Quantitative Portfolio Strategy

Albert Desclée
+44 20 7773 3382
albert.desclee@barclays.com
Barclays, UK

Anando Maitra
+44 20 3134 0091
anando.maitra@barclays.com
Barclays, UK

Simon Polbennikov
+44 20 3134 0752
simon.polbennikov@barclays.com
Barclays, UK

Scenario Analysis

May 2015

Motivation

Scenario analysis is a useful tool to complement portfolio risk management

- Scenario analysis usually relies on a few discretionary forecasts
- Historical data help propagate these forecasts to a variety of market factors, and provide consistent return projections across a broad investment universe
- But! Scenarios can be very different – not always well represented by available historical data
- Examples:
  - "Japan scenario"
    - Low inflation regime / weak GDP growth
  - "Monetization scenario"
    - Significant inflation / weak GDP growth
- Important issues:
  - Time horizon
  - Scenario and regime
  - Including macro-variables in stress-scenarios

Case Study

Consider tail-risk scenarios

	Scenario		Sub-scenario
1	Euro area woes	1a	Mild correction with possibility of a rebound
		1b	Spiral of contagion before stabilising and rebound
		1c	Escalation into a severe bear market
2	Demand-driven commodity shock	2a	Loose monetary policy or resource hungry economies
		2b	Commodity rally feeding into inflation pressure and stifling growth
3	Middle East tensions - Oil price spike driven by supply shock	3a	Threat to oil supply disruption
		3b	Oil price rally feeding headline inflation pressure
4	Geopolitical tensions	4a	Localised conflict, temporary impact
		4b	Regional conflict involving key global players
5	Chinese RMB revaluation	5a	Large unexpected Chinese RMB Revaluation
6	Natural disasters	6a	Pandemics
		6b	Earthquakes

Source: Barclays Research

We look at each scenario using a two-step approach

- Scenario shock defined by a few selected risk factors that are stressed based on a macro-analysis
- Estimate change in asset prices to be expected following the shock
- Note, this analysis is based on market conditions as of end-March 2012.

	Step 1 Macro-economic analyses	Step 2 Quantitative projections
Team in charge	• Barclays, Global Asset Allocation Research	• Barclays, Quantitative Portfolio Strategy
Methodology	• Forward-looking approach based on - Economic theory - Academic studies - Comparable historical studies	• Based on multi-factor risk model • Takes scenario stresses as inputs • Uses historical relationships to project scenario outcomes
Output	• Expected sequence of events • Assumptions on key asset classes impacted (to be used as input for step 2)	• Expected 'shock-to-trough' by asset class

Scenario 1a – Euro area woes: Mild correction
Macro-economic analysis

Macro Overview

- Fiscal slippage related news triggers risk asset correction
- Focus mainly on European events rather than global growth fears
- Likelihood of a short lived risk asset correction followed by a swift rebound
- Spain and Italy are impacted together initially before spreading to other core countries
- Mild recession in the Euro area due to fiscal constraint. Unchanged outlook with real GDP growth expected at -0.4%y/y 2012

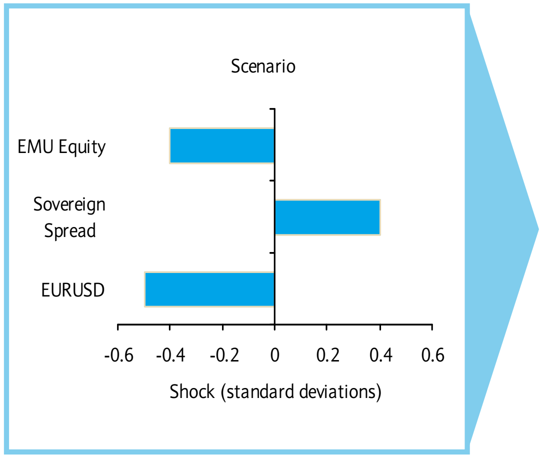
View by Asset Class

Fixed income	• Fiscally challenged sovereign spreads widen • Spanish and Italian yields exceed 6.5%, debt sustainability fears spread • Spread to safe havens such as Bunds and Gilts widen a further 100bps as safe havens rally • French and Belgian spread to safe havens widen by 50-100bps • Euribor – EONIA spreads widen from the usual 20-40bp range to exceed 50bps as solvency fears spill into liquidity concerns. However, latest 3yr LTRO has somewhat mitigated this
Equity	• European equities fall on average by 10% • S&P 500, NKY and equities of "unaffected" economies fall • EM equities expected to fall • VIX and VSTOXX expected to rise
Commodity	• Mild correction in commodities as investors take profits in case of broader global growth impact • Copper and oil expected to fall
FX	• EURUSD declines less than 5% at this stage

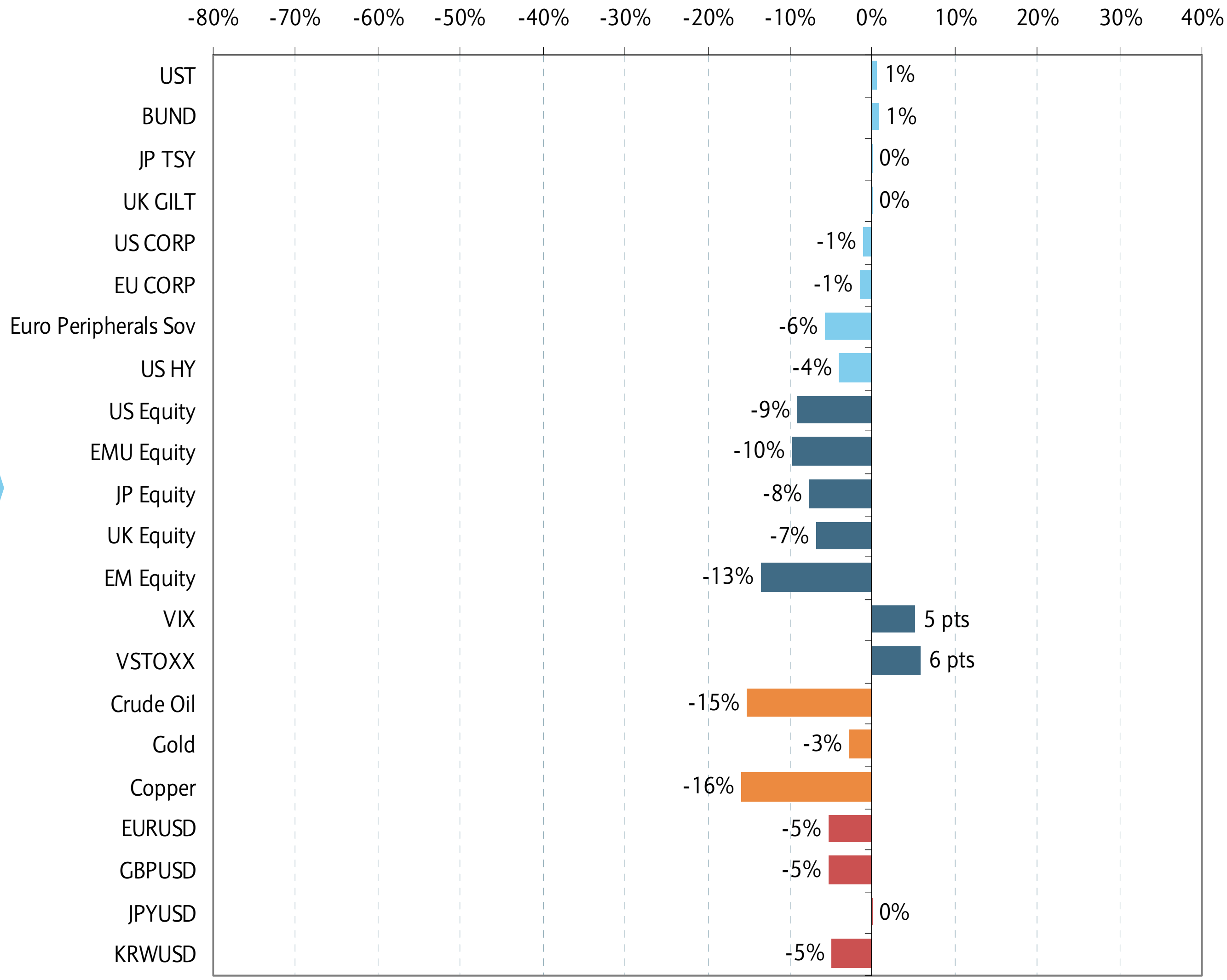
Source: Barclays Research

Scenario 1a – Euro area woes: Mild correction
Quantitative Projections

Inputs



Projected Returns



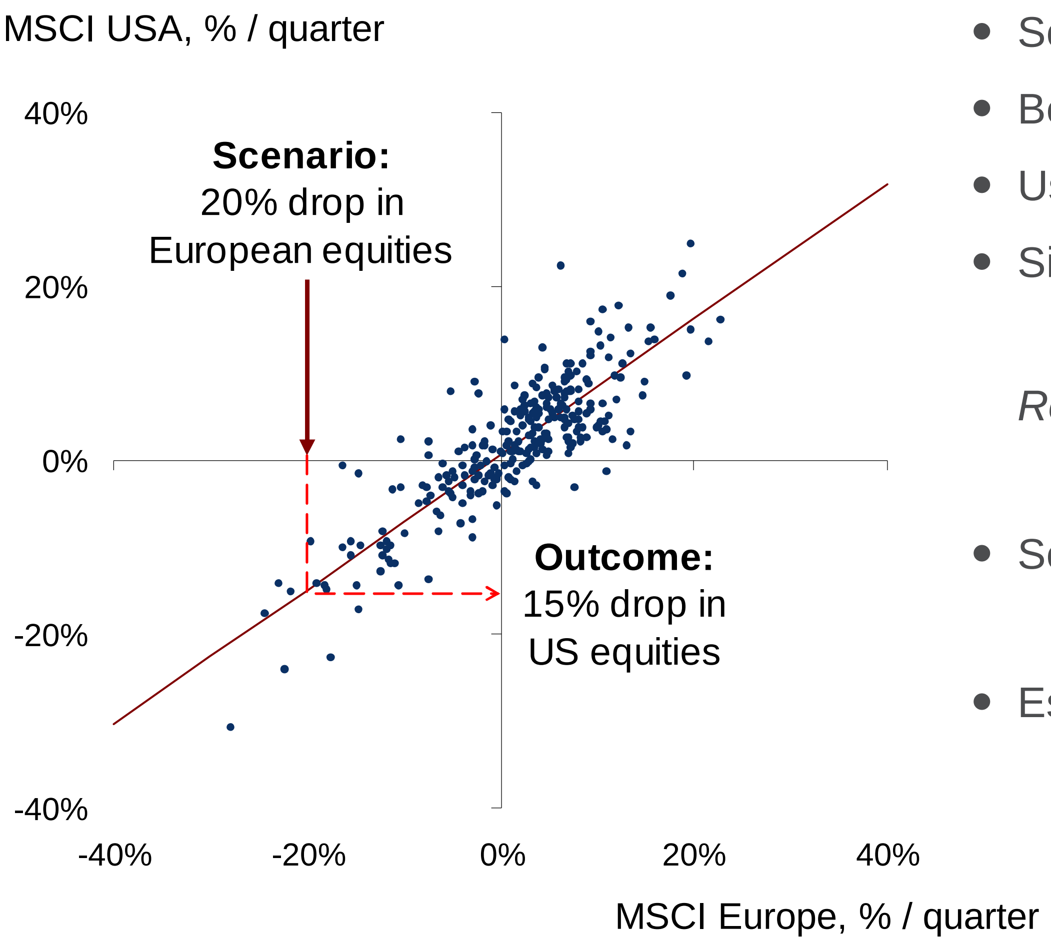
Source: Barclays Research

Analysis

Scenario Analysis – Maximum Likelihood Approach

Maximum Likelihood method help to propagate a partially specified scenario to a broad asset universe

Return Scenario for European Equities Translated into Return for US Equities



- Scenario: -20% return on European equities
- Beta of US equities: 78%
- Use to project US equity expected return
- Similar to OLS regression

Ret US = Const + Beta x Scen Ret EU

- Scenario return of US equities: -15%
- Estimation Period: Jan 1988 to Dec 2011

Source: Barclays Research, Bloomberg

Example: Effect of YC Widening on Credit Portfolio

Consider a scenario where treasury yields increase by 100 bp (parallel shift)

Yield Curve Widening Scenario – Implications for the US Corporate Index

Portfolio Rate Exposures		Rate Scenario / Return	
6m KRD	0.07	+ 100 bps	- 0.07
2y KRD	0.60	+ 100 bps	- 0.60
5y KRD	1.68	+ 100 bps	- 1.68
10y KRD	1.66	+ 100 bps	- 1.66
20y KRD	1.50	+ 100 bps	- 1.50
30y KRD	1.35	+ 100 bps	- 1.35
			- 6.86 %

Portfolio Spread Exposure		Spread Scenario / Return	
DTS	15.73	- 15.13 %	+ 2.38 %
			- 4.48 %

- Portfolio: US Corporate Index
- Scenario: 100 bps parallel shift of the YC
- Beta of corporate spreads: -0.15

- Rate return: -6.86%
- Spread return: +2.38%
- Portfolio returns: -4.48%

- Estimation Period: Jan 1990 to Dec 2011

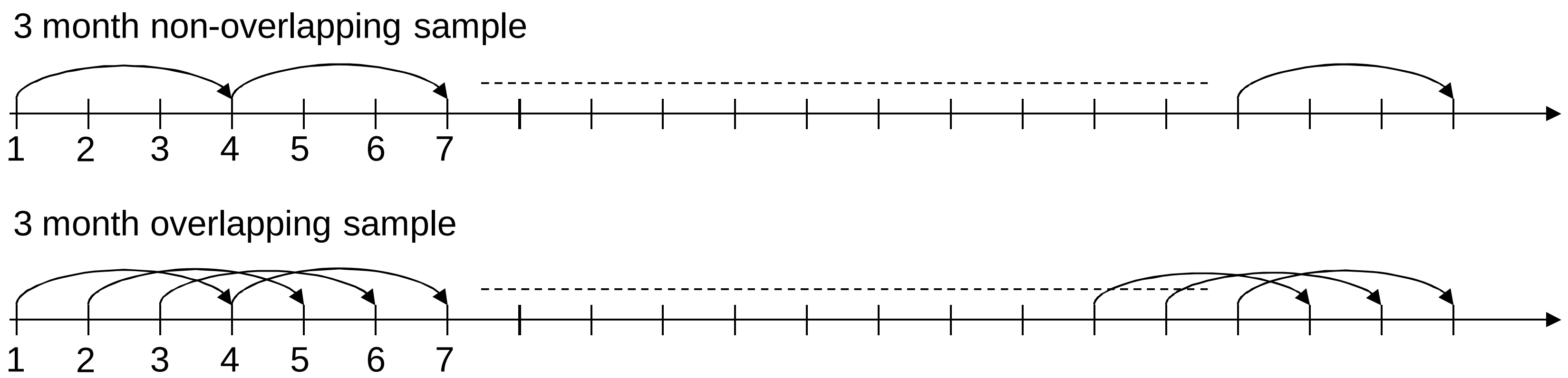
- Factor correlations and volatilities play an important role in translating scenarios into projected returns
- **But correlations can depend on investment horizons, economic regimes, and scenarios**

Source: Barclays Research

Correlations and Investment Horizon: Methodology

For longer investment horizons volatilities and correlations can be estimated from overlapping samples

Consistent Estimates: Non-Overlapping and Overlapping Samples

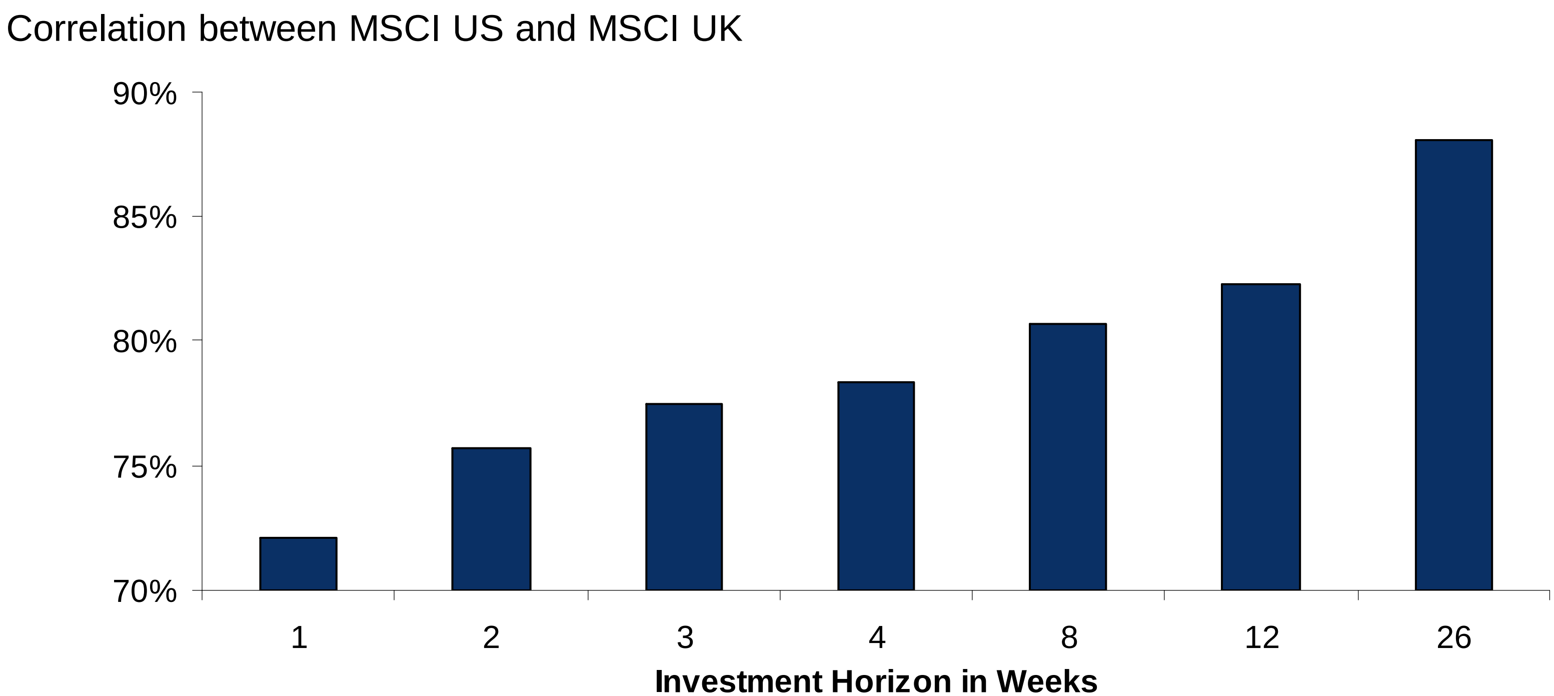


- Data frequency: monthly
- Investor is interested in a longer horizon – e.g. quarterly (3 months)
  - A) Use non-overlapping samples of 3 months returns – few data points – inefficient
    - From which month to start?
    - 2/3 of possible 3months return realizations are ignored
  - B) Overlapping samples of 3 months returns
    - Uses all possible 3 months return realizations (larger effective sample)
    - Observations are auto-correlated – wider confidence intervals for estimated parameters
    - **BUT: estimated parameters are still consistent**

Correlations and Investment Horizon

Asset correlations can change according to the investment horizon

Correlation between US and UK Equities for various Investment Horizons



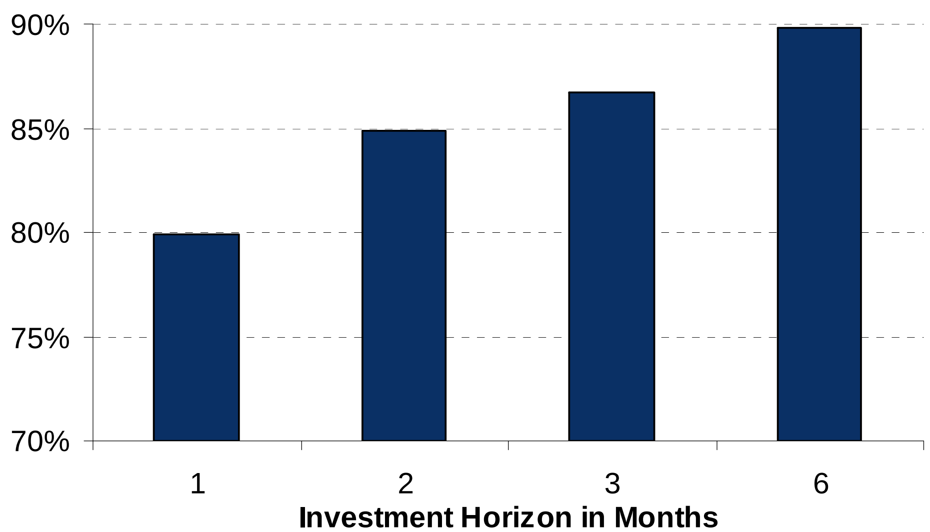
- Correlation between MSCI US and MSCI UK increases with the investment horizon
  - From 72% for 1-week returns
  - To almost 90% for 26-week returns
- Calibration period: 01 Jul 1988 - 30 Dec 2011

Source: Barclays Research, Bloomberg

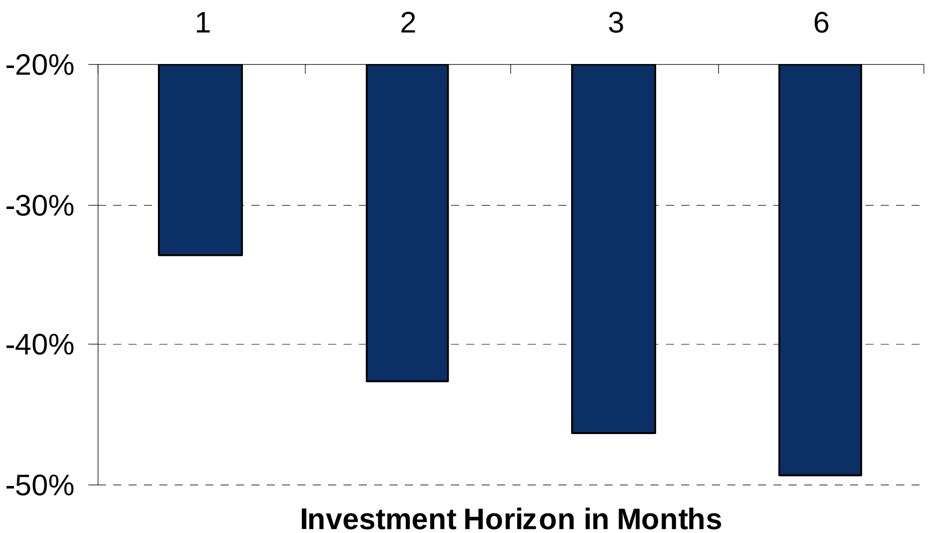
Correlations and Investment Horizon (cont)

Asset correlations can change according to the investment horizon

US Financials vs. Non-Financials



US Corporates vs. US Equity

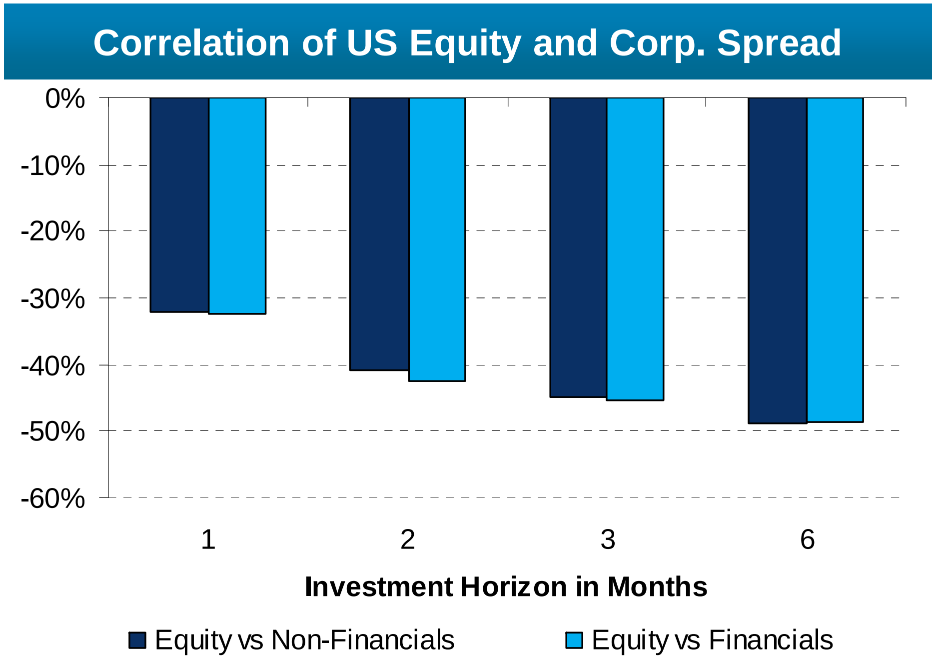


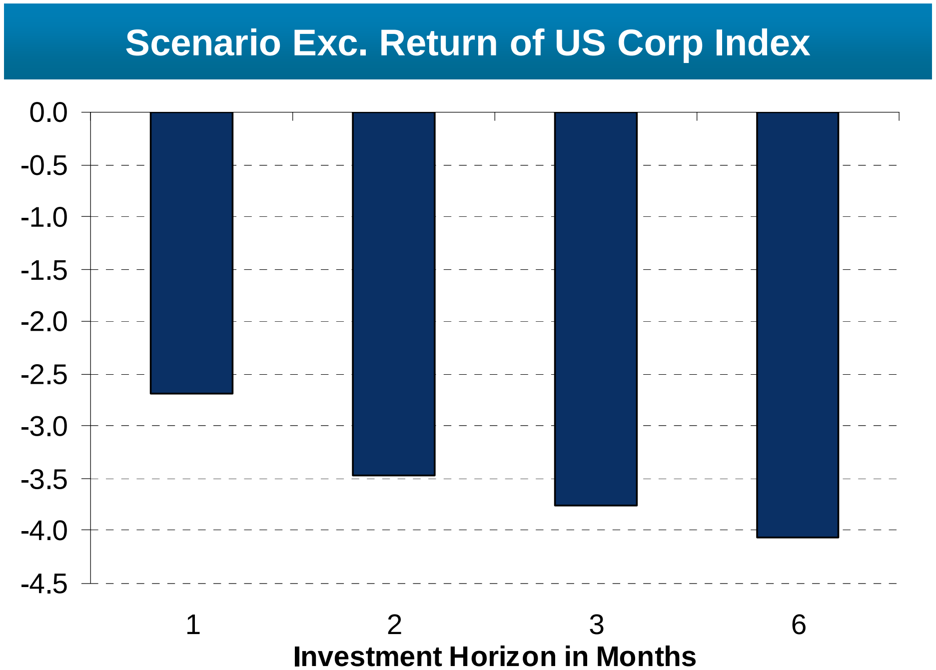
- Correlation between relative spread changes of US Financial and Non-Financial sectors increases with the investment horizon (from 80% to 90%)
- Correlation between relative spread changes of US Corporates and returns of S&P 500 drops with the investment horizon (from 34% to 50%)
- Calibration period: Jul 1973 - Dec 2011

Source: Barclays Research, Bloomberg

Example: Credit Portfolio and Equity Market Crash

How does the excess return of a corporate portfolio change according to investment horizon in a 20% equity drop scenario?





- Scenario: 20% drop in S&P500
- How are excess returns of US corporate bonds affected?
- The equity-spread correlation declines with the investment horizon
- A longer horizon implies a lager drop in corporate excess returns in the considered scenario
- -2.6% for 1 month horizon vs -4.1% for 6 month horizon
- Calibration period: Jul 1973 - Dec 2011

Source: Barclays Research, Bloomberg

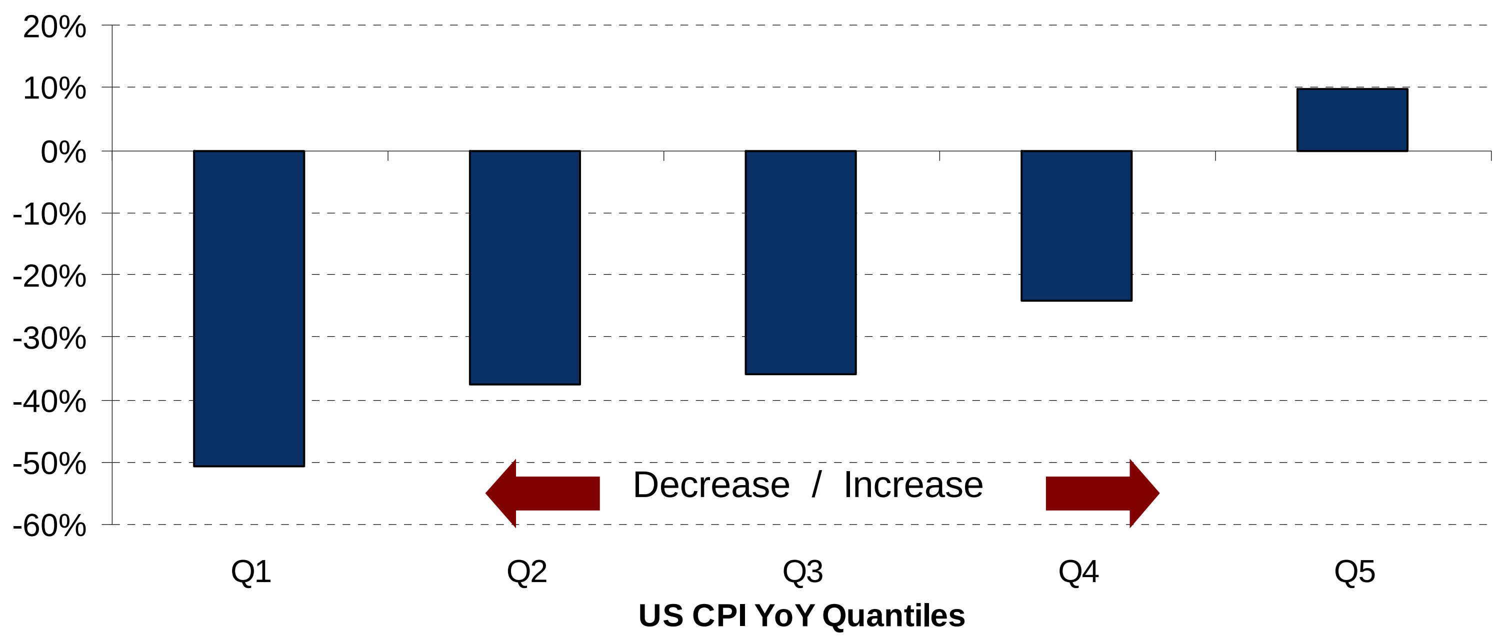
BARCLAYS

Scenario Analysis and Economic Regimes

Asset correlations can change in different economic regimes

- Correlation: US corporate bond excess returns vs US treasury returns
  - Low and negative when inflation is low
  - Can turn positive when inflation is high
  - Think of “Japan” vs. “Monetization” scenarios
- Calibration period: Feb 1973 - Dec 2011

Correlation Between Treasury Returns and US Corp ER in Different Inflation Regimes



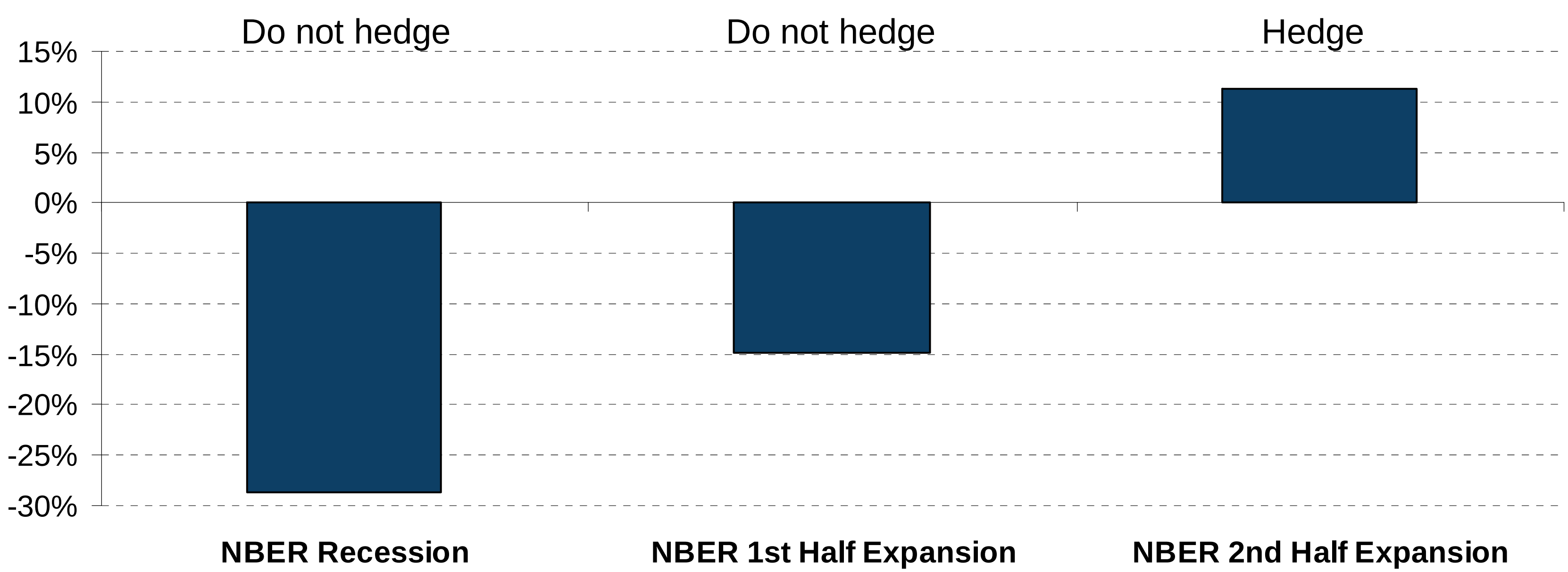
Source: Barclays Research, Bloomberg, Bureau of Labor Statistics

Economic Regimes: Hedging FX Exposure

Should the FX exposure of a US equity portfolio be hedged by a European investor?

- Depends on the correlation between returns of EURUSD and US equities
  - Negative / Low correlation -> do not hedge
  - Positive / High correlation -> hedge
  - Estimate possible losses in a bearish scenario for the US equity market
- Calibration period: Jan 1973 - Dec 2011

Correlation Between returns of USD-EUR Exchange Rate and MSCI USA



Source: Barclays Research, Bloomberg, NBER

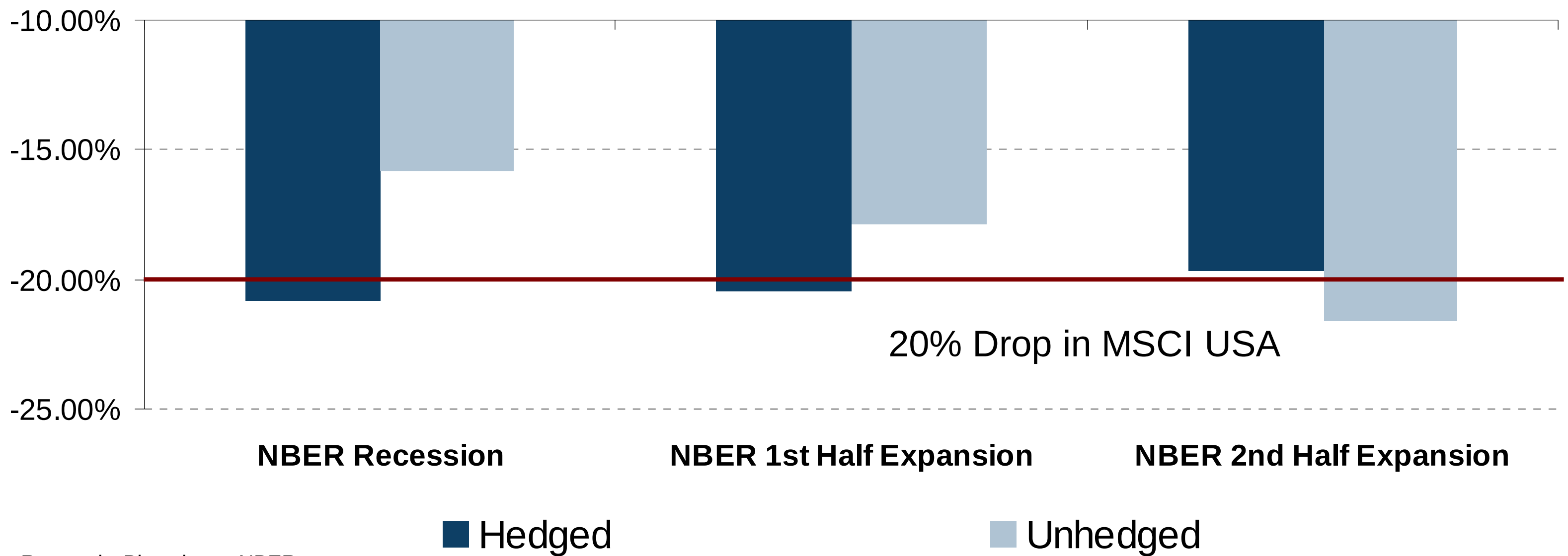
BARCLAYS

Economic Regimes: Hedging FX Exposure (cont)

Estimate losses for FX hedged/unhedged portfolios in a bearish equity scenario

- **Scenario: US equities drop by 20%**
  - Losses for hedged/unhedged portfolios in different NBER regimes for a European investor?
  - In NBER Recessions USD exposure diversifies portfolio risk:
    - – EUR loss for unhedged portfolio is smaller
    - – Hedged portfolio turns out to be over-hedged by 20%, so overall losses are even higher
  - The opposite is observed in NBER expansion (2nd half)
  - Calibration period: Jan 1973 - Dec 2011

Scenario Losses of FX Hedged and Unhedged Portfolios in Different NBER Regimes



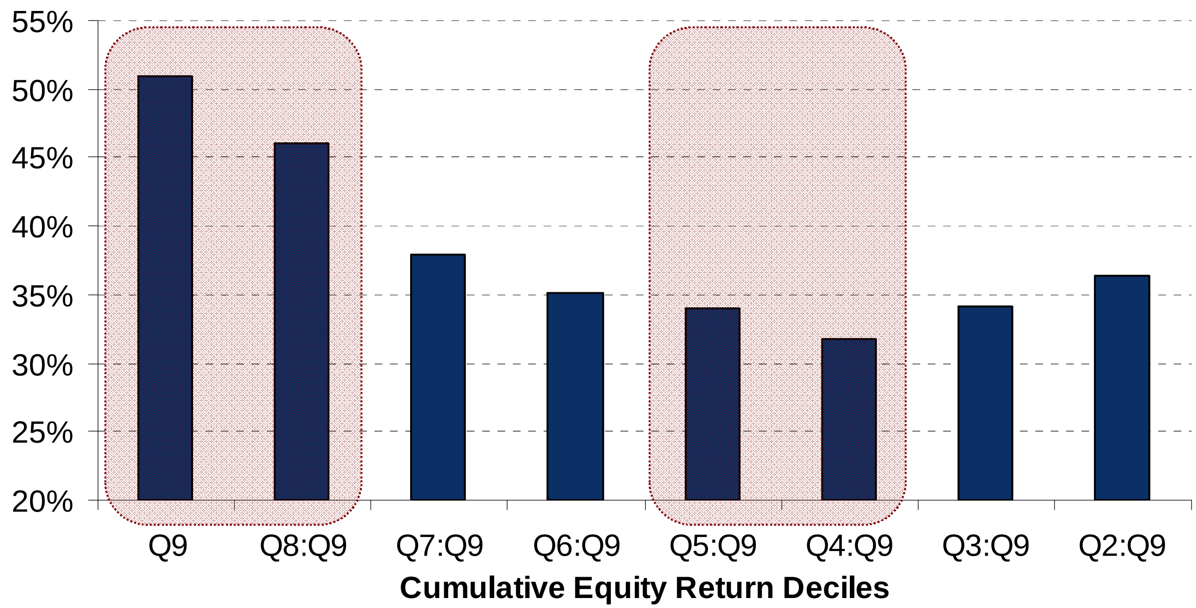
Source: Barclays Research, Bloomberg, NBER

Scenario Correlations

Asset correlations can depend on the scenario considered

- **A familiar phenomenon: higher correlations in extreme market events**
- Example:
  - Return scenarios in the context of various US equity market returns (from bearish to bullish)
  - Correlation: relative corporate spread changes vs treasury returns
- Correlation breaks down when equity market declines
- Period: Feb 1973 - Dec 2011

Correlation between % Corporate Spread Changes and Long Treasury Returns



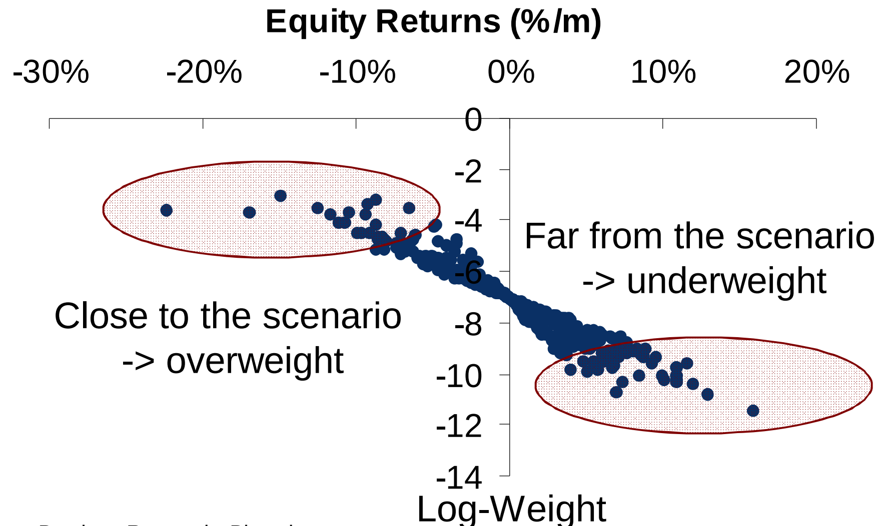
Source: Barclays Research, Bloomberg

Scenario Correlations – How to Adjust?

Historical observations can be weighted by their proximity to the chosen scenario

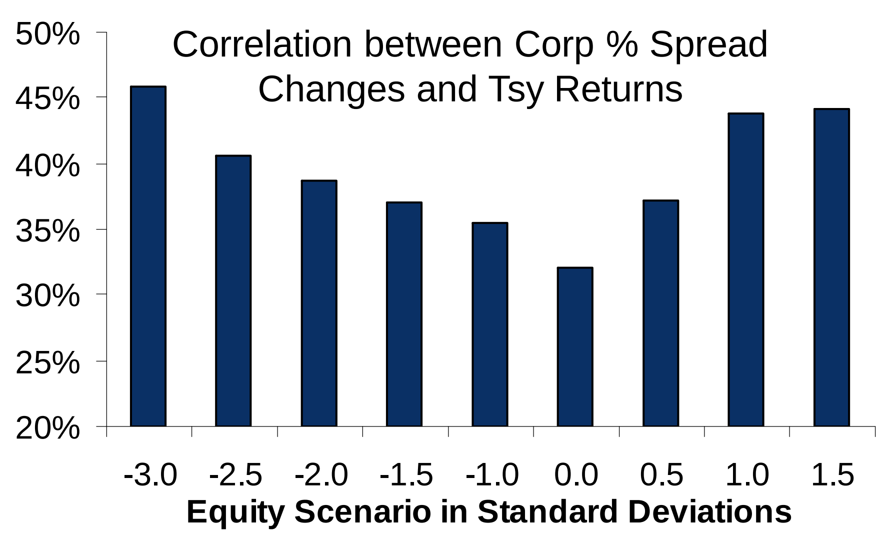
- How to ensure that the asset correlation matrix is consistent with the chosen scenario?
- Weight observations by their proximity to the scenario
- Example Scenario: -3 standard deviations in equity returns = -16% / month
  - Observations with comparable equity returns are given large weights:
    - Sep 1974: -12.4%
    - Aug 1998: -15%
    - Sep 2008: -9.2%, etc.
  - Estimated correlations rely more on observations closer to the chosen scenario
- Period: Feb 1973 - Dec 2011

Log-Weights in -3-Sigma Scenario



Source: Barclays Research, Bloomberg

Scenario-Weighted Correlations



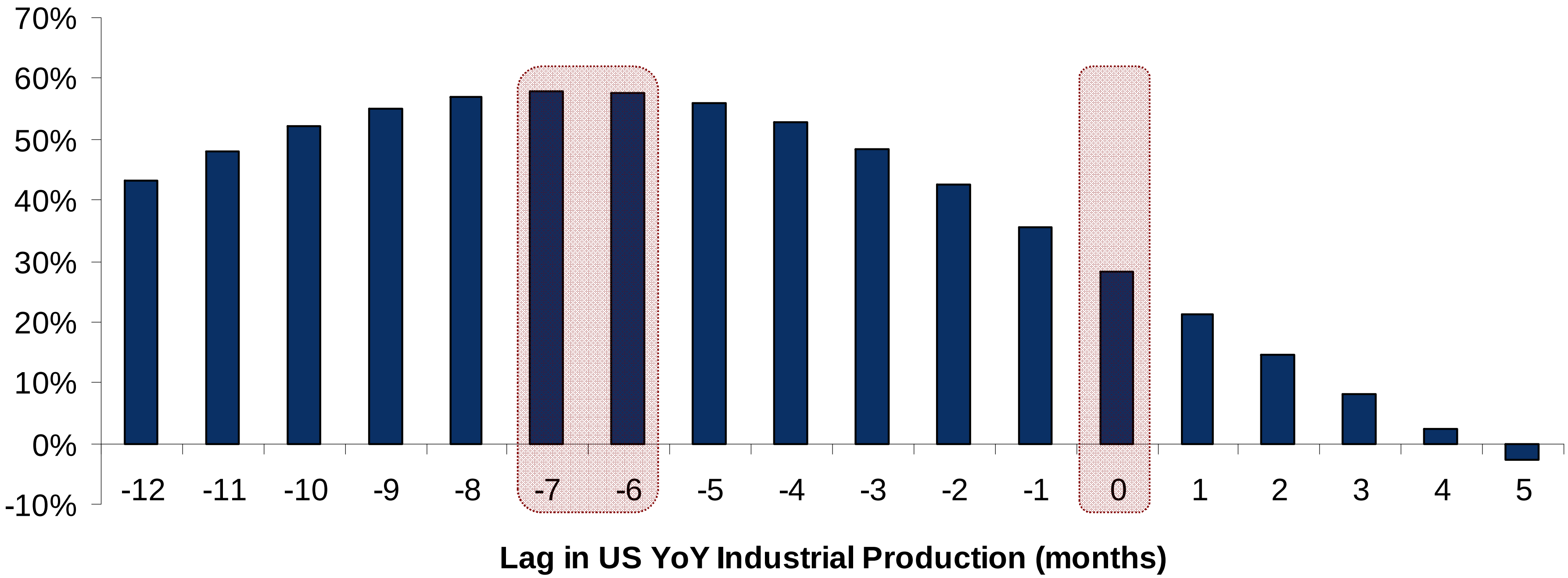
BARCLAYS

Scenarios in Macro Variables

Changes in macro-variables generally lag changes in market prices

- Official macro-statistics frequently lag the market
- Illustration:
  - US YoY Industrial Production lags annual return of S&P 500 by about 6-7 months
  - Correlation between S&P YoY returns and the US YoY Industrial Production is highest at the 6-7 month lag
  - Period: March 1962 – Dec 2011

Correlation Between S&P 500 YoY Returns and US YoY Industrial Production



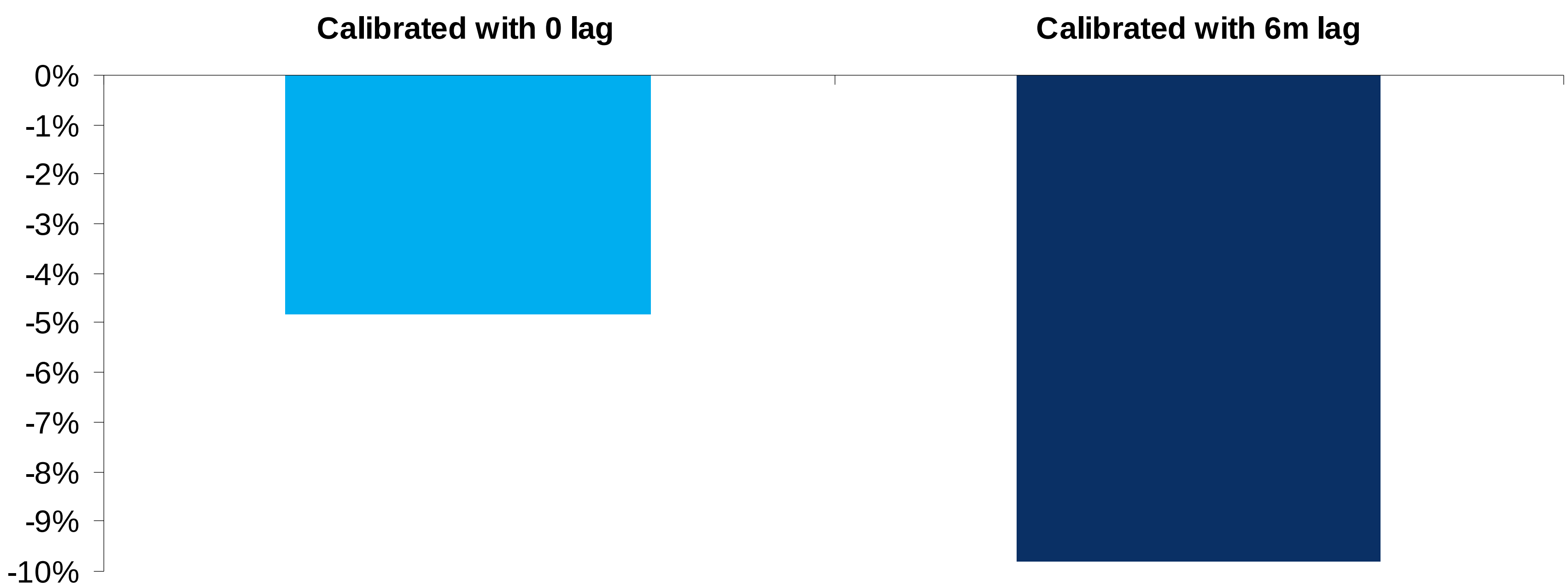
Source: Barclays Research, Bloomberg, Federal Reserve

Example: Macro Scenario

How does a decline in industrial production affect equities?

- **Scenario: 5% decline in US industrial production**
- Impact on the equity portfolio (S&P 500)?
  - Case 1: Correlation is calibrated with 0 lag between Industrial Production and Equity returns
  - Case 2: Correlation is calibrated with 6 months lag between Industrial Production and Equity returns
  - Loss for the equity portfolio doubles (from -4.8% to -9.8%) when the 6 months lag is taken into account
- Period: March 1962 – Dec 2011

Scenario Impact on the Equity Portfolio (%)



Source: Barclays Research, Bloomberg, Federal Reserve

Analyst Certifications and Important Disclosures

Analyst Certification(s)

I, Simon Polbennikov, hereby certify (1) that the views expressed in this research report accurately reflect my personal views about any or all of the subject securities or issuers referred to in this research report and (2) no part of my 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 Zaimukyokucho (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.