 - A longer horizon may lead to higher long-term performance at the expense of higher return volatility
- Required minimum return threshold
- Confidence level of achieving required minimum return:
 - Higher confidence of avoiding losses reduces risk appetite
- Duration constraints
- Asset concentration constraint

Including Equities in This “No View” Framework

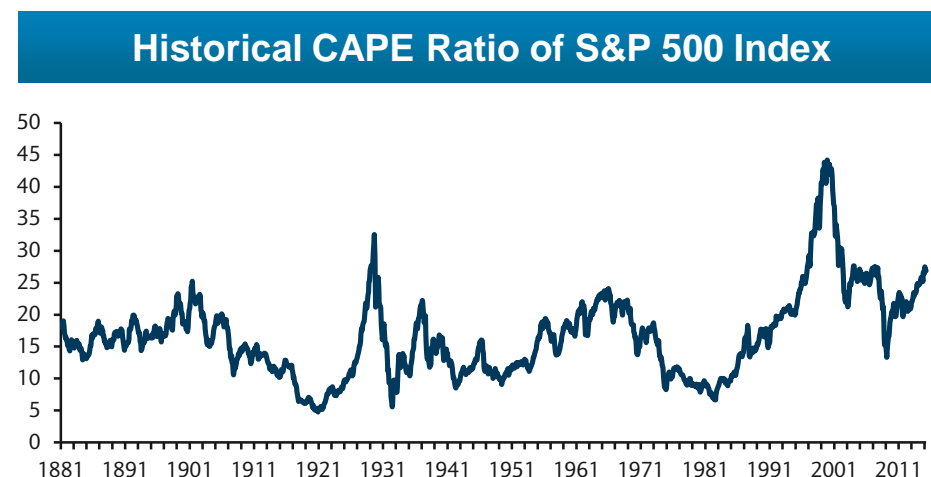
- One main difference between our “No View” optimization framework and standard Mean-Variance Optimization (MVO) is in the choice of expected returns
- For Treasury assets, we use an unchanged yield curve assumption, in which each asset earns its current yield, plus adjustments for rolldown and convexity
- How can we form an estimated return estimate for equities that is consistent with this approach?
- For equities, we have chosen to use the Shiller earnings to Price ratio:
 - Take the average earnings over the past 10 years, adjusted for inflation
 - Divide by current price to get a measure of expected “earnings yield”
 - This can give a measure of the long-term return potential for equities consistent with the yield-based approach we use for bonds

Brief Historical Review of Shiller Equity Valuation Indicators

- We document historical performance of US bond /equity portfolios in the period from 1926 through 2011
 - Equities outperformed bonds considerably over the sample period
 - Combining bonds and equities improves portfolio Sharpe ratio
- We demonstrate that valuation indicators can provide a useful signal for future long horizon equity returns:
 - Cyclically Adjusted Price Earnings Ratio (CAPE) is negatively related to long-term total and dividend returns
 - The ratio of the Cyclically Adjusted Earning Yield over Treasury yield is positively related to performance of equities over Treasury bonds

Cyclically Adjusted Price-Earnings Ratio (CAPE)

- Price-earnings (PE) ratio is a simple valuation indicator for equity markets
 - A high PE ratio might indicate richness of the stock market
 - A low PE ratio might indicate cheapness of the market
- Shiller in 1988 (and Benjamin Graham and David Dodd in 1934) suggested that for the purpose of examining valuation ratios, one should use earnings averaged over a substantial time period
- Shiller introduced cyclically adjusted PE (CAPE) ratio: S&P 500 divided by the average inflation-adjusted earnings from the previous 10 years
- CAPE is appropriate for use over long time horizons because it smoothes out the peaks and valleys in earnings

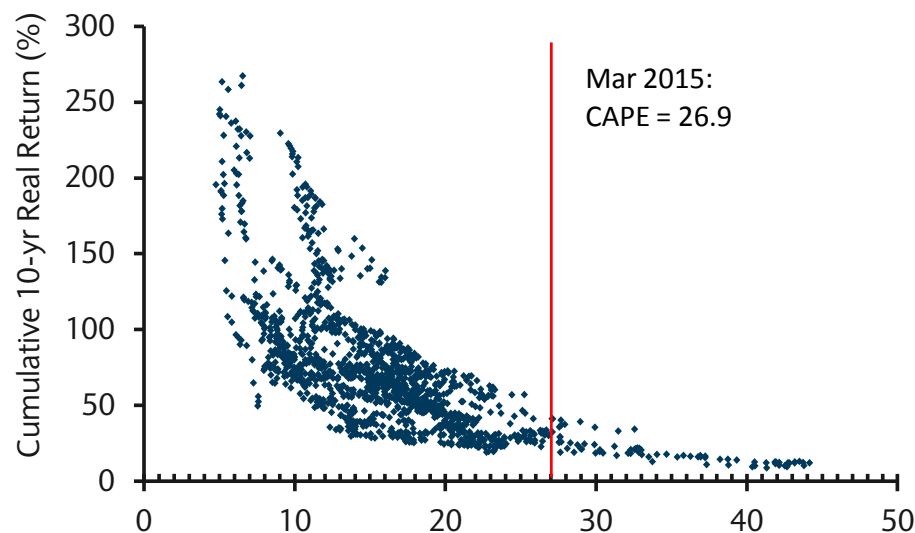


Source: Robert Shiller Data

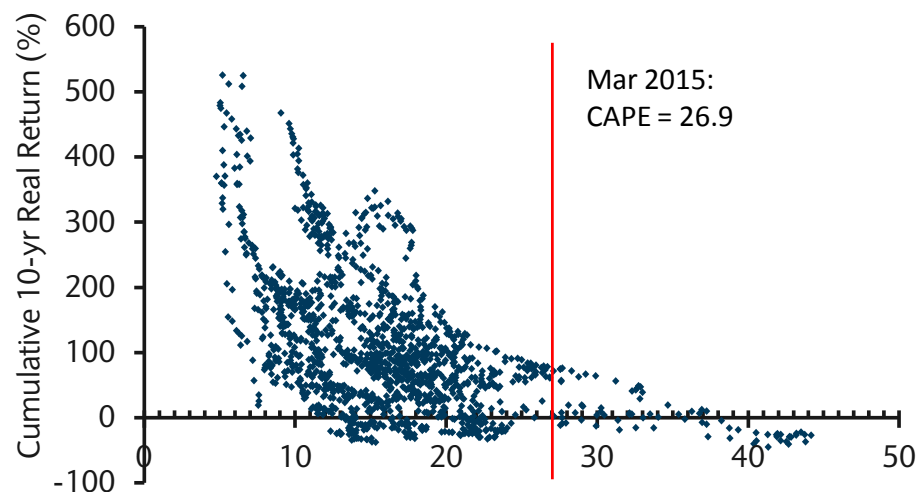
CAPE as an Indicator of Long-Term Equity Performance

- We analyze whether CAPE ratio is related to future long-horizon performance of the equity market
- Using overlapping samples of monthly returns from January 1881 to March 2015, we plot subsequent equity dividend and total returns over a 10yr horizon against CAPE ratios
- Two diagrams below show that subsequent dividend returns and total returns of the equity market over the 10yr horizon are negatively related to the CAPE ratio

10yr Future Dividend Returns vs. CAPE Ratio



10yr Future Total Returns vs. CAPE Ratio

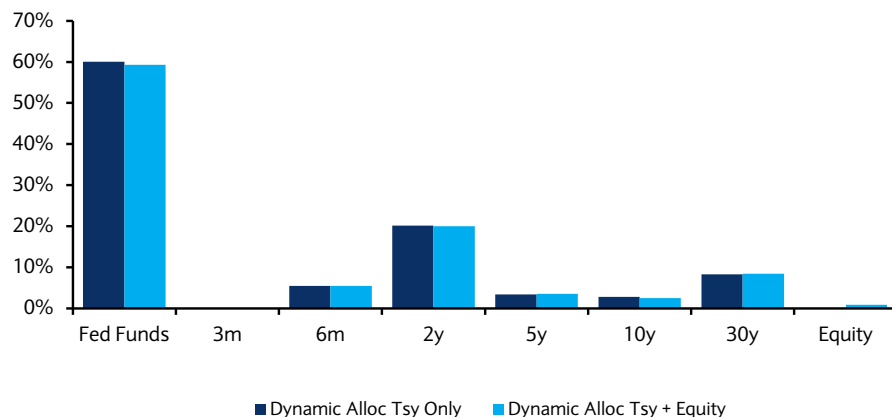


Source: Robert Shiller Data, Barclays Research

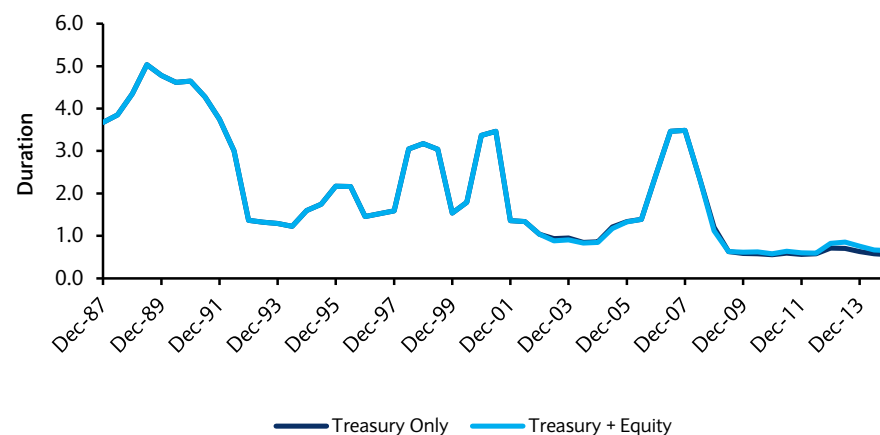
Dynamic Allocation Using “No View” Optimization

Historical backtest of results, semi-annual rebalancing, Dec 1987 – Dec 2014

Average Allocations: Worst Case 6mo Return ≥ -50 bp

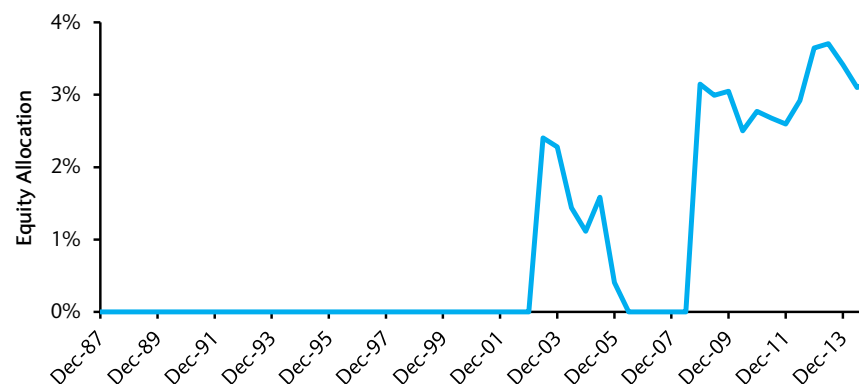


Time Series of Optimal Portfolio Durations



- We choose a fairly risk-averse strategy formulation:
 - Require 6mo returns ≥ -50 bp with 95% confidence
- We run twice, with and without equity asset
- Allocations vary a lot; we show long-term average weights, time series for duration and equity allocation
- In many months, equity allocation is zero
- When add equity, duration can increase or decrease

Time Series of Optimal Equity Allocations



Source: Robert Shiller Data, Barclays Research

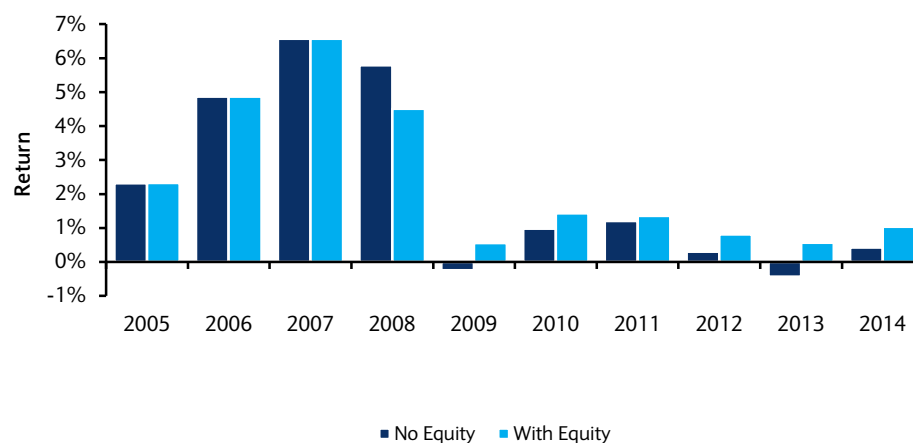
Dynamic Allocation Using “No View” Optimization

Historical performance, semi-annual rebalancing, Dec 1987 – Dec 2014

Long Term Performance of Dynamic Optimal Portfolios

	Treasuries Only	Treasuries + Equity
Average return (%/year)	4.43	4.53
Average Duration	2.01	2.01
Min. Return target met (%)	98%	100%
Confidence (%)	95%	95%

Strategy Performance in Recent Calendar Years



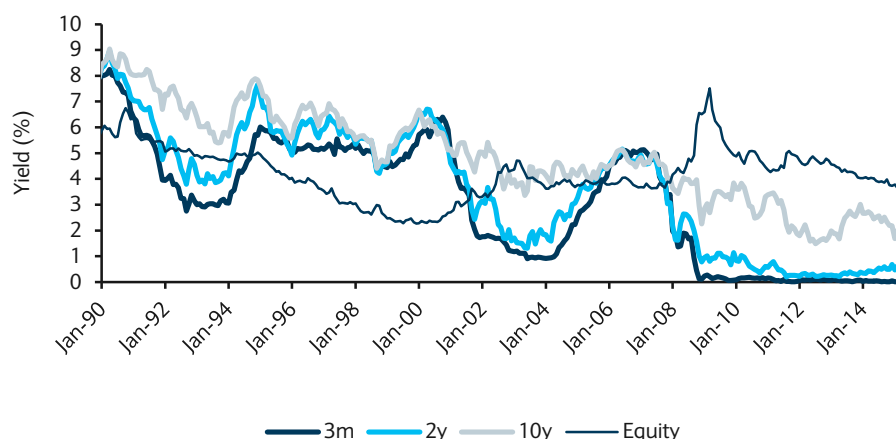
- Over longer term, including a small equity allocation gives a small increase to returns
- With equity, we did not breach our minimum return threshold; both backtested strategies stayed within specified confidence limit
- In recent years, inclusion of equity has roughly same effect that we saw in static allocation case:
 - Decreased portfolio performance in 2008
 - Moderate improvement in portfolio performance in each year since 2008

Source: Robert Shiller Data, Barclays Research

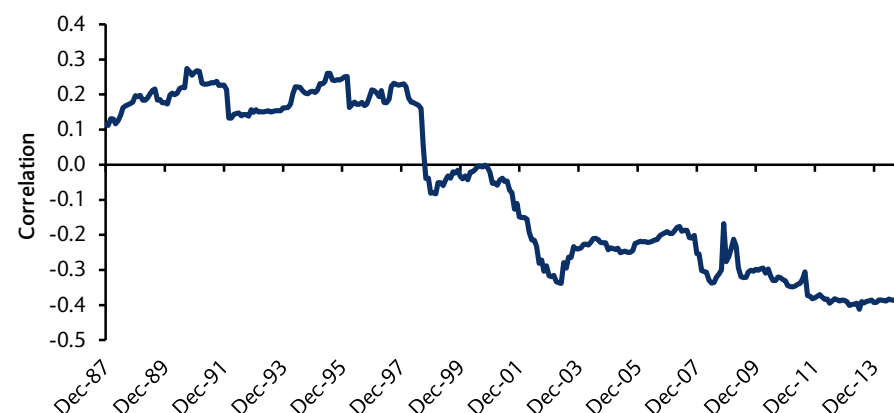
Exploring the Dynamic Drivers of Equity Allocation

Treasury and Equity Yield Levels and Return Correlations, Dec 1987 – Dec 2014

Equity Earnings Yield vs. Treasury Yields



Trailing Return Correlation of Equity and 10-Yr Treasury



- When Treasury yields exceed equity earnings yields, optimizer has little incentive to include equity
- Since 2008, cyclically adjusted earnings yield for equity looks attractive compared to Treasuries
- An additional argument for including some equity is as a diversification of Treasury risk, given the negative correlation between stocks and bonds that has held sway in the current regime.
- We plot the return correlation of Treasury 10yr bonds with equities, using monthly data and exponential weighting with a 3-year half-life.

Source: Robert Shiller Data, Barclays Research

Conclusions

- Every official institution has its own particular goals, needs, constraints, concerns
- The examples in this presentation can all be customized
- A conservative, risk-averse investment philosophy does not necessarily mean that equity has no place in the portfolio

Analyst Certifications and Important Disclosures

Analyst Certification(s)

We, Albert Desclée, Jay Hyman, Anando Maitra and Simon Polbennikov, hereby certify (1) that the views expressed in this research report accurately reflect our personal views about any or all of the subject securities or issuers referred to in this research report and (2) no part of our compensation was, is or will be directly or indirectly related to the specific recommendations or views expressed in this research report.

Important Disclosures

Barclays Research is a part of the Investment Bank of Barclays Bank PLC and its affiliates (collectively and each individually, "Barclays"). For current important disclosures regarding companies that are the subject of this research report, please send a written request to: Barclays Research Compliance, 745 Seventh Avenue, 14th Floor, New York, NY 10019 or refer to <http://publicresearch.barclays.com> or call 212-526-1072.

Barclays Capital Inc. and/or one of its affiliates does and seeks to do business with companies covered in its research reports. As a result, investors should be aware that Barclays may have a conflict of interest that could affect the objectivity of this report. Barclays Capital Inc. and/or one of its affiliates regularly trades, generally deals as principal and generally provides liquidity (as market maker or otherwise) in the debt securities that are the subject of this research report (and related derivatives thereof). Barclays trading desks may have either a long and / or short position in such securities, other financial instruments and / or derivatives, which may pose a conflict with the interests of investing customers. Where permitted and subject to appropriate information barrier restrictions, Barclays fixed income research analysts regularly interact with its trading desk personnel regarding current market conditions and prices. Barclays fixed income research analysts receive compensation based on various factors including, but not limited to, the quality of their work, the overall performance of the firm (including the profitability of the Investment Banking Department), the profitability and revenues of the Markets business and the potential interest of the firm's investing clients in research with respect to the asset class covered by the analyst. To the extent that any historical pricing information was obtained from Barclays trading desks, the firm makes no representation that it is accurate or complete. All levels, prices and spreads are historical and do not represent current market levels, prices or spreads, some or all of which may have changed since the publication of this document. The Investment Bank's Research Department produces various types of research including, but not limited to, fundamental analysis, equity-linked analysis, quantitative analysis, and trade ideas. Recommendations contained in one type of research may differ from recommendations contained in other types of research, whether as a result of differing time horizons, methodologies, or otherwise. Unless otherwise indicated, trade ideas contained herein are provided as of the date of this report and are subject to change without notice due to changes in prices. In order to access Barclays Statement regarding Research Dissemination Policies and Procedures, please refer to <https://live.barcap.com/publiccp/RSR/nyfipubs/disclaimer/disclaimer-research-dissemination.html>. In order to access Barclays Research Conflict Management Policy Statement, please refer to: <https://live.barcap.com/publiccp/RSR/nyfipubs/disclaimer/disclaimer-conflict-management.html>.

Barclays legal entities involved in publishing research:

Barclays Bank PLC (Barclays, UK)
Barclays Capital Inc. (BCI, US)
Barclays Securities Japan Limited (BSJL, Japan)
Barclays Bank PLC, Tokyo branch (Barclays Bank, Japan)
Barclays Bank PLC, Hong Kong branch (Barclays Bank, Hong Kong)
Barclays Capital Canada Inc. (BCCI, Canada)
Absa Bank Limited (Absa, South Africa)
Barclays Bank Mexico, S.A. (BBMX, Mexico)
Barclays Capital Securities Taiwan Limited (BCSTW, Taiwan)
Barclays Capital Securities Limited (BCSL, South Korea)
Barclays Securities (India) Private Limited (BSIPL, India)
Barclays Bank PLC, India branch (Barclays Bank, India)
Barclays Bank PLC, Singapore branch (Barclays Bank, Singapore)
Barclays Bank PLC Australia branch (Barclays Bank, Australia)

Disclaimer

This publication has been produced by the Investment Bank of Barclays Bank PLC and/or one or more of its affiliates (collectively and each individually, "Barclays"). It has been distributed by one or more Barclays legal entities that are a part of the Investment Bank as provided below. It is provided to our clients for information purposes only, and Barclays makes no express or implied warranties, and expressly disclaims all warranties of merchantability or fitness for a particular purpose or use with respect to any data included in this publication. Barclays will not treat unauthorized recipients of this report as its clients. Prices shown are indicative and Barclays is not offering to buy or sell or soliciting offers to buy or sell any financial instrument.

Without limiting any of the foregoing and to the extent permitted by law, in no event shall Barclays, nor any affiliate, nor any of their respective officers, directors, partners, or employees have any liability for (a) any special, punitive, indirect, or consequential damages; or (b) any lost profits, lost revenue, loss of anticipated savings or loss of opportunity or other financial loss, even if notified of the possibility of such damages, arising from any use of this publication or its contents.

Other than disclosures relating to Barclays, the information contained in this publication has been obtained from sources that Barclays Research believes to be reliable, but Barclays does not represent or warrant that it is accurate or complete. Barclays is not responsible for, and makes no warranties whatsoever as to, the content of any third-party web site accessed via a hyperlink in this publication and such information is not incorporated by reference.

The views in this publication are those of the author(s) and are subject to change, and Barclays has no obligation to update its opinions or the information in this publication. The analyst recommendations in this publication reflect solely and exclusively those of the author(s), and such opinions were prepared independently of any other interests, including those of Barclays and/or its affiliates. This publication does not constitute personal investment advice or take into account the individual financial circumstances or objectives of the clients who receive it. The securities discussed herein may not be suitable for all investors. Barclays recommends that investors independently evaluate each issuer, security or instrument discussed herein and consult any independent advisors they believe necessary. The value of and income from any investment may fluctuate from day to day as a result of changes in relevant economic markets (including changes in market liquidity). The information herein is not intended to predict actual results, which may differ substantially from those reflected. Past performance is not necessarily indicative of future results.

This material has been issued and approved for distribution in the UK and European Economic Area by Barclays Bank PLC. It is being made available primarily to persons who are investment professionals as that term is defined in Article 19 of the Financial Services and Markets Act 2000 (Financial Promotion) Order 2005. It is directed at, and therefore should only be relied upon by, persons who have professional experience in matters relating to investments. The investments to which it relates are available only to such persons and will be entered into only with such persons. Barclays Bank PLC is authorised by the Prudential Regulation Authority and regulated by the Financial Conduct Authority and the Prudential Regulation Authority and is a member of the London Stock Exchange.

The Investment Bank of Barclays Bank PLC undertakes U.S. securities business in the name of its wholly owned subsidiary Barclays Capital Inc., a FINRA and SIPC member. Barclays Capital Inc., a U.S. registered broker/dealer, is distributing this material in the United States and, in connection therewith accepts responsibility for its contents. Any U.S. person wishing to effect a transaction in any security discussed herein should do so only by contacting a representative of Barclays Capital Inc. in the U.S. at 745 Seventh Avenue, New York, New York 10019.

Non-U.S. persons should contact and execute transactions through a Barclays Bank PLC branch or affiliate in their home jurisdiction unless local regulations permit otherwise.

Barclays Bank PLC, Paris Branch (registered in France under Paris RCS number 381 066 281) is regulated by the Autorité des marchés financiers and the Autorité de contrôle prudentiel. Registered office 34/36 Avenue de Friedland 75008 Paris.

This material is distributed in Canada by Barclays Capital Canada Inc., a registered investment dealer, a Dealer Member of IIROC (www.iiroc.ca), and a Member of the Canadian Investor Protection Fund (CIPF).

Subject to the conditions of this publication as set out above, the Corporate & Investment Banking Division of Absa Bank Limited, an authorised financial services provider (Registration No.: 1986/004794/06. Registered Credit Provider Reg No NCRCP7), is distributing this material in South Africa. Absa Bank Limited is regulated by the South African Reserve Bank. This publication is not, nor is it intended to be, advice as defined and/or contemplated in the (South African) Financial Advisory and Intermediary Services Act, 37 of 2002, or any other financial, investment, trading, tax, legal, accounting, retirement, actuarial or other professional advice or service whatsoever. Any South African person or entity wishing to effect a transaction in any security discussed herein should do so only by contacting a representative of the Corporate & Investment Banking Division of Absa Bank Limited in South Africa, 15 Alice Lane, Sandton, Johannesburg, Gauteng 2196. Absa Bank Limited is a member of the Barclays group.

In Japan, foreign exchange research reports are prepared and distributed by Barclays Bank PLC Tokyo Branch. Other research reports are distributed to institutional investors in Japan by Barclays Securities Japan Limited. Barclays Securities Japan Limited is a joint-stock company incorporated in Japan with registered office of 6-10-1 Roppongi, Minato-ku, Tokyo 106-6131, Japan. It is a subsidiary of Barclays Bank PLC and a registered financial instruments firm regulated by the Financial Services Agency of Japan. Registered Number: Kanto Zaimukyokuchō (kinsho) No. 143.

Disclaimer (continued)

Barclays Bank PLC, Hong Kong Branch is distributing this material in Hong Kong as an authorised institution regulated by the Hong Kong Monetary Authority. Registered Office: 41/F, Cheung Kong Center, 2 Queen's Road Central, Hong Kong.

Information on securities/instruments that trade in Taiwan or written by a Taiwan-based research analyst is distributed by Barclays Capital Securities Taiwan Limited to its clients. The material on securities/instruments not traded in Taiwan is not to be construed as 'recommendation' in Taiwan. Barclays Capital Securities Taiwan Limited does not accept orders from clients to trade in such securities. This material may not be distributed to the public media or used by the public media without prior written consent of Barclays.

This material is distributed in South Korea by Barclays Capital Securities Limited, Seoul Branch.

All Indian securities related research and other equity research are distributed in India by Barclays Securities (India) Private Limited (BSIPL). BSIPL is a company incorporated under the Companies Act, 1956 having CIN U67120MH2006PTC161063. BSIPL is registered and regulated by the Securities and Exchange Board of India (SEBI) as a Portfolio Manager INP000002585; Stock Broker/Trading and Clearing Member: National Stock Exchange of India Limited (NSE) Capital Market INB231292732, NSE Futures & Options INF231292732, NSE Currency derivatives INE231450334, Bombay Stock Exchange Limited (BSE) Capital Market INB011292738, BSE Futures & Options INF011292738; Merchant Banker: INM000011195; Depository Participant (DP) with the National Securities & Depositories Limited (NSDL): DP ID: IN-DP-NSDL-299-2008; Investment Adviser: INA000000391. The registered office of BSIPL is at 208, Ceejay House, Shivsagar Estate, Dr. A. Besant Road, Worli, Mumbai – 400 018, India. Telephone No: +91 22 67196000. Fax number: +91 22 67196100. Any other reports are distributed in India by Barclays Bank PLC, India Branch. Barclays Bank PLC Frankfurt Branch distributes this material in Germany under the supervision of Bundesanstalt für Finanzdienstleistungsaufsicht (BaFin).

This material is distributed in Malaysia by Barclays Capital Markets Malaysia Sdn Bhd.

This material is distributed in Brazil by Banco Barclays S.A.

This material is distributed in Mexico by Barclays Bank Mexico, S.A.

Barclays Bank PLC in the Dubai International Financial Centre (Registered No. 0060) is regulated by the Dubai Financial Services Authority (DFSA). Principal place of business in the Dubai International Financial Centre: The Gate Village, Building 4, Level 4, PO Box 506504, Dubai, United Arab Emirates. Barclays Bank PLC-DIFC Branch, may only undertake the financial services activities that fall within the scope of its existing DFSA licence. Related financial products or services are only available to Professional Clients, as defined by the Dubai Financial Services Authority.

Barclays Bank PLC in the UAE is regulated by the Central Bank of the UAE and is licensed to conduct business activities as a branch of a commercial bank incorporated outside the UAE in Dubai (Licence No.: 13/1844/2008, Registered Office: Building No. 6, Burj Dubai Business Hub, Sheikh Zayed Road, Dubai City) and Abu Dhabi (Licence No.: 13/952/2008, Registered Office: Al Jazira Towers, Hamdan Street, PO Box 2734, Abu Dhabi).

Barclays Bank PLC in the Qatar Financial Centre (Registered No. 00018) is authorised by the Qatar Financial Centre Regulatory Authority (QFCRA). Barclays Bank PLC-QFC Branch may only undertake the regulated activities that fall within the scope of its existing QFCRA licence. Principal place of business in Qatar: Qatar Financial Centre, Office 1002, 10th Floor, QFC Tower, Diplomatic Area, West Bay, PO Box 15891, Doha, Qatar. Related financial products or services are only available to Business Customers as defined by the Qatar Financial Centre Regulatory Authority.

This material is distributed in the UAE (including the Dubai International Financial Centre) and Qatar by Barclays Bank PLC.

This material is distributed in Russia by OOO Barclays Capital, affiliated company of Barclays Bank PLC, registered and regulated in Russia by the FSFM. Broker License #177-11850-100000; Dealer License #177-11855-010000. Registered address in Russia: 125047 Moscow, 1st Tverskaya-Yamskaya str. 21.

This material is distributed in Singapore by the Singapore branch of Barclays Bank PLC, a bank licensed in Singapore by the Monetary Authority of Singapore. For matters in connection with this report, recipients in Singapore may contact the Singapore branch of Barclays Bank PLC, whose registered address is One Raffles Quay Level 28, South Tower, Singapore 048583.

Barclays Bank PLC, Australia Branch (ARBN 062 449 585, AFSL 246617) is distributing this material in Australia. It is directed at 'wholesale clients' as defined by Australian Corporations Act 2001.

IRS Circular 230 Prepared Materials Disclaimer: Barclays does not provide tax advice and nothing contained herein should be construed to be tax advice. Please be advised that any discussion of U.S. tax matters contained herein (including any attachments) (i) is not intended or written to be used, and cannot be used, by you for the purpose of avoiding U.S. tax-related penalties; and (ii) was written to support the promotion or marketing of the transactions or other matters addressed herein. Accordingly, you should seek advice based on your particular circumstances from an independent tax advisor.

© Copyright Barclays Bank PLC (2015). All rights reserved. No part of this publication may be reproduced or redistributed in any manner without the prior written permission of Barclays. Barclays Bank PLC is registered in England No. 1026167. Registered office 1 Churchill Place, London, E14 5HP. Additional information regarding this publication will be furnished upon request.