PERFORMANCE AND RISK

GOVERNMENT PENSION FUND GLOBAL

**REPORT
/2015**

Our mission
is to safeguard
and build financial
wealth for future
generations

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2015

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Main figures

5.64%

+0.26%

Since inception the fund has returned **5.64** percent annually. The fund has had a relative return of **0.26** percentage point.

**EQUITY
INVESTMENTS**

—

5.27%

+0.51%

**FIXED-INCOME
INVESTMENTS**

—

4.87%

+0.14%

Since inception, the equity investments have returned **5.27** percent and a relative return of **0.51** percentage point. The fixed-income investments have returned **4.87** percent and have a relative return of **0.14** percentage point.

The main purpose of this report is to give an overview of performance and risk with a focus on equities and fixed income.

The fund's quarterly and accumulated annualised return.
Percent
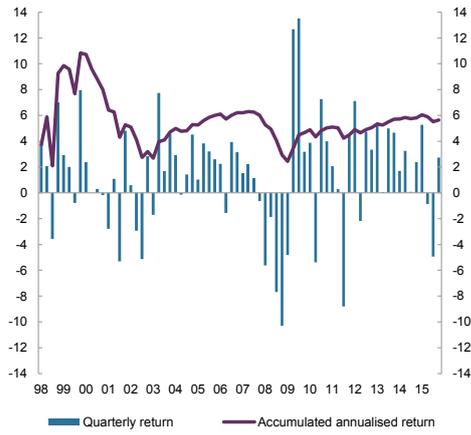
Source: Norges Bank Investment Management

Annual return for equity, fixed income, real estate
investments and total fund. Percent
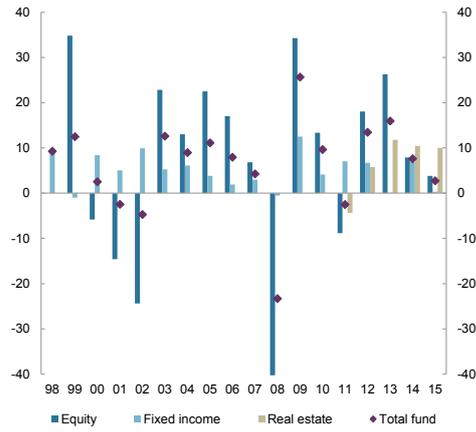
Source: Norges Bank Investment Management

The fund's quarterly and accumulated annualised relative
return. Percentage points
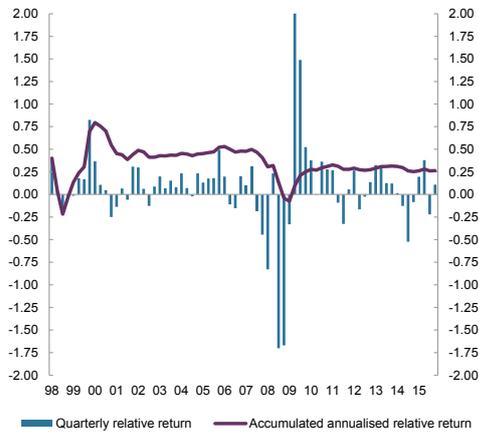
Source: Norges Bank Investment Management

Annual relative return for equity and fixed-income
investments and total fund excluding real estate.
Percentage points

Source: Norges Bank Investment Management

The fund's expected absolute volatility. Percent
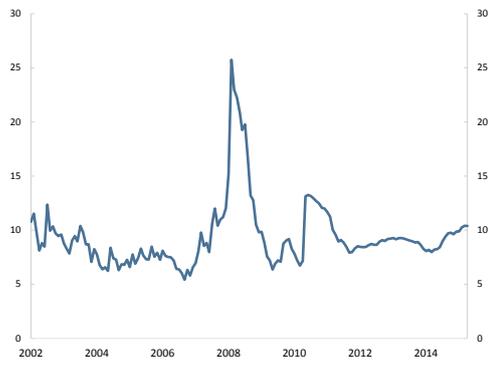
Source: Norges Bank Investment Management

The fund's expected relative volatility. Basis points
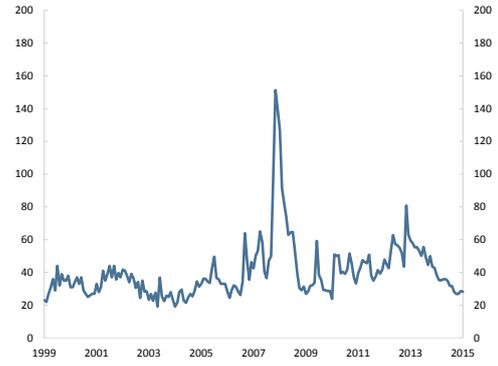
Source: Norges Bank Investment Management

Yngve Slyngstad

Chief Executive Officer of
Norges Bank Investment Management

Long-term management

Norges Bank has been tasked by the Ministry of Finance to manage the fund on its behalf, within a defined mandate. The mandate represents the owner's investment strategy and risk preferences.

Our mission is to provide long-term and professional management of the fund so that Norway's oil wealth benefits both current and future generations. As a manager, our objective is to achieve a high long-term return with an acceptable level of risk.

Since inception, the fund has returned 5.64 percent. After inflation and management costs, the annual net real return on the fund has been 3.70 percent. Over the same period, the fund has had a relative return of 0.26 percentage point. The results should be seen in the context of the fund's management mandate and the owner's risk preferences.

> Our investment strategies are grouped into three broad categories that complement each other

Our investment strategies aim at exploiting the fund's main characteristics as a large, global investor with limited short-term liquidity requirements. Our strategies are grouped into three broad categories: fund allocation, security selection and asset management. The different strategies complement each other and should be evaluated in this light.

Norges Bank Investment Management attaches great importance to transparency on all aspects of the fund management. The main purpose of this report is to give an overview of performance and risk with a focus on equities and fixed income. The report assembles numbers that we have previously published, as well as a few new numbers. We continuously assess reporting frequency and methods. This year we also publish reports on responsible investment and real estate. We hope that this report will provide a good insight into the different dimensions of the fund's return and risk characteristics.

Oslo, 16 March 2016

Yngve Slyngstad
Chief Executive Officer of Norges Bank Investment Management

Dag Huse

Chief Risk Officer of
Norges Bank Investment Management

A volatile year

2015 was a volatile year in the global capital markets, but still produced a positive 2.7 percent return for the fund. This report looks in detail at the fund's return and risk characteristics.

Negative yields on government bonds, increased uncertainty about growth in China, tumbling oil prices, general emerging-market weakness and increased geopolitical tensions contributed to the volatile markets in 2015. In response to this turbulence, the fund's expected absolute volatility increased from 8.2 to 10.4 percent during the year. At the same time, expected relative volatility fell from 0.38 to 0.28 percentage point.

Equity investments returned 3.8 percent and fixed income gained 0.3 percent. Our real estate investments gained 10.0 percent. The relative return was 0.45 percentage point, with an average expected relative volatility of 0.32 percentage point for the year.

This report is made up of two parts: a main report and an appendix aimed at the specialist reader. The report aims to incorporate the recommendations from an academic advisory panel on principles for risk adjustment of performance figures, and at the same time address the detailed reporting requirements related to risk and performance given in the management mandate.

> The fund's long investment horizon means that the relevant horizon for risk should also be long-term

We report performance, risk and cost estimates for each main investment strategy. Most of the risk statistics presented in this report are derived from quantitative models using monthly historical return as a basis for the calculations. It is important to recognise the limitations of this kind of analysis. To present a broader picture, we therefore complement the calculated risk figures with a range of data and background information which are independent of statistical models. The fund's long investment horizon means that the relevant horizon for risk should also be long-term. Assessments of long-term risk include elements that are not easily computed based on historical price movements, such as those related to sustainability and climate change risk. These risks are assessed in our separate annual report on responsible investment. In addition, a separate real estate report addresses performance and key risks related to our direct real estate investments.

2015 has demonstrated how the value of the fund can change substantially from one period to the next. We have to be prepared for these types of fluctuations in value given the fund's strategy. Our main ambition with this report is to increase the understanding of the driving forces behind the fund's value over time.

Oslo, 16 March 2016

Dag Huse,
Chief Risk Officer of Norges Bank Investment Management

CURRENT STRATEGIC ASSET MIX

EQUITIES

—

60%

REAL ESTATE

—

0-5%

FIXED INCOME

—

35-40%
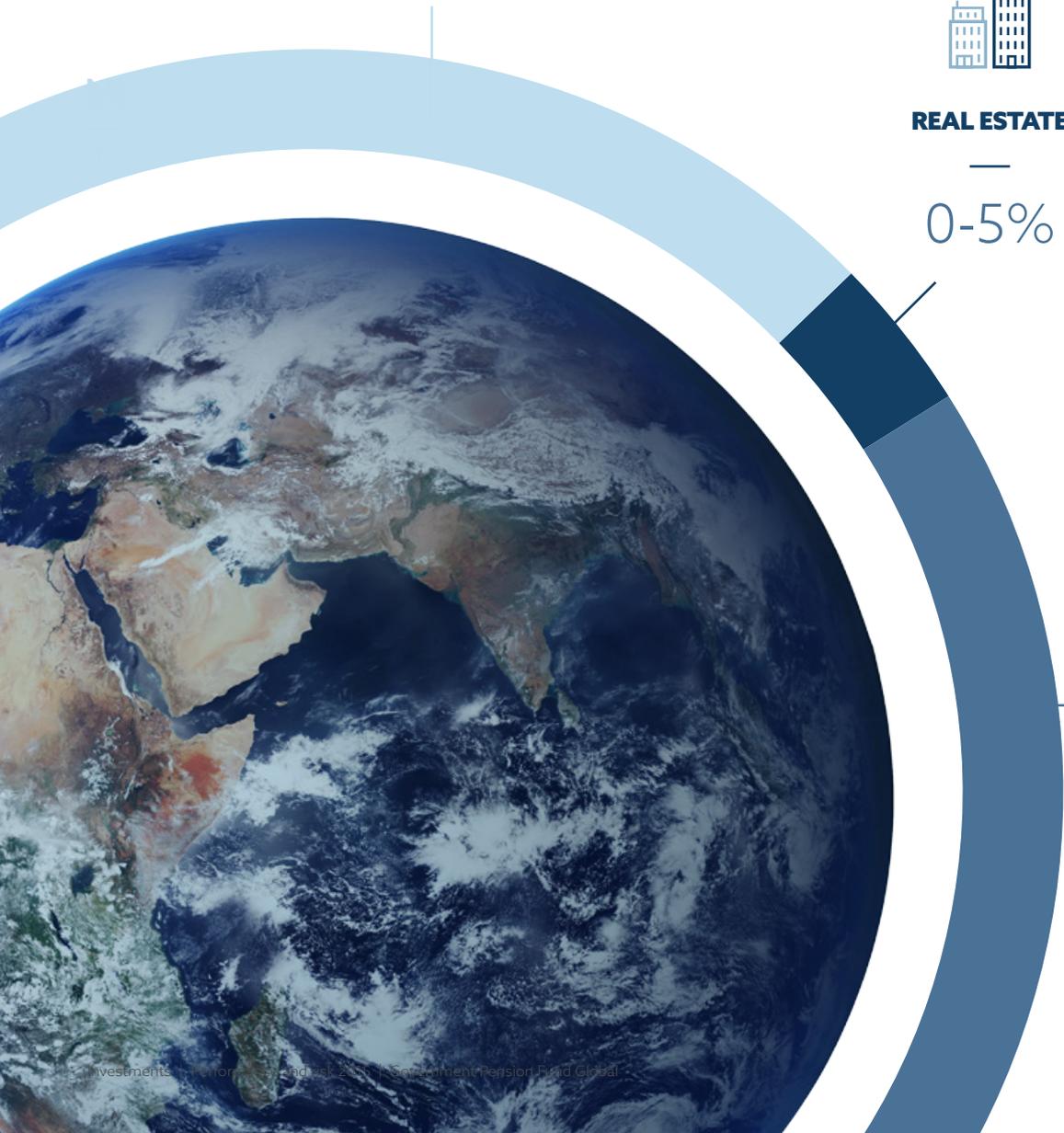
The fund

—

The fund's investment universe consists of listed equities, fixed-income instruments and real estate investments.

The Government Pension Fund Global was established in 1990 as a fiscal tool to ensure a long-term approach when phasing petroleum revenues into the Norwegian economy. Sound long-term management of the fund will help ensure that both present and future generations can benefit from Norway's oil wealth. Norges Bank Investment Management manages the fund on behalf of the Ministry of Finance. Our mission is to safeguard and build financial wealth for future generations.

Key decisions on fund strategy are anchored in the Storting (the Norwegian parliament). Our investment mandate is laid down by the Ministry of Finance on the basis of the Storting's deliberations. The most important strategic decisions in terms of return relate to which types of assets the fund can be invested in, how much is invested in each of these asset classes, how the weights of different asset classes should be adjusted back to their strategic weights, benchmarks and the scope for deviations from these benchmarks.

The fund's investment universe is restricted to investments in listed equities, tradable fixed-income instruments and unlisted real estate. In addition, the fund may invest in unlisted companies where the board has expressed an intention to seek public listing. The strategic asset allocation for the fund is defined by a strategic benchmark index comprising 60 percent equities, up to 5 percent real estate and 35-40 percent fixed income. If the equity allocation in the benchmark index moves above 64 percent or below 56 percent, it is rebalanced back to 60 percent. Return on the fund is measured against benchmarks based on broad, publicly available equity and fixed-income indices. As at February 2016, the scope for deviation from these indices is given by a tracking error limit of 125 basis points. The fund's return is measured in a basket of global currencies corresponding to the currency composition of the benchmark index for fixed income and equities.

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Key strategic decisions

INVESTMENT UNIVERSE

ASSET ALLOCATION

REBALANCING

BENCHMARKS

INVESTMENT MANDATE

The strategic benchmark index

The fund has a strategic benchmark index that forms the basis for our investments.

The overall return on the fund over time will to a large extent be determined by developments in the broad markets the fund is invested in. These markets are represented by the strategic benchmark index defined in the mandate from the Ministry of Finance. The composition of the strategic benchmark index has evolved over time.

The fund's benchmark indices for equities and fixed income are based on publicly available and widely used indices to ensure transparency and tractability. The actual value of the fund's real estate investments is included in the overall strategic benchmark index for the fund. The return on the fund's real estate investments is compared to a return target defined in the mandate.

> The composition of the strategic benchmark index has evolved over time

BENCHMARK INDEX FOR EQUITY INVESTMENTS
The fund's benchmark index for equities is based on the FTSE Global All Cap, which is a global market-capitalisation-weighted index covering approximately 7,400 stocks, or roughly 98 percent of the world's investable market capitalisation, in 47 countries. FTSE conducts an annual review of all countries in the index, as well as those being considered for inclusion, against minimum standards of governance and investability. Eligible securities are assigned a nationality and are required to pass screens for liquidity, free float and foreign ownership restrictions prior to being included. Companies with a free float of 5 percent or below are excluded from the index.

The fund's strategic equity benchmark deviates from the composition of the FTSE index along two important dimensions: country factors and exclusions. The fund's equity benchmark has a relative overweight of European developed markets and a relative underweight of the US and Canada, while the weighting of other countries is more or less the same as in the FTSE index. These adjustments are implemented using country factors defined in the management mandate. As a result of these adjustments, average ownership of European developed-market equities in our index is 2.5 times higher than for companies listed in North America. In addition, securities issued in Norway or denominated in Norwegian kroner are removed from the fund's benchmark, as are securities issued by companies excluded by Norges Bank under the guidelines for observation and exclusion from the fund.

BENCHMARK INDEX FOR FIXED-INCOME INVESTMENTS

The fund's fixed-income benchmark is based on various indices from Barclays. The benchmark index consists of two sub-indices, government and corporate, with fixed weights and monthly rebalancing. The government sub-index is assigned a weight of 70 percent and draws its constituents from the Barclays Treasury GDP Weighted by Country, the Barclays Global Inflation Linked and eligible currencies in the supranational segment of the Barclays Global Aggregate. The corporate sub-index comprises all securities included in the corporate sector and the covered bond sub-sector of the Barclays Global Aggregate in seven developed-market currencies, and is assigned a weight of 30 percent.

The Barclays Global Aggregate is a global market-capitalisation-weighted index of investment-grade debt from 24 local currency markets, including treasury, government-related, corporate and securitised bonds. Barclays evaluates the fixed-income landscape annually and reviews which currencies should be included in the index. To be considered for inclusion, currencies must be rated investment-grade and be sufficiently tradable, convertible and hedgeable for international investors. Securities must meet a number of criteria in areas such as quality, issue size and maturity.

The most significant difference between the fund's benchmark index and the Barclays Global Aggregate is that while government bonds in the Barclays index are market-weighted, government bonds in the fund's benchmark index are weighted according to the size of the respective issuer's GDP. Another difference is that agencies, local authorities, sovereigns, MBS pass-through bonds, ABS and CMBS are excluded from the fund's benchmark, while inflation-linked bonds are included. For corporate bonds, the main difference is the number of currencies. The Barclays Global Aggregate includes corporate bonds issued in fifteen currencies, while the fund's benchmark index only includes bonds issued in dollars, Canadian dollars, euros, British pounds, Swedish kronor, Danish kroner and Swiss francs. Furthermore, the fund's benchmark index has a relatively higher weight of covered bonds than the Barclays Global Aggregate.

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CHANGES TO THE FUND'S STRATEGIC BENCHMARK INDEX

1996
100 percent government bonds.

1998
Equities introduced with an allocation of 40 percent.

2002
Non-government bonds added to the fixed-income index.

2007
Equity allocation targeted towards 60 percent. Small-cap companies added to the equity benchmark.

2008
All emerging markets added to the equity benchmark.

2010
Real estate introduced with an allocation target of 5 percent.

2012
New regional distribution for the fund. Changes to the sector composition and introduction of emerging markets currencies to the fixed-income benchmark.

THE FUND'S BENCHMARK INDICES FOR EQUITIES AND FIXED INCOME COMPARED TO BROAD MARKET INDICES

The fund's benchmark index for equities is compared to the FTSE Global All Cap at a country and sector level and the equivalent broad market index from MSCI (MSCI ACWI IMI). The fund's benchmark index for fixed income is compared to the Barclays Global Aggregate at a currency and sector level.

The differences in the equity capital allocation are due primarily to the country factors specified in the mandate from the Ministry of Finance. The country factors also influence the sector composition of the equity benchmark. For fixed income, the main reasons for the capital allocation differences are weighting by GDP versus market capitalisation and the inclusion and exclusion of certain sectors.

Chart 1 Return difference between the fund's equity benchmark and the FTSE Global All Cap Index. Measured in dollar. Percentage points

Annual return difference (left-hand axis) ▬▬ Accumulated return difference (right-hand axis)
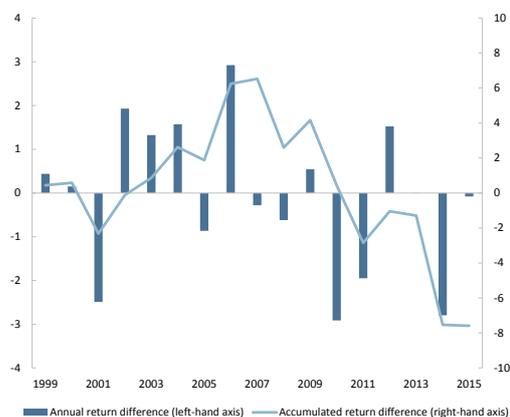
Source: Norges Bank Investment Management and FTSE

Chart 2 Return difference between the fund's fixed-income benchmark and the Barclays Global Aggregate Index. Measured in dollar. Percentage points

Annual return difference (left-hand axis) ▬▬ Accumulated return difference (right-hand axis)
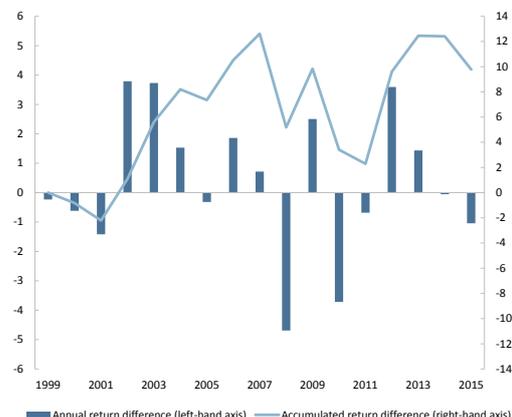
Source: Norges Bank Investment Management and Barclays

Table 1 Expected relative volatility and expected shortfall of the mandate's equity benchmark versus the FTSE Global All Cap Index as at 31 December 2015. Expected shortfall measured at 97.5 percent confidence level. Measured in kroner. Percentage points

Asset class	Expected relative volatility using 3-years price history	Expected relative volatility using 10-years price history	Expected shortfall using 10-years price history
Equity	1.73	2.20	6.23

Table 2 The fund's equity benchmark versus the FTSE Global All Cap Index (GEISAC) and the MSCI ACWI Investable Market Index (ACWI IMI) by country as at close of 31 December 2015

Country	Share of equity benchmark Percent	Share of FTSE GEISAC index Percent	Share of MSCI ACWI IMI index Percent	Deviation from FTSE	
				Percent	Millions of kroner
UK	11.5	6.9	6.8	4.6	219,790
Switzerland	5.4	3.0	3.0	2.4	113,015
Germany	5.3	3.0	3.0	2.3	111,534
France	5.1	3.0	3.1	2.1	100,665
Spain	1.9	1.1	1.1	0.8	39,775
Qatar	0.0	0.0	0.1	0.0	0
Mexico	0.4	0.4	0.4	0.0	-503
Norway	0.0	0.2	0.2	-0.2	-10,731
Canada	1.9	2.7	2.8	-0.8	-38,705
US	36.6	52.9	53.0	-16.4	-777,569

Table 3 The fund's equity benchmark versus the FTSE Global All Cap Index (GEISAC) and the MSCI ACWI Investable Market Index (ACWI IMI) by sector as at close of 31 December 2015

Indutry	Share of equity benchmark Percent	Share of FTSE GEISAC index Percent	Share of MSCI ACWI IMI index Percent	Deviation from FTSE	
				Percent	Millions of kroner
Financials	23.8	22.6	22.5	1.2	55,899
Telecommunications	3.7	3.3	3.3	0.5	22,218
Basic materials	4.8	4.3	4.2	0.4	21,371
Consumer goods	13.8	13.4	13.4	0.4	20,601
Utilities	3.4	3.2	3.2	0.2	10,397
Health care	11.6	11.5	11.5	0.1	5,920
Oil and gas	5.8	5.8	5.7	0.0	-1,497
Industrials	12.8	13.1	13.1	-0.3	-13,176
Consumer services	10.7	11.5	11.6	-0.8	-38,334
Technology	9.6	11.3	11.5	-1.8	-83,398

Table 4 The fund's fixed-income benchmark versus the Barclays Global Aggregate Index by sector as at close of 31 December 2015

Sector	Share of fixed-income benchmark Percent	Share of Barclays Global Aggregate index Percent	Deviation from Barclays	
			Percent	Millions of kroner
Treasuries	61.0	53.9	7.1	192,710
Inflation-linked bonds	6.1	0.0	6.1	166,920
Industrial	13.4	9.4	4.0	107,894
Financial institutions	10.2	7.1	3.2	85,827
Covered	4.3	3.0	1.4	36,956
Supranational	2.9	2.2	0.7	18,521
Utility	2.0	1.4	0.7	18,482
ABS	-	0.2	-0.2	-6,795
CMBS	-	0.5	-0.5	-13,208
Sovereign	-	1.3	-1.3	-34,339
Local authorities	-	2.9	-2.9	-80,250
Agencies	-	6.2	-6.2	-167,808
MBS Passthrough	-	11.9	-11.9	-324,910

Table 5 The fund's fixed-income benchmark versus the Barclays Global Aggregate Index by currency as at close of 31 December 2015

Currency	Share of fixed-income benchmark Percent	Share of Barclays Global Aggregate index Percent	Deviation from Barclays	
			Percent	Millions of kroner
Euro	27.5	24.3	3.2	87,309
Mexican peso	1.7	0.4	1.4	37,139
Australian dollar	2.2	1.3	0.9	23,329
Swiss franc	1.5	0.7	0.8	22,143
Canadian dollar	3.3	2.5	0.8	21,749
Hong Kong dollar	0.1	0.0	0.1	2,084
Norwegian krone	0.0	0.1	-0.1	-3,414
Pound sterling	5.7	5.9	-0.2	-6,357
US dollar	41.9	44.8	-2.9	-79,073
Japanese yen	7.3	16.3	-9.0	-244,490
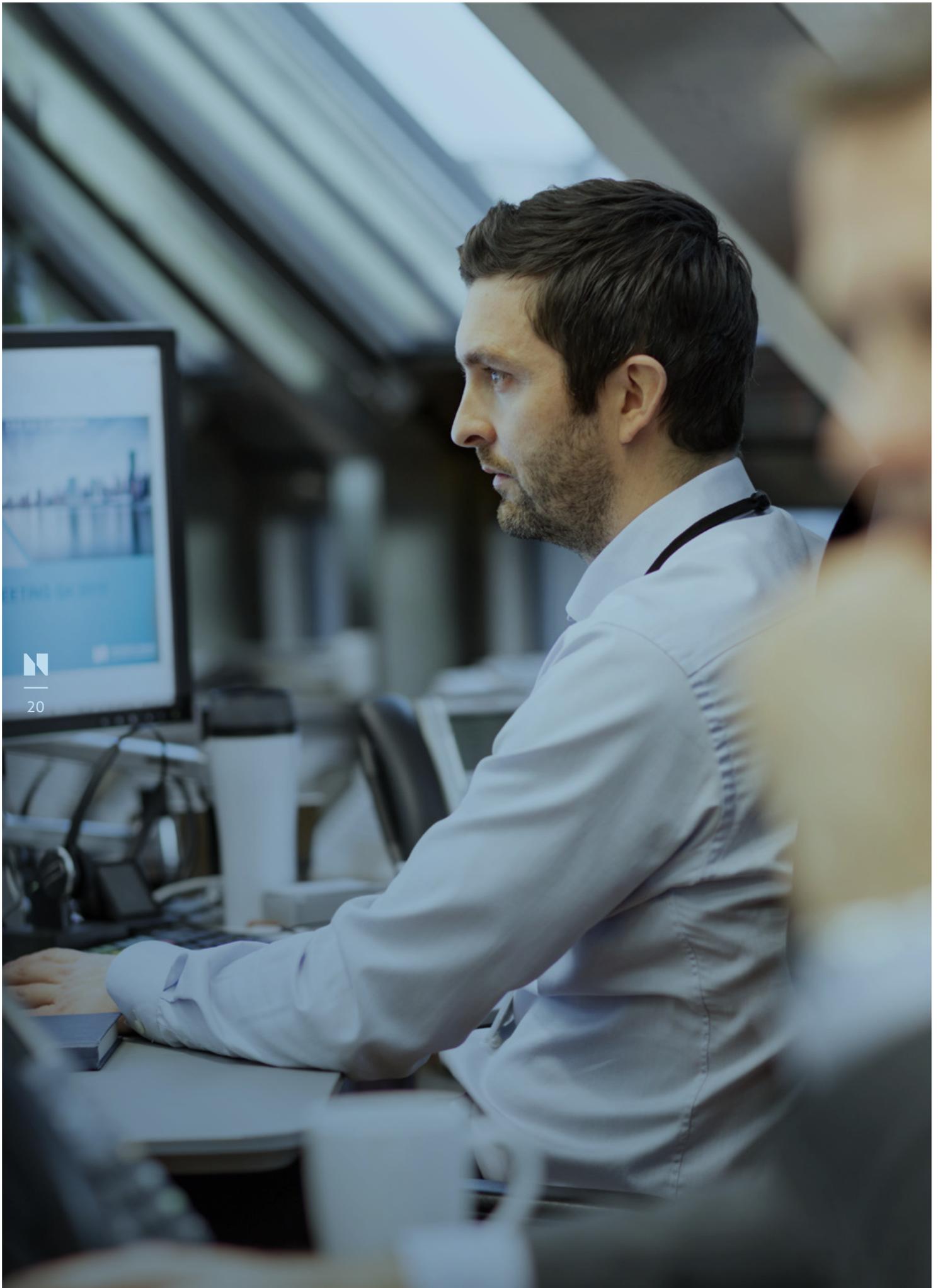
IMPACT OF COMPANY EXCLUSIONS ON PERFORMANCE

Companies excluded from the fund's investment universe under the guidelines for observation and exclusion laid down by the Ministry of Finance are removed from the fund's strategic benchmark index. These exclusions explain part of the return differential between the FTSE Global All Cap and the strategic benchmark index. 65 companies were excluded at the end of 2015. 54 of these would have been represented in the benchmark index with a combined market value of 127 billion kroner. When companies are excluded, this alters the risk and return characteristics of the index, as remaining companies are assigned a higher weight. Since 2006, these exclusions and the associated re-weighting have had a cumulative performance impact of -1.17 percentage points. The expected relative volatility was 0.16 percentage point at year-end 2015 between the equity benchmark and an index with no exclusions.

Table 6   Impact on return and weights from company exclusions

Sector	Cumulative return contribution for 2006-2015 Percentage points	Excluded Market value per 31.12.2015 Percent	Excluded Market value per 31.12.2015 Millions of kroner
Tobacco	-0.68	1.35	61,809
Aerospace and defense	-0.36	0.75	34,298
Mining	0.04	0.21	9,560
General retailers	-0.12	0.20	9,343
General industrials	-0.07	0.14	6,611
Industrial metals and mining	0.01	0.06	2,688
Chemicals	0.00	0.03	1,189
Construction and materials	0.00	0.02	732
Support services	0.01	0.01	564
Travel and leisure	0.00	0.01	444
Technology hardware and equipment	0.00	0.00	202
Household goods and home construction	0.00	0.00	6
Oil and gas producers	-0.01	0.00	0
Industrial engineering	0.00	0.00	0
Automobiles and parts	0.00	0.00	0
Forestry and paper	0.00	0.00	0
Total	-1.17	2.79	127,447

Investment strategies

Our investment strategies aim at exploiting our characteristics as a large, global investor with limited short-term liquidity requirements to achieve a high return with acceptable risk.

We manage the fund with an aim to generate a high return after costs subject to the constraints in the management mandate. Our strategies are designed to capitalise on the fund's defining characteristics and are grouped into three broad categories: fund allocation, security selection and asset management. These different strategies complement each other. This should be taken into account when evaluating the performance.

FUND ALLOCATION
Fund allocation aims to improve the fund's exposure to broad markets and sources of return, in both the medium and the long term.

Internal reference portfolio
The equity and fixed-income components of the strategic benchmark index are based on standard, publicly available indices from leading index providers. These indices are designed to represent liquid investment alternatives for the typical broad equity or fixed-income investor, and may therefore exclude investment opportunities available to the fund as a large cross-asset investor. The management mandate from the Ministry of Finance also includes other requirements not reflected in standard benchmarks. We therefore established an internal reference portfolio in 2011.

Through a series of adjustments of these publicly available indices, the internal reference portfolio seeks to improve diversification, gain exposure to systematic factors and ensure cost-efficient implementation of changes to the investment strategy. Efforts to improve diversification involve expanding the universe by adding markets and segments, typically to broaden the geographical exposure. By setting security weights that deviate from market weights for the securities in the investment universe, we seek to capture systematic factor premiums such as value, quality and size and implement other mandate requirements. We use the internal reference portfolio to implement changes in the fund's strategic benchmark index at a different pace. We do this to lower transaction costs, while taking market liquidity, inflow to the fund and other portfolio changes into account.

Allocation decisions
We manage the relative risk resulting from the internal reference portfolio through allocation decisions. An example is the internal reference portfolio's broader geographical exposure, since the relative risk from a given allocation to these additional markets varies over time. We also manage the fund's exposure to key return drivers such as the equity and term premiums and ensure cost-efficient implementation of rebalancing, taking market liquidity and market movements into account. Finally, we manage the deviation between the internal reference portfolio and our security selection strategies' benchmarks through allocation decisions. The internal reference portfolio and allocation decisions combined make up the fund allocation.

SECURITY SELECTION

Through our security selection strategies, we seek to generate excess return over carefully designed benchmarks. This applies to both internal and external strategies. The results reported under this category only include excess return generated by our managers relative to these benchmarks.

Internal security selection

Our internal security selection strategies make investments based on a thorough understanding of individual companies. Companies and the markets they operate in are extensively researched by our investment professionals. We particularly emphasise how companies are expected to perform over the long term. Typically, each investment professional covers only one industry. This specialisation enables them to become highly knowledgeable in their area of expertise. Depending on the characteristics of the industry, coverage is either global or regional. Investments focus on geographies considered to have the greatest potential. There are a number of portfolios within our internal security selection strategies. Each portfolio manager typically covers a limited number of companies. By running concentrated portfolios, we ensure that our investments are made with a high level of conviction. Our managers' insight also plays a key role in our ownership activities.

External security selection

We use external managers for the management of our investments in segments and markets where local knowledge is of particular relevance. Most of our emerging-market investments are managed by external managers based in these countries. In addition, we use external managers in specific segments such as investments in smaller companies. Our external managers are experts in their respective fields.

They manage our funds with the aim of generating excess return over carefully designed country and strategy-specific benchmarks.

ASSET MANAGEMENT

Our asset management strategies aim to implement the targeted market exposure, balancing transaction costs, risk and return considerations.

Asset positioning

Our asset-positioning strategies focus particularly on avoiding the weaknesses a stricter, mechanical benchmark replication could have. We aim to avoid trading in the same direction at the same time as the benchmarks change. In addition, we dynamically manage exposure to systematic risk factors and follow strategies that seek to exploit price differences between securities with similar characteristics. We also try to minimise and control transaction costs generated by the other investment strategies by making the trading function an integrated part of the investment process.

We aim to generate excess return over time through carefully researched and selected systematic strategies coupled with an efficient transaction process and prudent risk management. Risk is tightly controlled at regional, sector and issuer level and is spread across a large number of relatively small positions.

Securities lending

Securities lending is part of our asset management strategies. We use both direct internal lending and external agency lending through our custodian. Securities lending exposes the fund to counterparty default risk. We manage this risk by ensuring that all securities lending transactions are secured with adequate collateral and manage this exposure at an individual counterparty level.

The fund's investments

The fund is diversified across asset classes, regions and sectors.

The fund is invested in equities, fixed income and real estate. At the end of 2015, the fund's asset allocation was 61.2 percent equities, 35.7 percent fixed income and 3.1 percent real estate. 38.1 percent of the fund's investments were in Europe, 40.0 percent in North America and 18.1 percent in Asia and Oceania. Emerging markets accounted for 9.8 percent of the fund's investments.

GLOBAL INVESTMENTS
We held equities in 70 countries at the end of 2015. 39.3 percent of our equity investments were in European markets, 37.3 percent in North America, 21.2 percent in Asia and Oceania, 1.1 percent in Latin America, 0.7 percent in Africa and 0.5 percent in the Middle East.

Our fixed-income investments were spread across 32 currencies. Investments in the G4 currencies made up 79.4 percent of our fixed-income investments: 42.0 percent were issued in dollars, 25.5 percent in euros, 6.4 percent in yen and 5.4 percent in pounds. Emerging-market currencies accounted for 12.4 percent of our holdings.

Most of our equity investments are in developed markets. 91.0 percent were in these markets at the end of 2015, 8.7 percent in emerging markets and 0.3 percent in frontier markets.

The fund's average holding in the world's listed companies, measured as its share of the FTSE Global All Cap stock index, was 1.3 percent. As a result of the European overweight in the strategic benchmark index, the fund has a higher average stake in European listed companies than in other regions of 2.3 percent, compared to an average of 1.0 percent in the other regions.

LARGEST SECTORS AND COMPANIES
Financials were the fund's largest equity sector at the end of 2015 and accounted for 23.4 percent of our equity investments. Consumer goods were our second-largest sector at 14.5 percent, and industrials the third-largest at 13.6 percent. In total, our equity investments were spread across 10 sectors.

56.0 percent of our fixed-income investments were in government bonds, 14.5 percent in government-related bonds, 4.5 percent in inflation-linked bonds, 20.5 percent in corporate bonds and 6.4 percent in securitised bonds. Our fixed-income portfolio had an average duration of 5.6 years and an average yield of 2.2 percent at the end of 2015.

The equity portfolio was invested in 9,050 companies at the end of the year. Our largest equity investment was in Nestlé, where we had 51.1 billion kroner invested in addition to 737 million kroner in bonds. Apple was our second-largest equity investment with 41.6 billion kroner. In addition we had 2.9 billion kroner in the company's bonds. Our third-largest equity investment was in Roche Holdings with 35.0 billion kroner where we also held 2.3 billion kroner in bonds.

Table 7 Regional composition of the fund's equity investments

Region	Market value Millions of kroner	Weight Percent
Europe	1,794,883	39.3
North America	1,705,879	37.3
Asia	868,352	19.0
Oceania	99,905	2.2
Latin America	49,823	1.1
Africa	31,603	0.7
Middle East	21,362	0.5

Table 8 Sector composition of the fund's equity holdings

Sector	Millions of kroner[1]	Percent
Financials	1,070,336	23.4
Banks	487,486	10.7
Insurance	238,903	5.2
Financial services	179,253	3.9
Real estate	164,694	3.6
Consumer goods	660,907	14.5
Food and beverage	241,494	5.3
Personal and household goods	239,562	5.2
Automobiles and parts	179,851	3.9
Industrials	619,965	13.6
Industrial goods and services	525,268	11.5
Construction and materials	94,697	2.1
Consumer services	503,247	11.0
Retail	242,942	5.3
Travel and leisure	135,748	3.0
Media	124,558	2.7
Health care	491,433	10.7
Health care	491,433	10.7
Technology	412,837	9.0
Technology	412,837	9.0
Oil and gas	247,392	5.4
Oil and gas	247,392	5.4
Basic materials	234,696	5.1
Chemicals	159,940	3.5
Basic resources	74,756	1.6
Telecommunications	154,268	3.4
Telecommunications	154,268	3.4
Utilities	149,260	3.3
Utilities	149,260	3.3

[1] Does not sum up to total market value of the equity asset class due to cash and derivatives.

Chart 3 The fund's holdings in equity markets. Percent of market value of equities included in the reference portfolio for equities
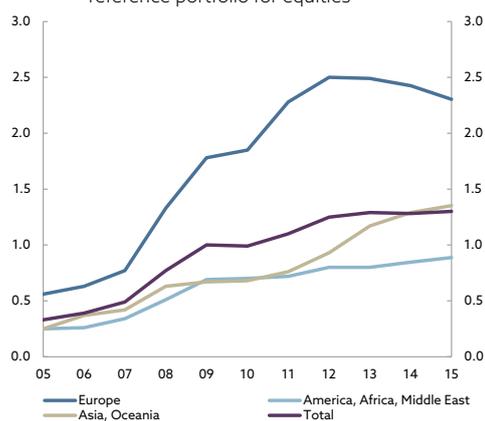
Source: FTSE, Norges Bank Investment Management

Table 9 Currency composition of the fund's largest fixed-income investments

Currency	Millions of kroner	Percent
USD	1,121,585	42.0
EUR	681,185	25.5
JPY	172,082	6.4
GBP	144,091	5.4
CAD	81,367	3.0
AUD	52,389	2.0
MXN	49,080	1.8
KRW	42,645	1.6
SEK	32,002	1.2
TRY	26,560	1.0
INR	26,266	1.0
CNY	21,677	0.8
CHF	21,478	0.8
PLN	20,532	0.8
BRL	18,611	0.7
IDR	18,424	0.7
RUB	16,933	0.6
DKK	15,139	0.6
THB	12,591	0.5
MYR	11,016	0.4
SGD	10,446	0.4
ZAR	10,328	0.4
ILS	10,276	0.4
CZK	9,466	0.4
CLP	9,233	0.3
TWD	9,109	0.3
NZD	6,468	0.2
COP	5,700	0.2
PHP	5,308	0.2
HKD	4,476	0.2
HUF	1,611	0.1

Table 10 Sector composition of the fund's bond holding. Millions of kroner

Sector	Millions of kroner[1]	Percent
Treasuries	**1,493,129**	**56.0**
Treasuries	1,493,129	56.0
Government related bonds	**386,828**	**14.5**
Agencies	194,925	7.3
Local authority	96,508	3.6
Supranational	72,351	2.7
Sovereign	23,045	0.9
Inflation-linked bonds	**120,275**	**4.5**
Inflation-linked bonds	120,275	4.5
Corporate bonds	**547,734**	**20.5**
Industrial	302,779	11.3
Financial institutions	202,004	7.6
Utility	42,951	1.6
Securitised bonds	**170,133**	**6.4**
Covered	168,925	6.3
CMBS	1,208	0.0

[1] Exposure does not sum up to market value due to cash and derivatives.

Chart 4 The fund's holdings in fixed-income markets. Percent of the market value of bonds in the reference index for bonds

- Government and government-related bonds
- Corporate bonds (incl. securitised debt)
- Total
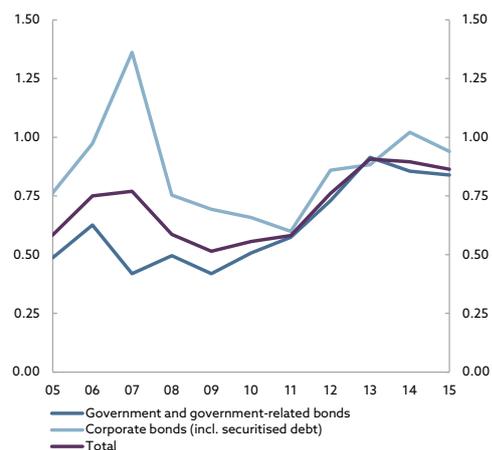
Source: Barclays, Norges Bank Investment Management

Table 11 Largest holdings of equities and bonds excluding sovereigns as at 31 December 2015. Covered bonds issued by financial institutions and debt issued by other underlying companies are included in the bonds. Millions of kroner

	Sector	Equities	Bonds	Total
Nestlé SA	Consumer goods	51,056	737	51,793
Apple Inc	Technology	41,599	2,864	44,463
Roche Holding AG	Health care	34,980	2,322	37,301
Novartis AG	Health care	33,935	3,066	37,002
Lloyds Banking Group Plc	Financials	17,412	18,516	35,928
Bank of America Corp	Financials	12,358	21,151	33,509
HSBC Holdings Plc	Financials	27,242	5,973	33,215
Kreditanstalt für Wiederaufbau	Government related		33,187	33,187
Microsoft Corp	Technology	30,448	2,532	32,981
JPMorgan Chase & Co	Financials	17,583	15,074	32,657
Alphabet Inc	Technology	30,499		30,499
Wells Fargo & Co	Financials	22,343	7,823	30,166
Credit Suisse Group AG	Financials	18,538	11,471	30,009
BlackRock Inc	Financials	27,984	1,264	29,248
UBS Group AG	Financials	20,437	7,974	28,411
Royal Dutch Shell Plc	Oil and gas	26,121	1,774	27,895
European Investment Bank	Government related		26,241	26,241
Prudential Plc	Financials	25,109	521	25,629
General Electric Co	Industrials	18,518	6,904	25,422
Barclays Plc	Financials	14,049	9,309	23,358
Berkshire Hathaway Inc	Financials	16,241	7,005	23,246
Verizon Communications Inc	Telecommunications	14,429	8,598	23,027
Exxon Mobil Corp	Oil and gas	22,502		22,502
AT&T Inc	Telecommunications	14,398	8,027	22,425
Sanofi	Health care	19,528	2,891	22,419
Banco Santander SA	Financials	11,202	10,786	21,989
Daimler AG	Consumer goods	20,516	1,440	21,956
Anheuser-Busch InBev SA/NV	Consumer goods	19,760	1,636	21,395
Johnson & Johnson	Health care	21,109		21,109
Citigroup Inc	Financials	10,830	9,534	20,364
GlaxoSmithKline Plc	Health care	17,999	2,292	20,292
BASF SE	Basic materials	19,685	583	20,268
Comcast Corp	Consumer services	16,839	2,881	19,720
Canada Mortgage & Housing Corp	Government related		19,469	19,469
Toyota Motor Corp	Consumer goods	18,723	415	19,138
BP Plc	Oil and gas	15,350	3,287	18,637
Bayerische Motoren Werke AG	Consumer goods	18,223	110	18,333
Novo Nordisk A/S	Health care	18,202		18,202
TOTAL SA	Oil and gas	15,403	2,596	17,999
SABMiller Plc	Consumer goods	16,939	889	17,829

Global investments

—

NORTH AMERICA 40.0%

2,352 companies
2,257 bonds from 599 issuers
431 properties

LATIN AMERICA 1.8%

277 companies
210 bonds from 37 issuers

INTERNATIONAL ORGANISATIONS 1.0%

122 bonds from 17 issuers

EUROPE 38.1%

1,974 companies
1,505 bonds from 498 issuers
366 properties

ASIA 16.1%

3,783 companies
540 bonds from 74 issuers

MIDDLE EAST 0.4%

160 companies
35 bonds from 14 issuers

AFRICA 0.6%

184 companies
16 bonds from 2 issuers

OCEANIA 2.0%

320 companies
139 bonds from 37 issuers

Regional weights are based on currency for fixed income.
Properties are investments in unlisted real estate. A property can consist of several buildings.

Fund return

The fund's gross annual return was 2.74 percent in 2015 and has been 5.64 percent since inception.

The fund's total market value rose 1,044 billion kroner to 7,475 billion kroner in 2015. The fund produced an investment return of 334 billion and received a net capital inflow of 42 billion kroner. The krone weakened against the main currencies the fund invests in, resulting in a 668 billion kroner increase in market value.

Since the first inflow of capital in May 1996, the fund has received a total of 3,468 billion kroner, net of management costs. The cumulative investment return since inception has been 2,676 billion kroner. Changes in the value of the krone against the currencies we invest in account for the remaining 1,331 billion kroner of the fund's market value.

PERCENTAGE RETURN

From 1998 to the end of 2015, the fund generated a gross annual investment return of 5.64 percent. In 2015, the fund returned 2.74 percent. The return on equity investments in 2015 was 3.83 percent, while fixed-income investments returned 0.33 percent and the real estate portfolio 10.00 percent.

Over the past three years, the gross annual return has been 8.62 percent for the fund as a whole, 12.26 percent for equity investments, 2.39 percent for fixed-income investments and 10.73 percent for real estate investments.

Since inception, the fund's investment return has been 5.64 percent. The return on equity investments has been 5.27 percent and the return on fixed-income investments 4.87 percent.

The fund has had positive annual return in 14 out of 18 years since inception. Equity investments have had positive return in 12 out of 17 years, and fixed-income investments in 16 out of 18 years. Real estate investments have put in a positive performance in four out of five years.

Chart 5   The fund's market value. Billions of kroner

Inflows ■   Return ■   Krone rate ■   Total ◆
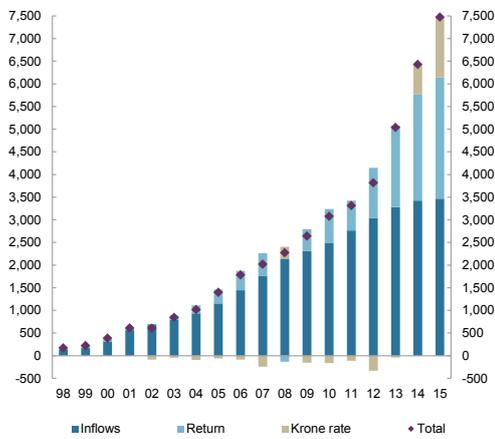
Source: Norges Bank Investment Management

Chart 6   Changes in the fund's market value.
Billions of kroner

Inflows ■   Return ■   Krone rate ■   Total ◆
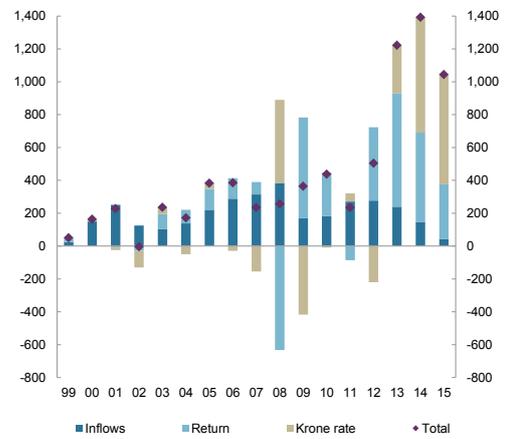
Source: Norges Bank Investment Management

Chart 7   The fund's quarterly and accumulated
annualised return. Percent

Quarterly return ■   Accumulated annualised return ▬
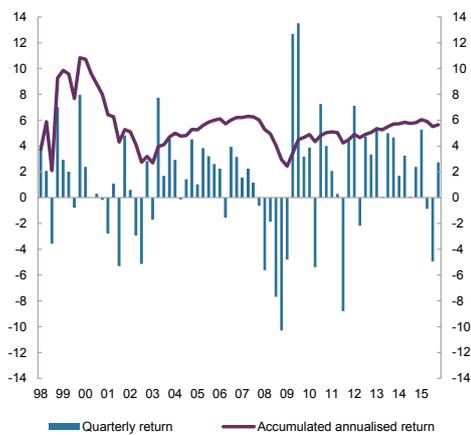
Source: Norges Bank Investment Management

Chart 8   Annual return for equity, fixed income,
real estate investments and total fund. Percent

Equity ■   Fixed income ■   Real estate ■   Total fund ◆
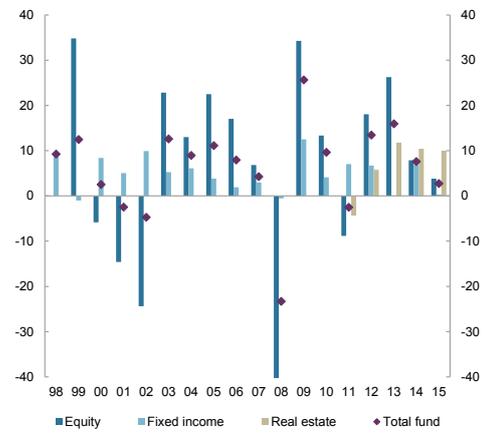
Source: Norges Bank Investment Management

Table 12   Absolute return key figures, measured in the currency basket. Annualised. Percent

	Since 01.01.1998	Last 10 years	Last 5 years	Last 3 years	2015
Return on equity investments[1]	5.27	5.56	8.77	12.26	3.83
Return on fixed-income investments	4.87	4.13	4.15	2.39	0.33
Return on real estate investments	-	-	-	10.73	10.00
Return on fund	5.64	5.34	7.21	8.62	2.74

[1] Since 01.01.1999

Table 13   Absolute return, 5-year buckets, measured in the currency basket. Annualised. Percent

	1998-2002	2003-2007	2008-2012	2013-2015	2015
Return on equity investments[1]	-4.85	16.28	-0.59	12.26	3.83
Return on fixed-income investments	6.26	4.00	5.87	2.39	0.33
Return on real estate investments	-	-	-	10.73	10.00
Return on fund	3.19	8.92	3.14	8.62	2.74

[1] Since 01.01.1999

Table 14   Absolute return per year, measured in the fund's currency basket. Percent

Year	Equity	Fixed income	Real estate	Total fund
1998		9.31		9.26
1999	34.81	-0.99		12.44
2000	-5.82	8.41		2.49
2001	-14.60	5.04		-2.47
2002	-24.39	9.90		-4.74
2003	22.84	5.26		12.59
2004	13.00	6.10		8.94
2005	22.49	3.82		11.09
2006	17.04	1.93		7.92
2007	6.82	2.96		4.26
2008	-40.71	-0.54		-23.31
2009	34.27	12.49		25.62
2010	13.34	4.11		9.62
2011	-8.84	7.03	-4.37	-2.54
2012	18.06	6.68	5.77	13.42
2013	26.28	0.10	11.79	15.95
2014	7.90	6.88	10.42	7.58
2015	3.83	0.33	10.00	2.74

RETURN IN THE FUND'S CURRENCY BASKET

The fund is invested in international securities. Return is generally measured in international currency – a weighted combination of the currencies in the fund's benchmark indices for equities and bonds. The fund's currency basket consisted of 33 currencies at the end of 2015. Unless otherwise stated in the text, results are measured in the fund's currency basket.

REAL INVESTMENT RETURN

The fund has generated a gross annual return of 5.64 percent since its inception on 1 January 1998. After adjusting for inflation and management costs, the fund has produced an annualised real return of 3.70 percent. This is slightly below the return of 4 percent assumed by the government's fiscal rule. Measured over the last five years, the real return has been 5.46 percent, and over the last ten years, it has been 3.35 percent.

ACCOUNTING INCOME

Total accounting income has increased as the fund has grown, and amounted to 193 billion kroner in 2015, up from 157 billion kroner in 2014. Equity dividends accounted for 107 billion kroner of this income, bond coupons 78 billion kroner, and net property rental income 7 billion kroner.

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Chart 9 The fund's annualised nominal and real returns since inception. Percent

Nominal return   Real return

Source: Norges Bank Investment Management

Chart 10 Annual accounting income by type. Billions of kroner

■ Stock dividends   ■ Bond coupon interest   ■ Net rental income

Source: Norges Bank Investment Management

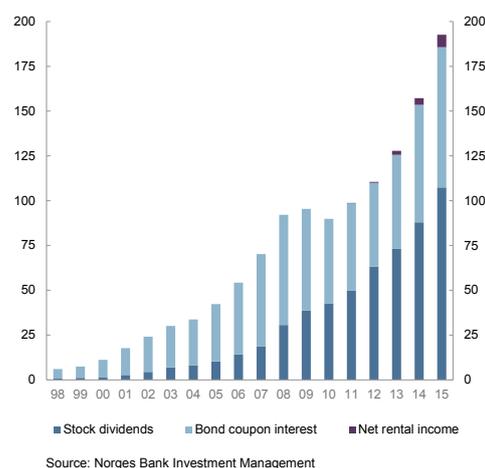**Table 15** The fund's real return, measured in the currency basket. Annualised. Percent

	Since 1998	Last 10 years	Last 5 years	Last 3 years	2015
Nominal return	5.64	5.34	7.21	8.62	2.74
Annual inflation	1.78	1.84	1.60	1.06	0.86
Annual management cost	0.09	0.09	0.06	0.06	0.06
Real return	3.70	3.35	5.46	7.42	1.80

BENCHMARK RETURN

While the fund's equity investments returned 3.83 percent in 2015, the fund's equity benchmark had an investment return of 3.00 percent.

The benchmark return for the three major regions were all positive in 2015: 3.64 percent in Europe, 3.68 percent in North America and 5.48 percent in Asia. Over the most recent five-year period, the best investment performance has come from North American equities with a 13.78 percent return.

Within regions, the investment performance of individual countries varied significantly in 2015. In the European region, Greek benchmark equities, at an aggregate country level, lost 46.20 percent of their value, while Hungarian stocks managed an investment gain of 38.86 percent. It is, however, the major equity market countries that determine most of the investment performance of both the fund and the benchmark due to their greater weighting in the benchmark index. The UK, Switzerland, Germany and France together represent more than two-thirds of European equities' weight in the benchmark, so the return in these countries have the largest impact on Europe's investment performance.

While most Asian countries had negative investment return in 2015, Japanese equities gained 16.39 percent, contributing the most to Asia's 5.48 percent overall return.

Emerging-market currencies generally weakened against the benchmark's currency basket in 2015, with the Brazilian real and the South African rand the most notable depreciating currencies. For Brazil, this meant that a negative investment performance of 14.15 percent in local currency translated into a 39.45 percent loss in currency basket terms.

The fund's fixed-income investments returned 0.33 percent in 2015. This was below the 0.57 percent investment return of the fund's fixed-income benchmark.

While yields across the benchmark's currency universe are generally at very low levels at present, especially for the major currencies, exchange rate movements can have a material impact on investment return in the benchmark's currency basket. The two largest currencies in the fixed-income benchmark are the dollar and the euro. Fixed-income investments in dollars returned 0.19 percent in local currency in 2015. However, due to the strengthening of the dollar, the investment return in the benchmark's currency basket was 5.17 percent. For euro-denominated bonds, the effect was the opposite, with a positive investment return of 0.77 percent in local currency translating into a negative return of 5.04 percent in currency basket terms.

Table 16   Equity benchmark return by region and country. Annualised. Percent

	The fund's currency basket			Local currency		
	2015	3-years	5-years	2015	3-years	5-years
Europe	**3.64**	**10.08**	**7.18**	**6.68**	**11.32**	**7.63**
United Kingdom	-0.64	8.16	7.56	0.14	7.13	6.02
Switzerland	7.06	14.22	10.88	2.74	12.82	9.54
Germany	4.49	10.37	7.62	10.89	12.87	9.32
France	6.06	10.60	7.29	12.55	13.10	8.99
Spain	-11.13	6.13	1.99	-5.69	8.53	3.60
Italy	11.37	10.85	3.40	18.18	13.36	5.04
Netherlands	5.79	11.67	6.19	12.26	14.19	7.87
Denmark	29.95	26.67	17.86	38.20	29.54	19.76
Belgium	17.07	18.48	15.05	24.23	21.16	16.87
Finland	9.14	17.90	6.06	15.82	20.57	7.74
Austria	7.40	1.29	-2.17	13.97	3.58	-0.61
Ireland	26.46	31.04	23.84	34.19	34.00	25.80
Portugal	8.90	0.91	-3.78	15.56	3.19	-2.26
Greece	-46.20	-20.88	-24.69	-42.90	-19.09	-23.49
Sweden	3.95	10.55	6.97	6.64	15.55	9.00
Russia	10.53	-14.68	-10.65	25.20	5.28	1.36
Hungary	38.86	4.17	-1.43	47.47	9.47	2.70
Czech Republic	-11.87	-5.13	-3.59	-8.81	-0.56	-0.60
Poland	-19.35	-7.94	-4.61	-14.58	-4.28	-1.56
Turkey	-27.63	-12.04	-6.10	-13.93	-0.64	3.93
North America	**3.68**	**18.01**	**13.78**	**-0.20**	**13.93**	**11.28**
United States	5.26	19.54	15.04	0.28	14.60	12.03
Canada	-19.49	-1.69	-1.39	-8.02	5.31	2.69
Asia	**5.48**	**9.08**	**4.91**	**2.49**	**11.52**	**6.77**
Japan	16.39	15.57	7.77	11.25	23.69	13.56
China	-0.89	6.33	3.76	-5.64	1.94	0.99
South Korea	1.11	0.59	1.91	2.76	-0.59	-0.10
Taiwan	-6.84	5.91	1.51	-7.76	5.79	1.24
Hong Kong	0.36	6.63	4.55	-4.45	2.22	1.76
Singapore	-13.09	-1.22	0.88	-11.46	-0.54	0.23
India	2.11	11.19	1.00	1.95	13.51	6.38
Thailand	-17.91	-2.92	5.27	-14.23	-1.66	6.27
Malaysia	-14.31	-4.65	0.30	0.24	2.35	4.36
Indonesia	-17.21	-4.81	-0.95	-12.22	2.82	5.02
Philippines	-4.27	5.86	12.17	-4.07	6.21	10.82
Pakistan	-9.21	16.19	13.49	-9.88	14.20	15.06
Oceania	**-3.99**	**1.10**	**2.30**	**2.92**	**8.95**	**6.57**
Australia	-4.35	0.76	2.01	2.49	8.75	6.40
New Zealand	5.28	11.96	12.83	14.50	14.22	12.82
Latin America	**-29.49**	**-17.00**	**-12.81**	**-10.33**	**-5.53**	**-3.11**
Mexico	-12.48	-4.48	-0.59	-2.30	0.71	3.55
Chile	-13.69	-13.17	-10.93	-3.99	-5.14	-5.75
Brazil	-39.45	-22.49	-17.81	-14.15	-7.45	-4.77
Colombia	-38.19	-24.98	-11.64	-21.34	-12.57	-4.85
Peru	-38.54	-22.94	-14.89	-41.45	-25.93	-17.58
Africa	**-22.15**	**-5.15**	**-3.03**	**-1.47**	**10.53**	**11.29**
South Africa	-21.99	-5.44	-2.77	-0.45	10.82	12.26
Egypt	-24.38	5.28	-3.27	-21.38	7.73	-0.34
Middle East	**9.40**	**18.42**	**5.27**	**4.28**	**14.44**	**3.96**
Israel	16.56	17.76	3.98	11.02	14.49	3.19
United Arab Emirates	-9.79	27.75	17.36	-14.07	22.47	14.29

Table 17 Equity benchmark return by sector. Annualised. Percent

	The fund's currency basket			Local currency		
	2015	3-years	5-years	2015	3-years	5-years
Financials	0.87	11.28	7.53	1.62	11.87	7.79
Banks	-4.22	6.79	3.19	-2.25	8.53	4.12
Nonlife insurance	10.02	18.73	14.67	9.98	18.03	14.16
Life insurance	2.76	17.82	12.58	3.01	17.14	11.89
Real estate investment and services	4.49	5.66	5.10	3.44	6.46	5.87
Real estate investment trusts	5.41	12.41	12.37	4.65	11.00	11.34
Financial services	4.51	18.42	12.33	3.65	17.87	12.15
Consumer goods	10.10	14.05	12.05	10.15	14.42	12.30
Automobiles and parts	6.09	15.24	10.00	5.98	17.66	11.67
Beverages	14.10	13.32	14.66	16.20	13.48	14.72
Food producers	9.20	13.11	12.09	8.01	12.52	11.64
Household goods and home construction	14.77	20.61	16.57	14.05	19.52	15.74
Leisure goods	10.78	10.83	-0.17	8.72	11.14	0.41
Personal goods	10.03	11.89	11.86	10.93	12.15	12.05
Industrials	1.19	11.09	7.51	0.82	11.33	7.60
Construction and materials	6.41	10.69	5.99	7.69	12.19	7.02
Aerospace and defense	-3.53	12.66	12.20	-4.13	10.80	10.75
General industrials	4.38	12.69	8.77	4.54	12.10	8.43
Electronic and electrical equipment	3.45	12.49	7.31	1.83	13.39	7.90
Industrial engineering	-4.65	4.98	2.92	-5.94	5.82	3.24
Industrial transportation	-8.49	12.16	8.16	-7.18	12.72	8.64
Support services	8.41	15.18	12.43	6.79	14.50	11.76
Consumer services	10.17	18.10	14.29	9.46	17.51	13.87
Food and drug retailers	5.28	13.00	8.86	6.05	13.07	8.81
General retailers	15.66	18.61	16.13	14.12	18.02	15.77
Media	3.97	19.44	16.02	4.53	18.59	15.48
Travel and leisure	12.95	19.00	13.75	10.88	18.33	13.19
Health care	13.32	23.55	19.89	11.11	21.85	18.79
Health care equipment and services	16.19	24.11	18.80	14.14	21.94	17.61
Pharmaceuticals and biotechnology	12.46	23.31	20.16	10.22	21.75	19.06
Technology	7.81	19.70	13.36	4.77	17.00	11.69
Software and computer services	21.02	22.65	16.81	17.74	19.47	15.06
Technology hardware and equipment	-3.15	16.88	10.54	-5.94	14.57	8.97
Oil and gas	-16.27	-4.65	-2.57	-15.62	-4.58	-2.63
Oil and gas producers	-14.72	-4.09	-1.97	-13.88	-3.78	-1.88
Oil equipment, services and distribution	-26.96	-9.87	-6.11	-27.22	-11.04	-6.96
Alternative energy	15.10	41.14	-5.06	17.01	40.79	-5.13
Basic materials	-11.23	-3.70	-4.50	-9.33	-2.20	-3.50
Chemicals	2.41	8.78	8.29	3.85	9.62	8.89
Forestry and paper	7.43	15.98	6.31	12.18	18.62	7.91
Industrial metals and mining	-28.87	-14.00	-15.21	-27.61	-11.94	-13.62
Mining	-41.11	-27.10	-22.13	-38.04	-24.92	-20.73
Telecommunications	3.29	12.76	7.87	4.79	13.64	8.39
Fixed line telecommunications	5.74	12.71	6.12	6.80	12.51	6.06
Mobile telecommunications	0.57	12.39	9.54	2.55	14.37	10.68
Utilities	-3.34	9.10	4.47	-2.38	9.25	4.51
Electricity	-0.69	10.60	4.77	-0.22	10.65	4.90
Gas, water and multiutilities	-6.67	7.23	3.95	-5.10	7.52	3.94

Table 18   Fixed-income benchmark return by region and currency. Annualised. Percent

	The fund's currency basket			Local currency		
	2015	3-years	5-years	2015	3-years	5-years
North America	**4.00**	**4.69**	**5.73**	**0.43**	**1.22**	**3.50**
US Dollar	5.17	5.44	6.19	0.19	1.09	3.42
Canadian Dollar	-9.51	-3.96	0.30	3.38	2.88	4.45
Europe	**-3.51**	**2.19**	**4.32**	**1.30**	**4.29**	**5.57**
Euro	-5.04	2.07	3.79	0.77	4.38	5.43
British Pound Sterling	-0.50	5.19	7.99	0.27	4.19	6.44
Swiss Franc	6.52	3.70	5.14	2.23	2.42	3.86
Swedish Krona	-2.08	-1.92	2.07	0.46	2.52	4.01
Danish Krone	-6.31	-0.11	2.63	-0.37	2.16	4.29
Polish Zloty[1]	-4.38	0.14	-	1.27	4.13	-
Czech Koruna[1]	-1.14	-0.59	-	2.28	4.20	-
Russian Ruble[2]	14.00	-	-	32.19	-	-
Turkish Lira[2]	-17.21	-	-	-1.53	-	-
Asia	**4.31**	**-2.13**	**-0.76**	**2.21**	**3.00**	**2.74**
Japanese Yen	5.81	-4.18	-2.90	1.14	2.55	2.32
South Korean Won[1]	3.84	6.29	-	5.53	5.04	-
Hong Kong Dollar[1]	7.33	5.12	-	2.18	0.77	-
Singapore Dollar	-1.13	-0.56	2.75	0.83	0.20	2.13
Thai Baht[1]	1.37	4.69	-	5.92	6.05	-
Malaysian Ringgit[1]	-10.85	-4.20	-	4.29	2.84	-
Oceania	**-4.21**	**-2.63**	**2.90**	**2.72**	**4.46**	**6.80**
Australian Dollar	-4.36	-3.15	2.46	2.48	4.53	6.86
New Zealand Dollar	-3.61	1.81	6.25	4.84	3.87	6.24
Latin America	**-6.66**	**-0.83**	**-**	**4.16**	**5.30**	**-**
Mexican Peso[1]	-6.59	-0.27	-	4.26	5.14	-
Chilean Peso[1]	-8.19	-3.40	-	2.13	5.53	-
Africa	**-23.79**	**-12.66**	**-**	**-2.76**	**2.35**	**-**
South African Rand[1]	-23.79	-12.66	-	-2.76	2.35	-
Middle East	**8.37**	**8.84**	**-**	**3.23**	**5.82**	**-**
Israeli Shekel[1]	8.37	8.84	-	3.23	5.82	-

[1] Polish Zloty, Czech Koruna, South Korean Won, Hong Kong Dollar, Thai Baht, Malaysian Ringgit, Mexican Peso, Chilean Peso, South African Rand and Israeli Shekel were introduced to the benchmark index on 2 July 2012.
[2] Russian Ruble and Turkish Lira were introduced to the benchmark index on 1 April 2014.

Table 19   Fixed-income benchmark return by sector[1]. Annualised. Percent

	The fund's currency basket			Local currency		
	2015	3-years	5-years	2015	3-years	5-years
Government (including supranationals)	**0.60**	**1.93**	**3.63**	**1.59**	**2.90**	**4.29**
Treasuries	0.74	1.96	3.56	1.80	3.13	4.34
Inflation-linked bonds	-0.27	1.57	4.66	-0.38	0.61	3.81
Supranational	-0.69	2.12	3.79	1.15	2.75	4.30
Corporate (including covered bonds)	**0.49**	**4.19**	**5.69**	**-0.10**	**2.66**	**4.72**
Financials	2.14	5.15	6.43	1.39	3.45	5.35
Industrials	0.66	4.17	5.79	-1.36	1.60	4.15
Utilities	0.30	4.93	6.69	-0.58	3.23	5.51
Covered	-3.35	1.66	3.64	0.58	3.40	4.85

[1] Other subcategories, including ABS, CMBS, Agencies, Local authorities and Sovereign bonds were included in the benchmark index until 31 January 2012.

Relative return

The fund's overall return was 45 basis points higher than the return on the benchmark indices in 2015 and has been 26 basis points higher since inception.

Investment return on the fund's equity and fixed-income investments can be compared with returns on global benchmark indices for equities and bonds set by the Ministry of Finance on the basis of indices from FTSE Group and Barclays Capital.

The overall return on the fund's equity and fixed-income investments was 45 basis points higher than the return on the benchmark indices in 2015. Since the fund's inception, the annualised return on the fund's equity and fixed-income investments has been 26 basis points higher than the return on the benchmark indices.

Equity investments returned 83 basis points more than the benchmark index in 2015. Since 1 January 1999, the annualised relative return for equity investments has been 51 basis points. The relative return on fixed-income investments was -24 basis points in 2015 and has been 14 basis points since the fund's inception.

The aggregate portfolio of equity and fixed-income investments has produced positive relative returns in 14 out of 18 years since 1 January 1998, equity investments in 13 out of 17 years, and fixed-income investments in 13 out of 18 years.

Chart 11 The fund's quarterly and accumulated annualised relative return. Percentage points

Quarterly relative return | Accumulated annualised relative return
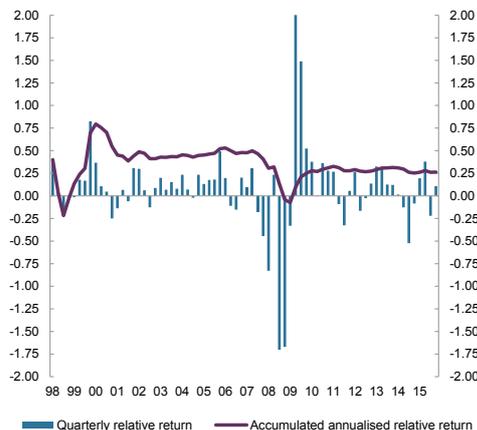
Source: Norges Bank Investment Management

Chart 12 Annual relative return for equity and fixed-income investments and total fund excluding real estate. Percentage points

Equity | Fixed income | Total fund ex real estate
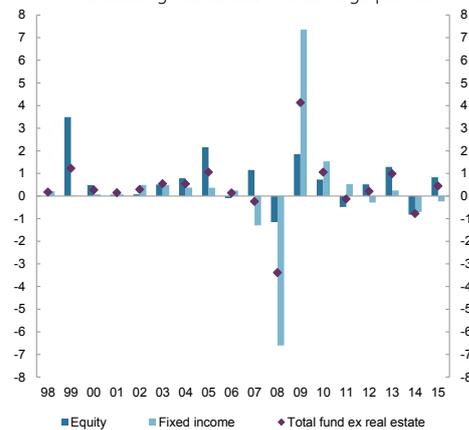
Source: Norges Bank Investment Management

Table 20   Relative return. Measured in the fund's currency basket. Annualised

	Since 01.01.1998	Last 10-years	Last 5-years	Last 3-years	2015
Return on equity and fixed-income investments (percent) [1]	5.62	5.32	7.17	8.53	2.52
Return on equity and fixed-income benchmark (percent) [1]	5.36	5.27	7.03	8.32	2.07
Relative return on equity and fixed-income investments (percentage points)	0.26	0.06	0.14	0.21	0.45

[1] Equity investments since 01.01.1999

	Since 01.01.1999	Last 10-years	Last 5-years	Last 3-years	2015
Return on equity investments (percent)	5.27	5.56	8.77	12.26	3.83
Return on equity benchmark (percent)	4.76	5.34	8.56	11.86	3.00
Relative return on equity investments (percentage points)	0.51	0.22	0.21	0.40	0.83

	Since 01.01.1998	Last 10-years	Last 5-years	Last 3-years	2015
Return on fixed-income investments (percent)	4.87	4.13	4.15	2.39	0.33
Return on bond benchmark (percent)	4.73	4.08	4.24	2.61	0.57
Relative return on fixed-income investments (percentage points)	0.14	0.04	-0.09	-0.22	-0.24

Table 21   Relative return, 5-year buckets. Measured in the fund's currency basket. Annualised

	1998-2002	2003- 2007	2008-2012	2013-2015
Return on equity and fixed-income investments (percent) [1]	3.19	8.92	3.15	8.53
Return on equity and fixed-income benchmark (percent) [1]	2.78	8.52	3.14	8.32
Relative return on equity and fixed-income investments (percentage points)	0.41	0.40	0.01	0.21

[1] Equity investments since 01.01.1999

	1999-2002	2003-2007	2008-2012	2013-2015
Return on equity investments (percent)	-4.85	16.28	-0.59	12.26
Return on equity benchmark (percent)	-5.63	15.37	-0.59	11.86
Relative return on equity investments (percentage points)	0.78	0.90	0.01	0.40

	1998-2002	2003-2007	2008-2012	2013-2015
Return on fixed-income investments (percent)	6.26	4.00	5.87	2.39
Return on bond benchmark (percent)	6.09	3.97	5.44	2.61
Relative return on fixed-income investments (percentage points)	0.17	0.03	0.43	-0.22

Table 22 Relative return per year. Measured in the fund's currency basket. Percentage points

Year	Equity	Fixed income	Total fund excl. real estate
1998		0.21	0.18
1999	3.49	0.01	1.23
2000	0.49	0.07	0.27
2001	0.06	0.08	0.15
2002	0.07	0.49	0.30
2003	0.51	0.48	0.55
2004	0.79	0.37	0.54
2005	2.16	0.36	1.06
2006	-0.09	0.25	0.14
2007	1.15	-1.29	-0.24
2008	-1.15	-6.60	-3.37
2009	1.86	7.36	4.13
2010	0.73	1.53	1.06
2011	-0.48	0.52	-0.13
2012	0.52	-0.29	0.21
2013	1.28	0.25	0.99
2014	-0.82	-0.70	-0.77
2015	0.83	-0.24	0.45

Table 23 Contributions from external management to the fund's relative return. Percentage points

	2015	2013-2015
Equity investments	0.08	0.13
Fixed-income investments	0.00	0.01
Total external management	0.09	0.14
Relative return on equity and fixed-income investments	0.45	0.21

CONTRIBUTIONS FROM INVESTMENT STRATEGIES

The overall relative return for equity and fixed-income investments of 45 basis points for 2015 can be broken down into the respective contributions from the equity and fixed-income portfolios as well as contributions from different investment strategies. Equity investments' relative return of 83 basis points contributed 52 basis points of the aggregate relative return, while fixed-income investments' relative return of -24 basis points resulted in a contribution of -10 basis points. Cross-asset allocation contributed 2 basis points.

The introduction of the internal reference portfolios has changed how the fund has been managed. 2013 was the first full year with internal reference portfolios for both asset classes.

Over the past three years, from 2013 to 2015, the annualised relative return for equity and fixed-income investments has been 21 basis points. Equity investments' annualised relative return of 40 basis points in this period contributed 25 basis points, fixed-income investments' annualised relative return of -22 basis points contributed -9 basis points, and cross-asset allocation contributed 5 basis points to the aggregate relative return.

External managers are used for taking a broad market exposure as part of the fund allocation strategy and for security selection mandates within specific regions and markets. These mandates contributed in total by 9 basis points in 2015 to the relative return for the equity and fixed-income investments.

Table 24 Contributions to relative return on equity and fixed-income investments from investment strategies in 2015. Percentage points

	Equity	Fixed income	Cross-asset allocation	Total
Fund allocation	0.15	-0.16	0.04	0.02
Internal reference portfolio	0.05	-0.17	0.00	-0.12
of which systematic factors	-0.12			-0.12
of which universe expansion	0.05	-0.18		-0.13
Allocation decisions	0.10	0.01	0.04	0.15
Security selection	0.21	0.03		0.24
Internal security selection	0.13	0.03		0.16
External security selection	0.08			0.08
Asset management	0.17	0.03	-0.01	0.18
Asset positioning	0.12	0.03	-0.01	0.14
Securities lending	0.05	0.00		0.05
Total	**0.52**	**-0.10**	**0.02**	**0.45**

Table 25 Contributions to relative return on equity and fixed-income investments from investment strategies from 2013-2015. Annualised. Percentage points

	Equity	Fixed income	Cross-asset allocation	Total
Fund allocation	-0.03	-0.17	0.06	-0.14
Internal reference portfolio	-0.02	-0.17	0.00	-0.20
of which systematic factors	-0.03			-0.03
of which universe expansion	0.04	-0.17		-0.13
Allocation decisions	-0.01	0.00	0.06	0.05
Security selection	0.11	0.01		0.12
Internal security selection	-0.01	0.01		0.00
External security selection	0.12			0.12
Asset management	0.18	0.06	0.00	0.24
Asset positioning	0.12	0.06	0.00	0.19
Securities lending	0.06	0.00		0.06
Total	**0.25**	**-0.09**	**0.05**	**0.21**

CONTRIBUTIONS PRIOR TO 2013

For the period 1999-2012, the relative return for the equity asset class can be decomposed into internal management and external management strategies. The internal management strategy for equities comprised asset management activities including transition, general risk management and securities lending, internally managed security selection mandates and other active portfolio management activities. External equity management mostly consisted of external security selection strategies.

Fixed-income investment activities' relative return can also be decomposed into internal and external management. During the financial crisis, a large portion of the externally managed mandates was transferred to the internal fixed-income portfolio for termination. During this period, the relative return from both internal and external fixed income strategies was impacted by the approach used when transitioning the external mandates into the internal fixed-income portfolio.

Table 26 Contributions to relative return from equity investment activities, 1999-2012. Annualised. Percentage points

	Contribution[1] to relative return
Relative return on equity investments	0.54
Contribution to relative return from internal management	0.22
Contribution to relative return from external management	0.32

[1] Based on aggregated profit and loss.

Table 27 Contributions to relative return from fixed-income investment activities, 1998-2012. Annualised. Percentage points

	Contribution[1] to relative return
Relative return on fixed-income investments	0.21
Contribution to relative return from internal management	0.42
Contribution to relative return from external management	-0.21

[1] Based on aggregated profit and loss.

FISCAL STRENGTH AND ENVIRONMENTAL MANDATES

The mandate from the Ministry of Finance requires the fund to take account of fiscal strength in its government bond investments. It also requires the fund to establish environment-related mandates with a market value that is normally in the range of 30-60 billion kroner.

Table 28 Impact on relative return to asset classes from Ministry of Finance requirements. Annualised. Percentage points

	2015	Last 3 years
Fiscal strength within fixed-income investments	-0.03	-0.07
Environmental mandates within equity investments	-0.02	0.03

Fund risk

The fund's absolute risk is to a large extent driven by its asset allocation. The expected absolute volatility of the fund was 10.4 percent at the end of 2015.

Market risk is defined as the risk of a decrease in the market value of the portfolio as a result of changes in financial market variables such as equity prices, exchange rates, interest rates, credit spreads and property prices. As no single measure or analysis can fully capture the fund's overall market risk, Norges Bank Investment Management uses a variety of measures and analyses. The fund's market risk is measured along different dimensions, including absolute exposure, volatility and correlation risk, systematic factor risk and liquidity risk.

The strategic benchmark index in the management mandate laid down by the Ministry of Finance largely dictates the fund's asset allocation, which is the main driver of the fund's overall risk. This can be demonstrated by plotting the returns of a hypothetical portfolio[1] made up of a fixed allocation of 60 percent

equities and 40 percent fixed income. The analysis shows that the majority of the return fluctuations in such a portfolio have been driven by equity volatility. Since 1900, the maximum loss in a single year is around 30 percent. Viewing return over periods of five and ten-years, the vast majority of these periods have a positive return. However, this asset allocation also results in both five and ten-year periods with negative return.

The management mandate requires the fund's equity exposure to be in the range of 50-70 percent. From 2007 to 2009, the fund's equity exposure increased gradually from 40 to 60 percent, mirroring the increase in the equity allocation in the strategic benchmark. At the end of 2015, actual equity allocation was 61.2 percent.

[1] The world equity and bond total return series from Dimson-Marsh-Staunton global return data is used for the analysis. The data mainly covers developed countries. The bond index tracks government bonds.

Chart 13 Annual return of 60 equity/40 fixed income. Measured in dollars. Percent

Equity contribution ◻ 60 equity/40 fixed income
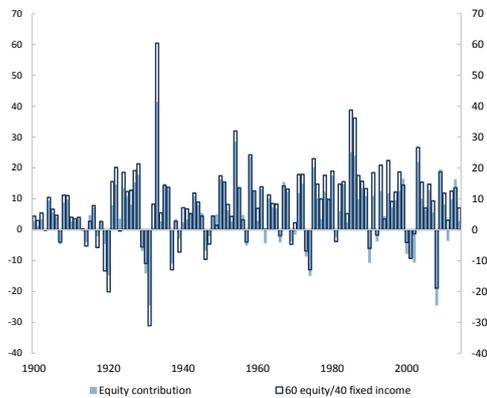
Source: Dimson-Marsh-Staunton Global Return Data

Chart 14 Annualised 5-year rolling return of 60 equity/40 fixed income. Measured in dollars. Percent

Equity contribution ◻ 60 equity/40 fixed income
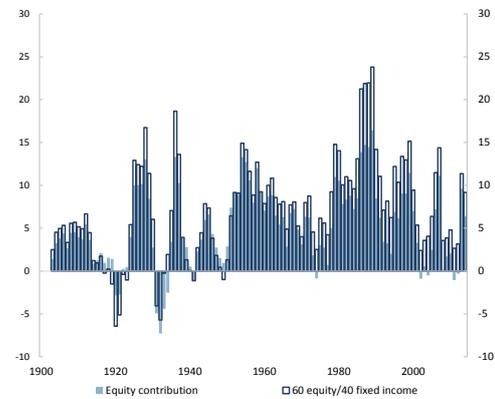
Source: Dimson-Marsh-Staunton Global Return Data

Chart 15 Annualised 10-year rolling return of 60 equity/40 fixed income. Measured in dollars. Percent

Equity contribution ◻ 60 equity/40 fixed income
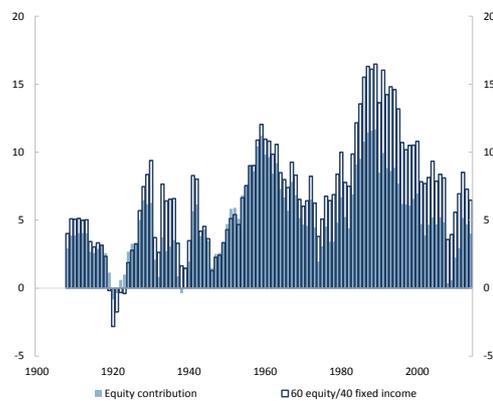
Source: Dimson-Marsh-Staunton Global Return Data

Chart 16 The fund's absolute equity exposure. Percent

Source: Norges Bank Investment Management

CONCENTRATION RISK

Concentration risk is absolute exposure to issuers, sectors, regions and other grouping levels. The main objective is to obtain a view of risk exposures without applying statistical assumptions.

The fund is invested globally and diversified across different dimensions, including asset classes, countries, sectors and issuers. Important aggregation levels for the equity portfolio include regional and sector allocation. For the fixed-income portfolio, regions, currencies and the allocation to sectors are important aggregation levels. Duration is another, reflecting exposure to interest rates.
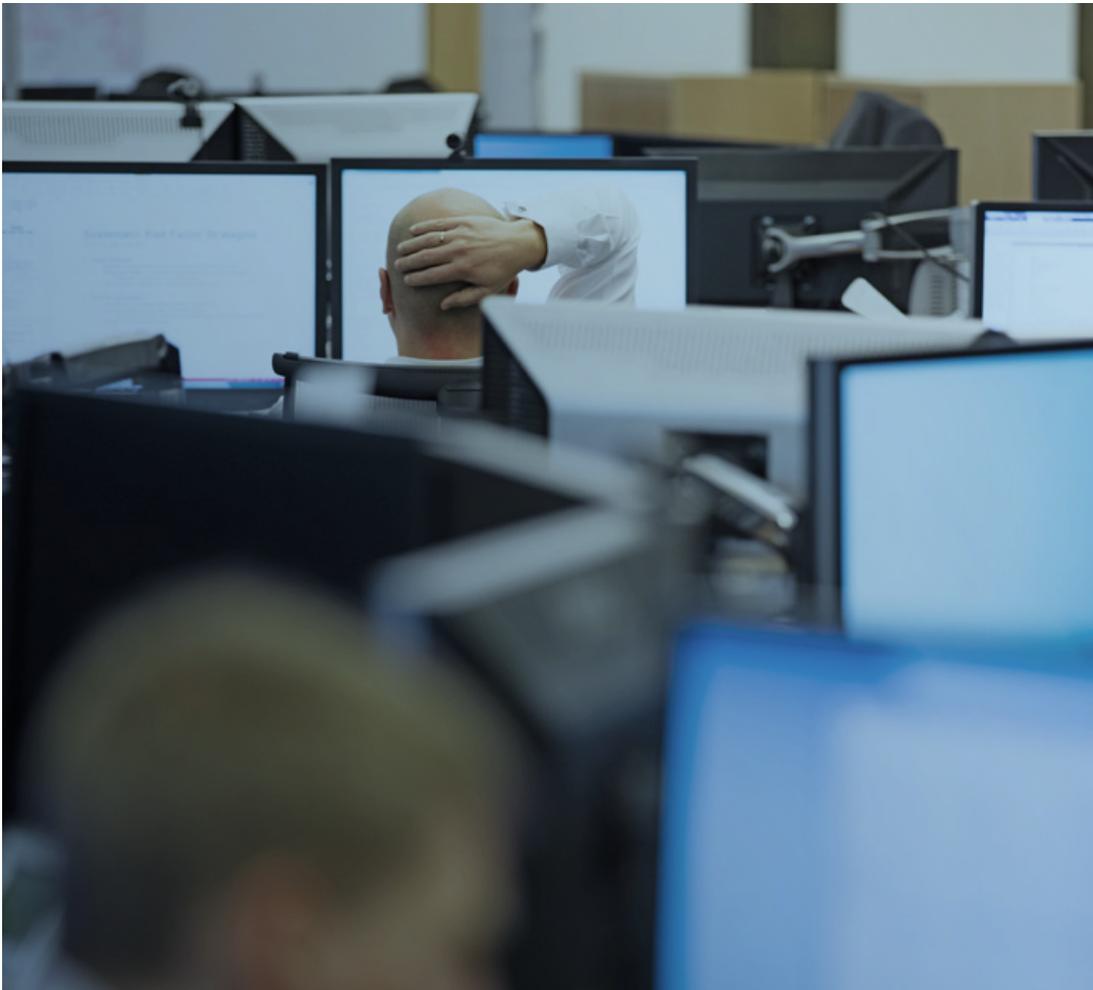
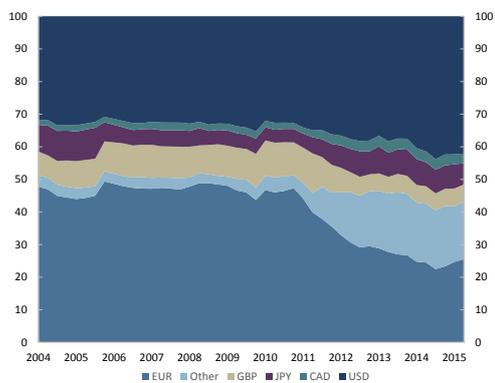**Chart 17** The fund's equity investments by region. Percent
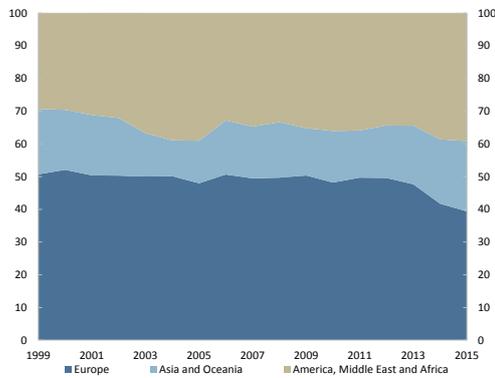
Source: Norges Bank Investment Management

Chart 18 The fund's fixed-income investments by region. Percent
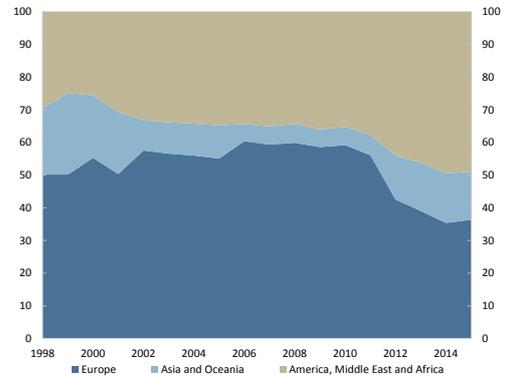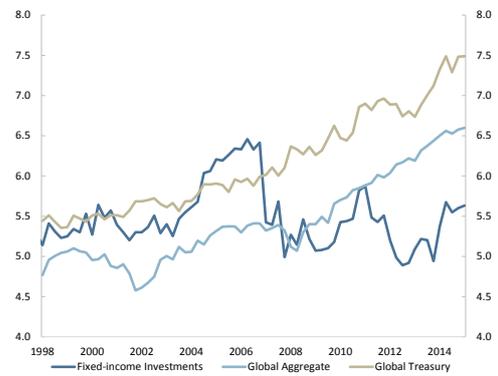

Source: Norges Bank Investment Management

Chart 19 The fund's fixed-income investments by currency distribution. Percent

Source: Norges Bank Investment Management

Chart 20 The duration of the fund's fixed-income investments, Barclays Global Aggregate Index and Barclays Global Treasury Index

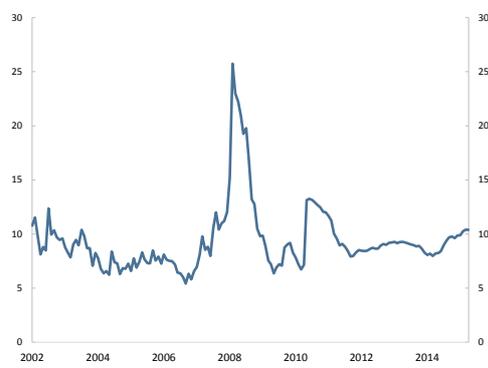Source: Barclays, Norges Bank Investment Management

EXPECTED ABSOLUTE VOLATILITY

The fund's expected absolute volatility, calculated using standard deviation, estimates how much the annual return on the fund's investments can be expected to fluctuate.

At the end of 2015, expected absolute volatility was 10.4 percent using a three-year price history. Estimated by simulations on the current portfolio, the expected volatility was 11.0 percent using a ten-year price history. Within this ten-year period the highest expected volatility of a consecutive three-year period was 14.4 percent and the lowest was 7.9 percent.

The volatility data show that the fund's expected absolute volatility increased significantly during the financial crisis and peaked at 25.7 percent at the end of October 2008, with the volatility of both the equity and fixed-income portfolios reaching record highs. Volatility fell back markedly in 2009, and except for a small spike in 2011, the fund's volatility has been around 10 percent in recent years. Over the last thirteen years, the average of expected absolute volatility was 9.4 percent at the fund level and 15.1 and 9.1 percent at the equity and fixed-income asset class level.

Chart 21   The fund's expected absolute volatility. Percent

Source: Norges Bank Investment Management

Chart 22   Expected absolute volatility per asset class. Percent
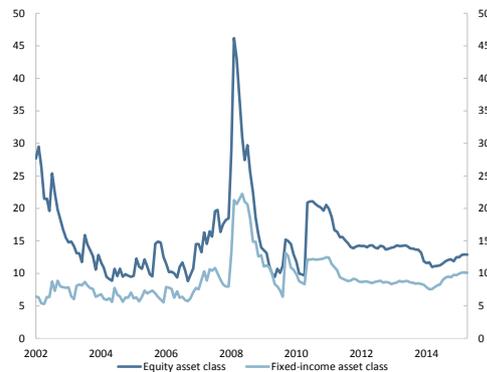
Source: Norges Bank Investment Management

BREAKDOWN OF EXPECTED ABSOLUTE VOLATILITY

The expected volatility of equity investments was 12.9 percent at the end of 2015. A decomposition of the portfolio by industry shows that investments in financials contributed most to the volatility in the portfolio, with 3.1 percentage points. This was, however, also the largest sector, representing 23.4 percent of equity investments at the end of 2015. The expected volatility of equity investments was 11.9 percent measured in the fund's currency basket at the end of the year.

The expected volatility of the fund's fixed-income investments was 10.1 percent at the end of 2015. Government bonds was the largest sector and contributed 5.8 percentage points of this. Volatility in the fixed-income portfolio was largely due to fluctuations in the value of the krone against the fund's currency basket. The expected absolute volatility of fixed-income investments was 2.7 percent measured in the currency basket at the end of the year.

Table 29 Risk contribution to equity investments as at 31 December 2015. Percent

Sector	Weight	Absolute volatility contribution
Oil and gas	5.4	0.6
Basic materials	5.1	0.6
Industrials	13.6	1.7
Consumer goods	14.5	1.8
Health care	10.7	1.5
Consumer services	11.0	1.4
Telecommunications	3.4	0.4
Utilities	3.3	0.4
Financials	23.4	3.1
Technology	9.0	1.2
Cash and derivatives	0.6	0.0
Total equities	**100.0**	**12.9**

Table 30 Risk contribution to fixed-income investments as at 31 December 2015. Percent

Sector	Weight	Absolute volatility contribution
Government bonds	56.0	5.8
Government related bonds	14.5	1.3
Inflation-linked bonds	4.5	0.5
Corporate bonds	20.5	2.3
Securitised bonds	6.4	0.6
Cash and derivatives	-1.9	-0.3
Total fixed income	**100.0**	**10.1**

Relative risk

Deviations from the benchmark are sources of relative risk. This section looks at different approaches to relative risk in the fund.

The composition of the fund differs from its benchmark indices along several dimensions, including currencies, sectors, countries, regions, individual stocks and individual bond issuers. These deviations from the benchmark are sources of relative risk. Relative risk is measured for the fund's equity and fixed-income investments, excluding real estate investments. The degree of deviation from the benchmark is regulated by the Ministry of Finance and Norges Bank's Executive Board.

EXPECTED RELATIVE VOLATILITY
The limit for expected relative volatility, or tracking error, is a restriction on how much the return on the fund's equity and fixed-income investments can be expected to deviate from the return on the benchmark index. This restriction is set out in the management mandate laid down by the Ministry of Finance. At the end of 2015, the fund should aim for expected relative volatility of no more than 1 percentage point. The limit for expected relative volatility was increased from 1 to 1.25 percentage points with effect from 1 February 2016. The estimated expected relative volatility at the end of 2015 was 0.28 percentage point using a three-year price history. Estimated by simulations on the current portfolio, the expected relative volatility using a ten-year price history was 0.37 percentage point. Within this ten-year period the highest expected relative volatility of a consecutive three-year period was 0.50 percentage point and the lowest was 0.26

percentage point. The average of expected relative volatility over the last 16 years was 0.40 percentage point.

Relative risk can be decomposed and calculated for different parts of the fund. The expected relative volatility of equity and fixed-income investments was 0.36 and 0.52 percentage points respectively at the end of 2015. The average of expected relative volatility over the last sixteen-years at the equity and fixed-income asset class levels was 0.60 and 0.44 percentage points respectively.

Relative volatility can also be estimated for different investment strategies. These calculations are performed for one strategy at a time, assuming that the rest of the fund is invested in line with the respective benchmarks. The relative volatility of the aggregated equity and fixed-income portfolio was lower than the sum of the relative volatilities of the corresponding sub-strategies, reflecting diversification across the strategies.

The mandate from the Ministry of Finance requires the Bank to take fiscal strength into account in its government bond investments. The mandate also requires the Bank to establish environment-related mandates with a market value that is normally in the range of 30-60 billion kroner. The expected relative volatility of these requirements at the end of 2015 was estimated to be 0.02 and 0.03 percentage points respectively, measured at fund level, and 0.05 percentage point each measured at respective asset class.

EXPECTED ABSOLUTE AND RELATIVE VOLATILITY
Expected absolute volatility estimates how much the annual return on the fund's investments can be expected to fluctuate,

while expected relative volatility, or expected tracking error, estimates how much the annual return on the fund's investments can be expected to deviate from the benchmark indices. Volatility is calculated using the statistical concept of standard deviation, which takes into account the correlation between different investments in the portfolio. Volatility is annualised using square root of time, with the underlying assumption that volatility and the composition of the portfolio are consistent over time.

From 1 January 2011, the method for calculating expected volatility, both absolute and relative, was revised to make it better suited to the fund's long-term investment horizon. Until the end of 2010, expected volatility was calculated using daily price observations, with observations from recent days being given greater weight than

observations further back in time. This meant that short-term changes in market conditions had a rapid and marked effect on expected volatility. The new method calculates volatility using weekly prices and a three-year price history, making it less sensitive to short-term market turbulence. As a result, changes in expected volatility will result more from changes in the fund's investments and less from short-term market volatility.

The increase in the fund's expected absolute and relative volatility in January 2011 was predominantly due to the introduction of the new calculation method. In addition, the limit for expected relative volatility set by the Ministry of Finance and Norges Bank's Executive Board was lowered from 1.5 percentage points to 1 percentage point from 1 January 2011.

Table 31 Expected relative volatility of investment strategies as at 31 December 2015. Each strategy measured stand-alone with the other strategies positioned in-line with the benchmarks. All numbers measured at fund level. Basis points

Strategy	Equity	Fixed income	Cross asset allocation	Total
Fund allocation	15	20	6	22
Internal reference portfolio	16	11	0	19
of which systematic factors	7			7
of which universe expansion	12	12		16
Allocation decisions	7	14	6	13
Security selection	15	2		14
Internal security selection	15	2		14
External security selection	5			5
Asset management	6	3	1	7
Asset positioning	6	3	1	7
Total	23	19	5	28

Table 32 Relative risk contribution to equity investments as at 31 December 2015. Basis points

| Sector	Relative volatility contribution
Oil and gas	2
Basic materials	2
Industrials	4
Consumer goods	7
Health care	4
Consumer services	3
Telecommunications	1
Utilities	2
Financials	8
Technology	3
Cash and derivatives	-1
Total equities	36

**Table 33** Relative risk contribution to fixed-income investments as at 31 December 2015. Basis points

Sector	Relative volatility contribution
Government bonds	33
Government-related bonds	-14
Inflation-linked bonds	14
Corporate bonds	15
Securitised bonds	1
Cash	4
Total fixed income	52

Chart 23 The fund's expected relative volatility. Basis points
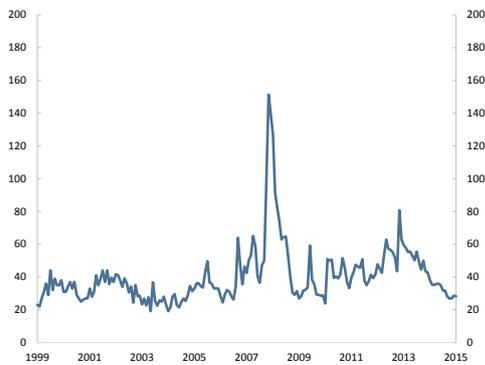
Source: Norges Bank Investment Management

Chart 24 Expected relative volatility per asset class. Basis points

Fixed-income asset class   Equity asset class
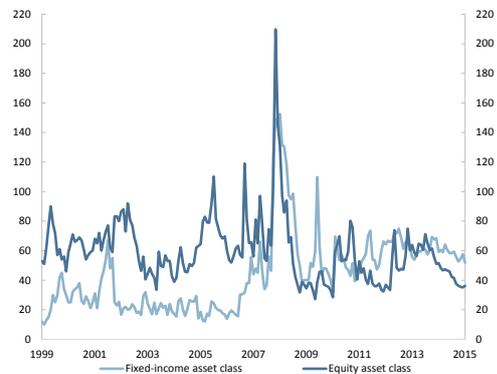
Source: Norges Bank Investment Management

EXPECTED SHORTFALL

Expected relative volatility is a point estimate of what happens under normal market conditions, but provides no information about the distribution and sizes of less probable outcomes (tail risk characteristics). Expected shortfall, also called conditional value at risk, is widely used as a tail risk measure. It measures the average expected loss in the worst q percent of observations, where q is the tail probability and equivalent to 1 minus the specified confidence level. The expected shortfall for the fund's portfolio at a 97.5 percent confidence level shows an expected negative deviation from the benchmark of 0.95 percentage point annually. The calculations are based on simulated relative return in the currency basket over the past ten years. The Executive board set a limit of 3.75 percent expected shortfall for the aggregated equity and fixed-income asset classes with effect from 1 March 2016.

Table 34 Expected relative volatility and expected shortfall of equity investments and fixed-income investments versus benchmark indexes as at 31 December 2015. Equity and fixed-income instruments measured versus market value of each asset class. Measured in the fund's currency basket. Basis points

	Expected relative volatility 3-years price history	Expected relative volatility 10-years price history	Expected shortfall 10-years price history
Equity	36	49	137
Fixed income	52	59	164
Equity and fixed income combined	28	37	95

Table 35 Expected relative volatility and expected shortfall relative to benchmark of investment strategies as at 31 December 2015. Each strategy measured stand-alone with the other strategies positioned in-line with the benchmarks. Measured in the fund's currency basket. Basis points

	Expected relative volatility 3-years price history	Expected relative volatility 10-years price history	Expected shortfall 10-years price history
Fund allocation	22	26	74
Internal reference portfolio	19	20	51
of which systematic factors	7	7	20
of which universe expansion	16	16	50
Allocation decisions	13	17	45
Security selection	14	24	73
Internal security selection	14	24	75
External security selection	5	5	14
Asset management	7	9	29
Asset positioning	7	9	29
Total	28	37	95

BENCHMARK OVERLAP

Benchmark overlap is an important part of relative risk and measures how closely the portfolios match the benchmark indices. In line with the management mandate from the Ministry of Finance, Norges Bank's Executive Board has set a minimum overlap between the equity and fixed-income portfolios and the corresponding benchmark indices of 60 percent. At the end of 2015, the benchmark overlap was 82.8 percent at security level for equities and 71.8 percent at issuer level for fixed income.

Over the past ten years, the equity benchmark overlap has been relatively stable and varied between 80 to 89 percent. The fixed-income overlap started at a low level before the financial crisis. As a result of portfolio restructuring and new mandate requirements for minimum benchmark overlap, the overlap increased sharply after 2008. In recent years, it has been in the range of 70-80 percent.
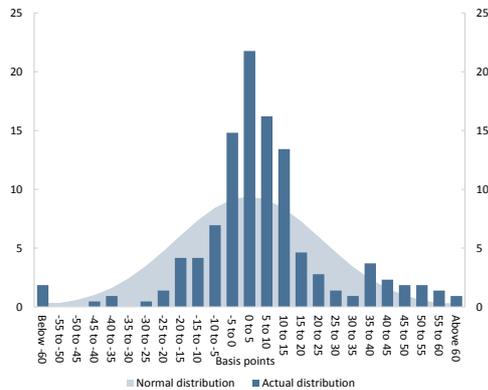
DISTRIBUTION OF RELATIVE RETURN

Another approach to relative risk is to analyse the distribution of the fund's realised relative return. Measured in the currency basket, the standard deviation of realised monthly relative return over the past five years has been 0.11 percent, smaller than those using longer sample periods. Excess kurtosis has also been lower over the past five years than over longer sample periods. Positive excess kurtosis indicates a higher probability of a large deviation from the benchmark than a normal distribution would predict.

Chart 25 The fund's benchmark overlap. Percent
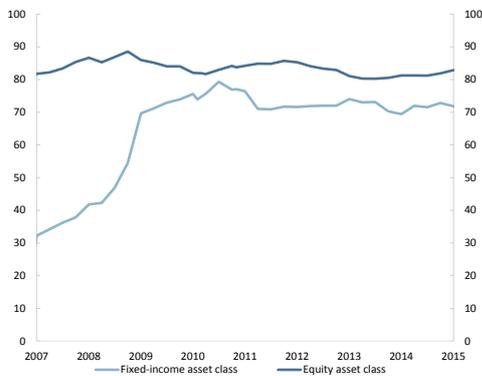
Source: Norges Bank Investment Management

Chart 26 The fund's monthly relative return distribution. Percent

Source: Norges Bank Investment Management

Table 36 Characteristics of the distribution for realised monthly relative return. Measured in the fund's currency basket

	Since 1998[1]	Last 10-years	Last 5-years	Last 3-years
Standard deviation relative return of equity and fixed-income investments (percent)	0.21	0.26	0.11	0.12
Skewness relative return of equity and fixed-income investments	-2.24	-1.97	-0.08	0.07
Excess kurtosis relative return of equity and fixed-income investments	16.25	10.69	0.53	0.67
Standard deviation relative return of equity investments (percent)	0.23	0.22	0.13	0.14
Skewness relative return of equity investments	-0.75	-2.78	-0.72	-0.74
Excess kurtosis relative return of equity investments	9.43	16.19	0.93	1.07
Standard deviation relative return of fixed-income investments (percent)	0.31	0.41	0.14	0.16
Skewness relative return of fixed-income investments	-0.55	-0.38	-0.09	0.10
Excess kurtosis relative return of fixed-income investments	15.31	7.82	-0.14	-0.53

[1] Equity investments since 01.01.1999

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Table 37 Characteristics of the distribution for realised monthly relative return. Five-year periods. Measured in the fund's currency basket

	1998-2002[1]	2003-2007	2008-2012	2013-2015
Standard deviation relative return of equity and fixed-income investments (percent)	0.12	0.12	0.35	0.12
Skewness relative return of equity and fixed-income investments	0.79	-1.44	-1.68	0.07
Excess kurtosis relative return of equity and fixed-income investments	2.44	4.47	6.18	0.67
Standard deviation relative return of equity investments (percent)	0.29	0.22	0.24	0.14
Skewness relative return of equity investments	1.03	-0.23	-3.62	-0.74
Excess kurtosis relative return of equity investments	3.10	0.54	20.37	1.07
Standard deviation relative return of fixed-income investments (percent)	0.09	0.11	0.57	0.16
Skewness relative return of fixed-income investments	-0.55	-3.48	-0.45	0.10
Excess kurtosis relative return of fixed-income investments	11.49	13.73	3.56	-0.53

[1] Equity investments since 01.01.1999

Cost and risk-adjusted return

The following looks at the costs associated with fund management and different approaches to risk-adjusted return.

The Ministry of Finance has delegated responsibility for the management of the fund to Norges Bank. The Executive Board of Norges Bank has in turn delegated the day-to-day management of the fund to Norges Bank Investment Management. The ministry reimburses Norges Bank for costs incurred in the management of the fund, in the form of a management fee. The ministry sets an annual limit for the management fee, and the fee paid is equivalent to the actual costs incurred by Norges Bank within this limit. Performance-based fees to external managers are reimbursed separately. Costs included in the management fee are specified in the management costs note in the annual report for the fund. Management costs are also incurred by subsidiaries of Norges Bank in relation to unlisted real estate investments. These costs are not reimbursed or included in the management fee, since they are expensed directly in the investment portfolio. Costs related to the management of Norges Bank's foreign exchange reserves and the Norwegian Finance Initiative are not included.

MANAGEMENT COSTS BY STRATEGY
Norges Bank Investment Management pursues different strategies in the management of the fund. There are information and cost synergies between the strategies, and there is not always a direct link between a specific cost type and investment strategy. For example, costs related to a specific system or data feed might be utilised in multiple strategies. Costs are allocated to the different strategies using an allocation key.

Costs are tracked through designated cost centres, and these cost centres have been mapped to the organisation and investment strategies. Costs related to office premises and IT infrastructure are allocated to the relevant strategy based on headcount.

Custody costs consist of safekeeping and transaction costs. Safekeeping costs are allocated to the asset management strategy, while transaction costs have been split between the relevant strategies. Costs allocated to the external security selection strategy consist of a base fee and a performance fee to external managers, as well as costs related to the internal team managing the external managers. Specific system costs are allocated to each strategy using an allocation key based on usage.

Chart 27 Total management cost versus total market value of fund. Cost as reimbursed by the Ministry of Finance. Basis points
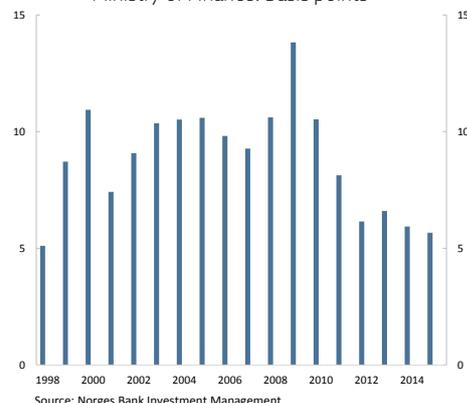
Source: Norges Bank Investment Management

Table 38 Management cost per investment strategy in 2015. Cost as reimbursed by the Ministry of Finance. Basis points

	Contribution to the fund's management cost	Management cost based on assets under management
Fund allocation	0.4	
Asset management	2.2	2.7
Security selection	2.6	16.4
Internal security selection	0.8	7.0
External security selection[1]	1.8	43.2
Real estate	0.5	18.5
Total	5.7	

[1] Includes all externally managed capital.

Table 39 Management cost per investment strategy 2013 - 2015. Cost as reimbursed by the Ministry of Finance. Basis points

	Contribution to the fund's management cost	Management cost based on assets under management
Fund allocation	0.4	
Asset management	2.5	2.9
Security selection	2.8	21.2
Internal security selection	0.7	7.5
External security selection[1]	2.1	54.0
Real estate	0.4	27.9
Total	6.1	

[1] Includes all externally managed capital.

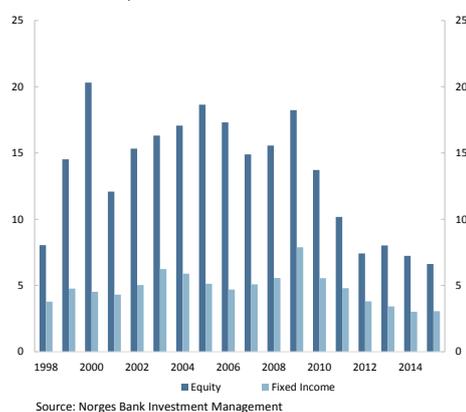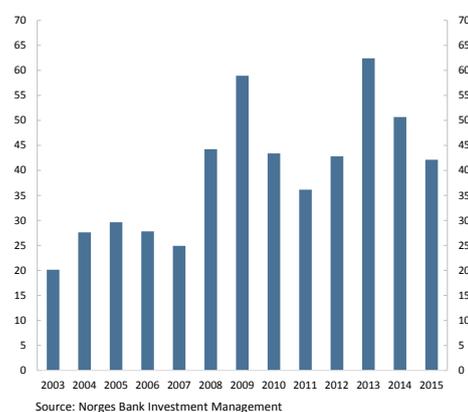**Chart 28** Management cost per asset class. Cost as reimbursed by the Ministry of Finance. Basis points

Equity   Fixed Income

Source: Norges Bank Investment Management

Chart 29 Fees to external equity managers. Basis points

Source: Norges Bank Investment Management

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RISK-ADJUSTED RETURN

The fund's return as discussed in the previous sections of this report is useful for assessing the fund's achievements against its long-term targets. It is, however, not appropriate to rely only on the figures presented so far when evaluating the fund's achievements as an asset manager or when comparing the results to other institutions in the industry. It is important to recognise that these figures depend on a number of guidelines and restrictions in the fund's management mandate which to a large extent govern the fund's exposure to risk and consequently the potential for higher return. Risk-adjusted performance measures aim to standardise performance results by accounting for the risks taken when obtaining these return. Even when using risk-adjusted performance measures to compare asset managers, the differences in their investment mandates should be kept in mind.

Monthly return

The risk-adjusted performance measures are estimated using monthly return and then annualised. The annualised mean return reported here reflect this and are therefore estimates of average return, as opposed to the return reported in previous sections that measure realised accumulation of wealth. Results are reported both before and after management costs. No adjustments for costs are applied to the benchmarks.

Sharpe ratio

The Sharpe ratio is a widely used risk-adjusted performance measure. The Sharpe ratio is computed by dividing the average portfolio return in excess of the risk-free rate by the standard deviation of portfolio return. A higher Sharpe ratio indicates a higher expected reward per unit of total risk.

Across all periods, the Sharpe ratio for the fund's equity and fixed-income investments was similar to the benchmark's Sharpe ratio. This is a consequence of the fund having limited scope to deviate from the benchmark. Although equity and fixed-income investments had a higher volatility of return than the benchmark, the average fund return was also higher, resulting in a similar reward-to-variability ratio.

Since periods that include the turmoil of 2008-2009 were characterised by both a lower average return and a higher volatility of return, the Sharpe ratios for both the fund and the benchmark in these periods were lower than for other periods. The negative Sharpe ratios in the period 1998-2002 reflect the relatively high risk-free rate compared to the average return of the investments and the benchmark index.

As in the case of the total investment portfolio, the Sharpe ratio for equity investments was close to the Sharpe ratio for the benchmark index for all periods, with both ratios displaying significant variation across time. For both the fund and the benchmark, the Sharpe ratios were lower than the ratios for the total equity and fixed-income investments.

When comparing fixed-income investments to the benchmark index, the choice of evaluation period is more important than for equity investments and the total portfolio. This is evident when comparing the Sharpe ratio difference for the past ten-years and the past five years.

Information ratio

The Sharpe ratio measures absolute risk-adjusted performance and ranks portfolios based on the estimated trade-off between

total risk and return. Compared to the Sharpe ratio, the information ratio substitutes the benchmark for the risk-free rate and divides the mean of the portfolio return relative to the benchmark by the standard deviation of that relative return. The information ratio therefore measures risk using deviations from the benchmark.

The information ratio for fixed-income investments was lower than the information ratio for equity and total investments in almost all periods. This was both due to greater volatility in relative return and a lower mean of relative return. For the past five years and past three years, the information ratio for fixed-income investments was negative and quite large in absolute magnitude due to a combination of negative relative return and low volatility in the relative return. Note that fixed-income investments had higher Sharpe ratios than the benchmark index in the same periods. For the period from 2008 to 2012, the opposite was true for fixed-income investments, with a positive information ratio but a lower Sharpe ratio than the benchmark index.

Jensen's alpha
Under the assumptions of the Capital Asset Pricing Model (CAPM), all differences in expected return are explained by beta. Beta measures systematic risk and is estimated using a regression of the portfolio return in excess of the risk-free rate on the benchmark excess return. Jensen's alpha is the residual average return after correcting for the portfolio's beta. Jensen's alpha assumes that the only relevant risk is the risk that cannot be diversified away, whereas the Sharpe ratio assumes that total risk is the relevant measure.

While the CAPM theoretically should be able to price all assets, it should be noted that it is most commonly applied to equities. Considering equity and fixed-income investments separately, Jensen's alpha was positive for all periods shown in the table before management costs. For equity and fixed-income investments combined, the sign of Jensen's alpha depends on the evaluation period. The periods containing the financial crisis in 2008-2009 had a higher beta than other periods indicating higher systematic risk.

Appraisal ratio
The appraisal ratio is similar to the Sharpe ratio, but instead of measuring the total risk/ return trade-off, it is computed after adjusting for systematic risk. For the fund, this corresponds to adjusting risk and return for variability stemming from the benchmark. The appraisal ratio is estimated by dividing Jensen's alpha by the standard deviation of the residuals from the CAPM regression.

Due to the negative Jensen's alpha for equity and fixed-income investments over the past ten-years and the period 2008-2012, these periods had a negative appraisal ratio. The appraisal ratio was higher for equity investments than for fixed-income investments in most periods. However, as indicated above, care should be taken when evaluating risk using the CAPM for fixed-income investments.

Table 40 Risk-adjusted measures for equity investments. Before and after management costs. Annualised

	Since 01.01.1999		Last 10 years		Last 5 years		Last 3 years	
	Before costs	After costs	Before costs	After costs	Before costs	After costs	Before costs	After costs
Returns								
Mean return equity investments (percent)	6.26	6.12	6.58	6.46	9.11	9.03	12.13	12.06
Mean return equity benchmark index (percent)	5.72	5.72	6.31	6.31	8.89	8.89	11.75	11.75
Mean relative return equity investments (percentage points)	0.54	0.41	0.27	0.15	0.22	0.14	0.38	0.30
Mean risk-free rate (percent)	1.88	1.88	1.12	1.12	0.02	0.02	0.00	0.00
Risk measures								
Standard deviation return of equity investments (percent)	14.84	14.84	15.12	15.12	11.65	11.65	10.24	10.24
Standard deviation return of equity benchmark index (percent)	14.49	14.49	14.72	14.72	11.43	11.43	10.05	10.05
Standard deviation relative return of equity investments (percent)	0.81	0.81	0.75	0.75	0.45	0.45	0.47	0.47
CAPM beta equity investments	1.02	1.02	1.03	1.03	1.02	1.02	1.02	1.02
Standard deviation residuals of CAPM regression for equity investments (percent)	0.74	0.74	0.65	0.64	0.40	0.40	0.44	0.44
Risk-adjusted measures								
Sharpe ratio equity investments	0.30	0.29	0.36	0.35	0.78	0.77	1.18	1.18
Sharpe ratio equity benchmark index	0.26	0.26	0.35	0.35	0.78	0.78	1.17	1.17
Sharpe ratio difference equity investments versus benchmark index	0.03	0.02	0.01	0.00	0.00	0.00	0.02	0.01
Information ratio equity investments	0.67	0.50	0.36	0.21	0.49	0.32	0.80	0.65
Jensen's alpha equity investments (percent)	0.46	0.32	0.14	0.02	0.06	-0.02	0.17	0.10
Appraisal ratio equity investments	0.62	0.43	0.21	0.03	0.14	-0.06	0.38	0.22

Table 41 Risk-adjusted measures for equity investments. Before and after management costs. Annualised

	1999-2002		2003-2007		2008-2012		2013-2015	
	Before costs	After costs	Before costs	After costs	Before costs	After costs	Before costs	After costs
Returns								
Mean return equity investments (percent)	-3.54	-3.70	15.59	15.43	1.25	1.12	12.13	12.06
Mean return equity benchmark index (percent)	-4.42	-4.42	14.78	14.78	1.15	1.15	11.75	11.75
Mean relative return equity investments (percentage points)	0.88	0.72	0.81	0.64	0.11	-0.02	0.38	0.30
Mean risk-free rate (percent)	3.93	3.93	2.88	2.88	0.37	0.37	0.00	0.00
Risk measures								
Standard deviation return of equity investments (percent)	16.88	16.88	9.24	9.24	19.11	19.11	10.24	10.24
Standard deviation return of equity benchmark index (percent)	16.55	16.55	9.00	9.00	18.60	18.60	10.05	10.05
Standard deviation relative return of equity investments (percent)	1.00	1.00	0.76	0.76	0.84	0.84	0.47	0.47
CAPM beta equity investments	1.02	1.02	1.02	1.02	1.03	1.03	1.02	1.02
Standard deviation residuals of CAPM regression for equity investments (percent)	0.97	0.97	0.74	0.74	0.68	0.68	0.44	0.44
Risk-adjusted measures								
Sharpe ratio equity investments	-0.44	-0.45	1.38	1.36	0.05	0.04	1.18	1.18
Sharpe ratio equity benchmark index	-0.50	-0.50	1.32	1.32	0.04	0.04	1.17	1.17
Sharpe ratio difference equity investments versus benchmark index	0.06	0.05	0.05	0.03	0.00	0.00	0.02	0.01
Information ratio equity investments	0.87	0.72	1.07	0.85	0.13	-0.03	0.80	0.65
Jensen's alpha equity investments (percent)	1.03	0.87	0.53	0.36	0.09	-0.04	0.17	0.10
Appraisal ratio equity investments	1.06	0.90	0.72	0.49	0.13	-0.07	0.38	0.22

Table 42 Risk-adjusted measures for fixed-income investments. Before and after management costs. Annualised

	Since 01.01.1998		Last 10 years		Last 5 years		Last 3 years	
	Before costs	After costs	Before costs	After costs	Before costs	After costs	Before costs	After costs
Returns								
Mean return fixed-income investments (percent)	4.82	4.77	4.11	4.07	4.11	4.07	2.40	2.36
Mean return fixed-income benchmark index (percent)	4.68	4.68	4.06	4.06	4.20	4.20	2.62	2.62
Mean relative return fixed-income investments (percentage points)	0.14	0.09	0.05	0.00	-0.09	-0.13	-0.22	-0.26
Mean risk-free rate (percent)	2.04	2.04	1.12	1.12	0.02	0.02	0.00	0.00
Risk measures								
Standard deviation return of fixed-income investments (percent)	3.38	3.38	3.53	3.53	2.57	2.57	2.64	2.64
Standard deviation return of fixed-income benchmark index (percent)	3.21	3.21	3.24	3.24	2.80	2.80	2.92	2.92
Standard deviation relative return of fixed-income investments (percent)	1.08	1.08	1.43	1.43	0.47	0.47	0.54	0.54
CAPM beta fixed-income investments	1.00	1.00	1.00	1.00	0.91	0.91	0.89	0.89
Standard deviation residuals of CAPM regression for fixed-income investments (percent)	1.08	1.08	1.44	1.44	0.40	0.40	0.45	0.45
Risk-adjusted measures								
Sharpe ratio fixed-income investments	0.82	0.81	0.85	0.84	1.59	1.57	0.91	0.90
Sharpe ratio fixed-income benchmark index	0.82	0.82	0.91	0.91	1.49	1.49	0.90	0.90
Sharpe ratio difference fixed-income investments versus benchmark index	0.00	-0.01	-0.06	-0.07	0.10	0.08	0.01	0.00
Information ratio fixed-income investments	0.13	0.08	0.03	0.00	-0.19	-0.27	-0.41	-0.47
Jensen's alpha fixed-income investments (percent)	0.13	0.08	0.04	-0.01	0.29	0.26	0.06	0.03
Appraisal ratio fixed-income investments	0.12	0.08	0.02	-0.01	0.73	0.64	0.14	0.07

Table 43 Risk-adjusted measures for fixed-income investments. Before and after management costs. Annualised

	1998-2002		2003-2007		2008-2012		2013-2015	
	Before costs	After costs	Before costs	After costs	Before costs	After costs	Before costs	After costs
Returns								
Mean return fixed-income investments (percent)	6.13	6.08	3.98	3.92	5.81	5.75	2.40	2.36
Mean return fixed-income benchmark index (percent)	5.97	5.97	3.95	3.95	5.37	5.37	2.62	2.62
Mean relative return fixed-income investments (percentage points)	0.16	0.12	0.03	-0.02	0.44	0.38	-0.22	-0.26
Mean risk-free rate (percent)	4.09	4.09	2.88	2.88	0.37	0.37	0.00	0.00
Risk measures								
Standard deviation return of fixed-income investments (percent)	3.06	3.06	3.04	3.04	4.27	4.27	2.64	2.64
Standard deviation return of fixed-income benchmark index (percent)	3.05	3.05	3.10	3.10	3.62	3.62	2.92	2.92
Standard deviation relative return of fixed-income investments (percent)	0.31	0.31	0.37	0.37	1.96	1.96	0.54	0.54
CAPM beta fixed-income investments	1.00	1.00	0.98	0.98	1.06	1.06	0.89	0.89
Standard deviation residuals of CAPM regression for fixed-income investments (percent)	0.31	0.31	0.37	0.37	1.96	1.96	0.45	0.45
Risk-adjusted measures								
Sharpe ratio fixed-income investments	0.67	0.65	0.36	0.34	1.27	1.26	0.91	0.90
Sharpe ratio fixed-income benchmark index	0.62	0.62	0.34	0.34	1.38	1.38	0.90	0.90
Sharpe ratio difference fixed-income investments versus benchmark index	0.05	0.04	0.02	0.00	-0.11	-0.12	0.01	0.00
Information ratio fixed-income investments	0.52	0.38	0.08	-0.06	0.22	0.20	-0.41	-0.47
Jensen's alpha fixed-income investments (percent)	0.16	0.12	0.05	0.00	0.15	0.10	0.06	0.03
Appraisal ratio fixed-income investments	0.52	0.38	0.13	-0.01	0.08	0.05	0.14	0.07

Table 44 Risk-adjusted measures for equity and fixed-income investments. Before and after management costs. Annualised

	Since 01.01.1998		Last 10 years		Last 5 years		Last 3 years	
	Before costs	After costs	Before costs	After costs	Before costs	After costs	Before costs	After costs
Returns								
Mean return equity and fixed-income investments (percent)	5.77	5.68	5.60	5.51	7.19	7.13	8.44	8.38
Mean return equity and fixed-income benchmark index (percent)	5.49	5.49	5.49	5.49	7.05	7.05	8.24	8.24
Mean relative return equity and fixed-income investments (percentage points)	0.28	0.19	0.11	0.02	0.14	0.08	0.20	0.15
Mean risk-free rate (percent)	2.04	2.04	1.12	1.12	0.02	0.02	0.00	0.00
Risk measures								
Standard deviation return of equity and fixed-income investments (percent)	7.58	7.58	8.93	8.93	7.11	7.11	6.80	6.80
Standard deviation return of equity and fixed-income benchmark index (percent)	7.17	7.17	8.34	8.34	6.96	6.96	6.68	6.68
Standard deviation relative return of equity and fixed-income investments (percent)	0.72	0.72	0.90	0.90	0.38	0.38	0.40	0.40
CAPM beta equity and fixed-income investments	1.05	1.05	1.07	1.07	1.02	1.02	1.02	1.02
Standard deviation residuals of CAPM regression for equity and fixed-income investments	0.61	0.61	0.71	0.71	0.36	0.36	0.39	0.39
Risk-adjusted measures								
Sharpe ratio equity and fixed-income investments	0.49	0.48	0.50	0.49	1.01	1.00	1.24	1.23
Sharpe ratio equity and fixed-income benchmark index	0.48	0.48	0.52	0.52	1.01	1.01	1.23	1.23
Sharpe ratio difference equity and fixed-income investments versus benchmark index	0.01	0.00	-0.02	-0.03	0.00	-0.01	0.01	0.00
Information ratio equity and fixed-income investments	0.39	0.27	0.12	0.02	0.37	0.20	0.51	0.36
Jensen's alpha equity and fixed-income investments (percent)	0.10	0.01	-0.19	-0.27	0.00	-0.06	0.07	0.01
Appraisal ratio equity and fixed-income investments	0.16	0.01	-0.26	-0.38	0.01	-0.16	0.17	0.02

Table 45 Risk-adjusted measures for equity and fixed-income investments. Before and after management costs. Annualised

	1998-2002		2003-2007		2008-2012		2013-2015	
	Before costs	After costs	Before costs	After costs	Before costs	After costs	Before costs	After costs
Returns								
Mean return equity and fixed-income investments (percent)	3.33	3.24	8.65	8.55	3.74	3.64	8.44	8.38
Mean return equity and fixed-income benchmark index (percent)	2.92	2.92	8.27	8.27	3.63	3.63	8.24	8.24
Mean relative return equity and fixed-income investments (percentage points)	0.41	0.32	0.38	0.28	0.11	0.01	0.20	0.15
Mean risk-free rate (percent)	4.09	4.09	2.88	2.88	0.37	0.37	0.00	0.00
Risk measures								
Standard deviation return of equity and fixed-income investments (percent)	6.13	6.13	3.82	3.82	11.31	11.31	6.80	6.80
Standard deviation return of equity and fixed-income benchmark index (percent)	6.02	6.02	3.66	3.66	10.46	10.46	6.68	6.68
Standard deviation relative return of equity and fixed-income investments (percent)	0.43	0.42	0.42	0.42	1.20	1.20	0.40	0.40
CAPM beta equity and fixed-income investments	1.02	1.02	1.04	1.04	1.08	1.08	1.02	1.02
Standard deviation residuals of CAPM regression for equity and fixed-income investments	0.42	0.42	0.39	0.39	0.87	0.87	0.39	0.39
Risk-adjusted measures								
Sharpe ratio equity and fixed-income investments	-0.12	-0.14	1.51	1.48	0.30	0.29	1.24	1.23
Sharpe ratio equity and fixed-income benchmark index	-0.19	-0.19	1.47	1.47	0.31	0.31	1.23	1.23
Sharpe ratio difference equity and fixed-income investments versus benchmark index	0.07	0.06	0.03	0.01	-0.01	-0.02	0.01	0.00
Information ratio equity and fixed-income investments	0.96	0.76	0.91	0.67	0.09	0.01	0.51	0.36
Jensen's alpha equity and fixed-income investments (percent)	0.43	0.34	0.16	0.06	-0.15	-0.25	0.07	0.01
Appraisal ratio equity and fixed-income investments	1.03	0.83	0.41	0.15	-0.17	-0.28	0.17	0.02

FACTOR-ADJUSTED RETURN

Analyses of this type involve multivariate regressions of relative return against sets of historical factor return series. Estimated regression coefficients are then interpreted as active exposures to systematic factors over the historical period. Regression intercepts are interpreted as performance attributable to manager value creation over and above the exposure to the set of factors considered in the regression. All regressions are conducted using relative return after management costs and factor return in dollars.

For equity investments, the factor set used for the main regression specification is the five-factor model of Fama and French (2015)[1]. The factor return data used are research factors from Kenneth French's website. In these regressions, factors explain between 31 and 48 percent of the variability in the relative return of equity investments for the three sample periods considered: Since inception, past ten years and past five years. Under this model specification, the relative return of equity investments are estimated to have had a positive active exposure to the market factor (MKT) and the small firm (SMB) factor both for the full sample period and for the past ten-year period. In the past five-year period, only the market factor is significant at standard statistical confidence levels. The external academic advisory panel Norges Bank's Expert Group on Principles for Risk Adjustment of Performance Figures argue that it is important for interpretation of the results that the factor portfolios used in these types of regressions are investable for the portfolio manager. The impact of making simple investability

adjustments to the factor return series is considered in the appendix. Subsequent reporting will be updated to reflect future research on this topic.

For fixed-income investments, the factor set is based on Fama and French (1993)[2], who use a default factor and a term factor. The factor return data have been calculated by Norges Bank Investment Management, based on Barclays data. Both have been constructed as global factors, and the default factor has been adjusted to take duration differences in the credit and government segments of the fixed-income benchmark into account. The construction of global factors introduces sovereign risk into the term factor due to differences in currency composition between global long-maturity and global short-maturity indices. This is discussed in more detail in the appendix. In the fixed-income regressions, factors explain between 30 and 40 percent of the variability in the relative return. Under this model specification, the relative return of fixed-income investments are estimated to have had exposure to the default premium factor over the full sample period and the past ten-year period. Over the past five-year period, only the regression coefficient for the negative term premium is significant at standard statistical confidence levels.

For equity and fixed-income investments combined, the chosen factor set is the combination of the factors used for each asset class. In line with the expert group's recommendation, the only market factor included is the Fama-French equity market factor (MKT). In these regressions, factors

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[1] Fama, E. and French, K. (2015): "International Tests of a Five-Factor Asset Pricing Model", Fama-Miller Working Paper, Tuck School of Business Working Paper No. 2622782.
[2] Fama, E. and French, K. (1993): "Common Risk Factors in the Returns on Stocks and Bonds", Journal of Financial Economics 33, 3-56.

Table 46 Equity investments. Regression analysis of relative return in dollars after management costs

	Intercept, bps annualised		Regression coefficients						Variance explained in percent (R squared)
Sample period	Before management costs	After management costs	Market (MKT)	Small vs large (SMB)	Cheap vs expensive (HML)	Profitable vs unprofitable (RMW)	Conservative vs aggressive investment (CMA)		
Since 01.01.1999	35	21	**0.02**	**0.05**	-0.01	0.02	-0.01		47
Last 10 years	15	3	**0.02**	**0.04**	-0.01	0.02	-0.03		48
Last 5 years	19	11	**0.02**	0.02	0.01	-0.01	-0.01		31

Source: Norges Bank Investment Management, Kenneth French. Bold indicates significant at 5 percent confidence level.
Note: Regression coefficients are equal for both before and after management cost regressions. Reported R^2 is from the after management cost regressions.

Table 47 Fixed-income investments. Regression analysis of relative return in dollars after management costs

	Intercept, bps annualised		Regression coefficients	Default (duration adjusted)	Term	Variance explained in percent (R squared)
Sample period	Before management costs	After management costs				
Since 01.01.1998	13	9		**0.08**	-0.02	30
Last 10 years	1	-4		**0.10**	-0.03	40
Last 5 years	15	11		0.00	**-0.05**	31

Source: Norges Bank Investment Management, Barclays Capital. Bold indicates significant at 5 percent confidence level.
Note: Regression coefficients are equal for both before and after management cost regressions. Reported R^2 is from the after management cost regressions.

Table 48 Equity and fixed-income investments. Regression analysis of relative return in dollars after management costs. Sample period

	Intercept, bps annualised		Regression coefficients							Variance explained in percent (R squared)
Sample period	Before management costs	After management costs	Market (MKT)	Small vs large (SMB)	Cheap vs expensive (HML)	Profitable vs unprofitable (RMW)	Conservative vs aggressive investment (CMA)	Default (duration adjusted)	Term	
Since 01.01.1998	7	-2	**0.02**	**0.03**	0.01	0.03	**-0.02**	**0.03**	-0.01	57
Last 10 years	1	-7	**0.02**	**0.04**	**0.02**	0.02	**-0.05**	**0.03**	-0.01	69
Last 5 years	16	10	**0.01**	0.03	0.00	0.02	0.01	0.01	**-0.04**	49

Source: Norges Bank Investment Management, Kenneth French, Barclays Capital. Bold indicates significant at 5 percent confidence level.
Note: Regression coefficients are equal for both before and after management cost regressions. Reported R^2 is from the after management cost regressions.

explain 49 to 69 percent of the variability in relative return for the three sample periods considered. Under this model specification, the signs of the estimated exposures are qualitatively in line with the results for the asset classes. However, for equity and fixed-income investments, the value (HML) coefficient is positive for the last ten-year period.

COST-ADJUSTED RELATIVE RETURN

The fund's relative return after management costs can be compared with the investment performance that could theoretically be expected to be achieved with a passive index management strategy. A passive investment strategy would aim at replicating a benchmark following set rules. The estimated relative return of a passive strategy is dependent on various estimated cost components. The key return adjustments made are management costs of a passive strategy, revenues from securities lending, transaction costs related to replication of the benchmark index, and transaction costs related to inflows and extraordinary benchmark changes.

Management costs of a passive strategy

The estimated management costs for a passive management strategy are based on the fund's actual management costs for each year, where costs related to both internal and external active management strategies have been subtracted.

Revenues from securities lending

Unlike a theoretical index, but similar to an actively managed portfolio, a passive index portfolio would also be expected to generate income from securities lending activities. In this analysis, actual revenues from securities lending have been used, consistent with the financial reporting for the fund.

Transaction costs related to replication of the benchmark index

Changes in the equity and bond indices, such as company inclusions and periodic index reweightings, would trigger transactions in the portfolio and subsequent costs. These index replication costs are estimated based on models and not on realised costs, and are therefore uncertain in nature.

Transaction costs related to inflows and extraordinary benchmark changes

These costs are estimated costs related to the phasing-in of new capital into the fund, costs related to the set rules for rebalancing of the asset allocation in the benchmark, and transition costs related to rule changes for the benchmark. The broad benchmark indices for equity and fixed-income investments set by the Ministry of Finance are used as the underlying indices. The costs related to inflows, rebalancing and index transition costs are estimated based on standard market assumptions about trading costs and not actual realised costs, and are therefore uncertain in nature.

Comparing the fund's relative return after management costs with the estimated relative return of a passive strategy, the estimated relative return difference over the past three years has been 19 basis points. Measured over the past five years and since inception, the difference is estimated at 13 and 27 basis points, respectively.

Table 49 The fund's relative return after management costs. Annualised. Basis points

	3-years	5-years	01.01.1998
The fund's relative return before management costs	21	14	26
The fund's management costs excluding real estate	-6	-6	-9
The fund's relative return after management costs	**15**	**7**	**18**

Table 50 Estimated relative return of a passive strategy. Annualised. Basis points

	3-years	5-years	01.01.1998
Management costs of a passive strategy	-3	-3	-5
Revenues from securities lending	5	6	6
Transaction costs related to replication of the benchmark index	-3	-4	-4
Transaction costs related to inflows and extraordinary benchmark changes	-2	-4	-6
Estimated relative return of a passive strategy	**-3**	**-6**	**-10**

Table 51 Cost-adjusted relative return comparison. Annualised. Basis points

	3-years	5-years	01.01.1998
The fund's relative return after management costs	15	7	18
Estimated relative return of a passive strategy	-3	-6	-10
Estimated relative return difference	**19**	**13**	**27**

Credit risk

The fund is exposed to credit risk through its fixed-income investments. We monitor credit risk and include it in our risk assessments.

Credit risk is the risk of loss caused by the bond issuer not fulfilling its payment obligations. Issuer default depends on both the issuer's ability and willingness to pay. For a bond investor, losses in case of default can be full or partial depending on the outcome of the bankruptcy or debt restructuring.

CREDIT RISK IN THE FUND

Fixed-income securities and derivatives have varying credit risk characteristics and can be categorised according to their credit quality and security type. The Ministry of Finance's benchmark index for fixed-income investments has 70 percent allocated to government and government-related bonds and 30 percent allocated to corporate and covered bonds. The bonds in the benchmark are all rated investment-grade by the major credit rating agencies.

Over the past ten years, an increasing share of the fixed-income portfolio has been invested in government and government-related bonds. By the end of 2015, 73.6 percent of the fund's bond portfolio was invested in these bonds. Investments in emerging-market government bonds have also increased and constituted 12.7 percent of the fixed-income portfolio at the end of 2015.

The concentration of large issuers of debt is an important element of portfolio credit risk. The three largest issuers in the fixed-income portfolio at the end of 2015 were the US, Japan and Germany, which together accounted for 35 percent of the bonds in the fund.
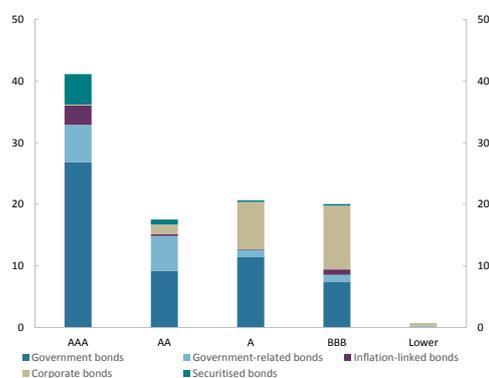
CREDIT RISK MANAGEMENT

The Ministry of Finance has set a requirement that the fixed-income investments shall be managed with the aim of sub-investment grade bonds not exceeding 5 percent of the fixed-income portfolio, and all bond investments are to have an external or internal credit rating. External ratings involve an independent assessment by a major rating agency (S&P, Moody's or Fitch) of the credit quality of a bond. If a bond is not rated by the major credit rating agencies, an internal rating will be given.

At the end of 2015, 59 percent of the fixed-income portfolio was rated AAA or AA, and 41 percent A or BBB. The fund's investments in sub-investment grade bonds (BB+ or lower) increased following the 2008 financial crisis to 2.3 percent of total bond investments but has since fallen back to 0.7 percent.

Credit risk is monitored by analysing changes in the portfolio's credit ratings and credit default spreads. In order to analyse issuer, sector or instrument-specific credit risk, both fundamental credit risk and market developments are assessed. Concentration risk is also monitored closely.
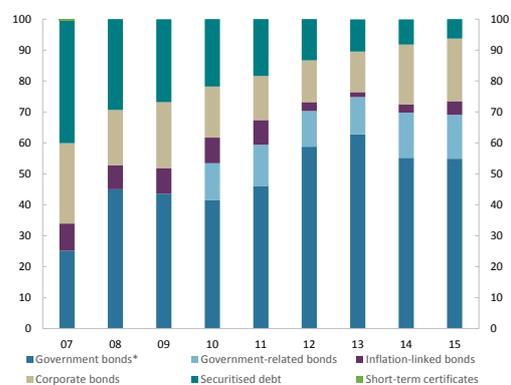
The monitoring of credit risk is supplemented with credit risk models. These models use credit ratings and spread ratings as input to measure the probability of default, which is the likelihood that an issuer will not make repayments of principal or payments of interest as agreed. The credit models also take the recovery rate and the correlation between bonds in a bankruptcy situation into account.

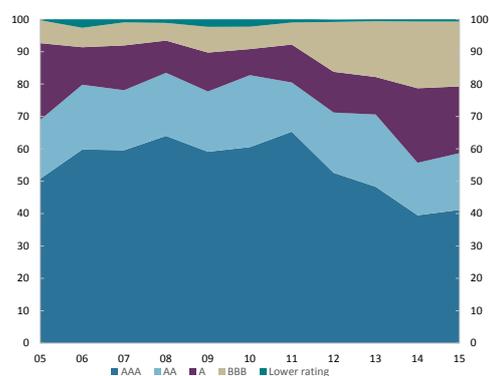**Chart 30** The fund's fixed-income investments by credit rating as at 31 December 2015. Percentage of bond holdings

- Government bonds
- Government-related bonds
- Inflation-linked bonds
- Corporate bonds
- Securitised bonds

Source: Norges Bank Investment Management

Chart 31 The fund's fixed-income investments by sector. Percentage of bond holdings

- Government bonds*
- Government-related bonds
- Inflation-linked bonds
- Corporate bonds
- Securitised debt
- Short-term certificates

Source: Norges Bank Investment Management
*For 2007, 2008, 2009 government bonds includes government-related bonds

Chart 32 The fund's fixed-income investments by credit rating. Percentage of bond holdings

- AAA
- AA
- A
- BBB
- Lower rating

Source: Norges Bank Investment Management

Chart 33 The fund's fixed-income benchmark by credit rating. Percentage of bond holdings

- AAA
- AA
- A
- BBB

Source: Norges Bank Investment Management

71
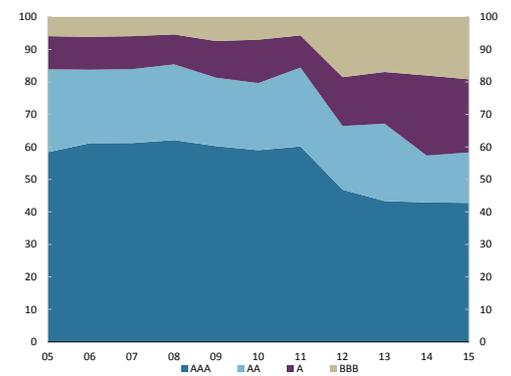
Counterparty risk

The fund is exposed to counterparty risk through various financial instruments and settlement systems. We work to control, mitigate and measure this risk.

Norges Bank Investment Management defines counterparty risk as the risk of loss due to the bankruptcy of a counterparty or other similar events leading to a counterparty defaulting on its obligations.

COUNTERPARTY RISK IN THE FUND

The Government Pension Fund Global is exposed to counterparty risk through unsecured deposits, OTC trading, exchange-traded derivatives and currency contracts. In addition, counterparty risk is generated by participatory certificates, repurchase and reverse repurchase agreements and securities lending transactions. The fund is also exposed to counterparty risk through international settlement and custody systems. For most currency trades, the fund has limited settlement risk due to the use of the currency settlement system CLS or trading directly with the custodian. For some emerging-market currencies, however, there is a risk attached to settlements. Norges Bank has entered into netting and collateral agreements to reduce counterparty risk.

COUNTERPARTY RISK MEASUREMENT

Norges Bank's Executive Board sets limits on exposure per counterparty, and counterparties must have a minimum credit rating. Counterparty risk exposure is measured daily against the Executive Board's limits.

For OTC derivatives and currency transactions, the current exposure method is used to measure counterparty risk. For each transaction, the market value and anticipated future counterparty risk exposure are calculated. Netting agreements and collateral are taken into account in the calculation of net exposure. For repurchase agreements, securities lending transactions and exchange-traded derivatives, a method is used that adds a premium to the market value to reflect the position's volatility. These positions are also adjusted for netting and actual received and posted collateral when calculating the net counterparty risk exposure.

Relative to the fund's market value, net counterparty risk exposure decreased from 2010 to 2014. Net exposure increased again during 2015, mainly due to higher securities lending activity as well as a removal of securities lending agent indemnification, which means that the agent no longer guarantees losses stemming from borrower default.

The credit ratings of counterparties have deteriorated since 2008. Financial institutions in many countries experienced reduced government support in case of default, which also led to deteriorating credit quality.
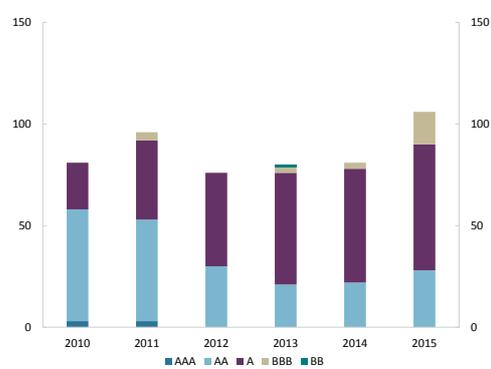
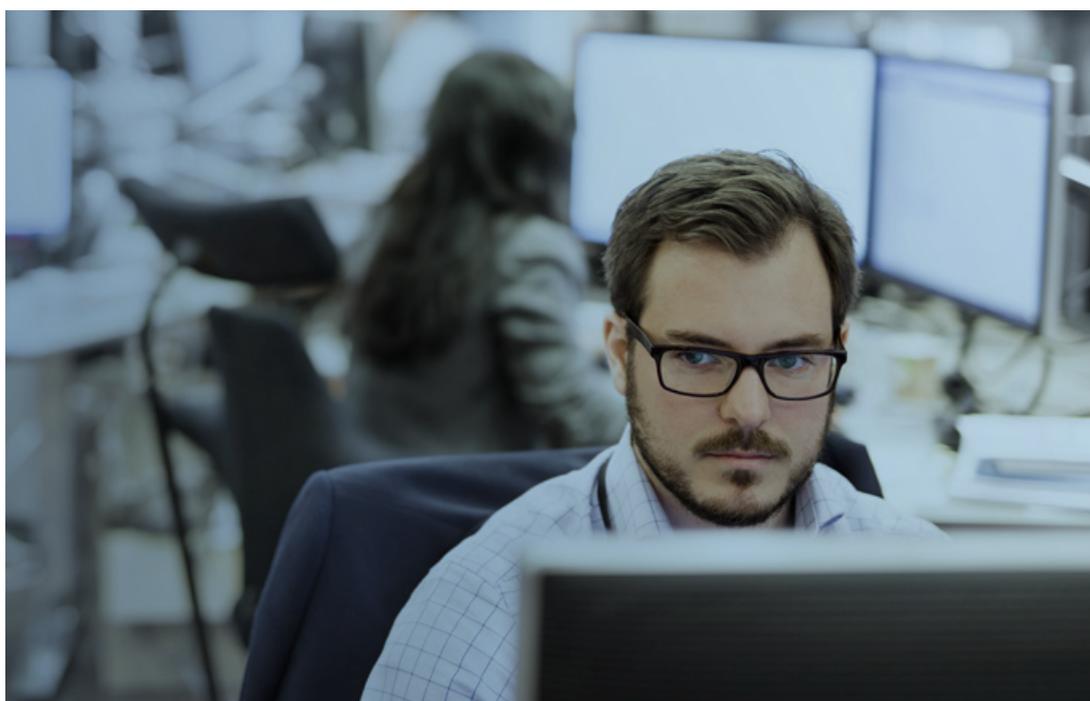**Chart 34** Counterparty exposure. In percent of the fund's market value

■ Gross exposure ■ Effect of netting ■ Collateral and guarantees ■ Net exposure
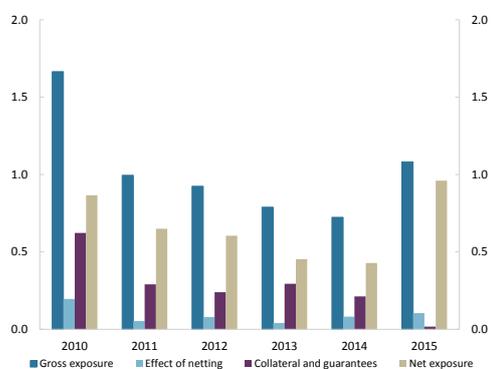
Source: Norges Bank Investment Management

Chart 35 Counterparties excluding brokers. Number of entities

■ AAA ■ AA ■ A ■ BBB ■ BB

Source: Norges Bank Investment Management

Other risk factors

The fund is also exposed to risk associated with derivatives, use of leverage, short positions and securities lending.

Norges Bank Investment Management uses derivatives for efficient portfolio management. Foreign exchange contracts were the most widely used derivative instrument in 2015. The use of leverage was scaled back in 2009, having previously been used in the fixed-income portfolio to exploit differences in interest rates or credit spreads. In the equity portfolio, the use of leverage has not been significant. Short positions are permitted where Norges Bank Investment Management has access to established loan facilities, but the use of short positions in the portfolio is minimal and immaterial.

SECURITIES LENDING

Norges Bank Investment Management has entered into an agency securities lending agreement with our custodian. The custodian has access to the securities holdings of the fund and may lend these to other market participants. The borrowers used are approved by Norges Bank and are for the most part large international financial institutions. Both equities and bonds are lent through the programme.

Securities lending provides the market with seamless access to securities and thereby increases market efficiency. When a security is lent, the borrower transfers collateral of equal or greater value to the agent in the form of cash or securities. The collateral is managed and held by the agent on behalf of Norges Bank. The borrower holds the voting rights to borrowed equities and is obliged to compensate the lender for corporate events relating to the securities during the lending period.

Securities lending gives rise to counterparty risk. If the borrower defaults and is unable to return the borrowed securities, Norges Bank will sell the collateral and buy back the borrowed securities in the market. Norges Bank may experience a loss if the replacement cost of the securities is higher than the value of the collateral. Counterparty risk is managed through minimum credit ratings for borrowers, counterparty risk limits and restrictions on collateral types.

At the end of 2015, loans of equities amounted to 313 billion kroner, and loans of bonds 133 billion kroner. This corresponds to around 6 percent of the net asset value of the fund.

Chart 36 Leverage of equity and fixed-income investments. Percent
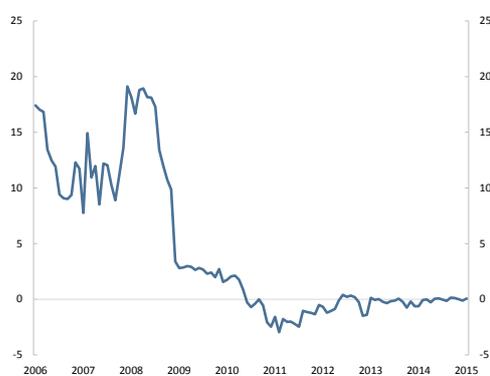
Source: Norges Bank Investment Management

Chart 37 The equity and fixed-income net leverage by asset class. Percent
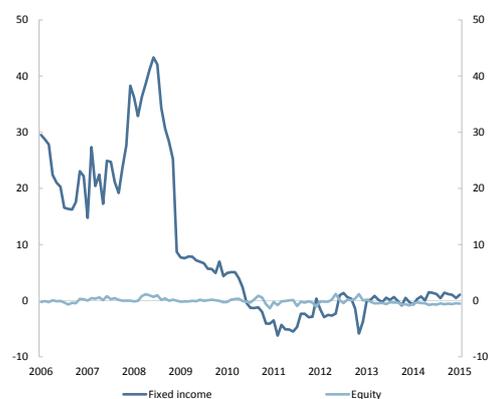
Source: Norges Bank Investment Management

Table 52 Financial derivatives. Average exposure in 2015. Millions of kroner

	2015	
Financial derivatives	Purchased	Sold
Foreign exchange contracts	183,034	
Exchange traded futures	11,155	27,933
Interest-rate swaps	4,339	41,558
Warrant and rights	613	
Participatory certificates	2,429	

Table 53 External securities lending as at 31 December 2015. Millions of kroner

	2015	
Asset class	Securities lent out	Received collateral
Equity	312,662	290,529
Bonds	132,569	146,803
Cash		38,478
Other guarantees		8,278
Total	445,231	484,088

Appendix

Contents

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1 Factor-adjusted returns

1.1 Introduction

This part of the appendix aims to shed light on the robustness of the estimated alphas and factor exposures reported in the "Cost and risk adjusted return" section in the main part of this performance and risk report. Where possible, we have aligned our treatment of the material with the recommendations in "Norges Bank's Expert Group on Principles for Risk Adjustment of Performance Figures" (the expert group), see Dahlquist, Polk, Priestley, and Ødegaard (2015).

We present results from several factor regressions using alternative model specifications, different sample periods, as well as results before and after management cost. In addition, for equities, we show how a simple adjustment for investability and differences in factor construction affect the results. For fixed income we show how adjusting for duration differences in one of the fixed-income factors impact the results.

Section 1.2 describes the data and the regression model specifications used in the analysis. Section 1.3 presents results for the fund's equity and fixed-income investments separately and for the combined equity and fixed-income investments. Finally, Section 1.4 provides summary statistics on the factor return series used. All relevant data used in this appendix that is not publicly available can be found on www.nbim.no. For the publicly available data, the reader is referred to the section on data and methodology.

1.2 Data and methodology

Methodology

Following the recommendations from the expert group, we use the global Fama and French (2015) five-factor model as the main model (Equation 1.1a), along with global versions of the Capital Asset Pricing Model (CAPM) one-factor model (Equation 1.1d) by Treynor (1962); Sharpe (1964); Lintner (1965a,b); Mossin (1966), the Fama and French (1992) three-factor model (Equation 1.1e) and the Carhart (1997) four-factor model (Equation 1.1f) when evaluating the equity investments. For the fixed-income investments the main model is a two-factor model (Equation 1.1b) with the duration adjusted default premium and term premium as factors. For robustness a two-factor model with the unadjusted duration premium and term premium is also estimated, along with one-factor models for each of the factors. For the combined equity and fixed-income investments the specification used is the global Fama and French (2015) five-factor model augmented with the two fixed income factors (Equation 1.1c).

Main model specification:

$$r - r_b = \alpha + \beta_1 MKT + \beta_2 SMB + \beta_3 HML + \beta_4 RMW + \beta_5 CMA + \epsilon \tag{1.1a}$$

$$r - r_b = \alpha + \beta_1 DEF + \beta_2 TERM + \epsilon \tag{1.1b}$$

$$\begin{aligned} r - r_b = {}& \alpha + \beta_1 MKT + \beta_2 SMB + \beta_3 HML + \beta_4 RMW + \beta_5 CMA \\ & + \beta_6 DEF + \beta_7 TERM + \epsilon \end{aligned} \tag{1.1c}$$

Additional specifications used to assess robustness of results:

$$r - r_b = \alpha + \beta_1 MKT + \epsilon \tag{1.1d}$$

$$r - r_b = \alpha + \beta_1 MKT + \beta_2 SMB + \beta_3 HML + \epsilon \tag{1.1e}$$

$$r - r_b = \alpha + \beta_1 MKT + \beta_2 SMB + \beta_3 HML + \beta_4 WML + \epsilon \tag{1.1f}$$

For each of the specifications the left-hand side variable $(r - r_b)$ is the monthly returns on the portfolio relative to the returns of the benchmark, and the MKT variable is the equity market return in excess of the risk free rate. Regressions are estimated using Newey and West (1987) adjusted standard errors (using 3-month lag). For the equity return factors, three sources are used: Fama and French (F-F), AQR Capital Management (AQR) and MSCI. For our base-line

specification factor data from Kenneth French's web site have been used, while the two other sources are included to provide further sensitivity and robustness analysis of the results. For the fixed income return factors, relevant data is sourced from Barclays in order to construct the factor returns. Table 4 provides a summary of all the factor abbreviations and data sources used.

The data sourced from Fama and French was downloaded as of February 26th 2016, while data from AQR and Barclays were downloaded as of February 17th 2016. Monthly USD returns are used in all of the regressions. This facilitates replicability of the analysis conducted in this appendix, as publicly available factor returns are typically denominated in USD.

Table 1 lists the time periods used in the regressions, indicating the relevant start date for "since inception" regressions reported in this appendix. The start dates are aligned with the inception of the relevant composites as used in the Global Investment Performance Standards (GIPS) reporting by Norges Bank Investment Management.

<div align="center">

Table 1
Time period for regressions

</div>

	Start	End	Average %-USD relative returns		
			Since inception	Last 10 years	Last 5 years
Equity investments	Jan 1999	Dec 2015	0.41	0.17	0.15
Fixed-income investments	Jan 1998	Dec 2015	0.10	0.03	-0.13
Equity and fixed-income investments	Jan 1998	Dec 2015	0.20	0.04	0.08

Note: Average relative returns are based on the annualised arithmetic average of monthly USD returns after management costs.

All regressions are performed after adjusting for management costs, except where explicitly noted. The cost numbers are available on an annual basis, and have been divided by twelve and subtracted from the monthly portfolio returns, matched to the respective year.

Factors sourced from Kenneth French's data library

Global research factors commonly used in empirical asset pricing studies are available from Kenneth French's data library.[1] From this data library we have collected global factor returns required for the Fama and French (1992) three-factor model, the Carhart (1997) four-factor model and the Fama and French (2015) five-factor model. One-month treasury bills has been used as the risk-free rate in all of the regressions performed in the appendix, and are sourced from the same data library

Factors sourced from MSCI

As input for this analysis, Norges Bank Investment Management requested MSCI to calculate factor return series in USD, using the factor construction methodology in Fama and French (2015) on the MSCI ACWI IMI index universe (representing the broadest opportunity set of equities available from MSCI for the purpose of this analysis), and using MSCI's global equity factor descriptors that provide the closest match to those described in Fama and French (2015). A description of the global equity factor descriptors can be found in "A Global Implementation of the Fama and French 5-factor model" [2015, MSCI].[2]

As the universe and asset characteristics are not overlapping fully with that used by Fama and French, the return series generated by MSCI are not expected to be identical. One key difference is the profitability factor which is defined as operating profitability (sales less cost of goods sold, selling, general and administrative expenses and interest expenses to book equity) by Fama and

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[1] The data is available from http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html, in the "Developed Market Factors and Returns" section.
[2] The document is available on http://www.nbim.no

French, while gross profitability is used by MSCI (the same approach was taken by Novy-Marx (2013)). Another key difference is the definition of the investment descriptor where Fama and French use year-over-year growth in total assets, while the respective measure calculated by MSCI use trend growth over 5 years. Correlations between the factors can be found in Section 1.4.

Factors sourced from AQR

To further highlight the sensitivity and robustness of the estimated parameters, results are also shown using global factor returns from AQR Capital Management.[3] Return series for the market (MKT), size (SMB), value (HML), momentum (UMD), Quality Minus Junk (QMJ) and Betting Against Beta (BAB) factors are downloaded from their data library. Two different value factors are available from AQR, one version based on the original Fama and French (1992) methodology using market price aligned with the date of the book value of equity. The other version provided by AQR is constructed using market prices as of the rebalancing date, taking into account price movements between fiscal year end and the rebalancing date. In the regressions using AQR data, we refer to the former as "HML lag" and the latter as "HML cur". Detailed information on the construction of factor return series for QMJ can be found in Asness et al. (2014), of BAB in Frazzini and Pedersen (2010) and of the HML factors in Asness and Frazzini (2011). The factor returns for MKT, SMB, HML and UMD should resemble the equivalents found in the global factor returns from Fama and French (1992) and Carhart (1997), but due to minor differences in sorting procedures and country neutralisations, discrepancies are expected. Correlations between the factors can be found in Section 1.4.

Size-constrained equity factors

Dahlquist et al. (2015, p. 13) writes: "[a] key insight from the academic literature is that in order to interpret an alpha estimate as a performance measure, it is necessary that the factor used in the regressions are investable for the portfolio manager". An initial attempt to adjust the factor regressions for investability has been done by using size-constrained return factors. The size-constrained factor returns are restricted to the factor portfolios classified as "Big" where available from Kenneth French's data library and MSCI.[4] The small portfolios as defined by Fama and French (2015) represent only the bottom 10 percent of market cap, but are included with a 50 percent weighting in the research factors. These adjustments are intended to act as a simple alignment of factors to the constraints and characteristics of the fund.[5] The size-constrained factors results in four new factors, HML-big, WML-big, RMW-big and CMA-big, which we then use as independent variables in an adjusted regression later in the appendix. A similar simple adjustment of the size factor is not available due to the methodology used in the construction of the factors. Table 2 outline which size-constrained factors are created using the various sources. As evident from the table, four factors are constructed using data from Fama and French, while three factors use data from MSCI.

Table 2
Providers of size-constrained factors

	Fama and French	MSCI
HML-big	X	X
WML-big	X	
CMA-big	X	X
RMW-big	X	X

[3]The data is available from https://www.aqr.com/library/data-sets

[4]The original Fama and French factors are constructed as an equal weighted average of component returns. For example the value factor is defined as $HML = 1/2(\text{Small Value} + \text{Big Value}) - 1/2(\text{Small Growth} + \text{Big Growth})$, while our size-constrained HML factor is defined as $HML = \text{Big Value} - \text{Big Growth}$.

[5]Further analysis of size constraints is a subject which is relevant for future research.

For the factors using Fama and French, the value-weighted portfolios sorted on size and book-to-market, size and momentum, size and operating profitability and size and investment have been used, and the return spread between the large capitalisation companies in the upper 30th and the lower 30th percentile for the respective characteristic have been calculated. For the series based on MSCI, long-short factor return series for only large capitalisation companies are calculated directly by MSCI.

Fixed income data

For the fixed income factors we follow the expert group and use a default and a term factor, both based on the definitions from Fama and French (1993). Historical series for these two factors are not publicly available for a global portfolio. Therefore we use data from Barclays. All data required to construct the fixed income factors have been sourced from either Barclays Live or from Barclays Point (Point being used to complement historical data), and are USD unhedged returns. The following three sections explain the construction of these factor returns.

Term premium factor (TERM)
The term factor used in the regressions is defined as the difference in returns from the Barclays Global Aggregate Treasury 10+Y index (more than 10 years to maturity) and the returns from Barclays Global Aggregate Treasury 1-3Y index. This term premium methodology is slightly different from the one used by Fama and French (1993), who use 1-3M Treasury returns rather than 1-3Y Treasury returns. Returns from 1-3Y Treasury bonds is applied in this analysis due to data availability (a similar approach is taken by Ilmanen (1996) and Ilmanen et al. (2004)), as historical consistent global returns for bonds with 1-3M to maturity was not readily available.[6]

A potential issue in the construction of the global term premium is the currency mismatch between long-term and short-term treasuries. An unbalanced distribution can lead to a factor incorporating sovereign credit risk and other drivers of currency returns. Thus regression analysis with a non-zero loading to the term premium could be an exposure to both the term premium and other risk factors. In order to provide insights into the potential issue, regression analyses using a term premium factor consisting of only USD treasury bonds are included in Section 1.3.

Default premium factor (DEF)
The default premium is defined in Fama and French (1993) as the difference between returns of corporate bonds and treasury bonds with more than 10 years to maturity. Table 3 summarises the sources that have been used to create the default premium factor return. Since 1999 data from Barclays Global Aggregate have been used, where the return is calculated as the return from bonds in the Barclays Global Aggregate Corporate 10+Y index less Barclays Global Aggregate Treasury 10+Y index. For the period before 1999 Barclays Global Aggregate data is not available, and we have used equivalent data for the Barclays US Aggregate universe (returns from US Aggregate Corporate Long index less returns from US Aggregate Treasury Long index). As indicated by the table, data for corporate bonds returns for the period from January 1999 to December 2000 has been sourced from Barclays Point using the Barclays Global Aggregate Corporate 10+Y returns universe.

The issue on currency distribution (as highlighted for the term premium) is highly relevant also for the default premium. Similarly, an additional return series for the default premium has been calculated using only USD-denominated treasury and corporate bonds.

Duration adjusted default premium factor (DEF Adj)
Hallerbach and Houweling (2011) observe that the default factor, as it is defined in Fama and French (1993), includes term effects by construction because corporate bonds tend to have lower duration than government bonds. This mismatch in duration should be corrected for in order to

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[6]Empirical observations on single currencies show that the calculated term premium using either bonds with one to three years until maturity or bonds with less than three months until maturity exhibit a high correlation.

Table 3
Summary of sources used for default premium factor returns

	Corporate bond index	Treasury bond index
Jan 1998 to Dec 1998	US Aggregate Corporate Long (Barclays Live)	US Aggregate Treasury Long (Barclays Live)
Jan 1999 to Dec 2000	Global Aggregate Corporate 10+Y (Barclays Point)	Global Aggregate Treasury 10+Y (Barclays Live)
Jan 2001 to Dec 2015	Global Aggregate Corporate 10+Y (Barclays Live)	Global Aggregate Treasury 10+Y (Barclays Live)

Note: Source of data in parentheses

better isolate the default premium, allowing more reliable estimates of the sensitivity to the default factor. The duration of the corporate bond series is matched to that of the government bond series with Equation 1.2 (similar to Asvanunt and Richardson (2015)).[7]

$$\text{DEF Adj}_t = \frac{D_t^{GOV}}{D_t^{CORP}} r_t^{CORP} - r_t^{GOV} \tag{1.2}$$

DEF Adj$_t$ is the return on the duration adjusted default factor, r_t^{GOV} and r_t^{CORP} are the monthly total returns on the government and corporate bond indices, and D_t^{GOV} and D_t^{CORP} are the analytical option-adjusted modified durations of the respective indices in month t. The data on index durations has been obtained from the Barclays index return universe for the relevant indices. For the regression results reported in Section 1.3 we include both the unadjusted default premium and the duration adjusted default premium as independent variables.

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[7]Note the equation is slightly modified to the one appearing in Asvanunt and Richardson (2015) as they estimate empirical durations, while we use analytical durations provided by Barclays.

Table 4
Summary information about the factors used for regressions

Factor	Description	Source	Time period used in analysis
MKT	Equity market return in excess of the risk free rate	F-F	Jan 1998 to Dec 2015
		MSCI	Jan 1998 to Dec 2015
		AQR	Jan 1998 to Nov 2015
SMB	Small Minus Big, return spread between small cap and large cap stocks	F-F	Jan 1998 to Dec 2015
		MSCI	Jan 1998 to Dec 2015
		AQR	Jan 1998 to Nov 2015
HML	High Minus Low, return spread between high book-to-market and low book-to-market stocks[a]	F-F	Jan 1998 to Dec 2015
		MSCI	Jan 1998 to Dec 2015
		AQR	Jan 1998 to Nov 2015
WML	Winners Minus Losers, return spread between past winners and losers (labelled UMD by AQR)	F-F	Jan 1998 to Dec 2015
		MSCI	Jan 1998 to Dec 2015
		AQR	Jan 1998 to Nov 2015
RMW	Robust Minus Weak, return spread between high and low profitability stocks	F-F	Jan 1998 to Dec 2015
		MSCI	Jan 1998 to Dec 2015
CMA	Conservative Minus Aggressive, return spread between stocks with low and high investment ratios	F-F	Jan 1998 to Dec 2015
		MSCI	Jan 1998 to Dec 2015
HML-big	Same as HML, constrained to only large cap stocks	F-F	Jan 1998 to Dec 2015
		MSCI	Jan 1998 to Dec 2015
WML-big	Same as RMW, constrained to only large cap stocks	F-F	Jan 1998 to Dec 2015
RMW-big	Same as RMW, constrained to only large cap stocks	F-F	Jan 1998 to Dec 2015
		MSCI	Jan 1998 to Dec 2015
CMA-big	Same as CMA, constrained to only large cap stocks	F-F	Jan 1998 to Dec 2015
		MSCI	Jan 1998 to Dec 2015
QMJ	Quality Minus Junk, return spread between quality and junk stocks as defined in Asness et al. (2014)	AQR	Jan 1998 to Nov 2015
BAB	Betting Against Beta, return spread between low and high beta stocks as defined in Frazzini and Pedersen (2010)	AQR	Jan 1998 to Nov 2015
DEF	Default premium, excess returns from long term corporate bonds to long-term government bonds (10Y+)	Barclays	Jan 1998 to Dec 2015
DEF Adj	Adjusted default premium, default premium adjusted for differences in duration between corporates and treasuries	Barclays	Jan 1998 to Dec 2015
TERM	Term premium, return spread between long term government bonds (10Y+) and short term bonds (1-3 years)	Barclays	Jan 1998 to Dec 2015

[a]The HML variable comes in two versions from AQR, the first version based on the methodology as in Fama and French (1992), and the second based on the methodology described in Asness and Frazzini (2011) where prices are chosen as of the rebalancing date.

1.3   Results

In the next sections, separate regression results for the equity and fixed-income investments are presented, followed by regression results for the combined equity and fixed-income investments. Regression results are shown using relative returns after management costs, comparing the results from different model specifications and sample periods. For the main models recommended in Dahlquist et al. (2015), results from regressions using relative returns before and after management costs since inception are included.

Equity investments

Table 5 presents regression results for equity relative returns after management costs for different time periods using the Fama and French (2015) five-factor model. The alpha estimates are positive for all time periods, however, none of the alpha estimates are significantly different from zero at conventional significance levels.

Table 5

Equity five-factor regressions for selected time periods

Regression results with Fama-French global return factors for selected time periods. The dependent variable is the monthly return on the equity portfolio relative to the equity benchmark after management costs. Period (1) starts in 1999, period (2) covers the last 10 years and period (3) covers the last 5 years. Newey and West (1987) corrected t-statistics (using 3-month lag) are shown in parentheses. The alpha estimates are annualised and in percent.

	Since 1999 (1)	Last 10 years (2)	Last 5 years (3)
Alpha	0.21	0.03	0.11
	(1.09)	(0.14)	(0.40)
F-F MKT	0.02	0.02	0.02
	(4.68)	(4.75)	(2.75)
F-F SMB	0.05	0.04	0.02
	(6.82)	(4.56)	(1.74)
F-F HML	−0.01	−0.01	0.01
	(−1.76)	(−0.92)	(0.77)
F-F RMW	0.02	0.02	−0.01
	(1.91)	(0.80)	(−0.46)
F-F CMA	−0.01	−0.03	−0.01
	(−1.35)	(−1.94)	(−0.46)
Observations	204	120	60
Adjusted R^2	0.46	0.46	0.25

Table 6 summarise the estimated parameters for the five-factor model using the original Fama-French factor returns, or Fama-French factor returns which incorporate adjustments for investability. The table indicates the sensitivity of the estimates to the choice between original and size-constrained factors.

Table 6
Equity five-factor size-constrained regressions

Full period regression results with Fama-French global return factors. The dependent variable is the monthly return on the equity portfolio relative to the equity benchmark after management costs. All of the models are based on the 5-factor Fama-French model, with model (1) using the original research factors, model (2) using a value factor constrained to only big cap companies, model (3) using a profitability factor constrained to big cap only companies, model (4) using an investment factor constrained to only big cap companies, and model (5) using value, profitability and investment factors constrained to only big cap companies. Newey and West (1987) corrected t-statistics (using 3-month lag) are shown in parentheses. The alpha estimates are annualised and in percent.

	(1)	(2)	(3)	(4)	(5)
Alpha	0.21	0.19	0.22	0.19	0.18
	(1.09)	(0.96)	(1.25)	(0.98)	(1.02)
F-F MKT	0.02	0.02	0.02	0.02	0.02
	(4.68)	(4.31)	(4.84)	(4.55)	(4.45)
F-F SMB	0.05	0.05	0.05	0.05	0.05
	(6.82)	(6.61)	(7.22)	(6.86)	(6.98)
F-F HML	−0.01		−0.01	−0.01	
	(−1.76)		(−1.14)	(−1.70)	
F-F RMW	0.02	0.02		0.02	
	(1.91)	(1.64)		(1.90)	
F-F CMA	−0.01	−0.02	−0.02		
	(−1.35)	(−1.94)	(−1.56)		
F-F HML Big		−0.01			−0.00
		(−1.81)			(−0.78)
F-F RMW Big			0.02		0.02
			(2.40)		(2.27)
F-F CMA Big				−0.01	−0.02
				(−1.93)	(−2.33)
Observations	204	204	204	204	204
Adjusted R^2	0.46	0.46	0.47	0.46	0.47

Table 7 presents results based on the same model specifications as in Table 6, but with the Fama-French factors substituted for factors using MSCI data. The alpha estimates using MSCI calculated factor returns are all higher than those calculated using factor returns from Fama-French, and are all estimated to be statistically different from zero. Exposure to the market and small cap companies does not change much between the two sets of factor returns. Exposure to value is more negative using factor returns from MSCI, while a positive exposure to companies with higher profitability is turned to a negative exposure using MSCI factor returns. Potential explanations for the difference is the estimation universes used to calculate factor returns (as MSCI have a higher market capitalisation requirement and additional liquidity requirements for stocks to be included in the MSCI AWCI IMI), and differences in the definitions of characteristics used (as explained in Section 1.2).

Table 7
Equity five-factor size-constrained regressions (MSCI factor returns)

Full period regression results with MSCI global return factors. The dependent variable is the monthly return on the equity portfolio relative to the equity benchmark after management costs. All of the models are based on a 5-factor specification, with model (1) using factors which cover big and small companies, model (2) using a value factor constrained to only big cap companies, model (3) using a profitability factor constrained to only big cap companies, model (4) using an investment factor constrained to only big cap companies, and model (5) using value, profitability and investment factors constrained to only big cap companies. Newey and West (1987) corrected t-statistics (using 3-month lag) are shown in parentheses. The alpha estimates are annualised and in percent.

	(1)	(2)	(3)	(4)	(5)
Alpha	0.51	0.50	0.46	0.49	0.42
	(2.51)	(2.38)	(2.21)	(2.53)	(2.12)
MSCI MKT	0.01	0.01	0.01	0.01	0.01
	(2.77)	(2.71)	(2.76)	(2.68)	(2.69)
MSCI SMB	0.05	0.05	0.05	0.05	0.06
	(5.65)	(5.35)	(5.70)	(6.22)	(5.77)
MSCI HML	−0.04		−0.03	−0.04	
	(−5.36)		(−4.74)	(−5.45)	
MSCI RMW	−0.01	−0.01		−0.02	
	(−1.45)	(−0.91)		(−1.78)	
MSCI CMA	−0.03	−0.04	−0.03		
	(−2.27)	(−2.53)	(−2.24)		
MSCI HML Big		−0.03			−0.03
		(−5.32)			(−4.98)
MSCI RMW Big			−0.00		−0.00
			(−0.27)		(−0.40)
MSCI CMA Big				−0.03	−0.03
				(−2.60)	(−2.58)
Observations	204	204	204	204	204
Adjusted R^2	0.42	0.40	0.42	0.43	0.40

Table 8 presents the average equity relative return after management costs, along with estimated results from four different factor model specifications typically employed in empirical asset pricing. The table provides insights into the sensitivity of the results starting from a one-factor model with only the market as a factor, to the Fama and French (2015) five-factor model. For the different specifications (including the unadjusted version) the estimated alpha is not significantly different from zero at conventional significance levels.

Table 8
Equity one-, three-, four- and five-factor regressions

Full period regression results with Fama-French global return factors. The dependent variable is the monthly return on the equity portfolio relative to the equity benchmark after management costs. Model (1) is raw unadjusted active return, model (2) is a 1-factor model, model (3) is the 3-factor Fama-French model, model (4) is the 4-factor Fama-French model, and model (5) is the 5-factor Fama-French model. Newey and West (1987) corrected t-statistics (using 3-month lag) are shown in parentheses. The alpha estimates are annualised and in percent.

	Unadj. (1)	1-factor (2)	3-factor (3)	4-factor (4)	5-factor (5)
Alpha	0.41 (1.77)	0.31 (1.55)	0.30 (1.70)	0.19 (1.15)	0.21 (1.09)
F-F MKT		0.02 (4.70)	0.02 (5.00)	0.02 (5.34)	0.02 (4.68)
F-F SMB			0.04 (7.28)	0.04 (7.01)	0.05 (6.82)
F-F HML			−0.02 (−2.54)	−0.01 (−2.58)	−0.01 (−1.76)
F-F WML				0.01 (2.75)	
F-F RMW					0.02 (1.91)
F-F CMA					−0.01 (−1.35)
Observations	204	204	204	204	204
Adjusted R^2	0.00	0.18	0.43	0.47	0.46

Table 9 present regression results for equity relative returns after management costs since inception using three- and four-factor Fama-French models, using both the original and size-constrained factor returns. Estimated factor exposures are stable across the different specifications, and for the three-factor model there is a fall in estimated alpha when using size-constrained factor returns.

Table 9
Equity three- and four-factor size-constrained regressions

Full period regression results with Fama-French global return factors. The dependent variable is the monthly return on the equity portfolio relative to the equity benchmark after management costs. Model (1) is the 3-factor Fama-French model, model (2) is the Fama-French 3-factor model using a size-constrained value factor, model (3) is the 4-factor Fama-French model, model (4) is the Fama-French 4-factor model using a value factor constrained to only big cap companies, model (5) is the Fama-French 4-factor model using a momentum factor constrained to only big cap companies, and model (6) uses both value and momentum factors constrained to only big cap companies. Newey and West (1987) corrected t-statistics (using 3-month lag) are shown in parentheses. The alpha estimates are annualised and in percent.

	3-factor		4-factor			
	(1)	(2)	(3)	(4)	(5)	(6)
Alpha	0.30	0.23	0.19	0.14	0.23	0.18
	(1.70)	(1.38)	(1.15)	(0.89)	(1.44)	(1.15)
F-F MKT	0.02	0.02	0.02	0.03	0.02	0.03
	(5.00)	(5.09)	(5.34)	(5.39)	(5.34)	(5.40)
F-F SMB	0.04	0.05	0.04	0.04	0.04	0.04
	(7.28)	(6.99)	(7.01)	(7.00)	(6.61)	(6.66)
F-F HML	−0.02		−0.01		−0.01	
	(−2.54)		(−2.58)		(−2.66)	
F-F WML			0.01	0.01		
			(2.75)	(2.59)		
F-F HML Big		−0.02		−0.01		−0.01
		(−2.59)		(−2.41)		(−2.51)
F-F WML Big					0.01	0.01
					(2.92)	(2.75)
Observations	204	204	204	204	204	204
Adjusted R^2	0.43	0.44	0.47	0.47	0.47	0.47

Tables 10 through 12 present regression results for the three-, four- and five-factor models for selected time periods, both using original factor returns and size-constrained factor returns. These tables give some indication to the sensitivity of the estimated parameters to varying time periods and model specifications.

Table 10
Equity three-factor size-constrained regressions for selected time periods

Regression results with Fama-French global return factors for selected time periods. The dependent variable is the monthly return on the equity portfolio relative to the equity benchmark after management costs. Model (1), model (3) and model (5) are based on using the original research factors, while model (2), model (4), and model (6) are based on size-constrained factors. Newey and West (1987) corrected t-statistics (using 3-month lag) are shown in parentheses. The alpha estimates are annualised and in percent.

	Since 1999		Last 10 years		Last 5 years	
	(1)	(2)	(3)	(4)	(5)	(6)
Alpha	0.30	0.23	0.01	−0.08	0.07	0.07
	(1.70)	(1.38)	(0.05)	(−0.39)	(0.31)	(0.31)
F-F MKT	0.02	0.02	0.03	0.03	0.02	0.02
	(5.00)	(5.09)	(5.06)	(4.32)	(4.57)	(4.39)
F-F SMB	0.04	0.05	0.04	0.05	0.03	0.02
	(7.28)	(6.99)	(5.34)	(5.45)	(2.95)	(2.72)
F-F HML	−0.02		−0.03		0.01	
	(−2.54)		(−2.05)		(0.96)	
F-F HML Big		−0.02		−0.03		0.00
		(−2.59)		(−2.06)		(0.61)
Observations	204	204	120	120	60	60
Adjusted R^2	0.43	0.44	0.44	0.47	0.27	0.27

Table 11
Equity four-factor size-constrained regressions for selected time periods

Regression results with Fama-French global return factors for selected time periods. The dependent variable is the monthly return on the equity portfolio relative to the equity benchmark after management costs. Model (1), model (3) and model (5) are based on using the original research factors, while model (2), model (4), and model (6) are based on size-constrained factors. Newey and West (1987) corrected t-statistics (using 3-month lag) are shown in parentheses. The alpha estimates are annualised and in percent.

	Since 1999		Last 10 years		Last 5 years	
	(1)	(2)	(3)	(4)	(5)	(6)
Alpha	0.19	0.18	−0.01	−0.08	−0.02	0.04
	(1.15)	(1.15)	(−0.07)	(−0.39)	(−0.07)	(0.20)
F-F MKT	0.02	0.03	0.03	0.03	0.02	0.02
	(5.34)	(5.40)	(4.91)	(4.33)	(5.38)	(4.96)
F-F SMB	0.04	0.04	0.04	0.05	0.03	0.02
	(7.01)	(6.66)	(5.32)	(5.42)	(2.83)	(2.48)
F-F HML	−0.01		−0.03		0.01	
	(−2.58)		(−1.88)		(1.25)	
F-F WML	0.01		0.00		0.01	
	(2.75)		(1.24)		(1.43)	
F-F HML Big		−0.01		−0.03		0.01
		(−2.51)		(−1.85)		(0.85)
F-F WML Big		0.01		0.00		0.01
		(2.75)		(0.14)		(0.98)
Observations	204	204	120	120	60	60
Adjusted R^2	0.47	0.47	0.44	0.46	0.28	0.26

Table 12

Equity five-factor size-constrained regressions for selected time periods

Regression results with Fama-French global return factors for selected time periods. The dependent variable is the monthly return on the equity portfolio relative to the equity benchmark after management costs. Model (1), model (3) and model (5) are based on using the original research factors, while model (2), model (4), and model (6) are based on size-constrained factors. Newey and West (1987) corrected t-statistics (using 3-month lag) are shown in parentheses. The alpha estimates are annualised and in percent.

	Since 1999		Last 10 years		Last 5 years	
	(1)	(2)	(3)	(4)	(5)	(6)
Alpha	0.21	0.18	0.03	−0.05	0.11	0.08
	(1.09)	(1.02)	(0.14)	(−0.23)	(0.40)	(0.32)
F-F MKT	0.02	0.02	0.02	0.03	0.02	0.02
	(4.68)	(4.45)	(4.75)	(4.80)	(2.75)	(2.79)
F-F SMB	0.05	0.05	0.04	0.04	0.02	0.02
	(6.82)	(6.98)	(4.56)	(5.08)	(1.74)	(1.83)
F-F HML	−0.01		−0.01		0.01	
	(−1.76)		(−0.92)		(0.77)	
F-F RMW	0.02		0.02		−0.01	
	(1.91)		(0.80)		(−0.46)	
F-F CMA	−0.01		−0.03		−0.01	
	(−1.35)		(−1.94)		(−0.46)	
F-F HML Big		−0.00		−0.02		0.00
		(−0.78)		(−1.69)		(0.15)
F-F RMW Big		0.02		0.00		−0.01
		(2.27)		(0.28)		(−0.71)
F-F CMA Big		−0.02		−0.02		−0.00
		(−2.33)		(−1.80)		(−0.21)
Observations	204	204	120	120	60	60
Adjusted R^2	0.46	0.47	0.46	0.48	0.25	0.24

Table 13 compares regression results for the five-factor model using equity relative returns since inception before and after management costs.

Table 13
Equity five-factor size-constrained regressions before and after management costs

Regression results before and after management costs with the 5-factor Fama-French model. The dependent variable in model (1) and model (3) is the monthly return on the equity portfolio relative to the equity benchmark before management costs, while model (2) and model (4) present the same results after management costs. Newey and West (1987) corrected t-statistics (using 3-month lag) are shown in parentheses. The alpha estimates are annualised and in percent.

	Original factors		Big cap factors	
	(1)	(2)	(3)	(4)
Alpha	0.35	0.21	0.32	0.18
	(1.78)	(1.09)	(1.80)	(1.02)
F-F MKT	0.02	0.02	0.02	0.02
	(4.68)	(4.68)	(4.46)	(4.45)
F-F SMB	0.05	0.05	0.05	0.05
	(6.84)	(6.82)	(6.99)	(6.98)
F-F HML	−0.01	−0.01		
	(−1.70)	(−1.76)		
F-F RMW	0.02	0.02		
	(1.91)	(1.91)		
F-F CMA	−0.01	−0.01		
	(−1.37)	(−1.35)		
F-F HML Big			−0.00	−0.00
			(−0.73)	(−0.78)
F-F RMW Big			0.02	0.02
			(2.29)	(2.27)
F-F CMA Big			−0.02	−0.02
			(−2.34)	(−2.33)
Observations	204	204	204	204
Adjusted R^2	0.45	0.46	0.47	0.47

Finally, we present in tables 14 and 15 the regression results for the equity investments using the factors created by AQR Capital Management. As Asness and Frazzini (2011) describe, the date used for the market price in the construction of the HML factor is an important aspect when measuring the returns to the value premium. Table 14 shows results for the full sample period using different model specifications and the two versions of the HML factor. The regression results are stable to the choice of the value factor in terms of estimated factor exposure, though t-statistics are reported to be more negative using the Asness and Frazzini (2011) specification. Further, when using the alternative HML specification, the exposure to momentum (UMD) is no longer statistically significant. There is one less observation in the regressions using AQR data as December 2015 returns were not available from AQR at the time of writing this report.

Table 14
Equity three-, four- and six-factor regressions using AQR return series

Full period regression results with AQR global return factors. The dependent variable is the monthly return on the equity portfolio relative to the equity benchmark after management costs. Model (1) is a 3-factor model using the original specification of the value variable as in Fama and French (1992), model (2) is a 3-factor model with the value factor as defined in Asness and Frazzini (2011), model (3) and model (4) are 4-factor models with the same difference in value factor as for the two previous models, model (5) and model (6) are 6-factor models again with similar differences for the value factor. Newey and West (1987) corrected t-statistics (using 3-month lag) are shown in parentheses. The alpha estimates are annualised and in percent.

	3-factor		4-factor		6-factor	
	(1)	(2)	(3)	(4)	(5)	(6)
Alpha	0.34	0.33	0.14	0.25	0.22	0.31
	(1.84)	(2.07)	(0.87)	(1.42)	(1.07)	(1.54)
AQR MKT	0.02	0.02	0.02	0.02	0.02	0.02
	(3.82)	(4.58)	(4.88)	(4.72)	(2.95)	(2.97)
AQR SMB	0.04	0.04	0.04	0.04	0.03	0.03
	(3.85)	(6.15)	(5.85)	(6.50)	(4.00)	(4.30)
AQR HML lag	−0.02		−0.02		−0.02	
	(−2.12)		(−2.36)		(−2.81)	
AQR HML cur		−0.03		−0.02		−0.02
		(−4.36)		(−3.18)		(−3.72)
AQR UMD			0.02	0.01	0.02	0.00
			(4.14)	(1.40)	(3.32)	(0.70)
AQR QMJ					−0.01	−0.01
					(−1.31)	(−1.17)
AQR BAB					0.01	0.01
					(0.88)	(0.91)
Observations	203	203	203	203	203	203
Adjusted R^2	0.33	0.43	0.42	0.43	0.42	0.43

Table 15 shows results for the full six-factor model for different periods. The choice of HML factor affects the estimated sensitivity to the UMD factor (momentum) for the entire sample period and during the last 10 years, but has limited impact on the momentum factor estimated using last 5 years of data.

Table 15

Equity six-factor regressions for selected time periods using AQR return series

Regression results with AQR global return factors for selected time periods. The dependent variable is the monthly return on the equity portfolio relative to the equity benchmark after management costs. Model (1), model (3) and model (5) are 6-factor models using the original value definition used by Fama and French (1992), while model (2), model (4) and model (6) are 6-factor models which use the value factor as defined by Asness and Frazzini (2011). Newey and West (1987) corrected t-statistics (using 3-month lag) are shown in parentheses. The alpha estimates are annualised and in percent.

	Since 1999		Last 10 years		Last 5 years	
	(1)	(2)	(3)	(4)	(5)	(6)
Alpha	0.22	0.31	0.18	0.32	0.32	0.29
	(1.07)	(1.54)	(0.75)	(1.26)	(0.93)	(0.83)
AQR MKT	0.02	0.02	0.02	0.02	0.01	0.01
	(2.95)	(2.97)	(2.79)	(2.83)	(2.10)	(2.01)
AQR SMB	0.03	0.03	0.02	0.03	0.03	0.03
	(4.00)	(4.30)	(1.47)	(2.19)	(2.41)	(2.24)
AQR HML lag	−0.02		−0.03		0.01	
	(−2.81)		(−1.97)		(1.26)	
AQR HML cur		−0.02		−0.04		0.01
		(−3.72)		(−2.52)		(1.06)
AQR UMD	0.02	0.00	0.01	−0.01	0.01	0.01
	(3.32)	(0.70)	(2.24)	(−1.28)	(1.87)	(1.86)
AQR QMJ	−0.01	−0.01	−0.03	−0.03	−0.01	−0.01
	(−1.31)	(−1.17)	(−2.14)	(−1.92)	(−0.82)	(−0.92)
AQR BAB	0.01	0.01	0.01	0.00	−0.02	−0.01
	(0.88)	(0.91)	(1.03)	(0.46)	(−1.73)	(−1.53)
Observations	203	203	119	119	59	59
Adjusted R^2	0.42	0.43	0.39	0.40	0.29	0.29

Fixed-income investments

Table 16 shows the regression results for fixed-income relative returns for different periods using global factors (with the default premium adjusted for differences in duration). Relative returns are estimated to have positive exposure to the default factor over the full sample period and last 10 years, while for the last 5 years there has been a negative exposure to the term premium.

Table 16
Fixed-income two-factor regressions for selected time periods

Regression results with global fixed-income factor returns constructed from Barclays data for selected time periods. The dependent variable is the monthly return on the fixed-income portfolio relative to the fixed-income benchmark after management costs. Period (1) starts in 1998, period (2) covers the last 10 years and period (3) covers the last 5 years. Newey and West (1987) corrected t-statistics (using 3-month lag) are shown in parentheses. The alpha estimates are annualised and in percent.

	Since 1998 (1)	Last 10 years (2)	Last 5 years (3)
Alpha	0.09	−0.04	0.11
	(0.28)	(−0.08)	(0.68)
DEF Adj	0.08	0.10	−0.00
	(3.22)	(3.99)	(−0.15)
TERM	−0.02	−0.03	−0.05
	(−1.39)	(−1.91)	(−4.43)
Observations	216	120	60
Adjusted R^2	0.29	0.39	0.29

Table 17 shows the sensitivity of the alpha estimates and factor exposures for the fixed-income relative returns to different model specifications. None of the alpha estimates are significantly different from zero at conventional significance levels across the specifications. The estimated exposure to the default factor is stable across the specifications, both using the unadjusted version and the duration adjusted one (for the duration adjusted version t-statistics increase).

Table 17
Fixed-income one- and two-factor regressions using global factor returns

Full period regression results with global fixed-income factor returns constructed from Barclays data. The dependent variable is the monthly return on the fixed-income portfolio relative to the fixed-income benchmark after management costs. Model (1), model (2) and model (3) are 1-factor models, while model (4) and model (5) are 2-factor models. Model (2) and model (5) use the duration adjusted default premium. Newey and West (1987) corrected t-statistics (using 3-month lag) are shown in parentheses. The alpha estimates are annualised and in percent.

	(1)	(2)	(3)	(4)	(5)
Alpha	0.09	0.03	0.15	0.10	0.09
	(0.29)	(0.10)	(0.36)	(0.30)	(0.28)
DEF	0.09			0.09	
	(2.89)			(2.83)	
DEF Adj		0.08			0.08
		(3.28)			(3.22)
TERM			−0.01	−0.00	−0.02
			(−1.12)	(−0.06)	(−1.39)
Observations	216	216	216	216	216
Adjusted R^2	0.25	0.29	0.00	0.24	0.29

The global fixed-income factors have different currency compositions between the long term treasuries and the short term treasuries. Table 18 reports regression results for the same specifications as in Table 17, but with the factors only consisting of USD-denominated bonds. Changes are minor for most of the specifications with increased estimates of alpha for the one-factor models, and lower for the two-factor models. None of the alpha estimates are significantly different from zero at conventional significance levels.

Table 18
Fixed-income one- and two-factor regressions using US factor returns

Full period regression results with US fixed-income factor returns constructed from Barclays data. The dependent variable is the monthly return on the fixed-income portfolio relative to the fixed-income benchmark after management costs. Model (1), model (2) and model (3) are 1-factor models, while model (4) and model (5) are 2-factor models. Model (2) and model (5) use the duration adjusted default premium. Newey and West (1987) corrected t-statistics (using 3-month lag) are shown in parentheses. The alpha estimates are annualised and in percent.

	(1)	(2)	(3)	(4)	(5)
Alpha	0.14	0.10	0.18	0.08	0.07
	(0.45)	(0.30)	(0.43)	(0.29)	(0.24)
DEF	0.07			0.08	
	(3.05)			(3.19)	
DEF adj		0.07			0.07
		(2.99)			(2.96)
TERM			−0.02	0.02	0.01
			(−2.43)	(1.34)	(0.61)
Observations	216	216	216	216	216
Adjusted R^2	0.29	0.28	0.02	0.30	0.28

Finally Table 19 shows the regression results for fixed-income relative returns before and after management costs since inception using default- and term premium factors.

Table 19
Fixed-income two-factor regressions before and after management costs

Full period regression results with global fixed-income factor returns constructed from Barclays data. The dependent variable in model (1) is the monthly return on the fixed-income portfolio relative to the fixed-income benchmark before management costs while in model (2) it is after management costs. Newey and West (1987) corrected t-statistics (using 3-month lag) are shown in parentheses. The alpha estimates are annualised and in percent.

	Before costs (1)	After costs (2)
Alpha	0.13	0.09
	(0.44)	(0.28)
DEF Adj	0.08	0.08
	(3.22)	(3.22)
TERM	−0.02	−0.02
	(−1.40)	(−1.39)
Observations	216	216
Adjusted R^2	0.29	0.29

Equity and fixed-income investments

Table 20 presents the regression results for the combined equity and fixed-income investments relative return after management costs using the seven-factor model recommended in Dahlquist et al. (2015) for different sample periods with the original factors. An issue not addressed by the regression model is the changes in the strategic benchmark over time. The use of relative returns should mitigate the issues introduced by benchmark changes if they are neutral to factor exposures. In the case of changing factor exposures, the factor model will not account for these appropriately. Further the regressions will also incorporate the sensitivity of equity relative returns to fixed-income factors, and the sensitivity of fixed-income relative returns to equity factors. The result of this is that the estimated alpha is not directly comparable to the sum of the stand-alone alpha estimates for the equity investments and the fixed-income investments. The relative returns are estimated to have a statistically significant positive loading to the market, size, profitability and default premium since inception, while the investment factor (CMA) exhibits a statistically significant negative loading.

Table 20
Fund ex-Real Estate factor regressions for selected time periods

Regression results with global 7-factor model for selected time periods. Factor return series are based on Fama-French and Barclays data. The dependent variable is the monthly return of the fund portfolio excluding Real Estate relative to the fund excluding Real Estate benchmark after management costs. Period (1) starts in 1998, period (2) covers the last 10 years and period (3) covers the last 5 years. Newey and West (1987) corrected t-statistics (using 3-month lag) are shown in parentheses. The alpha estimates are annualised and in percent.

	Since 1998 (1)	Last 10 years (2)	Last 5 years (3)
Alpha	−0.02 (−0.14)	−0.07 (−0.40)	0.10 (0.63)
F-F MKT	0.02 (5.76)	0.02 (4.50)	0.01 (2.68)
F-F SMB	0.03 (6.93)	0.04 (5.49)	0.03 (2.86)
F-F HML	0.01 (1.70)	0.02 (2.18)	0.00 (0.12)
F-F RMW	0.03 (3.06)	0.02 (1.17)	0.02 (1.61)
F-F CMA	−0.02 (−2.20)	−0.05 (−2.48)	0.01 (0.67)
DEF Adj	0.03 (3.00)	0.03 (3.38)	0.01 (0.97)
TERM	−0.01 (−1.69)	−0.01 (−1.67)	−0.04 (−4.59)
Observations	216	120	60
Adjusted R^2	0.55	0.67	0.43

Table 21 presents regression results using original and size-constrained factor returns. The alpha estimates for the model incorporating only original factors, and the model incorporating all of the size-constrained factors alpha estimates are close to zero. The combined equity and fixed-income investments has positive loadings to the market, small cap, profitability and the default premium, while a negative loading for the investment factor. The introduction of size-constrained factor returns has little impact on the estimated factor exposures for the relative returns.

Table 21
Fund ex-Real Estate size-constrained factor regressions

Full period regression results with global 7-factor model. Factor return series are based on Fama-French and Barclays data. The dependent variable is the monthly return of the fund portfolio excluding Real Estate relative to the fund excluding Real Estate benchmark after management costs. Model (1) includes Fama-French factors for both small and large caps and the global fixed-income factors, model (2) adjust the value factor to only include big cap companies, model (3) adjust the profitability factor to only include big cap companies, model (4) adjust the investment factor to only include big cap companies, and model (5) adjust the value, investment and profitability factor to only include big cap companies. Newey and West (1987) corrected t-statistics (using 3-month lag) are shown in parentheses. The alpha estimates are annualised and in percent.

	(1)	(2)	(3)	(4)	(5)
Alpha	−0.02	−0.01	0.03	−0.07	0.02
	(−0.14)	(−0.05)	(0.19)	(−0.41)	(0.12)
F-F MKT	0.02	0.02	0.02	0.02	0.02
	(5.76)	(5.50)	(5.53)	(5.88)	(5.61)
F-F SMB	0.03	0.03	0.03	0.03	0.03
	(6.93)	(7.04)	(7.14)	(7.10)	(7.48)
F-F HML	0.01		0.02	0.01	
	(1.70)		(2.30)	(1.61)	
F-F RMW	0.03	0.03		0.03	
	(3.06)	(3.33)		(3.15)	
F-F CMA	−0.02	−0.02	−0.02		
	(−2.20)	(−2.28)	(−2.36)		
DEF Adj	0.03	0.03	0.03	0.03	0.03
	(3.00)	(2.94)	(3.02)	(3.04)	(2.97)
TERM	−0.01	−0.01	−0.01	−0.01	−0.01
	(−1.69)	(−1.74)	(−1.44)	(−1.61)	(−1.42)
F-F HML Big		0.01			0.01
		(1.77)			(2.49)
F-F RMW Big			0.02		0.02
			(2.48)		(3.01)
F-F CMA Big				−0.02	−0.02
				(−2.07)	(−2.27)
Observations	216	216	216	216	216
Adjusted R^2	0.55	0.55	0.54	0.55	0.54

Table 22 presents the regression results for the combined equity and fixed-income relative returns after management costs with the seven-factor model for different sample periods using the size-constrained factor returns from Fama-French.

Table 22
Fund ex-Real Estate size-constrained factor regressions for selected time periods

Regression results with global 7-factor model for selected time periods. Factor return series are based on Fama-French and Barclays data, with equity factors constrained to big cap companies and the duration adjusted default premium. The dependent variable is the monthly return of the fund portfolio excluding Real Estate relative to the fund excluding Real Estate benchmark after management costs. Period (1) starts in 1998, period (2) covers the last 10 years and period (3) covers the last 5 years. Newey and West (1987) corrected t-statistics (using 3-month lag) are shown in parentheses. The alpha estimates are annualised and in percent.

	Since 1998 (1)	Last 10 years (2)	Last 5 years (3)
Alpha	0.02	−0.08	0.16
	(0.12)	(−0.43)	(1.23)
F-F MKT	0.02	0.02	0.01
	(5.61)	(4.95)	(2.96)
F-F SMB	0.03	0.04	0.02
	(7.48)	(5.66)	(2.94)
F-F HML Big	0.01	0.01	−0.01
	(2.49)	(0.65)	(−0.82)
F-F RMW Big	0.02	0.01	0.01
	(3.01)	(0.42)	(1.33)
F-F CMA Big	−0.02	−0.03	0.01
	(−2.27)	(−1.67)	(0.80)
DEF Adj	0.03	0.04	0.01
	(2.97)	(3.79)	(1.01)
TERM	−0.01	−0.01	−0.04
	(−1.42)	(−1.53)	(−4.93)
Observations	216	120	60
Adjusted R^2	0.54	0.65	0.44

Table 23 and Table 24 presents global seven-factor regression results where the Fama-French equity factors have been substituted to equivalent factors calculated by MSCI. For both of the tables the alpha estimates increase when using the factor returns from MSCI, though none of them are significantly different from zero at conventional significance levels across the specifications.

Table 23
Fund ex-Real Estate factor regressions for selected time periods (MSCI factor returns)

Regression results with global 7-factor model for selected time periods. Factor return series are based on MSCI and Barclays data. The dependent variable is the monthly return of the fund portfolio excluding Real Estate relative to the fund excluding Real Estate benchmark after management costs. Period (1) starts in 1998, period (2) covers the last 10 years and period (3) covers the last 5 years. Newey and West (1987) corrected t-statistics (using 3-month lag) are shown in parentheses. The alpha estimates are annualised and in percent.

	Since 1998 (1)	Last 10 years (2)	Last 5 years (3)
Alpha	0.20	0.06	0.14
	(1.48)	(0.30)	(0.90)
MSCI MKT	0.01	0.01	0.01
	(3.24)	(2.60)	(2.93)
MSCI SMB	0.04	0.04	0.03
	(7.78)	(4.33)	(3.04)
MSCI HML	−0.01	−0.01	−0.00
	(−2.48)	(−1.61)	(−0.45)
MSCI RMW	−0.01	−0.00	0.01
	(−1.97)	(−0.34)	(0.71)
MSCI CMA	−0.02	−0.04	0.00
	(−3.05)	(−2.45)	(0.12)
DEF Adj	0.03	0.04	0.00
	(2.91)	(3.68)	(0.62)
TERM	−0.01	−0.02	−0.03
	(−1.95)	(−2.30)	(−4.66)
Observations	216	120	60
Adjusted R^2	0.53	0.65	0.43

Table 24
Fund ex-Real Estate size-constrained factor regressions (MSCI factor returns)

Full period regression results with global 7-factor model. Factor return series are based on MSCI and Barclays data. The dependent variable is the monthly return of the fund portfolio excluding Real Estate relative to the fund excluding Real Estate benchmark after management costs. Model (1) includes MSCI factors for both small and large caps and the global fixed-income factors, model (2) adjust the value factor to only include big cap companies, model (3) adjust the profitability factor to only include big cap companies, model (4) adjust the investment factor to only include big cap companies, and model (5) adjust the value, investment and profitability factor to only include big cap companies. Newey and West (1987) corrected t-statistics (using 3-month lag) are shown in parentheses. The alpha estimates are annualised and in percent.

	(1)	(2)	(3)	(4)	(5)
Alpha	0.20	0.22	0.16	0.18	0.16
	(1.48)	(1.69)	(1.13)	(1.39)	(1.22)
MSCI MKT	0.01	0.01	0.01	0.01	0.01
	(3.24)	(3.38)	(3.56)	(3.26)	(3.65)
MSCI SMB	0.04	0.04	0.04	0.04	0.05
	(7.78)	(7.92)	(7.72)	(8.16)	(8.09)
MSCI HML	−0.01		−0.01	−0.01	
	(−2.48)		(−2.02)	(−2.60)	
MSCI RMW	−0.01	−0.02		−0.01	
	(−1.97)	(−2.37)		(−2.20)	
MSCI CMA	−0.02	−0.02	−0.02		
	(−3.05)	(−3.18)	(−3.00)		
DEF Adj	0.03	0.03	0.03	0.03	0.03
	(2.91)	(2.95)	(2.89)	(2.92)	(2.92)
TERM	−0.01	−0.01	−0.01	−0.01	−0.01
	(−1.95)	(−2.20)	(−1.79)	(−2.03)	(−2.09)
MSCI HML Big		−0.02			−0.01
		(−2.88)			(−2.69)
MSCI RMW Big			−0.00		−0.01
			(−0.93)		(−1.88)
MSCI CMA Big				−0.02	−0.02
				(−3.28)	(−3.22)
Observations	216	216	216	216	216
Adjusted R^2	0.53	0.54	0.53	0.54	0.54

Table 25 presents the regression results since inception before and after costs using original and adjusted factors.

Table 25
Fund ex-Real Estate factor regressions before and after management costs

Full period regression results with global 7-factor model. Factor return series are based on Fama-French and Barclays data, with equity factors constrained to big cap companies and the duration adjusted default premium. The dependent variable is the monthly return of the fund portfolio excluding Real Estate relative to the fund excluding Real Estate benchmark. Model (1) and model (3) are before management costs, while model (2) and model (4) are after management costs. Newey and West (1987) corrected t-statistics (using 3-month lag) are shown in parentheses. The alpha estimates are annualised and in percent.

	Original factors		Big cap factors	
	(1)	(2)	(3)	(4)
Alpha	0.07	−0.02	0.11	0.02
	(0.41)	(−0.14)	(0.68)	(0.12)
F-F MKT	0.02	0.02	0.02	0.02
	(5.77)	(5.76)	(5.61)	(5.61)
F-F SMB	0.03	0.03	0.03	0.03
	(6.95)	(6.93)	(7.51)	(7.48)
F-F HML	0.01	0.01		
	(1.72)	(1.70)		
F-F RMW	0.03	0.03		
	(3.06)	(3.06)		
F-F CMA	−0.02	−0.02		
	(−2.22)	(−2.20)		
DEF Adj	0.03	0.03	0.03	0.03
	(2.99)	(3.00)	(2.97)	(2.97)
TERM	−0.01	−0.01	−0.01	−0.01
	(−1.70)	(−1.69)	(−1.43)	(−1.42)
F-F HML Big			0.01	0.01
			(2.52)	(2.49)
F-F RMW Big			0.02	0.02
			(3.01)	(3.01)
F-F CMA Big			−0.02	−0.02
			(−2.28)	(−2.27)
Observations	216	216	216	216
Adjusted R^2	0.55	0.55	0.54	0.54

1.4   Factor return statistics

To inform the interpretation of the previous results, we here present some statistics on the factors used in this appendix. We show statistics relating to factor returns, time-series characteristics and correlations between factors. Figure 1 shows the cumulative return of the original Fama-French factors for the sample period used in this report. Figure 2 shows the cumulative factor returns of the MSCI version of the Fama-French five-factor model.

Figure 1
Cumulative returns, global Fama-French factors, 1998-2015

Figure 2
Cumulative returns, global MSCI factors, 1998-2015

The global Fama-French factors are a simple average of the factors constructed in small cap stocks and big cap stocks. As seen in Figures 3 through 6 the cumulative return is different for small cap and big cap stocks for the Value, Momentum, Profitability and Investment factors.

Figure 3
Cumulative returns, global HML factor along with Big and Small versions, 1998-2015

— F–F HML   — F–F HML Big   — F–F HML Small
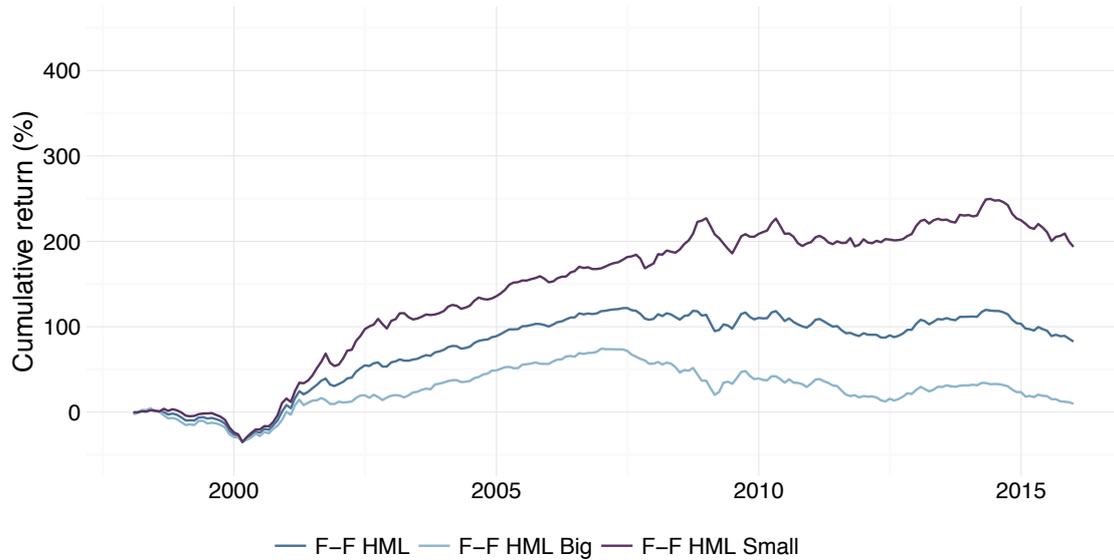
Figure 4
Cumulative returns, global WML factor along with Big and Small versions, 1998-2015

— F–F WML   — F–F WML Big   — F–F WML Small

Figure 5
Cumulative returns, global RMW factor along with Big and Small versions,
1998-2015

F—F RMW — F—F RMW Big — F—F RMW Small
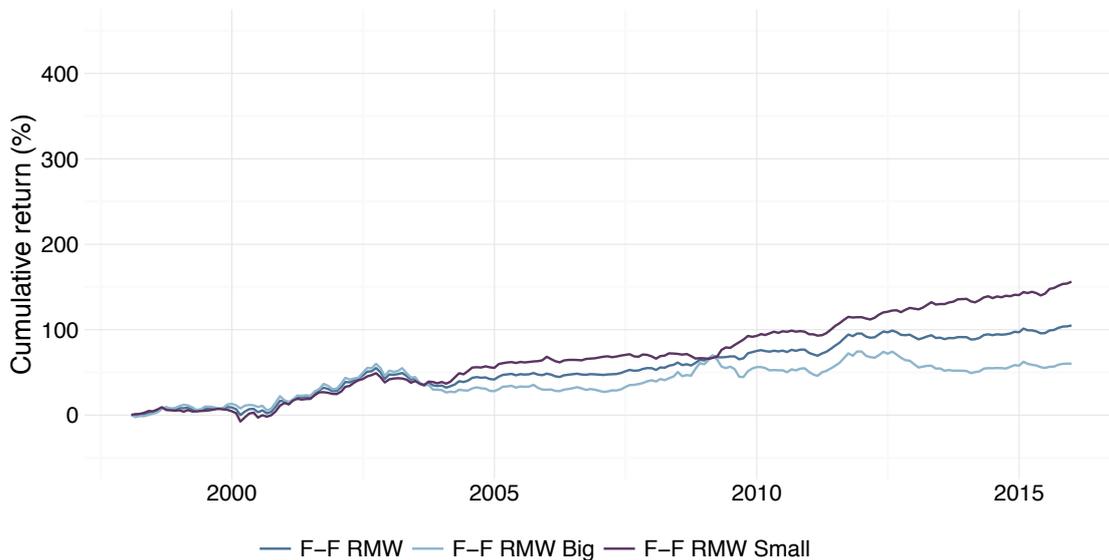
Figure 6
Cumulative returns, global CMA factor along with Big and Small versions,
1998-2015

F—F CMA — F—F CMA Big — F—F CMA Small
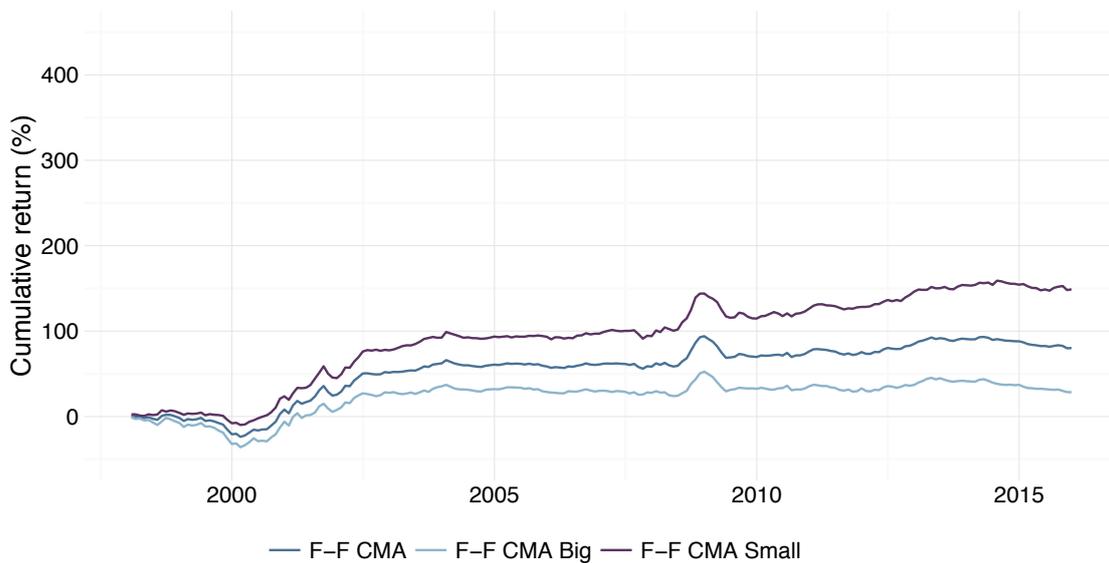
Figure 7 shows the cumulative returns of the factors from AQR Capital Management.

Figure 7
Cumulative returns, global AQR factors, 1998-2015
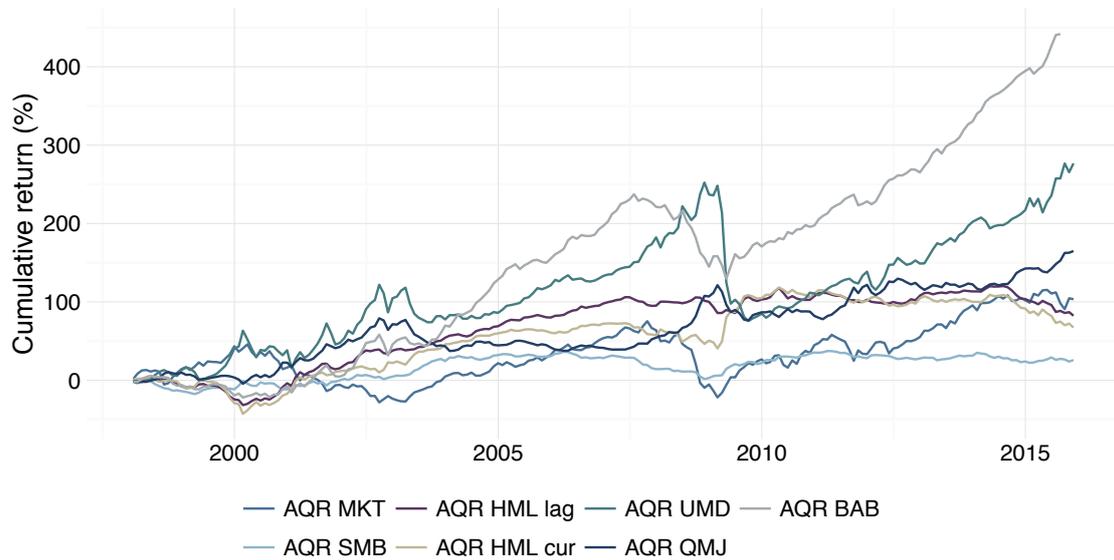
Figure 8 shows the cumulative return of the fixed-income factors of Fama and French (1993) replicated with global and US Barclays indices, including versions of the Default factor adjusted for term effects.

Figure 8
Cumulative returns, global Fixed Income factors, 1998-2015

Tables 26 through 28 show factor return statistics for the different periods since the fund's inception. We see that HML, WML, RMW and CMA have higher volatility-adjusted returns in the small and micro cap end of the universe.

Table 26
Factor return statistics since 1998

Arithmetic average return and volatility of monthly returns (annualised) over the period 1998-2015 for all factors. Figures are annualised with simple distributional assumptions of independence and stationarity. Note that AQR factors have data only up to November 2015.

Factor	Average return	Volatility	Return-to-volatility
AQR BAB	10.22	11.08	0.92
AQR HML lag	3.68	8.14	0.45
AQR HML cur	3.56	11.79	0.30
AQR MKT	5.33	16.36	0.33
AQR QMJ	5.83	8.81	0.66
AQR SMB	1.51	6.85	0.22
AQR UMD	8.74	15.87	0.55
F-F CMA	3.53	7.28	0.49
F-F CMA Big	1.78	8.89	0.20
F-F CMA Small	5.29	6.62	0.80
F-F HML	3.74	8.93	0.42
F-F HML Big	1.01	9.88	0.10
F-F HML Small	6.49	9.95	0.65
F-F MKT	5.27	15.95	0.33
F-F RMW	4.15	5.69	0.73
F-F RMW Big	2.90	7.42	0.39
F-F RMW Small	5.41	5.87	0.92
F-F SMB	1.43	7.23	0.20
F-F WML	7.52	15.41	0.49
F-F WML Big	4.83	17.19	0.28
F-F WML Small	10.21	14.60	0.70
MSCI CMA	2.67	6.65	0.40
MSCI CMA Big	1.91	8.11	0.24
MSCI CMA Small	3.44	6.20	0.55
MSCI HML	4.75	8.96	0.53
MSCI HML Big	5.01	9.79	0.51
MSCI HML Small	4.50	9.39	0.48
MSCI MKT	5.34	16.87	0.32
MSCI RMW	2.03	6.42	0.32
MSCI RMW Big	1.50	8.76	0.17
MSCI RMW Small	2.56	5.75	0.45
MSCI SMB	2.47	5.49	0.45
DEF	0.11	6.26	0.02
DEF Adj	0.89	7.16	0.12
TERM	3.41	5.71	0.60
DEF US	-0.54	8.14	-0.07
DEF Adj US	0.09	8.40	0.01
TERM US	4.05	9.60	0.42

<div align="center">

Table 27
Factor return statistics during the last 10 years

</div>

Arithmetic average return and volatility of monthly returns (annualised) over the period 2006-2015 for all factors. Figures are annualised with simple distributional assumptions of independence and stationarity. Note that AQR factors have data only up to November 2015.

Factor	Average return	Volatility	Return-to-volatility
AQR BAB	8.17	7.65	1.07
AQR HML lag	0.27	5.29	0.05
AQR HML cur	0.85	9.73	0.09
AQR MKT	5.82	16.97	0.34
AQR QMJ	6.64	8.02	0.83
AQR SMB	-0.21	5.81	-0.04
AQR UMD	6.50	14.29	0.45
F-F CMA	1.38	4.69	0.29
F-F CMA Big	0.12	5.36	0.02
F-F CMA Small	2.64	4.84	0.55
F-F HML	-0.76	5.76	-0.13
F-F HML Big	-3.20	8.10	-0.39
F-F HML Small	1.68	5.65	0.30
F-F MKT	5.73	16.61	0.34
F-F RMW	3.29	3.82	0.86
F-F RMW Big	2.32	6.31	0.37
F-F RMW Small	4.27	3.55	1.20
F-F SMB	-0.30	5.28	-0.06
F-F WML	4.89	12.61	0.39
F-F WML Big	2.74	13.40	0.20
F-F WML Small	7.04	12.48	0.56
MSCI CMA	2.89	5.55	0.52
MSCI CMA Big	2.24	6.21	0.36
MSCI CMA Small	3.55	5.69	0.62
MSCI HML	1.83	8.19	0.22
MSCI HML Big	1.87	9.33	0.20
MSCI HML Small	1.80	7.72	0.23
MSCI MKT	6.00	17.68	0.34
MSCI RMW	4.02	5.91	0.68
MSCI RMW Big	4.44	7.89	0.56
MSCI RMW Small	3.60	5.61	0.64
MSCI SMB	0.91	4.92	0.19
DEF	0.83	7.28	0.11
DEF Adj	1.62	8.60	0.19
TERM	2.85	5.93	0.48
DEF US	-0.63	9.99	-0.06
DEF Adj US	0.01	10.28	0.00
TERM US	4.77	11.00	0.43

Table 28
Factor return statistics during the last 5 years

Arithmetic average return and volatility of monthly returns (annualised) over the period 2011-2015 for all factors. Figures are annualised with simple distributional assumptions of independence and stationarity. Note that AQR factors have data only up to November 2015.

Factor	Average return	Volatility	Return-to-volatility
AQR BAB	12.89	4.58	2.82
AQR HML lag	-2.50	4.47	-0.56
AQR HML cur	-4.53	6.01	-0.75
AQR MKT	7.78	13.13	0.59
AQR QMJ	7.88	6.97	1.13
AQR SMB	-1.40	4.51	-0.31
AQR UMD	12.30	9.20	1.34
F-F CMA	0.48	2.80	0.17
F-F CMA Big	-0.98	3.78	-0.26
F-F CMA Small	1.95	2.80	0.70
F-F HML	-1.94	5.15	-0.38
F-F HML Big	-3.66	6.65	-0.55
F-F HML Small	-0.24	5.16	-0.05
F-F MKT	8.16	12.88	0.63
F-F RMW	3.48	3.91	0.89
F-F RMW Big	1.41	5.42	0.26
F-F RMW Small	5.55	3.10	1.79
F-F SMB	-1.83	4.69	-0.39
F-F WML	9.51	8.08	1.18
F-F WML Big	6.09	9.55	0.64
F-F WML Small	12.95	7.15	1.81
MSCI CMA	3.29	3.16	1.04
MSCI CMA Big	2.60	3.59	0.72
MSCI CMA Small	3.98	3.44	1.16
MSCI HML	-3.15	5.84	-0.54
MSCI HML Big	-3.18	6.83	-0.47
MSCI HML Small	-3.12	5.69	-0.55
MSCI MKT	8.09	13.57	0.60
MSCI RMW	3.53	4.97	0.71
MSCI RMW Big	2.47	5.93	0.42
MSCI RMW Small	4.58	5.06	0.91
MSCI SMB	-0.59	3.81	-0.16
DEF	3.28	5.16	0.64
DEF Adj	4.20	5.95	0.71
TERM	5.09	5.71	0.89
DEF US	-1.69	8.24	-0.20
DEF Adj US	-0.51	8.39	-0.06
TERM US	7.43	11.37	0.65

Tables 29 through 34 show the linear correlation between monthly factor returns.

Table 29
Correlations between the Fama-French-Carhart factors and fixed income factors

	F-F MKT	F-F SMB	F-F HML	F-F WML	F-F RMW	F-F CMA	DEF Adj	TERM
F-F MKT	1.00	0.02	-0.12	-0.26	-0.48	-0.46	0.47	-0.13
F-F SMB	0.02	1.00	-0.20	0.26	-0.30	-0.19	0.11	-0.01
F-F HML	-0.12	-0.20	1.00	-0.28	0.25	0.74	-0.09	-0.01
F-F WML	-0.26	0.26	-0.28	1.00	0.14	-0.03	-0.19	0.06
F-F RMW	-0.48	-0.30	0.25	0.14	1.00	0.31	-0.12	0.20
F-F CMA	-0.46	-0.19	0.74	-0.03	0.31	1.00	-0.33	0.05
DEF Adj	0.47	0.11	-0.09	-0.19	-0.12	-0.33	1.00	0.02
TERM	-0.13	-0.01	-0.01	0.06	0.20	0.05	0.02	1.00

Table 30
Correlations between the MSCI factors and fixed income factors

	MSCI MKT	MSCI SMB	MSCI HML	MSCI RMW	MSCI CMA	DEF Adj	TERM
MSCI MKT	1.00	0.04	0.16	-0.39	-0.54	0.47	-0.13
MSCI SMB	0.04	1.00	0.20	-0.14	0.06	0.14	0.05
MSCI HML	0.16	0.20	1.00	-0.66	0.21	0.01	-0.09
MSCI RMW	-0.39	-0.14	-0.66	1.00	0.09	-0.17	0.01
MSCI CMA	-0.54	0.06	0.21	0.09	1.00	-0.40	0.07
DEF Adj	0.47	0.14	0.01	-0.17	-0.40	1.00	0.02
TERM	-0.13	0.05	-0.09	0.01	0.07	0.02	1.00

Table 31
Correlations between the MSCI and Fama-French factors

	MSCI MKT	MSCI SMB	MSCI HML	MSCI RMW	MSCI CMA
F-F MKT	0.99	0.06	0.07	-0.36	-0.56
F-F SMB	-0.05	0.78	-0.16	0.04	-0.16
F-F HML	-0.07	0.23	0.76	-0.48	0.52
F-F RMW	-0.45	-0.14	0.07	0.21	0.42
F-F CMA	-0.43	0.14	0.43	-0.14	0.74

Table 32
Correlations between the AQR Capital Management factors

	AQR MKT	AQR SMB	AQR HML lag	AQR HML cur	AQR UMD	AQR QMJ	AQR BAB
AQR MKT	1.00	0.26	-0.17	0.12	-0.35	-0.80	-0.30
AQR SMB	0.26	1.00	-0.11	0.09	-0.22	-0.56	-0.04
AQR HML lag	-0.17	-0.11	1.00	0.68	-0.09	0.17	0.50
AQR HML cur	0.12	0.09	0.68	1.00	-0.73	-0.17	0.06
AQR UMD	-0.35	-0.22	-0.09	-0.73	1.00	0.44	0.35
AQR QMJ	-0.80	-0.56	0.17	-0.17	0.44	1.00	0.40
AQR BAB	-0.30	-0.04	0.50	0.06	0.35	0.40	1.00

Table 33
Correlations between the AQR factors and the Fama-French factors

	AQR MKT	AQR SMB	AQR HML lag	AQR HML cur	AQR UMD
F-F MKT	1.00	0.24	-0.15	0.14	-0.37
F-F SMB	0.05	0.84	-0.09	-0.19	0.14
F-F HML	-0.14	-0.14	0.94	0.70	-0.15
F-F WML	-0.24	-0.11	-0.20	-0.78	0.97

Table 34
Correlations between global and USD fixed-income factors

	US DEF	US DEF Adj	US TERM
DEF	0.75	0.77	-0.16
DEF Adj	0.75	0.79	-0.03
TERM	-0.30	-0.20	0.88

2   Risk-adjusted returns

The purpose of this section is to give a detailed description of the methods used to compute the risk-adjusted performance measures in the "Cost- and risk-adjusted return" section in the main report. These performance measures are point estimates and therefore confidence intervals are also reported in this section. Finally, an R^2 for the regression behind Jensen's alpha is also computed.

The fund return and the benchmark return are both measured in the currency basket. The 1-month US T-bill rate collected from Kenneth French's web page is used as a proxy for the risk-free return. In principle, this is not consistent with measuring the fund and benchmark returns in the currency basket. On the other hand, there is no established alternative. See also the discussion by Dahlquist et al. (2015). Further, using short-term interest rates of major currencies weighted according to the currency basket gives similar results. Constructing a more well-suited proxy for the risk-free rate of the fund will be investigated further at a later stage.

2.1   Methodology

In the following section, the methods used for calculating risk-adjusted measures and confidence intervals are described. Define r_t, rb_t and rf_t to be the return in month t of the fund's investments, the Ministry of Finance benchmark and the risk-free asset, respectively. T is the number of months in the sample period. All returns are simple rather than in logs.

Sharpe ratio

Let rx_t denote the portfolio excess return $r_t - rf_t$ in month t. The formula for the monthly Sharpe ratio is[8]

$$\widehat{SR}_m = \hat{\mu}_{rx}/\hat{\sigma}_r, \tag{2.1}$$

where $\hat{\mu}_{rx}$ is the sample average of portfolio excess returns, and $\hat{\sigma}_r$ is the sample standard deviation of portfolio returns computed with the $T-1$ divisor. The Sharpe ratio of the benchmark is

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[8]See Sharpe (1966, 1994).

computed similarly. Monthly Sharpe ratios are annualised using

$$\widehat{SR}_a = \widehat{SR}_m \sqrt{12}. \tag{2.2}$$

This annualisation is an approximation as it ignores compounding by assuming that annual returns are sums of monthly returns. This is not the case when using simple returns. It also assumes that monthly returns have zero autocorrelation. This formula is used as it is the most conventional way of annualising Sharpe ratios and therefore makes the results comparable. To measure the uncertainty in the estimates, 95 percent confidence intervals around the annual Sharpe ratios are computed using[9]

$$\widehat{SR}_a \pm 1.96 \times se\left(\widehat{SR}_a\right), \tag{2.3}$$

where

$$se\left(\widehat{SR}_a\right) = \sqrt{12\left(1 + \frac{1}{2}\widehat{SR}_m^2\right)/T}. \tag{2.4}$$

This formula is an asymptotic approximation and assumes that monthly returns are normally, independently and identically distributed. These distributional assumptions are made for simplicity and to be consistent with the way Sharpe ratios are annualised from monthly data. The same critical value (1.96) is used to compute confidence intervals for the other risk-adjusted performance measures.

Information ratio

Let $rrel_t$ denote the relative return in month t, $r_t - rb_t$. The monthly information ratio is computed as

$$\widehat{IR}_m = \hat{\mu}_{rrel}/\hat{\sigma}_{rrel}, \tag{2.5}$$

where $\hat{\mu}_{rrel}$ is the sample average of relative returns, and $\hat{\sigma}_{rrel}$ is the sample standard deviation of relative returns using the $T-1$ divisor. The annualised information ratios and the corresponding confidence intervals are computed in the same way as for the Sharpe ratio.

Jensen's alpha

The Capital Asset Pricing Model (CAPM) regression using the benchmark as a proxy for the market portfolio is

$$rx_t = \alpha_m + \beta bx_t + \epsilon_t, \tag{2.6}$$

where $bx_t = rb_t - rf_t$ is the benchmark excess return in month t. Jensen's alpha measured on a monthly level is the Ordinary Least Squares (OLS) estimate of the intercept in this regression.[10] That is,

$$\hat{\alpha}_m = \hat{\mu}_{rx} - \hat{\beta}\hat{\mu}_{bx}, \tag{2.7}$$

[9]See Lo (2002).
[10]See Jensen (1968).

where $\hat{\beta}$ is the OLS estimate of the slope coefficient in the CAPM regression (2.6), and $\hat{\mu}_{bx}$ is the sample average of benchmark excess returns. The monthly alpha is annualised using

$$\hat{\alpha}_a = \hat{\alpha}_m \times 12. \tag{2.8}$$

A 95 percent confidence interval around the annual alpha is constructed using the OLS standard error of the intercept in the monthly regression multiplied by 12. The CAPM regression can be rewritten into a relative return form by subtracting bx_t on both sides

$$rrel_t = \alpha_m + (\beta - 1)bx_t + \epsilon_t. \tag{2.9}$$

We compute the R-squared of this relative return regression and denote it by R^2_{rrel}.

Appraisal ratio

The monthly appraisal ratio is computed in the following way[11]

$$\widehat{AR}_m = \hat{\alpha}_m / \hat{\sigma}_\epsilon, \tag{2.10}$$

where $\hat{\alpha}_m$ is Jensen's alpha from (2.7), and $\hat{\sigma}_\epsilon$ is the sample standard deviation of the residuals from estimating the CAPM regression model in (2.6). For computing $\hat{\sigma}_\epsilon$, we use the $T-2$ divisor to reflect the number of estimated parameters. Monthly appraisal ratios are annualised in the same way as the Sharpe ratios. For the 95 percent confidence intervals around the annual appraisal ratios, the following estimator for the standard error is used

$$se\left(\widehat{AR}_a\right) = \sqrt{12\left(\frac{\sum_{t=1}^{T} bx_t^2}{\sum_{t=1}^{T}\left(bx_t - \hat{\mu}_{bx}\right)^2} + \frac{1}{2}\widehat{AR}_m^2\right)/T}. \tag{2.11}$$

This formula can be derived using the delta method. The derivation is similar to the derivation of the standard error for the Sharpe ratio and also assumes normally, independently and identically distributed data.

2.2 Results

In this section, 95 percent confidence intervals for all the risk-adjusted measures are reported before and after management costs. Results are computed since inception, for the last 10 years, the last 5 years and for 5-year rolling windows.

Sharpe ratio

Tables 35 through 38 report Sharpe ratios along with confidence intervals before and after management costs.

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[11] See Treynor and Black (1973).

Table 35

Sharpe ratio before management costs for various sample sizes

Before cost annualised Sharpe ratio estimates for various sample periods, along with 95 percent confidence intervals (parentheses). The estimates are based on monthly returns of equity, fixed-income and combined portfolios and corresponding benchmarks.

	Asset class	Since inception	Last 10 years	Last 5 years
Portfolio	Equity	0.30 (-0.18, 0.77)	0.36 (-0.26, 0.98)	0.78 (-0.11, 1.67)
	Fixed income	0.82 (0.35, 1.29)	0.85 (0.22, 1.48)	1.59 (0.67, 2.51)
	Equity and fixed income	0.49 (0.03, 0.96)	0.50 (-0.12, 1.12)	1.01 (0.11, 1.90)
Benchmark	Equity	0.26 (-0.21, 0.74)	0.35 (-0.27, 0.97)	0.78 (-0.11, 1.66)
	Fixed income	0.82 (0.35, 1.29)	0.91 (0.28, 1.54)	1.49 (0.57, 2.41)
	Equity and fixed income	0.48 (0.02, 0.95)	0.52 (-0.10, 1.15)	1.01 (0.11, 1.90)

Table 36

Sharpe ratio before management costs for moving sample periods

Before cost annualised Sharpe ratio estimates for moving sample periods, along with 95 percent confidence intervals (parentheses). The estimates are based on monthly returns of equity, fixed-income and combined portfolios and corresponding benchmarks. The asterisk is to indicate that inception of active investment for the equity portfolio is January 1999.

	Asset class	1998-2002*	2003-2007	2008-2012	2013-2015
Portfolio	Equity	-0.44 (-1.43, 0.54)	1.38 (0.46, 2.29)	0.05 (-0.83, 0.92)	1.18 (0.02, 2.35)
	Fixed income	0.67 (-0.22, 1.55)	0.36 (-0.52, 1.24)	1.27 (0.37, 2.18)	0.91 (-0.24, 2.06)
	Equity and fixed income	-0.12 (-1.00, 0.75)	1.51 (0.59, 2.43)	0.30 (-0.58, 1.18)	1.24 (0.07, 2.41)
Benchmark	Equity	-0.50 (-1.49, 0.48)	1.32 (0.41, 2.23)	0.04 (-0.84, 0.92)	1.17 (0.01, 2.33)
	Fixed income	0.62 (-0.27, 1.50)	0.34 (-0.54, 1.22)	1.38 (0.47, 2.29)	0.90 (-0.25, 2.05)
	Equity and fixed income	-0.19 (-1.07, 0.68)	1.47 (0.56, 2.39)	0.31 (-0.57, 1.19)	1.23 (0.07, 2.40)

Table 37
Sharpe ratio after management costs for various sample sizes

After cost annualised Sharpe ratio estimates for various sample periods, along with 95 percent confidence intervals (parentheses). The estimates are based on monthly returns of equity, fixed-income and combined portfolios and corresponding benchmarks.

	Asset class	Since inception	Last 10 years	Last 5 years
Portfolio	Equity	0.29	0.35	0.77
		(-0.19, 0.76)	(-0.27, 0.97)	(-0.11, 1.66)
	Fixed income	0.81	0.84	1.57
		(0.34, 1.28)	(0.21, 1.46)	(0.65, 2.49)
	Equity and fixed income	0.48	0.49	1.00
		(0.02, 0.94)	(-0.13, 1.12)	(0.11, 1.89)
Benchmark	Equity	0.26	0.35	0.78
		(-0.21, 0.74)	(-0.27, 0.97)	(-0.11, 1.66)
	Fixed income	0.82	0.91	1.49
		(0.35, 1.29)	(0.28, 1.54)	(0.57, 2.41)
	Equity and fixed income	0.48	0.52	1.01
		(0.02, 0.95)	(-0.10, 1.15)	(0.11, 1.90)

Table 38
Sharpe ratio after management costs for moving sample periods

After cost annualised Sharpe ratio estimates for moving sample periods, along with 95 percent confidence intervals (parentheses). The estimates are based on monthly returns of equity, fixed-income and combined portfolios and corresponding benchmarks. The asterisk is to indicate that inception of active investment for the equity portfolio is January 1999.

	Asset class	1998-2002*	2003-2007	2008-2012	2013-2015
Portfolio	Equity	-0.45	1.36	0.04	1.18
		(-1.44, 0.53)	(0.45, 2.27)	(-0.84, 0.92)	(0.01, 2.34)
	Fixed income	0.65	0.34	1.26	0.90
		(-0.23, 1.54)	(-0.54, 1.22)	(0.36, 2.17)	(-0.25, 2.05)
	Equity and fixed income	-0.14	1.48	0.29	1.23
		(-1.02, 0.74)	(0.57, 2.40)	(-0.59, 1.17)	(0.07, 2.40)
Benchmark	Equity	-0.50	1.32	0.04	1.17
		(-1.49, 0.48)	(0.41, 2.23)	(-0.84, 0.92)	(0.01, 2.33)
	Fixed income	0.62	0.34	1.38	0.90
		(-0.27, 1.50)	(-0.54, 1.22)	(0.47, 2.29)	(-0.25, 2.05)
	Equity and fixed income	-0.19	1.47	0.31	1.23
		(-1.07, 0.68)	(0.56, 2.39)	(-0.57, 1.19)	(0.07, 2.40)

Information ratio

Tables 39 through 42 report information ratios along with confidence intervals before and after management costs.

Table 39

Information ratio before management costs for various sample sizes

Before cost annualised information ratio estimates for various sample periods, along with 95 percent confidence intervals (parentheses). The estimates are based on monthly returns of equity, fixed-income and combined portfolios and corresponding benchmarks.

Asset class	Since inception	Last 10 years	Last 5 years
Equity	0.67	0.36	0.49
	(0.19, 1.15)	(-0.26, 0.99)	(-0.39, 1.37)
Fixed income	0.13	0.03	-0.19
	(-0.34, 0.59)	(-0.59, 0.65)	(-1.07, 0.69)
Equity and fixed income	0.39	0.12	0.37
	(-0.07, 0.86)	(-0.50, 0.74)	(-0.51, 1.25)

Table 40

Information ratio before management costs for moving sample periods

Before cost annualised information ratio estimates for moving sample periods, along with 95 percent confidence intervals (parentheses). The estimates are based on monthly returns of equity, fixed-income and combined portfolios and corresponding benchmarks. The asterisk is to indicate that inception of active investment for the equity portfolio is January 1999.

Asset class	1998-2002*	2003-2007	2008-2012	2013-2015
Equity	0.87	1.07	0.13	0.80
	(-0.12, 1.87)	(0.17, 1.97)	(-0.75, 1.00)	(-0.34, 1.95)
Fixed income	0.52	0.08	0.22	-0.41
	(-0.36, 1.41)	(-0.80, 0.96)	(-0.65, 1.10)	(-1.55, 0.72)
Equity and fixed income	0.96	0.91	0.09	0.51
	(0.06, 1.85)	(0.02, 1.80)	(-0.79, 0.97)	(-0.63, 1.64)

Table 41

Information ratio after management costs for various sample sizes

After cost annualised information ratio estimates for various sample periods, along with 95 percent confidence intervals (parentheses). The estimates are based on monthly returns of equity, fixed-income and combined portfolios and corresponding benchmarks.

Asset class	Since inception	Last 10 years	Last 5 years
Equity	0.50	0.21	0.32
	(0.02, 0.98)	(-0.41, 0.83)	(-0.56, 1.19)
Fixed income	0.08	0.00	-0.27
	(-0.38, 0.54)	(-0.62, 0.62)	(-1.15, 0.61)
Equity and fixed income	0.27	0.02	0.20
	(-0.19, 0.73)	(-0.60, 0.64)	(-0.68, 1.08)

Table 42
Information ratio after management costs for moving sample periods

After cost annualised information ratio estimates for moving sample periods, along with 95 percent confidence intervals (parentheses). The estimates are based on monthly returns of equity, fixed-income and combined portfolios and corresponding benchmarks. The asterisk is to indicate that inception of active investment for the equity portfolio is January 1999.

Asset class	1998-2002*	2003-2007	2008-2012	2013-2015
Equity	0.72	0.85	-0.03	0.65
	(-0.27, 1.71)	(-0.04, 1.74)	(-0.90, 0.85)	(-0.49, 1.79)
Fixed income	0.38	-0.06	0.20	-0.47
	(-0.50, 1.26)	(-0.94, 0.81)	(-0.68, 1.07)	(-1.61, 0.67)
Equity and fixed income	0.76	0.67	0.01	0.36
	(-0.12, 1.65)	(-0.21, 1.56)	(-0.87, 0.88)	(-0.77, 1.50)

Jensen's alpha

Tables 43 through 46 report Jensen's alpha along with confidence intervals and relative return R-squared before and after management costs.

Table 43
Jensen's alpha before management costs for various sample sizes

Before cost annualised Jensen's alpha estimates (percent) for various sample periods, along with 95 percent confidence intervals (parentheses) and the R-squared from a regression of relative return on a constant and the benchmark excess return. The estimates are based on monthly returns of equity, fixed-income and combined portfolios and corresponding benchmarks.

Asset class	Since inception	Last 10 years	Last 5 years
Equity	0.46	0.14	0.06
	(0.10, 0.81)	(-0.26, 0.54)	(-0.31, 0.42)
	$R^2_{rrel} = 0.16$	$R^2_{rrel} = 0.27$	$R^2_{rrel} = 0.22$
Fixed income	0.13	0.04	0.29
	(-0.38, 0.65)	(-0.89, 0.96)	(-0.09, 0.68)
	$R^2_{rrel} = 0.00$	$R^2_{rrel} = 0.00$	$R^2_{rrel} = 0.30$
Equity and fixed income	0.10	-0.19	0.00
	(-0.19, 0.38)	(-0.63, 0.26)	(-0.32, 0.33)
	$R^2_{rrel} = 0.30$	$R^2_{rrel} = 0.39$	$R^2_{rrel} = 0.12$

Table 44
Jensen's alpha before management costs for moving sample periods

Before cost annualised Jensen's alpha estimates (percent) for moving sample periods, along with 95 percent confidence intervals (parentheses) and the R-squared from a regression of relative return on a constant and the benchmark excess return. The estimates are based on monthly returns of equity, fixed-income and combined portfolios and corresponding benchmarks. The asterisk is to indicate that inception of active investment for the equity portfolio is January 1999.

Asset class	1998-2002*	2003-2007	2008-2012	2013-2015
Equity	1.03	0.53	0.09	0.17
	(0.07, 1.99)	(-0.16, 1.22)	(-0.51, 0.68)	(-0.36, 0.69)
	$R^2_{rrel} = 0.09$	$R^2_{rrel} = 0.08$	$R^2_{rrel} = 0.35$	$R^2_{rrel} = 0.15$
Fixed income	0.16	0.05	0.15	0.06
	(-0.11, 0.44)	(-0.28, 0.38)	(-1.70, 2.01)	(-0.46, 0.58)
	$R^2_{rrel} = 0.00$	$R^2_{rrel} = 0.03$	$R^2_{rrel} = 0.01$	$R^2_{rrel} = 0.35$
Equity and fixed income	0.43	0.16	-0.15	0.07
	(0.06, 0.79)	(-0.21, 0.53)	(-0.92, 0.62)	(-0.41, 0.54)
	$R^2_{rrel} = 0.06$	$R^2_{rrel} = 0.13$	$R^2_{rrel} = 0.48$	$R^2_{rrel} = 0.08$

Table 45
Jensen's alpha after management costs for various sample sizes

After cost annualised Jensen's alpha estimates (percent) for various sample periods, along with 95 percent confidence intervals (parentheses) and the R-squared from a regression of relative return on a constant and the benchmark excess return. The estimates are based on monthly returns of equity, fixed-income and combined portfolios and corresponding benchmarks.

Asset class	Since inception	Last 10 years	Last 5 years
Equity	0.32	0.02	-0.02
	(-0.03, 0.67)	(-0.38, 0.42)	(-0.39, 0.34)
	$R^2_{rrel} = 0.16$	$R^2_{rrel} = 0.27$	$R^2_{rrel} = 0.23$
Fixed income	0.08	-0.01	0.26
	(-0.43, 0.60)	(-0.93, 0.91)	(-0.13, 0.64)
	$R^2_{rrel} = 0.00$	$R^2_{rrel} = 0.00$	$R^2_{rrel} = 0.30$
Equity and fixed income	0.01	-0.27	-0.06
	(-0.27, 0.29)	(-0.72, 0.17)	(-0.38, 0.27)
	$R^2_{rrel} = 0.30$	$R^2_{rrel} = 0.39$	$R^2_{rrel} = 0.12$

Table 46
Jensen's alpha after management costs for moving sample periods

After cost annualised Jensen's alpha estimates (percent) for moving sample periods, along with 95 percent confidence intervals (parentheses) and the R-squared from a regression of relative return on a constant and the benchmark excess return. The estimates are based on monthly returns of equity, fixed-income and combined portfolios and corresponding benchmarks. The asterisk is to indicate that inception of active investment for the equity portfolio is January 1999.

Asset class	1998-2002*	2003-2007	2008-2012	2013-2015
Equity	0.87	0.36	-0.04	0.10
	(-0.08, 1.83)	(-0.33, 1.05)	(-0.64, 0.55)	(-0.43, 0.62)
	$R^2_{rrel} = 0.09$	$R^2_{rrel} = 0.08$	$R^2_{rrel} = 0.35$	$R^2_{rrel} = 0.14$
Fixed income	0.12	-0.00	0.10	0.03
	(-0.16, 0.39)	(-0.33, 0.32)	(-1.75, 1.95)	(-0.49, 0.55)
	$R^2_{rrel} = 0.00$	$R^2_{rrel} = 0.03$	$R^2_{rrel} = 0.01$	$R^2_{rrel} = 0.35$
Equity and fixed income	0.34	0.06	-0.25	0.01
	(-0.02, 0.71)	(-0.31, 0.43)	(-1.01, 0.52)	(-0.46, 0.48)
	$R^2_{rrel} = 0.06$	$R^2_{rrel} = 0.13$	$R^2_{rrel} = 0.48$	$R^2_{rrel} = 0.08$

Appraisal ratio

Tables 47 through 50 report appraisal ratios along with confidence intervals before and after management costs.

Table 47
Appraisal ratio before management costs for various sample sizes

Before cost annualised appraisal ratio estimates for various sample periods, along with 95 percent confidence intervals (parentheses). The estimates are based on monthly returns of equity, fixed-income and combined portfolios and corresponding benchmarks.

Asset class	Since inception	Last 10 years	Last 5 years
Equity	0.62	0.21	0.14
	(0.13, 1.10)	(-0.41, 0.84)	(-0.76, 1.04)
Fixed income	0.12	0.02	0.73
	(-0.35, 0.60)	(-0.62, 0.66)	(-0.23, 1.70)
Equity and fixed income	0.16	-0.26	0.01
	(-0.31, 0.62)	(-0.89, 0.37)	(-0.90, 0.93)

Table 48
Appraisal ratio before management costs for moving sample periods

Before cost annualised appraisal ratio estimates for moving sample periods, along with 95 percent confidence intervals (parentheses). The estimates are based on monthly returns of equity, fixed-income and combined portfolios and corresponding benchmarks. The asterisk is to indicate that inception of active investment for the equity portfolio is January 1999.

Asset class	1998-2002*	2003-2007	2008-2012	2013-2015
Equity	1.06	0.72	0.13	0.38
	(0.05, 2.08)	(-0.23, 1.67)	(-0.75, 1.00)	(-0.82, 1.58)
Fixed income	0.52	0.13	0.08	0.14
	(-0.37, 1.42)	(-0.75, 1.01)	(-0.86, 1.02)	(-1.03, 1.31)
Equity and fixed income	1.03	0.41	-0.17	0.17
	(0.13, 1.92)	(-0.54, 1.37)	(-1.05, 0.71)	(-1.04, 1.37)

Table 49
Appraisal ratio after management costs for various sample sizes

After cost annualised appraisal ratio estimates for various sample periods, along with 95 percent confidence intervals (parentheses). The estimates are based on monthly returns of equity, fixed-income and combined portfolios and corresponding benchmarks.

Asset class	Since inception	Last 10 years	Last 5 years
Equity	0.43	0.03	-0.06
	(-0.05, 0.91)	(-0.60, 0.65)	(-0.96, 0.84)
Fixed income	0.08	-0.01	0.64
	(-0.40, 0.55)	(-0.65, 0.63)	(-0.32, 1.61)
Equity and fixed income	0.01	-0.38	-0.16
	(-0.45, 0.48)	(-1.01, 0.25)	(-1.08, 0.75)

Table 50
Appraisal ratio after management costs for moving sample periods

After cost annualised appraisal ratio estimates for moving sample periods, along with 95 percent confidence intervals (parentheses). The estimates are based on monthly returns of equity, fixed-income and combined portfolios and corresponding benchmarks. The asterisk is to indicate that inception of active investment for the equity portfolio is January 1999.

Asset class	1998-2002*	2003-2007	2008-2012	2013-2015
Equity	0.90	0.49	-0.07	0.22
	(-0.10, 1.91)	(-0.45, 1.43)	(-0.94, 0.81)	(-0.98, 1.41)
Fixed income	0.38	-0.01	0.05	0.07
	(-0.51, 1.27)	(-0.89, 0.87)	(-0.89, 0.99)	(-1.10, 1.24)
Equity and fixed income	0.83	0.15	-0.28	0.02
	(-0.06, 1.72)	(-0.80, 1.11)	(-1.17, 0.60)	(-1.18, 1.22)

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