

E.S.G. Risk Factors in a Portfolio Context

Integrated Modeling of Environmental, Social and Governance Risk Factors

An Innovative Study for Institutional Investors

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Integration of E.S.G. Risk Factors into Strategic Asset Allocation

For executive summaries of the risklab study 'E.S.G. risk factors in a portfolio context' please refer to

1

Responsible Investor - Quant study shows significant, long-term ESG risk reduction and return boost

<http://www.responsible-investor.com/home/article/risklab/>

2

IPE - ESG risk in a portfolio context - 1 April 2010

http://www.ipe.com/magazine/esg-risk-in-a-portfolio-context_34522.php

3

PROJECT M - Study: ESG delivers financial benefit

http://www.projectm-online.com/en/globalopportunities/2009_3/Pages/52StudyFinds.aspx

4

The study was also published as an article in German 'Nachhaltige Investments im Portfoliokontext (Hörter, Mader, Menzinger)' in 'Absolute Report 53/2010'

<http://www.absolut-report.de/absolutreport/ausgaben/>

Agenda

risklab Study E.S.G. Risk Factors in a Portfolio Context

1. risklab Approach Towards Responsible Investing
2. Modeling of E.S.G. Risk Factors
3. Portfolio Optimization and E.S.G. Risk Factors
4. Key Conclusions for Investors

Back-up

risklab Approach Towards Responsible Investing

1

risklab⁷ - Approach Towards Responsible Investing

1 Positive Selection

- Best in class E.S.G. scoring
- E.S.G. themed funds

2 Asset Owner Engagement Activity

- Voting (shareholder rights)
- Covenants (creditor)
- Dialogue

3 Exclusion (examples)

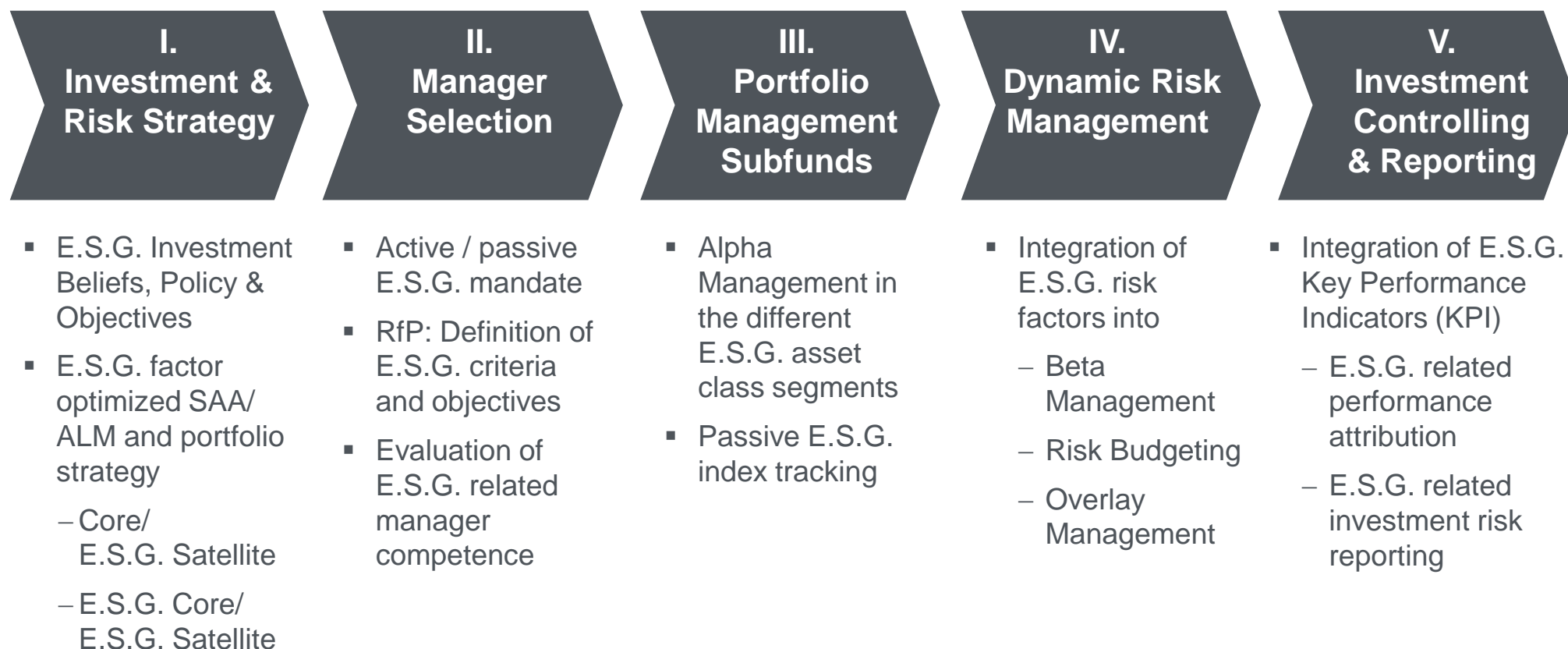
- Cluster munitions provider
- E.S.G. rogue corporates (which violate environmental standards, labor rights, ...)

4 Integration of E.S.G. factors

risklab⁷ - E.S.G. approach

- **Explicit and systematic inclusion of E.S.G. risk factors** into ,traditional' investment process and capital market research
 - **Full spelling of E.S.G. alphabet** – not only focus on climate risk
 - **Integrated E.S.G. client investment solutions**
 - Formulation of Investment Policy & Strategy
 - Asset Allocation & Risk management
 - **Asset Class Analysis incl. Alternative Real Assets**
 - Timber
 - Renewable Energy/ Cleantech
 - Other
- **Bottom-up modelling**

Considering E.S.G. Factors Along the Investment Process

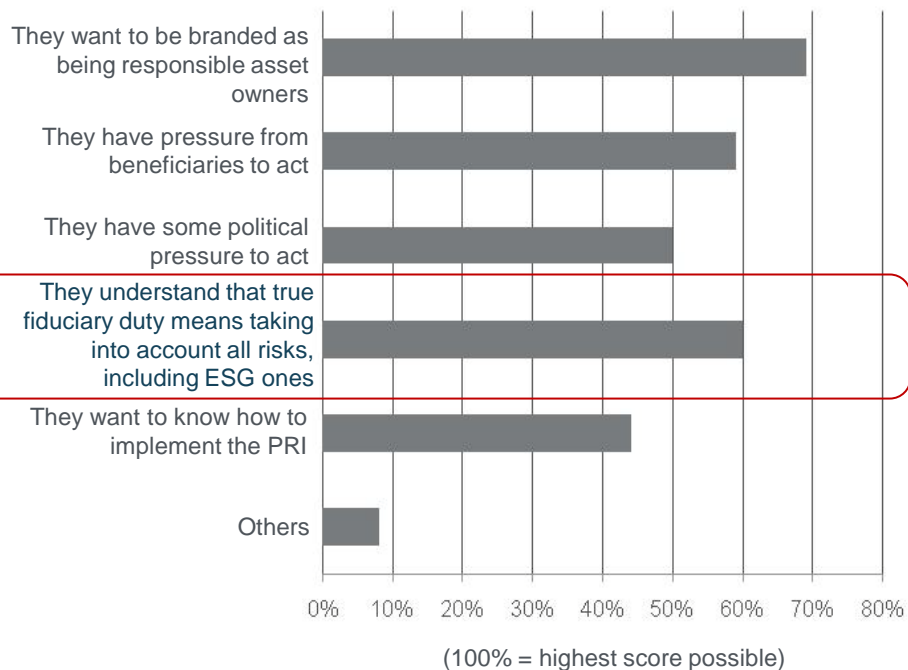


Source: risklab

Investor's Motivation to Consider E.S.G. Factors

Motivators to Consider E.S.G. Factors

What is the most powerful motivator for your clients to demand consulting services on RI? (rank by order of importance)*



Main drivers for E.S.G.

- Investor's Reputation Risks
- Beneficiary Pressure
- Government Bill's
- Fiduciary Duty (E.S.G. risks)

* Source: Eurosif Investment Consultants & Responsible Investment Survey, 2009

Modeling of E.S.G. Risk Factors

2

Missing Link Between E.S.G. Investing and Strategic Asset Allocation

Focus of E.S.G. Investing Research

- So far research has mainly focused on E.S.G. compliant equity investments from a bottom-up investment process perspective.
- The evidence on the performance of SRI Funds is mixed.
- Usually, there is no bottom up link of E.S.G. investment research and portfolio level

E.S.G. Factors not Fully Recognized on Portfolio Level

- Other top down SAA research has been often rather qualitative and focused on one element within the ESG acronym
 - usually the environmental as it relates to climate change
- There exists no systematic, long-term quantitative analysis explicitly examining E.S.G. risk factors and their portfolio impact.

Importance of Strategic Asset Allocation

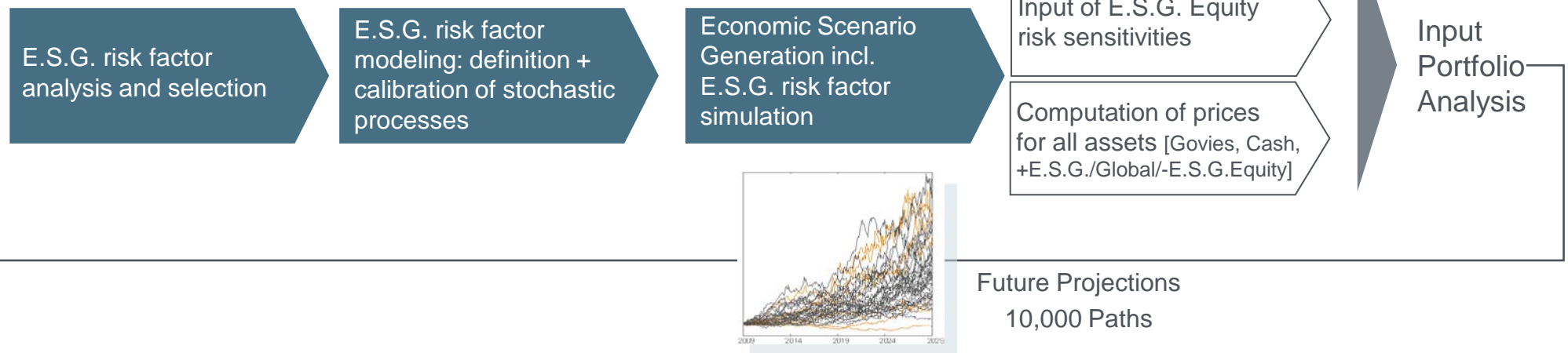
- risklab views Strategic Asset Allocation (SAA) as the most important factor driving long-term portfolio returns.
- Estimates conclude it accounts for up to 90% of portfolio risks, outweighing market timing and stock selection in importance.

Cornerstones of risklab E.S.G. Study

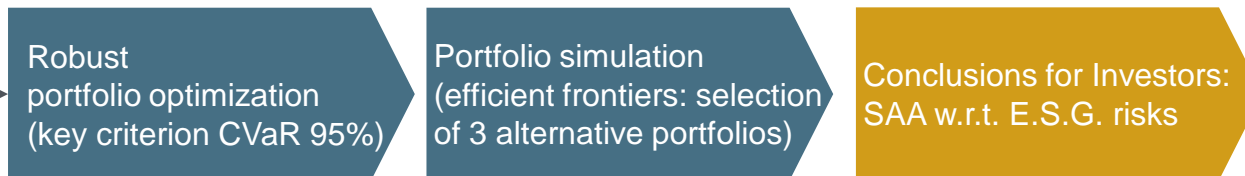
Objective

- Integrated modeling of environmental, social and governance risk factors in a portfolio context
- Focus is the analysis of long-term risks on a 20 years horizon
- Key assumption: E.S.G. risks do not impact expected returns

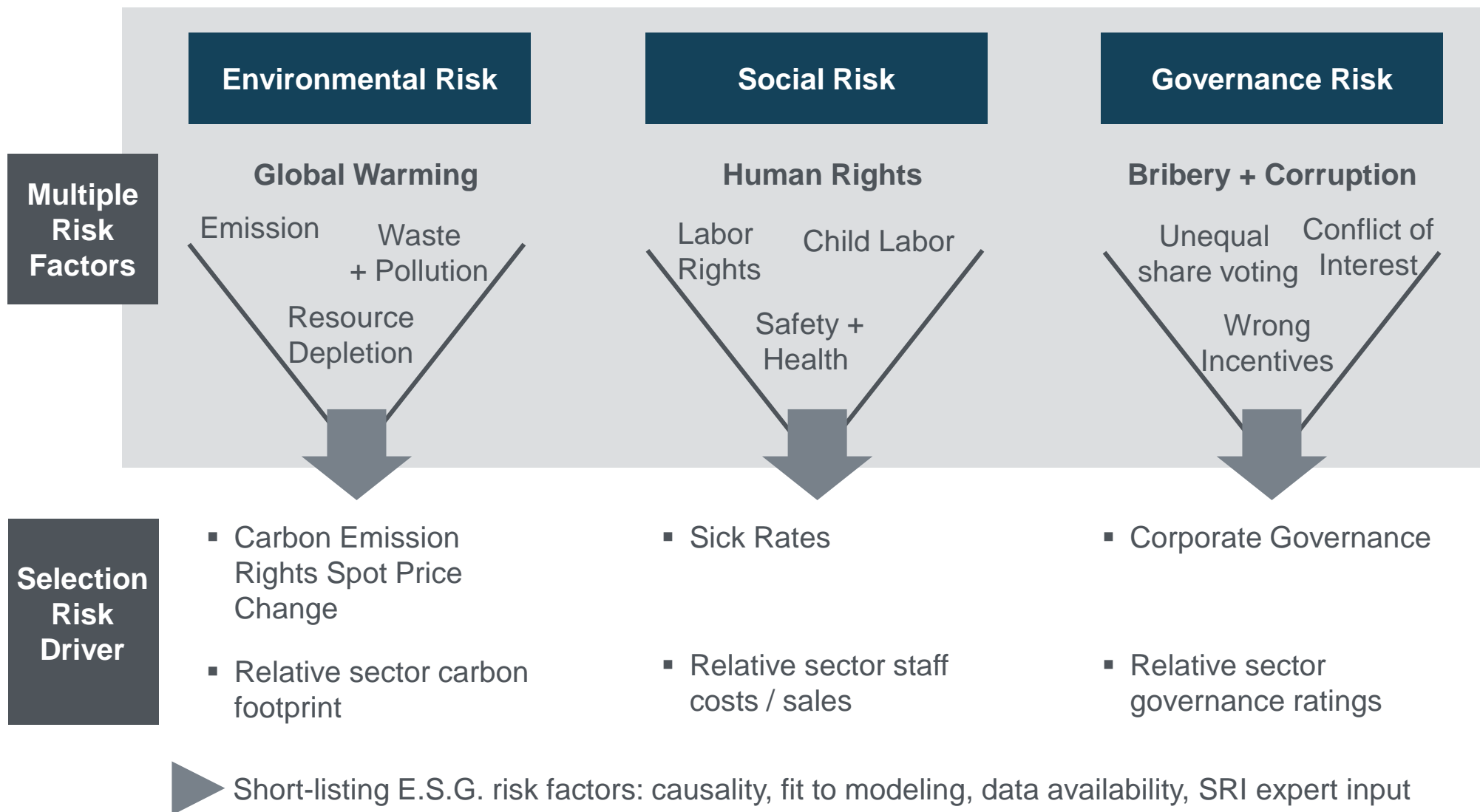
E.S.G. Risk Factor Modeling Process



E.S.G. Risk Portfolio Analysis



E.S.G. Risk Factor Screening and Short Listing



Modeling the E.S.G. Influence on Equity Returns

Equity Returns r_{EQ}

E.S.G. factor modeling

- Environmental: $\tilde{r}_E = \text{stochastic process}$
 - Social: $\tilde{r}_S = \text{stochastic process}$
 - Corporate Governance: $\tilde{r}_G = \text{stochastic process}$
- $$\left. \begin{array}{l} \tilde{r}_E = \text{stochastic process} \\ \tilde{r}_S = \text{stochastic process} \\ \tilde{r}_G = \text{stochastic process} \end{array} \right\} \rho = 0$$

Sensitivity derivation

- Environmental: $\beta_E^{\text{Sector,+}}, \beta_E^{\text{Sector,Global}}, \beta_E^{\text{Sector,-}}$
 - Social: $\beta_S^{\text{Sector,+}}, \beta_S^{\text{Sector,Global}}, \beta_S^{\text{Sector,-}}$
 - Corporate Governance: $\beta_G^{\text{Sector,+}}, \beta_G^{\text{Sector,Global}}, \beta_G^{\text{Sector,-}}$
- $$\xrightarrow[\text{Sector weighting}]{\vec{w}}$$
- $$\beta_E^+, \beta_E^{\text{Global}}, \beta_E^-$$
- $$\beta_S^+, \beta_S^{\text{Global}}, \beta_S^-$$
- $$\beta_G^+, \beta_G^{\text{Global}}, \beta_G^-$$

Return adjustment

$$\Delta \tilde{r}^+ = \Delta \tilde{r}_E^+ + \Delta \tilde{r}_S^+ + \Delta \tilde{r}_G^+ = \beta_E^+ \tilde{r}_E + \beta_S^+ \tilde{r}_S + \beta_G^+ \tilde{r}_G$$

$$\Delta \tilde{r}^{\text{Global}} = \Delta \tilde{r}_E^{\text{Global}} + \Delta \tilde{r}_S^{\text{Global}} + \Delta \tilde{r}_G^{\text{Global}} = \beta_E^{\text{Global}} \tilde{r}_E + \beta_S^{\text{Global}} \tilde{r}_S + \beta_G^{\text{Global}} \tilde{r}_G$$

$$\Delta \tilde{r}^- = \Delta \tilde{r}_E^- + \Delta \tilde{r}_S^- + \Delta \tilde{r}_G^- = \beta_E^- \tilde{r}_E + \beta_S^- \tilde{r}_S + \beta_G^- \tilde{r}_G$$

Capital market scenarios

Finally, the E.S.G. return difference is added to the equity return before inclusion of E.S.G. obtained from the Economic Scenario Generator.

$$\begin{aligned} \rightarrow \tilde{r}_{EQ}^+ &= \tilde{r}_{EQ} + \Delta \tilde{r}^+ \\ \rightarrow \tilde{r}_{EQ}^{\text{Global}} &= \tilde{r}_{EQ} + \Delta \tilde{r}^{\text{Global}} \\ \rightarrow \tilde{r}_{EQ}^- &= \tilde{r}_{EQ} + \Delta \tilde{r}^- \end{aligned}$$

Modeling the E.S.G. Influence on Equity Returns

Example: Environmental Risk

E.S.G. factor modeling

The environmental factor is modeled as a stochastic process.

$\tilde{r}_E = \text{stochastic process}$

The CO2 Emission rights spot price represents our environmental factor.

$$E[\tilde{r}_E] = 0$$

Sensitivity derivation

We model three equity assets: Equity of companies that are in line with E.S.G. criteria (+), of those that are not (-) and of those that have an average exposure to E.S.G. risk.

A sensitivity to the environmental factor is derived for each sector.

$$\beta_E^{\text{Sector,+}}, \beta_E^{\text{Sector,Global}}, \beta_E^{\text{Sector,-}}$$

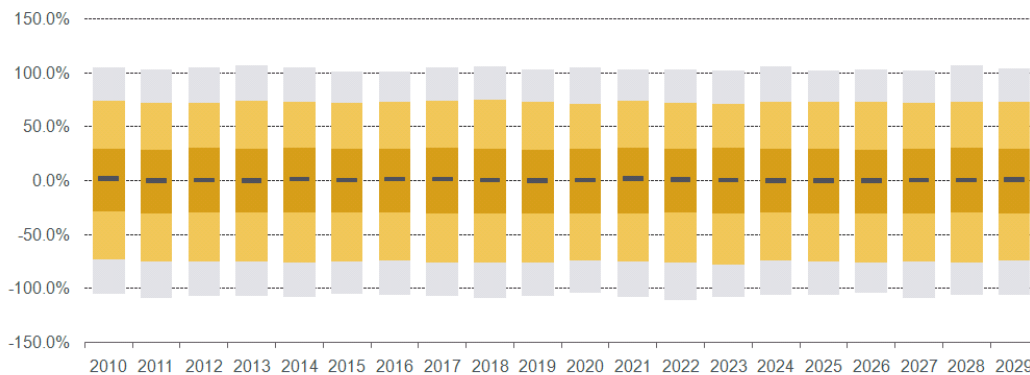
where $\beta_E^{\text{Sector,Global}} = f(\text{Carbon Footprint})$

The sector sensitivities are weighted according to the sector representation in the MSCI World.

$$\beta_E^+ = \sum_{\text{Sectors}} w^{\text{Sector}} \beta_E^{\text{Sector,+}}, \beta_E^{\text{Global}} = \sum_{\text{Sectors}} w^{\text{Sector}} \beta_E^{\text{Sector,Global}}$$

$$\beta_E^- = \sum_{\text{Sectors}} w^{\text{Sector}} \beta_E^{\text{Sector,-}}$$

- E.S.G. factor modeling: Simulation Results CO-2 Emission Right Spot Price Change



- Sensitivity: Analysis of Carbon Footprint Data

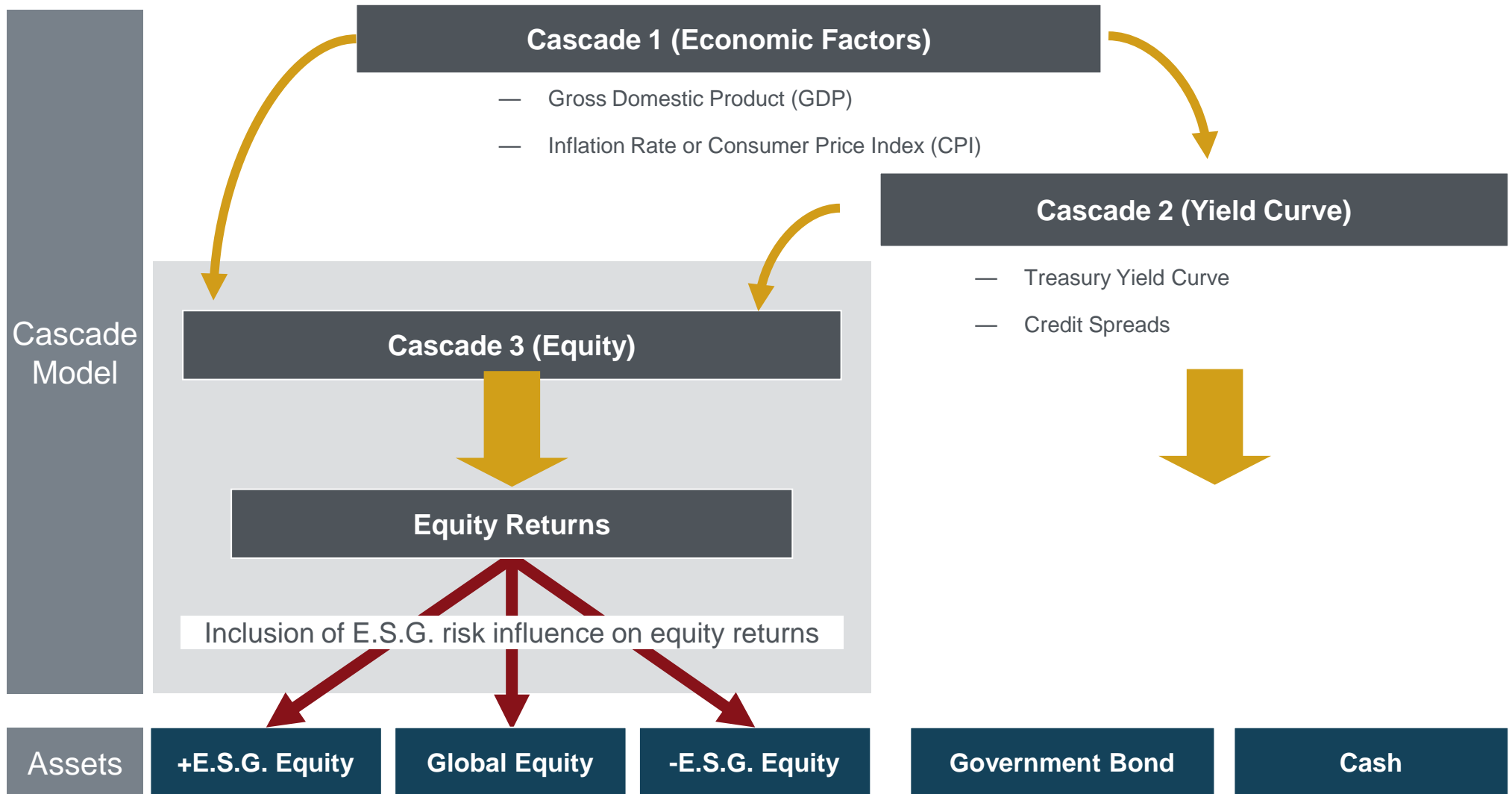
	MSCI AC Average of Carbon Footprints	MSCI AC Normalized Carbon Footprints (β)	+E.S.G. Equity (β)	-E.S.G. Equity (β)	MSCI AC (Weights)
Financials	-2.471	-0.067	-0.053	-0.080	21.92%
Consumer Discretionary	-1.826	-0.108	-0.087	-0.130	8.82%
IT	-1.314	-0.141	-0.113	-0.170	11.75%
Health Care	-1.150	-0.152	-0.122	-0.183	9.34%
Telecom Services	-0.975	-0.163	-0.131	-0.196	5.10%
Industrials	-0.643	-0.185	-0.148	-0.222	9.99%
Consumer Staples	-0.488	-0.195	-0.156	-0.234	9.49%
Energy	1.048	-0.294	-0.235	-0.353	11.19%
Materials	5.472	-0.581	-0.464	-0.697	7.74%
Utilities	11.954	-1.000	-0.800	-1.200	4.66%
Weighted Average	-0.027	-0.225	-0.180	-0.270	

Expert Modeling E.S.G. Risk

		Environmental Risk	Social Risk	Governance Risk
	Data Availability	Comparatively good +	Fractal --	Somewhat better o
Risk Factor	Risk Driver	Carbon Emission Rights Spot Price Change	Sick Rates	Corporate Governance
	Stochastic Model	Regime Switching	Geometrical Brownian Motion	Regime Switching
Risk Sensitivity (Equity)	Relative Sector Footprint	Carbon emission footprint	Staff Costs / Sales	Governance Ratings
	Data Source	“Relative Carbon Footprint in MSCI All Countries World” based on monthly ratings (2005-2009) from Trucost	Computations of staff costs / sales on the basis of Worldscope for staff costs and Datastream across GICS	Relative Corporate Governance Ratings in MSCI All Countries World” for different sectors on monthly ratings (2005-2009) from RiskMetrics.
Relative Weighting	Equal weighting between E.S.G. risk factors			

Integration of E.S.G. Generating Future Market Scenarios

risklab  - Economic Scenario Generator



Portfolio Optimization and E.S.G. Risk Factors

3

E.S.G. Risk Factors: What Does it Mean for Investors?

Possible impact of E.S.G. risks in the equity and portfolio context

- 1 Additional E.S.G. Equity investment risk – how much?

- 2 Solution space alternative portfolios?
 - efficient frontiers (+E.S.G./ Global / -E.S.G. Equity)
 - example portfolios

- 3 Optimal strategic asset allocation?
 - risk reduction
 - return enhancement

1 Risk / Return Characteristics of Equity Returns

Return / Risk Metric (average values p.a. over 20 years)	+E.S.G. Equity	Global Equity	-E.S.G. Equity
Expected Return	7.6%	7.6%	7.6%
CVaR 95%	-26.7%	-38.8%	-52.3%
Volatility	15.5%	19.3%	23.7%

Key findings

- In comparison the CVaR risk of +E.S.G./Global/-E.S.G. Equity is very different.
- The CVaR risk of +E.S.G. Equity is approx. one-third less than Global Equity*.
- The CVaR risk of -E.S.G. is approximately double that of +E.S.G. Equity.
- E.S.G. risk is assumed to have no impact on expected equity returns but is a risk driver.

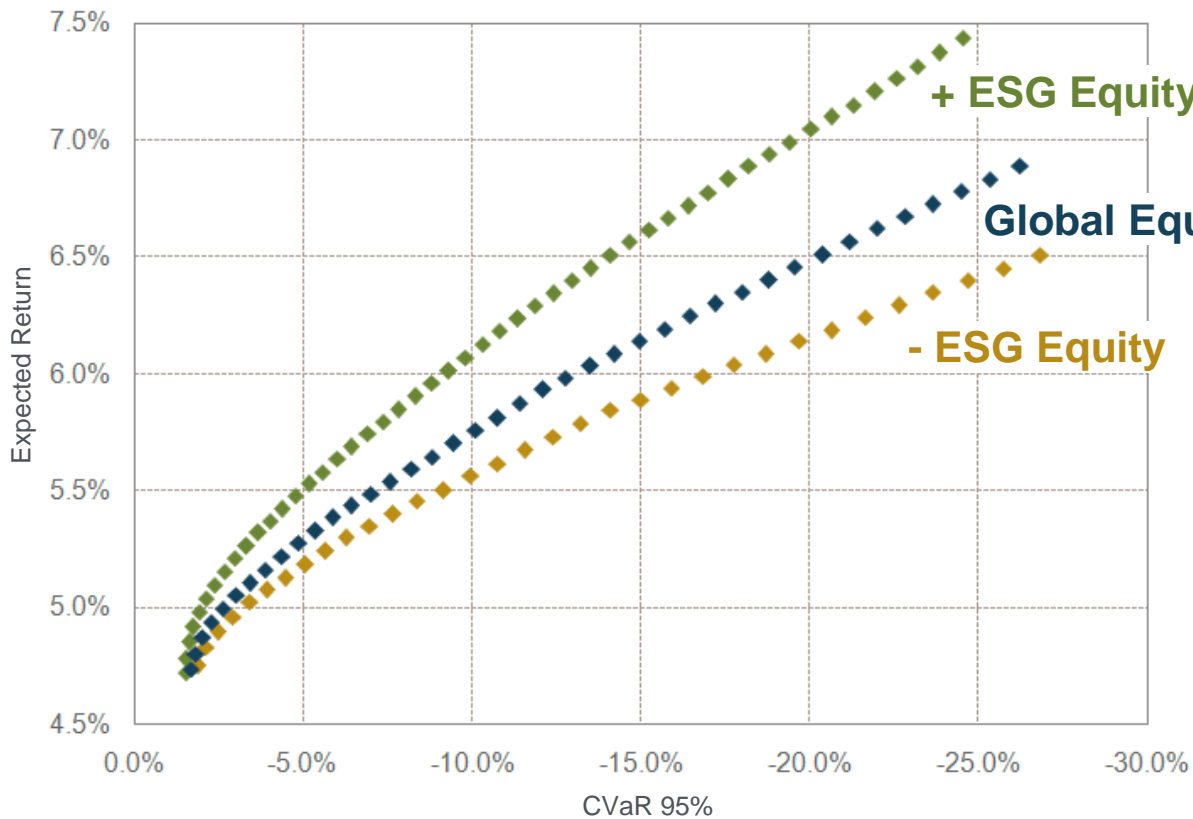
CVaR (95%):

Conditional Value at Risk (CVaR) 95%: Average expected return incurred in the 5% worst case scenarios p.a.

* Global Equity represents an equity allocation with an average E.S.G. exposure

Please note: concerning the return and risk related information please refer to the disclaimer at the end of the document.

2 Result of Optimization: CVaR Applied as Key Criterion



Starting point

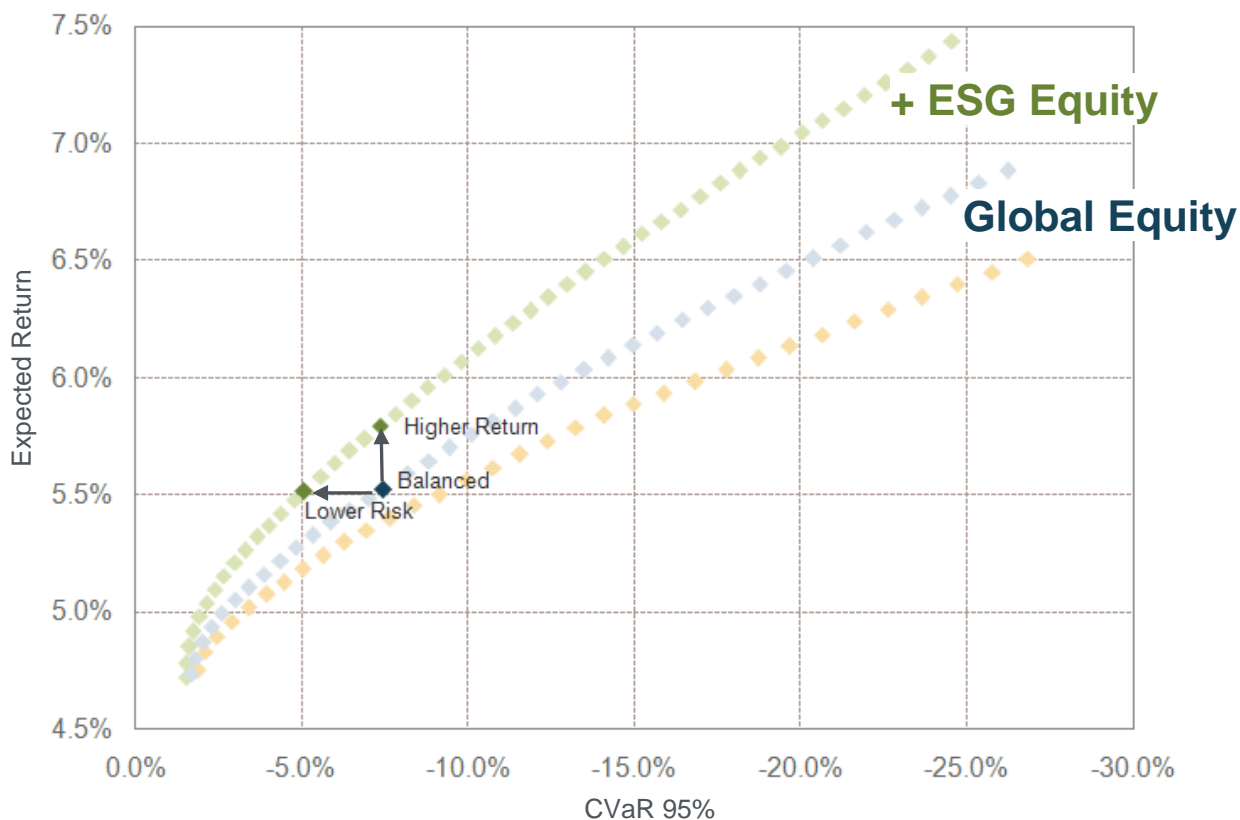
- Blue line shows efficient frontier with Government Bonds, Cash and Global Equity.
- Orange line same except full allocation of equity into -E.S.G. Equity.
- Green line same except full allocation of equity into +E.S.G. Equity.

Optimization opportunities

- Enhance return for given level of CVaR.
- Reduced CVaR for given level of return.

Please note: concerning the return and risk related information please refer to the disclaimer at the end of the document.

2 For the Analysis We Selected Three Alternative Portfolios



We picked 3 portfolios

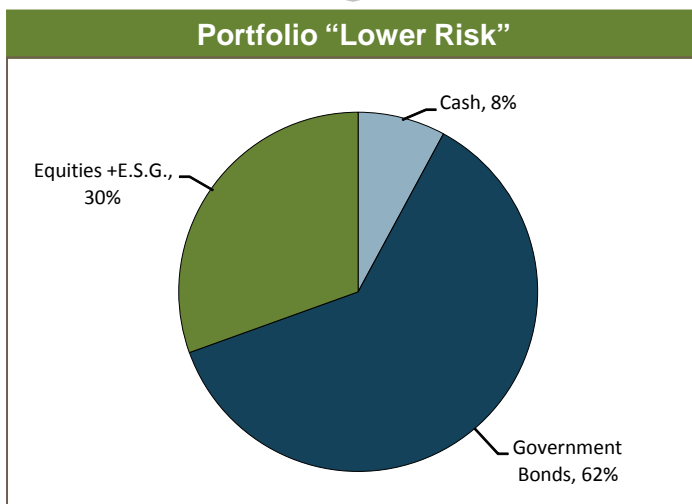
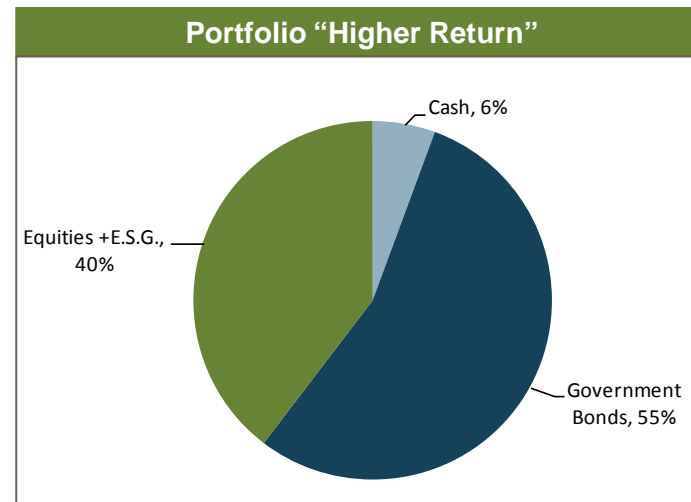
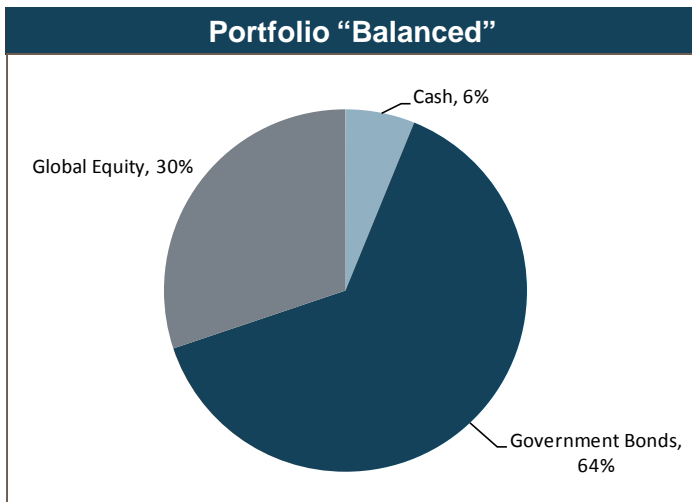
- Portfolio “Balanced”: on Global Equity efficient frontier (Blue)
- Portfolio “Lower Risk”: on +E.S.G. efficient frontier (Green)
- Portfolio “Higher Return”: on +E.S.G. efficient frontier (Green)

Reasons for selection

- “Balanced”: Starting point is a comparatively conservative portfolio (equity share 30%)
- “Lower Risk”: equal return expectation to “Balanced” but lower risk (“Higher Return” vice versa)

Please note: concerning the return and risk related information please refer to the disclaimer at the end of the document.

3 Significant Optimization Opportunities Through + E.S.G. Equity Allocation



Starting Point: Portfolio "Balanced"

- Comparatively conservative portfolio with Global Equity allocation of 30%

Option A: Portfolio "Lower Risk"

- Risk can be reduced at same levels of return with the same Equity (+E.S.G.) allocation.

Option B: Portfolio "Higher Return"

- Return expectation can be increased at same level of risk.

Please note: concerning the return and risk related information please refer to the disclaimer at the end of the document.

3 Risk / Return Characteristics of Selected Portfolios

Return / Risk Metric	Portfolio "Balanced"	Portfolio "Lower Risk"	Portfolio "Higher Return"
Expected Return	5.5%	5.5%	5.8%
CVaR 95%	-7.4%	-5.1%	-7.4%
Volatility	6.2%	5.2%	6.5%

Portfolio "Lower Risk" (Option A):

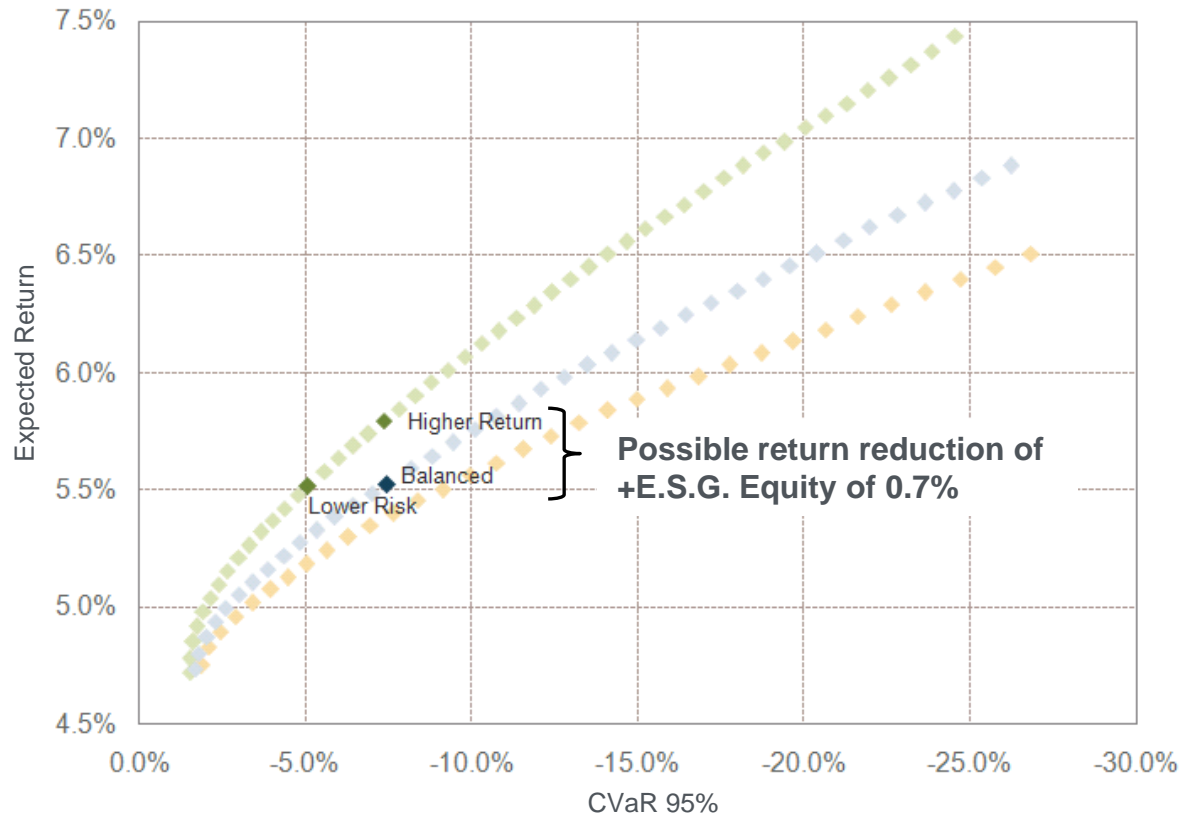
- All risks can be reduced at the same level of return compared to portfolio "Balanced".

Portfolio "Higher Return" (Option B):

- Expected return can be increased at similar level of risks.

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3 +E.S.G. Equity Even Attractive with Lower Expected Return



Key findings

- All equity asset classes (+E.S.G., -E.S.G., and Global Equity) provide the same expected return by assumption.
- Compared to the “Balanced” portfolio the “Higher Return” portfolio has a higher expected return due to the higher equity allocation (at equal CVaR 95% levels of -7.4%).
- Therefore, a decrease in expected +E.S.G. Equity return of up to 0.7% would still lead to a higher portfolio return expectation at similar levels of risk.

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Key Conclusions for Investors

4

E.S.G. Risk Factors: Key Conclusions for Investors



- In the long-term, over 20 years, **E.S.G. factors** are expected to have **significant risk impact on Equity investments**.
- Therefore, investors should strive to **optimize** their **Global Equity investments** and **minimize exposure to E.S.G. risk**.
- This can be achieved by **choosing Equity investments**, where corporate **management proactively mitigates these risk factors**.
- On the basis of a comparatively conservative portfolio with a global equity allocation of approx. one third, **optimized Equity allocation offers**:
 - Either a **portfolio risk reduction (CVaR 95%) of ca. 30%** at same levels of expected return.
 - Or an **increase of expected portfolio return by 0.3%-pts.** at similar levels of expected portfolio risk.
- The **effects illustrated amplify even more** when comparing more risky portfolios e.g. **when the equity allocation is even higher**.

BACK UP

Back Up: Motivation of Study

A.1

General Research Sources Used for Scoping the Study (1/3)

E.S.G. factors and sustainable investing (overall)

- **“The SRI Navigator – Objectively assessing Environmental, Social, and Governance Risks”** by Valerie Lucas-Leclin et al for Societe General, May 2009 – the risk indicators of this survey served as a good orientation for our study and helped to calibrate the risk factor weightings.
- **“Socially Responsible Investments”** by Sven Hross, Christofer Vogt and Rudi Zagst in “World Scientific Review”, 2009 – this article gives a great overview over on SRI in general, market development and the question “how sustainable is SRI”. A case study based on simulated returns of an auto-regressive Markov-Switching model with underlying data from 1992 to 2008 shows that risk-averse investors mix SRI investments in their portfolio in order to diversify – but it also claims that “the less risk-averse an investor is, the more he invests in SRI”.
- **“In Pursuit of a Sustainable Word – Socially Responsible Investing and Eco Investments”** by Darius Abde-Yazani et al – Bachelor Thesis by six students that summarizes very well the recent developments in SRI investing, introduces a Sustainability Scorecard to help companies implement E.S.G. standards, and builds the hypothesis that E.S.G. can indeed lead to competitive advantage. Other than the aforementioned “Socially Responsible Investments” report by Hros, Vogt, and Zagst, it finds that “risk-averse investors mix SRI/Eco indices to their existing bonds-stocks-portfolio in order to gain an optimal portfolio in terms of risk-return measures”
- **“The Materiality of Social, Environmental and Corporate Governance Issues to Equity Pricing”** by UNEP Finance Initiative - 11 Sector Studies
- **“Demystifying responsible investment performance – A Review of key academic and broker research on E.S.G. factors”** by UNEP Finance and Mercer, October 2007
- **“Fearless Forecast”** by Mercer 2006 - Surveys about the perceived importance of E.S.G. issues among financial professionals
- **“Climate Change Risk – Looking ahead: Implications for Strategic Asset Allocation”** lecture by Antoine de Salins for FRR at the UN Principles of Responsible Investing PRI in Person Conference on July 3rd 2009 in Sydney – describes a two level approach to assess financial risks under different financial scenarios.
- **“Innovest Integrated Oil- and Gas Sector Report”** by Christian Maede for Innovest, 2006 - This sector report covers a wide range of 'non-traditional' risk factors and value drivers for the integrated oil & gas sector. Areas such as strategic governance, environment, stakeholders and human capital are covered. A global selection of 28 companies is ranked according to social, environmental and combined ratings, as well as on a number of sub-factors. The report is notable for its comprehensive discussion of risk factors and a broad coverage of companies, including leading companies from emerging markets. But it stops short of assessing potential financial impacts of the described risk factors and proposing integrated company valuation approaches.
- **“Pharmaceuticals: Integration E.S.G. (Goldman Sachs Sustainability)”** by Sarah Forest for Goldman Sachs, 2007 - the sector-adapted E.S.G. framework is used as a proxy for overall management quality, and as an indicator for cash returns and therefore fair value. The report weaves the E.S.G. story with other, 'orthodox' strategic drivers, and is quite transparent in its E.S.G. methodology.
- **“Green Winners – The performance of sustainability focused companies during the financial crisis”** by AT Kearney
- **“Conference report: New Frontiers in Emerging Markets Investments”** by Who Cares Wins, 2007 – an initiative to integrate E.S.G. issues into mainstream investment decision-making. Provides good insight in E.S.G.-awareness in emerging markets.
- **“Clean Investor 2009 - Investing in sustainable themed funds: the new generation of returns?”** by Responsible Investor, 2009

General Research Sources Used for Scoping the Study (2/3)

Climate Change and mitigation costs with a view on global economy

- **“The Stern review on the Economics of Climate Change”** by Nicholas Stern (Baron Stern of Brentford) (and updates):
A 700-page report for the British government, which discusses the effect of climate change and global warming on the world economy. Its main conclusions are that one percent of GDP per annum is required to be invested in order to avoid the worst effects of climate change, and that failure to do so could risk global GDP being up to twenty percent lower than it otherwise might be. It provides prescriptions including environmental taxes to minimize the economic and social disruptions. In June 2008 Stern increased the estimate to 2% of GDP to account for faster than expected climate change.
- **“The Global Deal”** by Nicholas Stern (Baron Stern of Brentford), 2009 – newest update on political and economic plans to mitigate climate change and fight global warming and poverty.
- **“Pathways to a low-carbon economy – V2 Global Greenhouse Gas Abatement Cost Curve”**, McKinsey & Company, 2009
- **“The Economics of Climate Change”** by the Select Committee on Economics of the UK House of Lords, 2006
- **“A question of Balance”** by W. Nordhaus – about the mitigation costs of global warming
- **“Climate Change: The costs of inaction and the costs of adaptation”** by the European Environment Agency, 2007
- **“A Climate for Recovery”** by HSBC, February 2009 - reviews 20 economic recovery plans published by then to combat the credit crisis: 15% of the assets (or \$432bn) of a total \$2.8trn in fiscal measures could be associated with investments consistent with stabilizing and subsequently cutting global emissions of greenhouse gases.

Provides insight how the crisis effects the combat against climate change.

General Research Sources Used for Scoping the Study (3/3)

Effects of Climate Change on different sectors / regions

- **“Utilities 2020 Vision: favor low carbon generators, cautions on high carbon intensity”** by Graeme Moyse, 2008 for Goldman Sachs - a long-term (2020), generally quantitative analysis that tests various scenarios. The report takes a wide-ranging look at energy provision and its implications in Europe, including the role of clean tech, carbon capture & storage and nuclear energy. The authors are transparent regarding their assumptions and how they arrive at their conclusions.
- **“Adaption and Vulnerability to Climate Change: Role of the Finance Industry”** by UNEP Finance Initiative Climate Change Working Group, November 2006 - co-authored by Armin Sandhövel of Allianz Climate Solutions, this is a good summary of potential threats and challenges of climate change to the financial sector.
- **“Carbon Crunch: Meeting the Cost”** by UNEP Finance Initiative Climate Change Working Group, December 2007 – it continues the work from the previous article now with Armin Sandhövel as chair of the working group, now with more details and figures about the finance sector.
- **“Climate Change and the ASX100: An Assessment of Risks and Opportunities”** by Bruce Rolph for Citigroup, 2006 - A comprehensive climate impact study, which covers not only the impact of rising carbon prices on ASX100 companies, but also the effects of potential physical impacts. The analysis distinguishes between two scenarios for carbon prices and two scenarios for physical impacts.
- **“A Climate for Change”** by Mercer – a brief discussion on climate change effect on various asset classes
- **“Climate Change and Equity valuations”** a briefing for Equity analysts by PricewaterhouseCoopers for the Carbon Trust and the Institutional Investors Group on Climate Change, 2007 – good summary with focus on Europe and the US, stresses out that regulation and market response are still very uncertain and impacts vary widely between sectors.
- **“Up in Smoke – Threats from, and responses to, the impact of global warming on human development”** by Andrew Simms et al for The Working Group on Climate Change and Development, 2004 – very good report with interesting case studies, strong bias on developing countries.
- **“Africa up in Smoke”** by Andrew Simms et al for The Working Group on Climate Change and Development, 2005 – follow up on the previous report, good source for climate change-related issues in Africa

Back Up: Modeling of E.S.G. Risk Factors

A.2

Expert Modeling E.S.G. Risk (1/2)

Environmental risks

- For **environmental factor data** availability and quality is **comparatively good**
 - risklab expert modeling of Emissions Rights Spot Price Change (regime switching property)
 - On the basis of EU Emissions Right Spot Price data
 - Equity risk sensitivity derived on the basis of “Relative Carbon Footprint in MSCI All Countries World” for different sectors based on monthly ratings (2005-2009) from Trucost

Social risks

- The challenge is that there is only **fractal data available** to model **social risk factors**
 - Diverse interpretation of social risk (fatality rates, sick rates, staff turnover rates, ...)
 - No time series available to derive a stochastic process for the returns/price changes (like the CO₂ emission rights spot prices)
 - **Assumptions** have to be made regarding the **type of the stochastic process**
- risklab expert modeling of the social risk factor represents the general expected return impact of company standards and policy w.r.t. social aspects on Equity (positive or negative)
 - It is modeled with a Geometrical Brownian Motion, i.e. a normally distributed process characterized by mean and volatility
 - Equity risk sensitivity is derived through computations of staff costs / sales on the basis of Worldscope for staff costs and Datastream across sectors

Expert Modeling E.S.G. Risk (2/2)

Governance Risks

- There is **somewhat better data available** to model **governance risk factors** compared to social risks
 - Diverse interpretation of governance risk (bribery, insufficient corporate governance boards, ...)
 - No time series available to derive a stochastic process for the returns/price changes (like the CO₂ emission rights spot prices)
 - **Assumptions** have to be made regarding the **type of the stochastic process**
- risklab expert modeling of the governance risk factor represents the general return impact of company policy w.r.t. governance aspects on Equity (positive or negative)
 - Like environmental risk it is modeled with Regime Switching property
 - Equity risk sensitivity is derived through “Relative Corporate Governance Ratings in MSCI All Countries World” across different sectors on the basis of monthly governance ratings (2005-2009) from RiskMetrics.

SRI Expert Cross Checks

- The modeling and calibrating of E.S.G. risk by risklab has been challenged and as a result partly adapted upon **expert input and review** of AllianzGI Europe, in particular the **AllianzGI French Equity team**.

Modeling Environmental Risk: Key Data Sources

E.S.G. factor modeling

- **risklab expert modeling on the basis of EU Emissions Rights Spot Price Change.**
- The initial idea was to start with regional CO2 prices for Europe, US and China and to merge them in a single common CO2-price in the year 2020. This idea was disregarded, as only few sectors are part of an established emissions trading scheme and the price can be passed on to the end-consumer in different ways - so we used the **EU Emissions Rights Spot Price Change** as the most important input variable as sudden price changes pose bigger risks to the companies than long-term price-hikes. Also, companies that invest in sustainable techniques early on should be less susceptible to CO2 price changes.
- **“European emission data” since 2005 from <http://dataservice.eea.europa.eu/dataservice/metadetails.asp?id=1078>** (for an overview see the pivotal application "European Union Emissions Trading Scheme Data Viewer").
- As the Carbon Footprint data doesn't show the actual amount of tons of CO2 but just the tilts between different sectors and regions, we were looking for absolute data. In this precise form, they exist only in Europe and cover only the sectors with a trading scheme.

Sensitivity derivation

- **“Relative Carbon Footprint in MSCI All Countries World: tilts of the Carbon Footprint for different sectors against MSCI AC World” provided by IDS GmbH based on monthly ratings (2005-2009) from Trucost.**
- According to their own reports, Trucost has generated environmental impact profiles for over 464 different business activities. Trucost uses these profiles, along with financial and segmental analysis, to produce an estimate of a company's direct impacts. An input-output model is used to quantify the indirect impacts that a company has. Trucost then searches for any public disclosures that have been made by the company and incorporates them. Once the quantity profile has been calculated, an external cost is applied to each resource and emission to generate the external cost profile. Once the analysis has been completed, a verification sheet is sent to the company for feedback. Feedback is analysed and relevant additional data is incorporated, with Trucost monitoring any new environmental disclosures from the company. All in all, their database contains environmental data for 4,500 companies globally covering all the major investable indices including the MSCI AWD. In the MSCI AWD 22% of companies provide full disclosure and those that provide partial disclosure take the total to 48%. For data on the remaining 52% of the companies, they rely on their own model that calculates the likely emissions for each company in the index.

Modeling Environmental Risk: Additional Sources Analyzed

Selection

- **“Modeling the price dynamics of CO2 emission allowances”** by Benz, E. and Trück, S., in Energy Economics 31, 4–15, 2009.

Modeling Social Risk: Data Sources

E.S.G. factor modeling

- risklab expert modeling.

Sensitivity derivation

- **AllianzGI Europe SRI Equity Research, France: computations of staff costs / sales on the basis of Worldscope for staff costs and Datastream:**
 - Worldscope collected the public data for around 800 stocks every year, mainly European (2/3).
 - Using GICS, the evolution of the ratio over the last ten years for every stock was computed and then the data was aggregated (equally-weighted) per sector. The period covers 1999 to 2008.
 - Then a cross-period average and standard deviation was computed.
 - To be sure that the data is not too erratic e.g. if some stocks were "out of control", only those statistics for each data type and year were considered with data ranging from -2 to +2 standard deviations (keeping 95% of the data, roughly).

Modeling Social Risk: Additional Sources Analyzed

Selection

- **“Costs of Sick Days to UK Business”** by Bupa Foundation 2006 (http://www.bupa.co.uk/about/html/pr/110806_sickdays.html) and Economic Advisers Unit for UK Treasury 2004 ([http://www.hm-treasury.gov.uk/d/5\(1\).pdf](http://www.hm-treasury.gov.uk/d/5(1).pdf))

“Sick days” is another potential “social risk factor” as it is possible to assert the economic costs far better than for other factors, but sick rates are considered to be significantly influenced by the current unemployment rate and a country’s social security policy than by a company’s individual “employee standards”.

- **“European Social Statistics: Accidents at work and work related health problems – Data 1994-2000”** by the European Communities 2002.
- **“Reporting on Human Rights”** by the Global Reporting Initiative and the Roberts Environmental Center (Claremont McKenna College), 2008 – this survey covers many different area such as "investment in human rights", "child labor" and "non-discrimination and security practices", but the dataset covers only 100 companies with a strong bias on Europe.

It is also very difficult to assess the costs of ignoring this factor. We disregarded the idea to use the factor "Child Labor": child labor typically occurs only in developing countries, Western companies typically are only connected to this problem via sub-contractors. There is little data on these sub-contractor relationships and it is difficult to estimate the costs of child labor as they mostly consist of "reputation damage".

- **“Safety Spotlight: ASX 100 companies and more – Injury and Fatalities Data Presented and Interpreted”** by Elaine Prior for Citigroup, June 2009 – this thorough report on accident reports in Asian companies (2005-2009) led to the idea to use “fatalities rates” as a social factor describing labor conditions. The world-wide database <http://laborsta.ilo.org/> lists fatal occupational injuries by country and by year - and also by different sectors.

We voted against this risk factor as the data is not complete and it proved too difficult to assess the costs for every sector and country and its impact on investment performance.

Modeling Governance Risk: Data Sources

E.S.G. factor modeling

- risklab expert modeling.

Sensitivity derivation

- **“Relative Corporate Governance Ratings in MSCI All Countries World: tilts of the Corporate Governance Quotient (CGQ®) for different sectors against MSCI AC World” provided by IDS based on monthly ratings (2005-2009) from RiskMetrics.**
- This data proves to be very reliable and is available in a similar matrix as the Carbon Footprint data: relative monthly ratings since January 2005 for different sectors (Consumer Disc, Consumer Staples, Energy, Financials, IT, Industrials, Materials, Health Care, Telecom, and Utilities).
- RiskMetrics employ a “bottom up” approach to collect and analyze data from public disclosure documents, press releases and corporate websites and verify it with their in-house experts. The CGQ covers 7.400 companies worldwide, with underlying data points for up to 65 individual corporate governance variables in eight areas of focus: Board of Directors; Audit practices; Charter and bylaw provisions; Anti-takeover provisions; Executive and director compensation; Progressive practices; Ownership structure; Director education. These variables are weighted in the scoring methodology based on their statistical correlation to a range of risk and performance metrics. In some cases, variables are reviewed together based on the premise that corporate governance is enhanced when specific combinations of these factors are adopted. The exact weighting method was not revealed to us, but the resulting ratings proved to be similar to the other governance ratings.

Modeling Governance Risk: Additional Sources Analyzed

Selection

- **“The Economic Costs of Corruption: A Survey and new Evidence”** by Axel Dreher and Thomas Herzfeld, June 2005 – links corruption level with GDP growth rate.
- **“Aggregate Governance Indicators 1996-2008”** from by the Wordbank (www.govindicators.org) – ranks 212 countries by voice & accountability, political stability & no violence, government effectiveness, regulatory quality, rule of law, and control of corruption.

We liked the quality of those rating but decided against using those data as there was no sector breakdown available.
- **“The KPMG Survey on international corporate responsibility reporting”** by KPMG available for the years 2002, 2005 and 2005 - it summarizes how many companies submit reports on corporate governance, differentiated by sectors and countries.
For a short overview, look at table 3.1 and 3.3. as well as 4.3 and 4.4. We decided not to use this as a source as it covers only companies that adhere to ethical standards and do regularly publish their efforts.
- **“The Bribe Payers Index”** by Transparency International for 1999, 2002, 2006, and 2008 - unfortunately, the sample and the method of calculation have changed over time, so it is difficult to compare the 2008 BPI directly with earlier editions of the index. Same is true for the “Corruption Perceptions Index” which goes back until 1995 – we used both to verify the other available ratings.

Equity: A Closer Look at the Environmental Factor

E.S.G. factor modeling

The environmental factor is modeled as a stochastic process.

$\tilde{r}_E = \text{stochastic process}$

The CO2 Emission rights spot price represents our environmental factor.

$$E[\tilde{r}_E] = 0$$

Sensitivity derivation

We model three equity assets: Equity of companies that are in line with E.S.G. criteria (+), of those that are not (-) and of those that have an average exposure to E.S.G. risk.

A sensitivity to the environmental factor is derived for each sector.

$$\beta_E^{\text{Sector,+}}, \beta_E^{\text{Sector,Global}}, \beta_E^{\text{Sector,-}}$$

where $\beta_E^{\text{Sector,Global}} = f(\text{Carbon Footprint})$

The sector sensitivities are weighted according to the sector representation in the MSCI World.

$$\beta_E^+ = \sum_{\text{Sectors}} w^{\text{Sector}} \beta_E^{\text{Sector,+}}, \beta_E^{\text{Global}} = \sum_{\text{Sectors}} w^{\text{Sector}} \beta_E^{\text{Sector,Global}}$$

$$\beta_E^- = \sum_{\text{Sectors}} w^{\text{Sector}} \beta_E^{\text{Sector,-}}$$

Return adjustment

Environmental factor and relevant sensitivity are combined to give a return difference.

$$\Delta \tilde{r}_E^+ = \beta_E^+ \tilde{r}_E$$

$$\Delta \tilde{r}_E^{\text{Global}} = \beta_E^{\text{Global}} \tilde{r}_E$$

$$\Delta \tilde{r}_E^- = \beta_E^- \tilde{r}_E$$

The return differences due to a social and corporate governance factor are determined likewise.
 An overall return difference is obtained hereafter: $\Delta \tilde{r}^{+/Global/-} = \Delta \tilde{r}_E^{+/Global/-} + \Delta \tilde{r}_S^{+/Global/-} + \Delta \tilde{r}_G^{+/Global/-}$

Modeling Environmental Factor

Technical Details

- The environmental factor is reflected through *CO₂ emission rights spot price change*
- It is modeled with Regime Switching property, i.e. the additional equity return due to carbon price changes can be in either a
 - normal state (S=1) with a positive or negative return impact or in a
 - spike state (S=2) with a substantially negative return impact.
- These states are characterized by different means, volatilities and probabilities to remain in each state.
- Stochastically, the environmental factor can be expressed by

$$d\tilde{r}_{E,S}(t) = \alpha_{E,S} dt + \sigma_{E,S} dW_E(t)$$

where $S \in \{1,2\}$

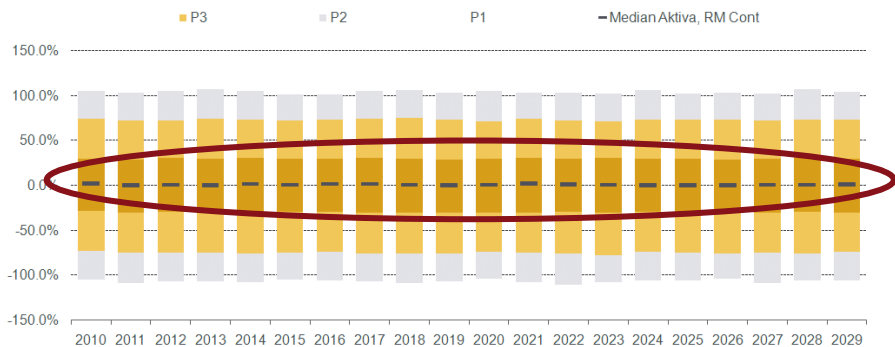
Research

- There is also literature suggesting a modeling of CO₂ through the change of the emission rights spot price change with Regime Switching models, e.g.
Benz, E., Trück, S., 2009. Modeling the price dynamics of CO₂ emission allowances. *Energy Economics* 31, 4–15.

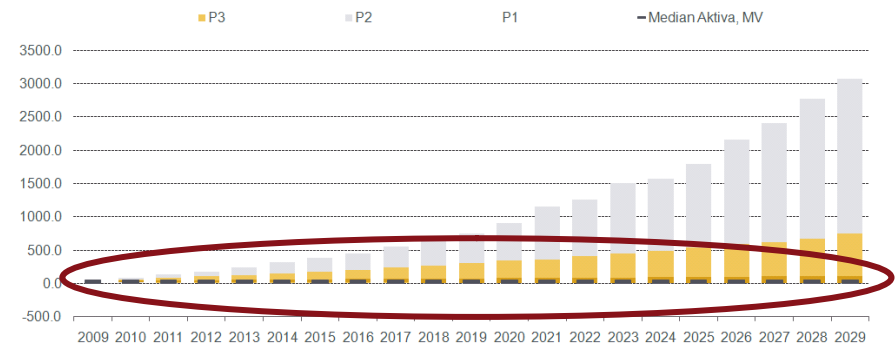
Modeling Environmental Factor

Simulation Results CO-2 Emission Right Spot Price

CO₂ Emission Right Spot Price Change (p.a.)



CO₂ Emission Right Spot Price (USD)



- Left chart: the expected CO₂ emission rights spot price change is assumed to be zero over time (it has no drift); however, it is expected to be quite volatile (volatility approx. 45%).
- Right chart: on average the CO₂ emission rights spot price is assumed to be constant over time (it does not change); since the price change is very volatile, the price can become very low or very high with a low probability.

Note: the level of the price is irrelevant for our approach since the return of the +E.S.G. Equity and -E.S.G. Equity only depends on the price change.

Sensitivity Derivation of Environmental Factor

Analysis of Carbon Footprint Data

- Average of relative Carbon Footprints in MSCI All Country for MSCI Sectors*

	MSCI AC Average of Carbon Footprints
Financials	-2.471
Consumer Discretionary	-1.826
IT	-1.314
Health Care	-1.150
Telecom Services	-0.975
Industrials	-0.643
Consumer Staples	-0.488
Energy	1.048
Materials	5.472
Utilities	11.954

- Observations:
 - Positive and negative relative Carbon Footprints
 - Positive value means that the carbon footprint of the MSCI AC sector is higher than the average carbon footprint of the whole MSCI AC
 - Negative value means that the carbon footprint of the MSCI AC sector is lower than the average carbon footprint of the whole MSCI AC
 - The lower the Carbon Footprint, the better.

* Source: "Relative Carbon Footprint in MSCI All Countries World" for different sectors based on monthly ratings (2005-2009) from Trucost.

Sensitivity Derivation of Environmental Factor

Analysis of Carbon Footprint Data

Steps to derive the sensitivity of factor E

- Normalization of Carbon Footprints to the interval $[-1;0]$ *:
the normalized values are equivalent to an average sensitivity of the sector w.r.t. CO₂ emission right price changes
- Applying a constant factor (here $\pm 20\%$) to the average sensitivities to determine the sensitivities (β) for +E.S.G. and -E.S.G. Equity
- Calculating the weighted averages of the sensitivities with MSCI AC sector weights** (see last line of the table)
- These sensitivities are used to adjust the equity return to obtain the returns of the +E.S.G., Global and -E.S.G. Equity

	MSCI AC Average of Carbon Footprints	MSCI AC Normalized Carbon Footprints (β)	+E.S.G. Equity (β)	-E.S.G. Equity (β)	MSCI AC (Weights)
Financials	-2.471	-0.067	-0.053	-0.080	21.92%
Consumer Discretionary	-1.826	-0.108	-0.087	-0.130	8.82%
IT	-1.314	-0.141	-0.113	-0.170	11.75%
Health Care	-1.150	-0.152	-0.122	-0.183	9.34%
Telecom Services	-0.975	-0.163	-0.131	-0.196	5.10%
Industrials	-0.643	-0.185	-0.148	-0.222	9.99%
Consumer Staples	-0.488	-0.195	-0.156	-0.234	9.49%
Energy	1.048	-0.294	-0.235	-0.353	11.19%
Materials	5.472	-0.581	-0.464	-0.697	7.74%
Utilities	11.954	-1.000	-0.800	-1.200	4.66%
Weighted Average	-0.027	-0.225	-0.180	-0.270	

* Note: A value of -1 means that the sector has the highest exposure w.r.t. CO₂ emission rights price changes and vice versa

** As per 31/08/2009

Relative Weighting of E.S.G. Risks

- It is **not obvious how to scale the influence of factors** E., S. & G. amongst each other with respect to their relative impact on equity risks
- **We have applied equal weightings** for E., S., & G. upon discussion with SRI experts
- For consistency matters of our assumptions we also took account of SocGen`s **S.R.I Navigator Equity study***



*Source: The SRI Navigator (methodology), Societe Generale Cross Asset Research 2009

Relative Weighting E.S.G. Risks (1/2)

Basis: SRI Navigator Results

- Weighting results SRI Navigator (Equity research based)

Industry sector	Environment (ENV)	Human Capital (HC)	Stakeholder Capital (SC)	Governance (GOV)	Total	Setor risk exposure
AUTOMOBILES & PARTS	40%	20%	20%	20%	100%	High
TRAVEL & LEISURE	10%	30%	30%	30%	100%	Medium
RETAIL	20%	30%	30%	20%	100%	Medium
CONSUMER GOODS	30%	30%	20%	20%	100%	
MEDIA	10%	20%	30%	40%	100%	Low
CONSUMER SERVICES	25%	25%	30%	20%	100%	
FOOD & BEVERAGE	25%	25%	30%	20%	100%	Medium
PERSONAL & HOUSEHOLD GOODS	25%	25%	20%	30%	100%	Medium
OIL & GAS	30%	15%	30%	25%	100%	Medium
FINANCIAL SERVICES	10%	40%	20%	30%	100%	Low
INSURANCE	30%	20%	20%	30%	100%	Low
BANKS	20%	20%	20%	40%	100%	Medium
REAL ESTATE	30%	10%	20%	40%	100%	Low
HEALTH CARE	20%	30%	30%	20%	100%	Low
INDUSTRIAL GOODS & SERVICES	30%	30%	20%	20%	100%	Medium
TECHNOLOGY	30%	40%	10%	20%	100%	Low
CHEMICALS	35%	15%	30%	20%	100%	High
CONSTRUCTION & MATERIALS	30%	25%	25%	20%	100%	High
TELECOMMUNICATIONS	20%	30%	30%	20%	100%	Low
UTILITIES	40%	10%	25%	25%	100%	Medium
BASIC RESOURCES	35%	15%	30%	20%	100%	High
AVERAGE	26%	24%	25%	25%	100%	

SOCIETE GENERALE
Cross Asset Research

Equity Research

Global
Sector Review
19 May 2009



The SRI Navigator (methodology)

Objectively assessing environmental, social & governance (ESG) risks



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SG SRI Navigator – sector risk exposure

HIGHER RISK	MEDIUM RISK	LOWER RISK
Automotive & Parts	Banks	Financial Services
Basic Resources	Food & Beverage	Health Care
Chemicals	Industrial Goods & Services	Insurance
Construction & Materials	Oil & Gas	Media
	Personal & Household Goods	Real Estate
	Retail	Technology
	Travel & Leisure	Telecommunications
	Utilities	

Source: SG Equity Research

Source: The SRI Navigator (methodology), Societe Generale Cross Asset Research 2009

Relative Weighting E.S.G. Risks (2/2)

risklab computations on basis of SRI navigator

Steps to derive the weighting scheme

- Mapping of data to MSCI sectors (GICS)
- Calculating the proportions per MSCI sector*

Industry sector	Mapping to MSCI sector
AUTOMOBILES & PARTS	Consumer Discretionary
TRAVEL & LEISURE	Consumer Discretionary
RETAIL	Consumer Discretionary
CONSUMER GOODS	Consumer Discretionary
MEDIA	Consumer Discretionary
CONSUMER SERVICES	Consumer Discretionary
FOOD & BEVERAGE	Consumer Staples
PERSONAL & HOUSEHOLD GOODS	Consumer Staples
OIL & GAS	Energy
FINANCIAL SERVICES	Financials
INSURANCE	Financials
BANKS	Financials
REAL ESTATE	Financials
HEALTH CARE	Health Care
INDUSTRIAL GOODS & SERVICES	Industrials
TECHNOLOGY	IT
CHEMICALS	Materials
CONSTRUCTION & MATERIALS	Materials
TELECOMMUNICATIONS	Telecom Services
UTILITIES	Utilities
BASIC RESOURCES	

	Environment	Human Capital	Governance	Total	MSCI AC
					Weights
Consumer Discretionary	30.06%	35.42%	34.52%	100.00%	8.82%
Consumer Staples	33.48%	33.48%	33.04%	100.00%	9.49%
Energy	42.86%	21.43%	35.71%	100.00%	11.19%
Financials	28.13%	28.13%	43.75%	100.00%	21.92%
Health Care	28.57%	42.86%	28.57%	100.00%	9.34%
Industrials	37.50%	37.50%	25.00%	100.00%	9.99%
IT	33.33%	44.44%	22.22%	100.00%	11.75%
Materials	45.00%	27.38%	27.62%	100.00%	7.74%
Telecom Services	28.57%	42.86%	28.57%	100.00%	5.10%
Utilities	53.33%	13.33%	33.33%	100.00%	4.66%
Weighted average	34.55%	32.76%	32.69%	100.00%	

* Note: Averaging if there are several industry sectors within a MSCI sector. Stakeholder capital is omitted.

Equity Return Adjustment by E.S.G. Factors

Simulation Results

- The expected return of the risk factors E., S. & G. is zero. Therefore, the expected returns of the +E.S.G., Global and -E.S.G. Equity remain unchanged.
- The risk factors E., S. & G. are calibrated in such a way that their average influence on Global Equity is equal.

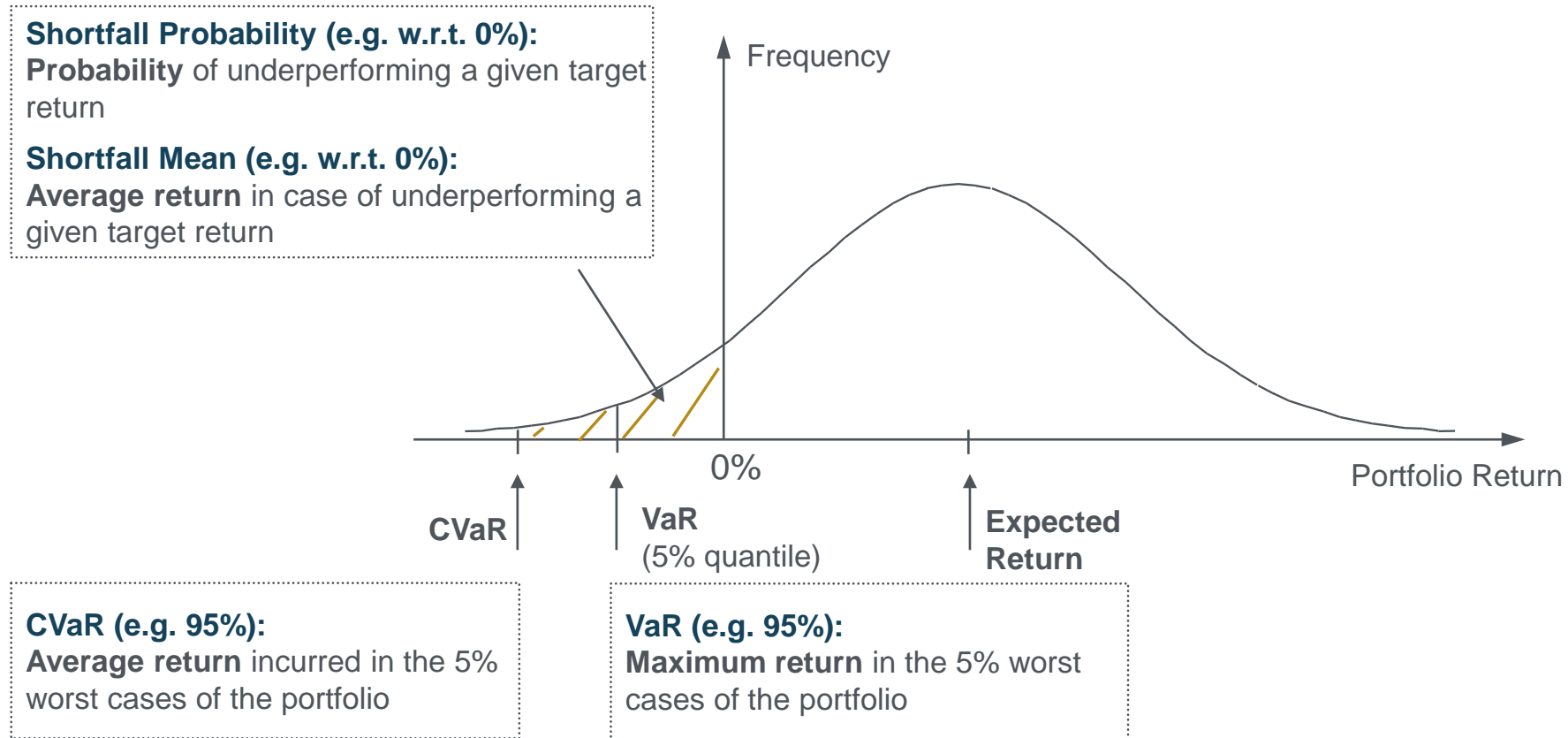
	Expected Return	Average Influence on Global Equity (Volatility)
Factor E	0.0%	10.1%
Factor S	0.0%	10.1%
Factor G	0.0%	10.1%

Please note: concerning the return and risk related information please refer to the disclaimer at the end of the document.

Back Up: Portfolio Optimization and E.S.G. Risk Factors

A.3

Illustration of the Key Risk Metrics: CVaR Applied for Optimization



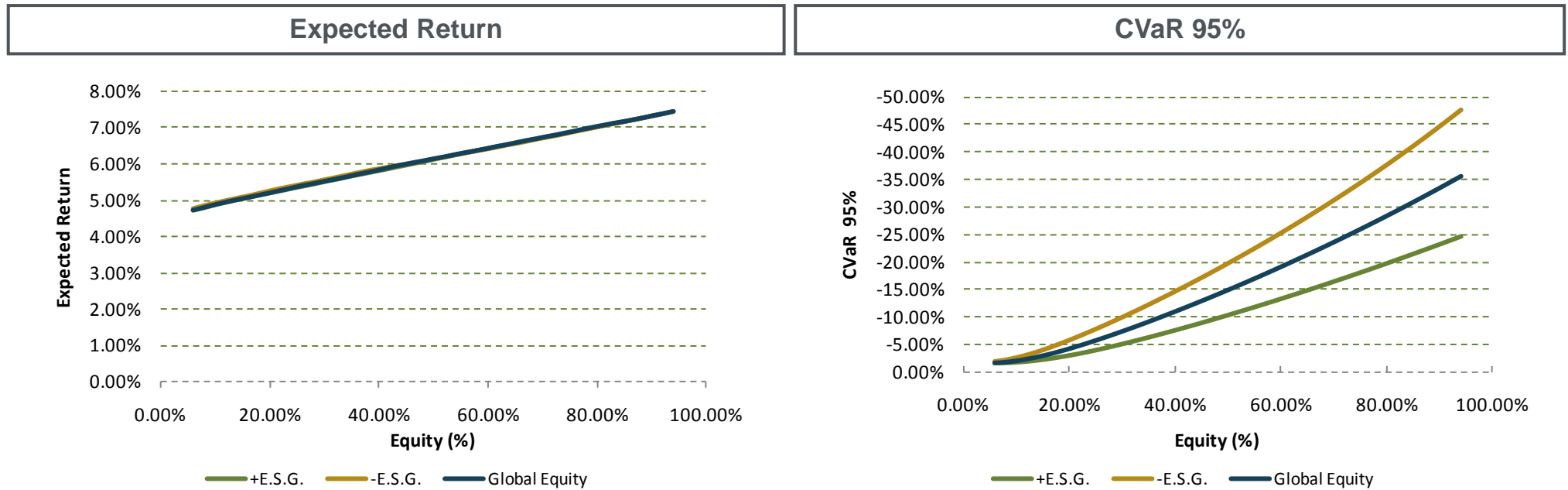
CVaR as key criterion for portfolio optimization

Definition of Risk / Return Metrics Analyzed in E.S.G. Study

Return / Risk Metric	Definition
Expected Return	Average expected return p.a.
CVaR 95%	Conditional Value at Risk (CVaR) 95%: Average expected return incurred in the 5% worst case scenarios p.a.
VaR 95%	Value at Risk (VaR) 95%: Average 5% quantile of all scenarios p.a.
Volatility	Average return volatility p.a.
Shortfall Probability	Average probability of a negative annual performance, i.e. return < 0% p.a.
Shortfall Mean	Average expected return in case of a negative annual performance, i.e. return < 0% p.a.

2 Result of Optimization: CVaR Applied as Key Criterion

Return and Risk of Optimal Portfolios w.r.t. Equity Allocation

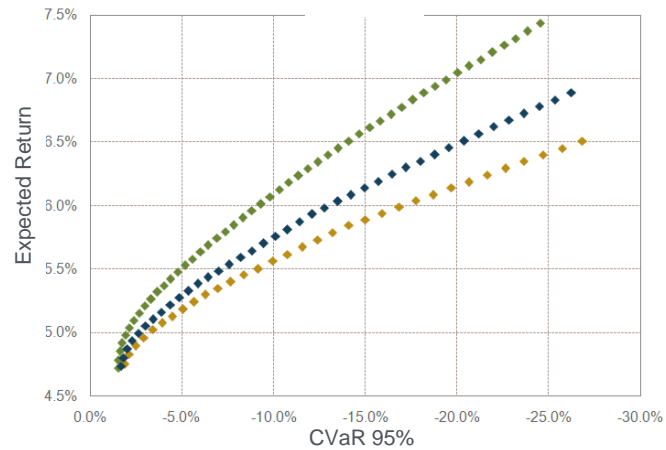


- With increasing equity allocation
 - **expected return remains unchanged** for all equity assets under consideration
 - risk in terms of **CVaR 95% increases substantially** for a certain equity allocation

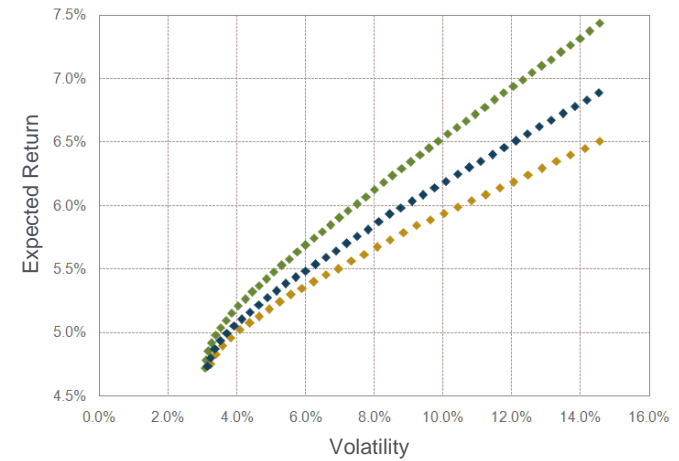
There is a high potential to reduce risk for a given equity allocation by allocation in +E.S.G. Equity.

2 Portfolio Analysis Consistent With Other Risk Metrics

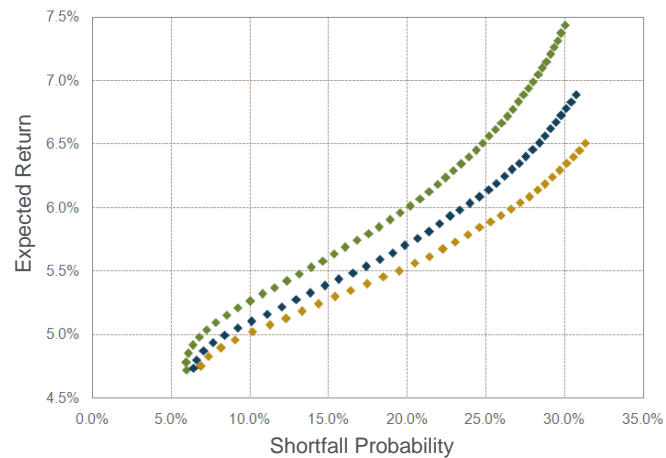
CVaR 95%



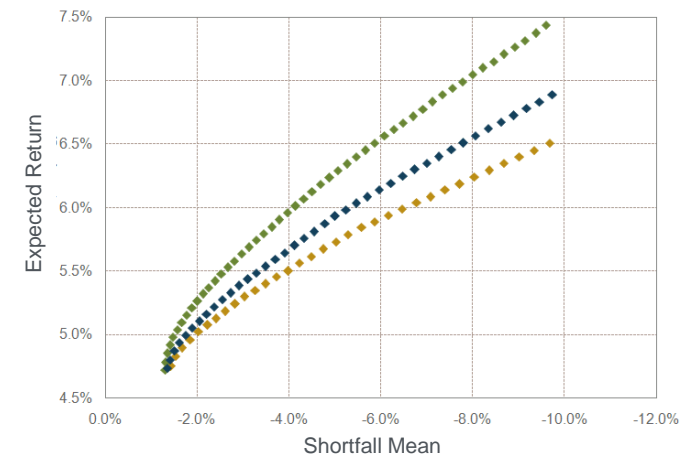
Volatility



Shortfall Probability



Shortfall Mean



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A backtest represents a model based on selection criteria applied backwards in time. The results are not indicative of how the proposed fund may perform in the future, and the model results have limitations as a representation of past performance.

The proposed risklab investment strategies may involve risk factors not characteristic of the risks of traditional investments in stocks and bonds, including the volatile and speculative qualities of commodities, emerging markets, currencies and variance swaps, the possible illiquidity of derivatives, the magnified loss potential of investments involving leverage, and the possible mispricing or improper valuation of derivatives. The proposed investment strategy may also involve short sales, in which the "covering" of borrowed securities could lead to losses for the fund under certain market conditions.

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