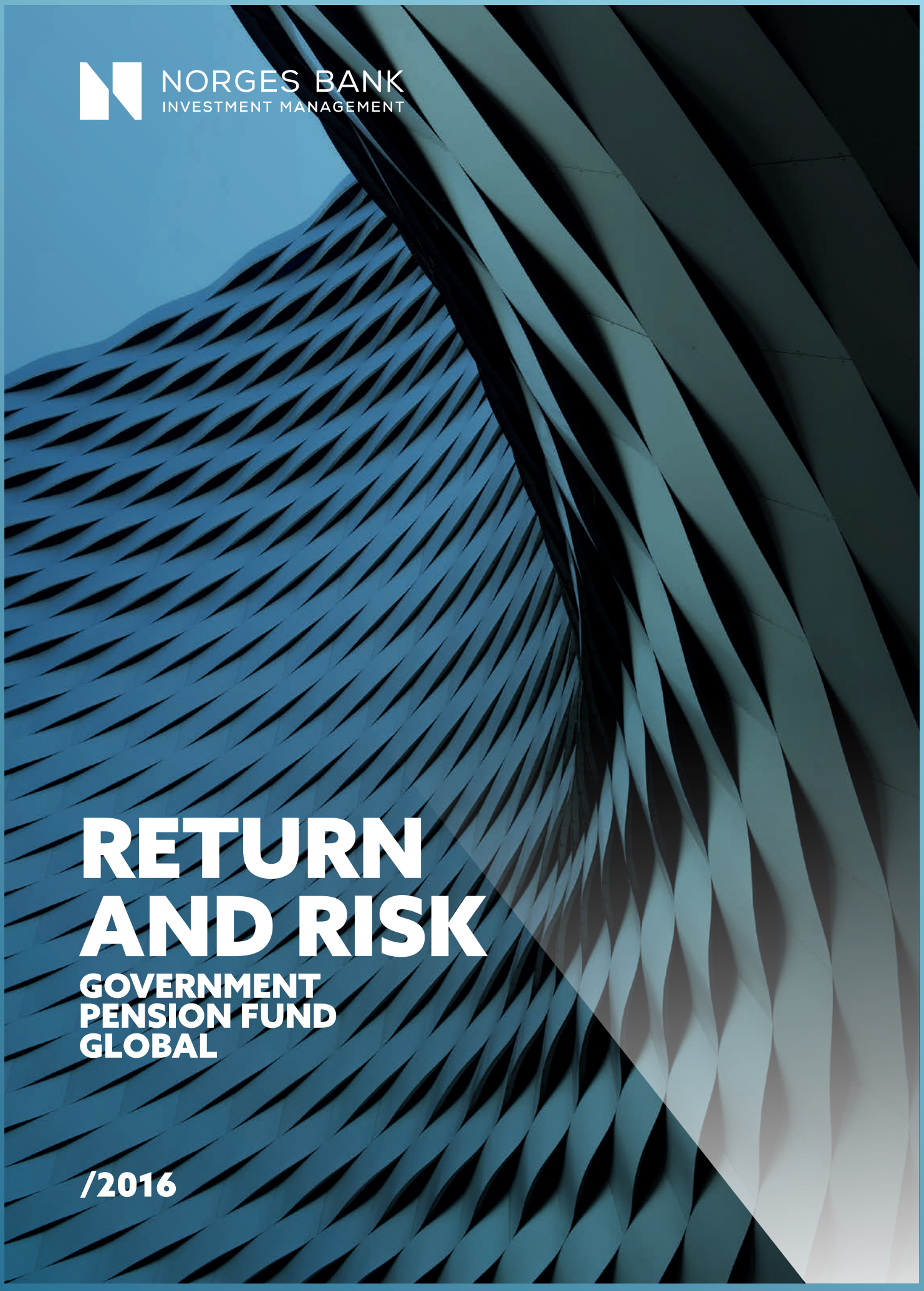


RETURN AND RISK

GOVERNMENT PENSION FUND GLOBAL

/2016

No. 02

Contents

2016

The fund's index

The total return on the fund over time will to a large extent be determined by developments in the broad markets in which the fund is invested. The strategic benchmark index defined in the management mandate from the Ministry of Finance captures developments in these markets.

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 the risk and return profile relate to which types of assets the fund can be invested in and how much is to be invested in each of these asset classes.

The 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 is defined by the strategic benchmark index which until 31 December 2016 was made up of 60 percent equities, up to 5 percent real estate and 35–40 percent fixed income. If the equity allocation in the benchmark index moved above 64 percent or below 56 percent, the benchmark index is rebalanced back to 60 percent. The fund's return is measured in a basket of international currencies corresponding to the currency composition of the benchmark index for fixed income and equities. Since February 2016, the scope for deviation from the strategic benchmark index has been given by a tracking error limit of 125 basis points.

The strategic benchmark index

The composition of the strategic benchmark index has evolved over time, but it was made up of listed equities, fixed income and real estate at the end of 2016. The sub-indices for equities and fixed income were based on publicly available, widely used, investable indices. This helps to ensure transparency and tractability. For unlisted real estate there is no investable index. Real estate investments were therefore included in the strategic benchmark index at their actual value.

In 2016, the Ministry of Finance announced that they planned to change the composition of the strategic benchmark index. As of January 2017, the strategic benchmark index is made up of listed equities and bonds only with 62.5 percent in equities and 37.5 percent in fixed income. The fund may still be invested in unlisted real estate. The decision about how much and how to invest in unlisted real estate has, however, been delegated to Norges Bank as the manager of the fund within the overall limits laid down in the mandate.

Benchmark index for equity investments

The benchmark index for equities is based on the FTSE Global All Cap, which is a global market-capitalisation-weighted index covering approximately 7,700 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 to a country and are required to pass screens for liquidity, free float and foreign ownership restrictions prior to being included.

The benchmark index for equities deviates from the composition of the FTSE Global All Cap index along two important dimensions: geographical distribution and ethical exclusions. In terms of the geographical distribution, the benchmark index has a relative overweight in European developed markets and a relative underweight in the US and Canada. The weighting of other countries is close to the FTSE Global All Cap index with the exception of Norway or securities denominated in Norwegian kroner. In addition, securities issued by companies excluded by Norges Bank under the guidelines for observation and ethical exclusion from the fund are not included in the benchmark index.

Benchmark index for fixed-income investments
The benchmark index for fixed-income investments consists of two sub-indices, government bonds and corporate bonds. Each sub-index is assigned a fixed weight, and the benchmark index is rebalanced back to these weights on a monthly basis. The government sub-index is assigned a weight of 70 percent and draws its constituents from three different Bloomberg Barclays indices in 22 currencies, both developed and emerging markets. The corporate sub-index is assigned a weight of 30 percent and comprises all securities issued in seven developed market currencies and included in the corporate sector and the covered bond sub-sector of the Bloomberg Barclays Global Aggregate Index.

Bloomberg Barclays Indices evaluates the fixed-income landscape annually. To be considered for inclusion in its flagship indices, currencies must be rated investment-grade and be sufficiently tradable, convertible and hedgeable for international investors.

The Bloomberg Barclays Global Aggregate is a global market-capitalisation-weighted index of investment-grade debt from 23 local currency markets, including government, government-related, corporate and securitised bonds. The most significant difference between the benchmark index for fixed income and the Bloomberg Barclays Global Aggregate is that while government bonds in the Bloomberg Barclays index are market-weighted, government bonds in the 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 not included in the benchmark, while inflation-linked bonds are included. For corporate bonds, the main difference is the number of currencies. The Bloomberg Barclays Global Aggregate includes corporate bonds issued in 15 currencies, while the benchmark index only includes bonds issued in US dollars, Canadian dollars, euros, British pounds, Swedish kronor, Danish kroner and Swiss francs. Furthermore, the benchmark index has a relatively higher weight of covered bonds than the Bloomberg Barclays Global Aggregate.

Table 1 The fund's equity benchmark versus the FTSE Global All Cap Index (GEISAC) by country as at close of 31 December 2016

Country	Share of equity benchmark Percent	Share of FTSE GEISAC index Percent	Deviation from FTSE	
			Percentage points	Millions of kroner
UK	10.3	6.1	4.2	198,280
Germany	5.3	2.9	2.4	113,118
Switzerland	5.0	2.7	2.3	106,262
France	5.1	2.9	2.2	102,434
Netherlands	1.8	1.0	0.8	39,224
Czech Republic	0.0	0.0	0.0	-262
Malaysia	0.3	0.3	0.0	-693
Norway	0.0	0.3	-0.3	-11,921
Canada	2.4	3.3	-0.9	-44,084
US	37.9	53.9	-16.0	-754,584

Table 2 The fund's equity benchmark versus the FTSE Global All Cap Index (GEISAC) by sector as at close of 31 December 2016

Sector	Share of equity benchmark Percent	Share of FTSE GEISAC index Percent	Deviation from FTSE	
			Percentage points	Millions of kroner
Financials	24.0	23.0	1.0	48,214
Basic materials	5.6	5.0	0.5	24,006
Consumer goods	13.1	12.6	0.5	23,077
Health care	10.5	10.1	0.4	17,818
Telecommunications	3.5	3.2	0.3	16,135
Oil and gas	7.0	7.0	0.0	-4
Industrials	13.6	13.6	-0.1	-3,428
Utilities	2.9	3.2	-0.4	-17,548
Consumer services	10.1	10.7	-0.7	-31,397
Technology	9.9	11.5	-1.6	-76,872

Table 3 The fund's fixed-income benchmark versus the Barclays Global Aggregate Index by sector as at close of 31 December 2016

Sector	Share of fixed-income benchmark Percent	Share of Barclays Global Aggregate index Percent	Deviation from Barclays	
			Percentage points	Millions of kroner
Inflation-linked bonds	6.7	0.0	6.7	175,761
Treasuries	60.3	53.9	6.4	167,776
Industrial	14.3	10.2	4.1	107,635
Financial institutions	10.0	7.0	3.0	78,625
Covered	3.9	2.7	1.2	30,838
Supranational	2.9	2.2	0.7	18,813
Utility	1.8	1.4	0.4	9,753
ABS	0.0	0.2	-0.2	-5,308
CMBS	0.0	0.4	-0.4	-9,942
Sovereign	0.0	1.2	-1.2	-30,819
Local authorities	0.0	3.0	-3.0	-77,909
Agencies	0.0	5.9	-5.9	-153,386
MBS Passthrough	0.0	11.9	-11.9	-311,837

Table 4 The fund's fixed-income benchmark versus the Barclays Global Aggregate Index by currency as at close of 31 December 2016

Currency	Share of fixed-income benchmark Percent	Share of Barclays Global Aggregate index Percent	Deviation from Barclays	
			Percentage points	Millions of kroner
Euro	26.4	23.8	2.6	67,466
Mexican Peso	1.8	0.3	1.5	40,003
South Korean Won	2.0	1.2	0.9	22,976
Swiss Franc	1.5	0.7	0.8	21,776
Swedish Krona	1.2	0.5	0.7	18,356
Hong Kong Dollar	0.1	0.0	0.1	2,429
Chilean Peso	0.1	0.0	0.1	2,143
Norwegian Krone	0.0	0.1	-0.1	-2,909
US Dollar	44.4	45.5	-1.1	-27,925
Japanese Yen	6.5	17.1	-10.5	-275,781

THE FUND'S BENCHMARK INDEX HISTORY

The first benchmark index for the fund was introduced in January 1998. The risk and return properties of the fund has been defined by the benchmark index, which thus can be seen as a representation of the investment strategy over time. Any deviations in the actual portfolio from the benchmark index has been explicitly contained through mandate constraints.

The authority to set and change the benchmark index has rested with the Ministry. The Ministry has drawn on advice from Norges Bank, and independent third party advice from experts appointed to provide such advice. Finally, on matters of strategic importance the government has used budget documents and periodic white papers.

The overarching strategic goal to maximise the long-term international purchasing power of the fund at acceptable risk has remained unchanged. The benchmark index derived from this goal has evolved over time.

The 2014 review of the active management of the fund advocated that the fund should report risk and returns from each discrete phase of the investment process. This recommendation reflects the view that no neutral point exists for the strategy.

The following analysis aims to illustrate the importance of the benchmark index composition.

Changing risk and return characteristics

We divide our analysis into four sections. First, we discuss the effects the choice of equity share has had on returns. Second, we assess the equity benchmark index. We do this by first analysing the regional allocation decision, the country allocation decision within regions and the segment allocation decisions in the benchmark index. We also analyse the impact that exclusions of companies for ethical reasons have had on the index return. Third, we apply a similar framework when assessing changes to the fixed-income benchmark index. Finally, we compare the overall effect of the chosen benchmark index paths to alternatives.

This framework captures the most important direction strategy has taken, which is an increase in the equity share over time, a changing regional allocation and the inclusions of new markets. Taken together the benchmark index decisions have defined a strategic path.

Changes to the benchmark index have had an indirect impact on other key portfolio characteristics. As an example, a changing regional allocation within the fixed-income benchmark index may affect the overall sensitivity of the benchmark index to interest rate changes as the average duration of the underlying securities may be different across regions.

The currency distribution implied by the composition of the benchmark index has defined the currency basket in which overall benchmark index returns are measured. When the strategic benchmark index changes, the yardstick with which returns are measured changes as well. In the current analysis, the aim has been to describe the impact of the strategic decisions and include currency effects of benchmark index changes. Throughout this analysis, we have fixed the yardstick and used US dollars as the denominator for return calculations.

We aim to contribute to an informed discussion about the impact of strategic decisions. To do this we compare simple return series. This abstracts from the fact that the real impact of decisions are much greater in the later years, when the fund has become larger. We leave these as avenues for future analysis.

THE ALLOCATION DECISION

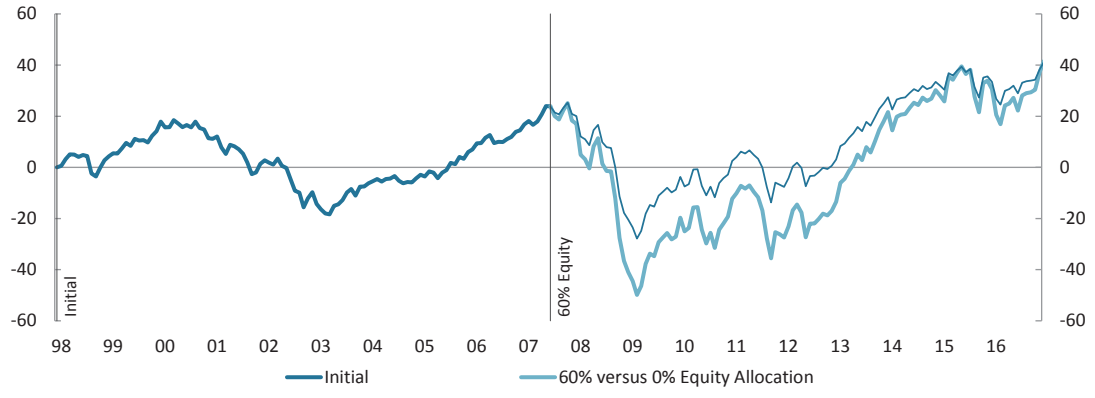
The equity share in the strategic benchmark index has been raised twice from a pure fixed income starting point.

In April 1997, Norges Bank advised the Ministry that at least 30 percent of the fund should be invested in equities, based on the low probability of short-term withdrawals. The Ministry opted for a 40 percent allocation to equities, obtaining parliamentary approval through the national budget for 1998 and subsequently deciding that the change should be implemented in the benchmark index from January 1998.

In February 2006, Norges Bank advised the Ministry to consider raising the equity share further to 50 or 60 percent. The Ministry announced its intention to increase the allocation, from 40 to 60 percent, in the first white paper to parliament on the management of the fund in 2007, and the decision was implemented from the end of June 2007.

These equity share decisions were expected to dominate the risk return properties of the benchmark index. Empirically, equities have been shown to provide higher returns over time, but to do so with higher return volatility, or risk, than investments in fixed income. The introduction of a 40 percent equity share did increase the accumulated return of the fund by more than 20 percent up until the 2007 decision, and another 20 percent from 2007 until end of 2016. The 2007 increase in the equity share from 40 to 60 percent increased the exposure to the equity market during the downturn associated with the global financial crisis and the return path has only just caught up with what it would have been. The actual implementation was structured to 2009 and in effect gave a better fund return.

Chart 1 Return of increasing the equity share to 40 percent from 1998 and 60 percent from 2007, relative to fixed income only. Asset classes represented with the market weighted FTSE World equity index and the Bloomberg Barclays Global Aggregate bond index. The thin lines show how continuations of earlier decisions would have performed in later periods. Constant 40% equity share from 1998, 60% equity share from June 2007. Percentage points



Sources: FTSE, Bloomberg Barclays Indices

THE EQUITY BENCHMARK INDEX

The key discussions concerning the benchmark index for equity investments have been the composition of regions, markets and market segments.

Regional allocation

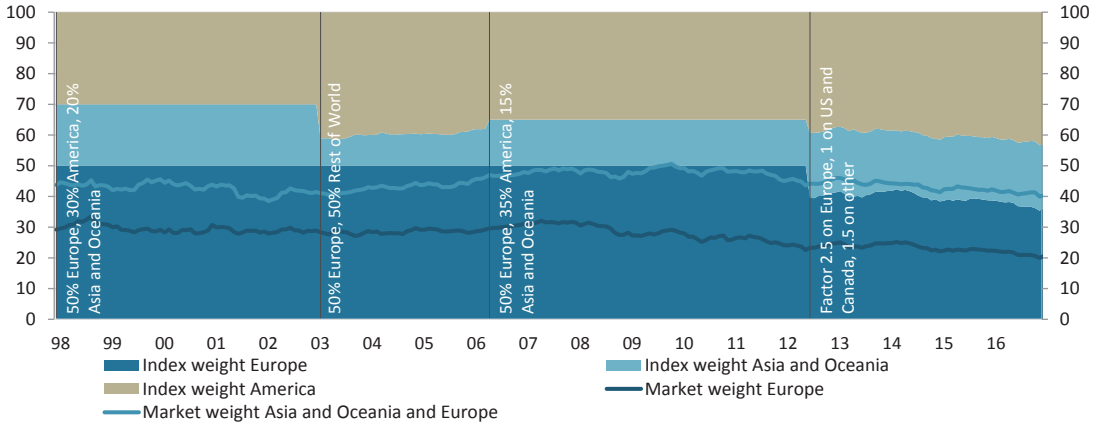
The primary decision made on the equity benchmark index has been the regional allocation between three broad geographic regions; Europe, Americas and the Asia and Oceania region. From January 1998 the emphasis was on limiting the difference in currency distribution between the benchmark index and expected future imports to Norway. The adopted regional benchmark index distribution was skewed towards Europe with an allocation of 50 percent Europe, 30 percent Americas and 20 percent Asia and Oceania.

This allocation was maintained until January 2003. The Ministry discussed the regional allocation in the 2002 revised budget, and subsequently decided to introduce market weights between Americas and Asia and Oceania. This implied a shift from the Asia and Oceania market to Americas of more than 10 percentage points of the equity benchmark index.

The next change took place in April 2005, based on Norges Bank's advice of august 2004. The Ministry informed the Storting in the 2006 revised budget that a benchmark index change had been decided. At this point the discrete allocations to three regions were reinstated. A lowering of fixed-income investments in Asia and Oceania region led an increase in the regional allocation in the equity benchmark index. The 50 percent allocation outside Europe was again split into a 35 percent allocation to Americas and the remaining 15 percent to Asia and Oceania. This implied an increase in the Asia and Oceania allocation of approximately 5 percentage points of the equity benchmark index, at the expense of the allocation to the Americas.

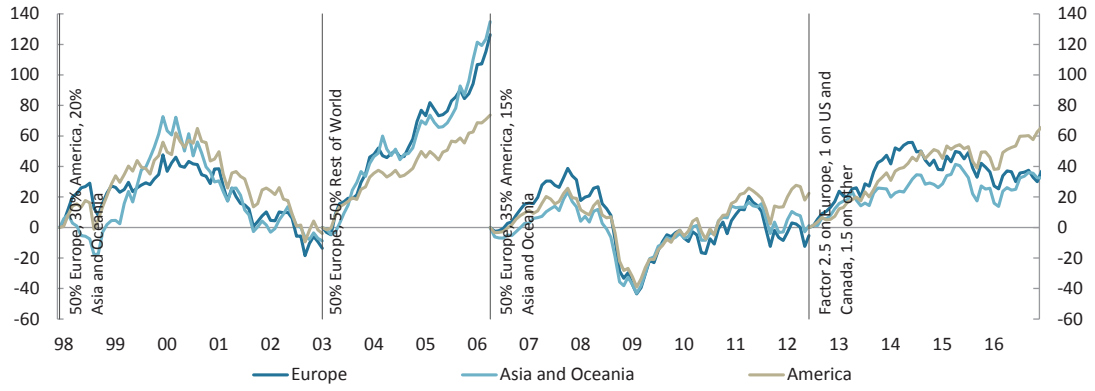
The Ministry made a major change to the regional equity allocations in June 2012, based on Norges Bank's letter of February 2012 and the following discussion in the 2012 white paper to parliament on the management of the fund. A system of country factor weights was introduced to replace the top down regional allocations. The factors were set to reduce the European emphasis in the benchmark index. Since 2012, benchmark index exposures in the US and Canada have had a factor of 1, European exposures 2.5 and all other markets 1.5. These factors set average ownership in European companies 2.5 times higher relative to US companies, but still entailed a reduction in the European share of the equity benchmark index of 10 percentage points.

Chart 2 The regional allocation of the strategic equity benchmark index compared to the market weighted regions like the FTSE World index (solid lines). Calculations are based on monthly constituent level data from FTSE. Percent



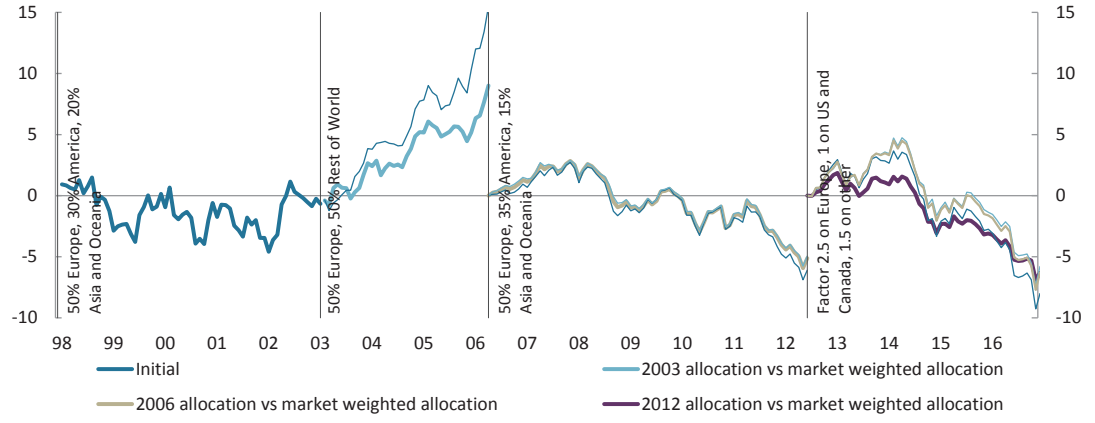
Sources: FTSE, FactSet

Chart 3 Return per region of the strategic equity benchmark index. Return series are reset for each of the regional allocation decisions. Calculations are based on monthly constituent level data from FTSE. Percent



Sources: FTSE, FactSet

Chart 4 Return of the regional allocations relative to market weights per region (bold lines) for the strategic equity benchmark index. The thin lines show how continuations of earlier decisions would have performed in later periods. Return series are reset for each of the regional allocation decisions. Calculations are based on monthly constituent level data from FTSE. Percentage points



Sources: FTSE, FactSet

Regional return

Regional equity returns can deviate substantially for prolonged periods of time. Europe and Asia and Oceania outperformed Americas significantly in the 2003–2008 period, but their subsequent decline during the global financial crisis were more severe. After the financial crisis, and particularly after the reconstitution of the equity benchmark index in 2012, the key development was a substantial outperformance by the Americas region, particularly in comparison with the European market.

Impact of the regional allocation

The market weighted regional allocation constitute a reasonable anchor if no priors had been held to which regional allocation were desirable for the fund. Overall, we find that that the regional allocations on the benchmark index have returned 16 percentage points less on a time-weighted basis compared to the alternative regional benchmark indices held at market weights. It is reasonable to attribute this to the lagging performance of the European equity markets since the global financial crisis, and in particular since 2014. The 2012 reconstitution of the benchmark index effectively reduced the European position.

Emerging market inclusion

The benchmark index composition within the regions has changed over time. The initial 1998 equity benchmark index allocation was to 21 developed OECD countries' equity markets. These markets were all part of the FTSE World index. The strategic direction has since been towards a gradual inclusion of the equity markets of emerging market economies at various stages of development. The reasoning have been to achieve better representation of the global economy and to improve overall diversification.

The Ministry implemented the first expansion of the benchmark index in January 2001, based on advice provided by Norges Bank in August 2000, and their discussion in the 2001 national budget. The decision at this point was an allocation to all markets included in the FTSE World plus some additional equity markets of large emerging market economies. These were Brazil, Korea, Mexico, Taiwan and Turkey. Later, a smaller change took place in the benchmark index in January 2004, when South Africa was added and Turkey removed from the benchmark index.

In 2008, the Ministry implemented a broadening of the benchmark index, based on Norges Bank's advice of February 2008, after gaining parliamentary consent. All markets, classified as developed, emerging or secondary emerging by FTSE was now included in the benchmark index. Consequently, 19 new equity markets in emerging market economies with less developed institutional frameworks for equity investing were added to the benchmark index.

The initial 2001 inclusion of new markets amounted to slightly less than 2 percent of the overall market capitalisation of the benchmark index. The following 2008 broadening with 19 new markets increased the share of new constituents by about 3 percentage points. The excess performance of these markets drove an increase in the share of new markets in the equity benchmark index, which reached close to 12 percent in 2010.

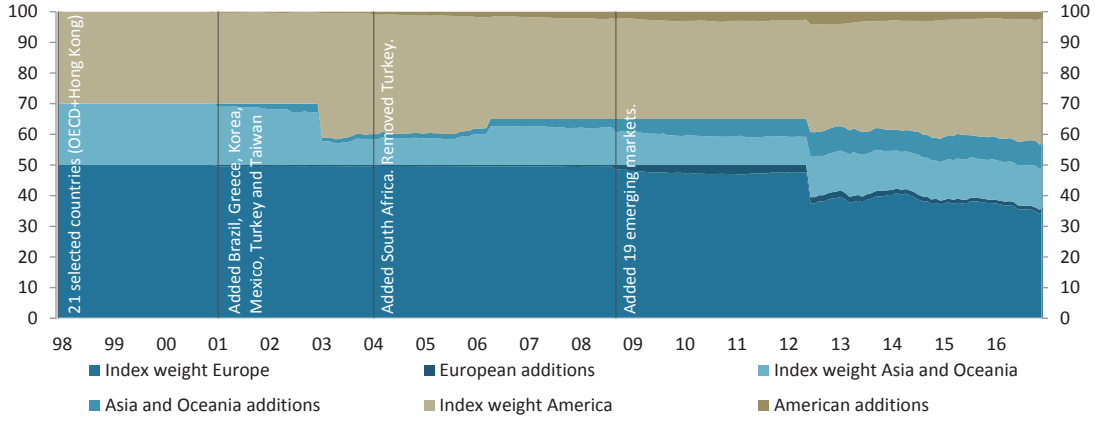
When the 2012 system with factor weights was introduced, the US and Canada received a lower factor, partly to reduce concentration risk in the North American markets. The share of the Americas additions increased as a consequence.

Emerging market equity return

The markets which were added to the index had considerable higher returns leading up to the global financial crisis. At this point the emerging markets, often perceived as financially riskier and more cyclically exposed, substantially underperformed. After the financial crisis, returns varied. The American and Asia and Oceania additions, as opposed to the European additions, regain their former position quickly. The 2013 to 2015 period is one where European and American emerging markets lag substantially as earnings dropped with the commodity cycle.

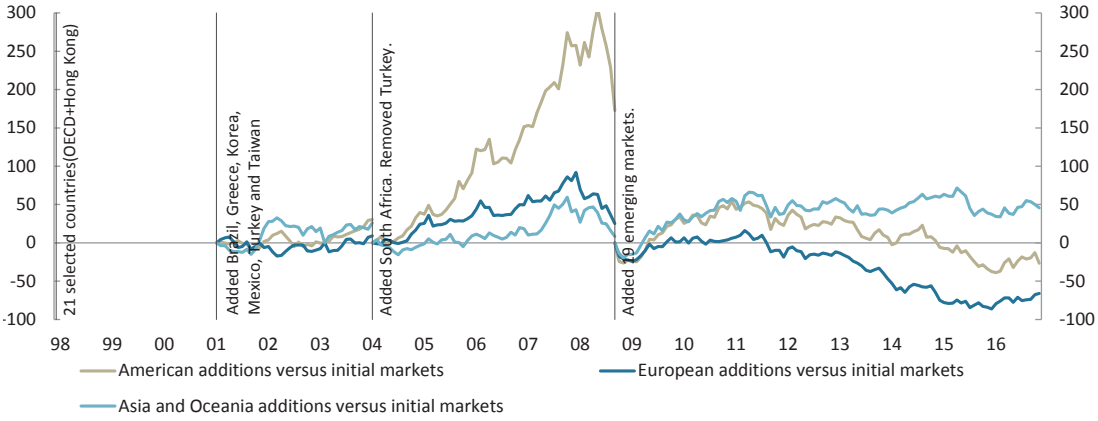
At the end of 2016 the overall accumulated return of the chosen strategic path did not deviate substantially from one based on a narrower market distribution confined to developed markets. The share of additional markets in the overall benchmark index increased due to their high performance. Consequently, shocks such as the 2013 to 2015 hit to emerging markets, had a larger impact on the returns to the decision to include emerging markets in the benchmark index.

Chart 5 The regional allocation in both initial markets and markets later added to the strategic equity benchmark index. Calculations are based on monthly constituent level data from FTSE. Percent



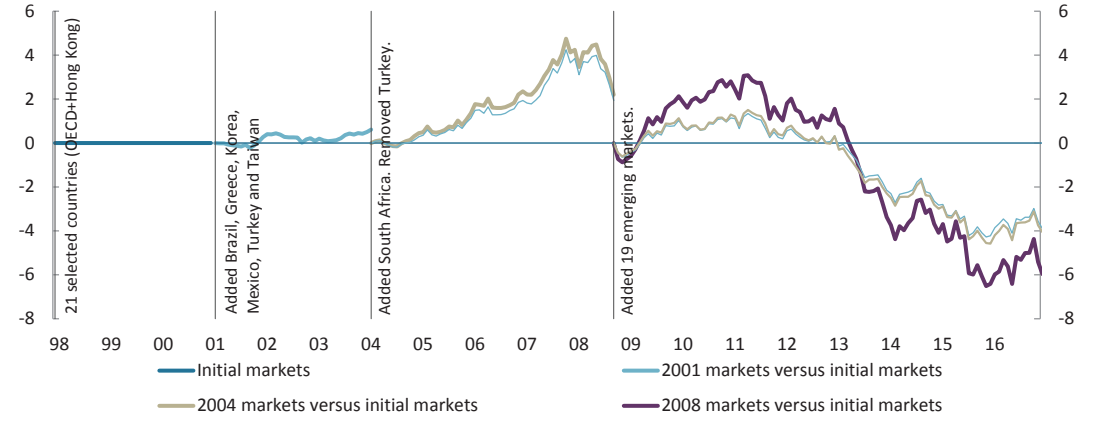
Sources: FTSE, FactSet

Chart 6 Return of added markets relative to initial markets of the strategic equity benchmark index. Implemented regional allocations and the size allocation are being used in the calculation of both indices. Return series are reset for each of the market allocation decisions. Calculations are based on monthly constituent level data from FTSE. Percent



Sources: FTSE, FactSet

Chart 7 Return of the strategic equity benchmark index with chosen markets relative to an alternative with initial markets only (bold lines). The thin lines show how continuations of earlier decisions would have performed in later periods. Return series are reset for each of the market allocation decisions. Calculations are based on monthly constituent level data from FTSE. Percentage points



Sources: FTSE, FactSet

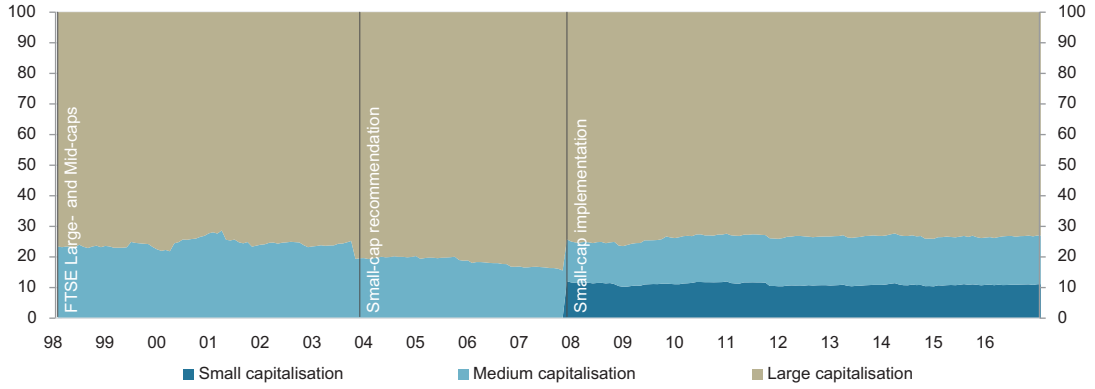
Smaller companies inclusion
The FTSE World index, chosen for the inaugural 1998 benchmark index, cover large and medium-sized market capitalisation. In 2003, FTSE introduced its new FTSE All Cap, which included global representation of companies with a smaller capitalisation. In a letter of April 2003 Norges Bank proposed an adoption of this index to represent the investment universe better. The FTSE All Cap adoption would have increased the number of constituents from around 2,000 to almost 7,000 companies.

Norges Bank raised the issue of including small-cap companies in the benchmark index again in October 2006. The Ministry supported the expansion of the benchmark index in their 2007 white paper on the management of the fund and subsequently decided to include the segment in the benchmark index from October 2007. The market weight of the new segments amounts to approximately 10 percent of the overall equity benchmark index.

Small cap
There is a significant performance lag in the dominant large-cap segment relative to the mid- and small-cap segments, both before and after the decision to include the smallest segment in the benchmark index.

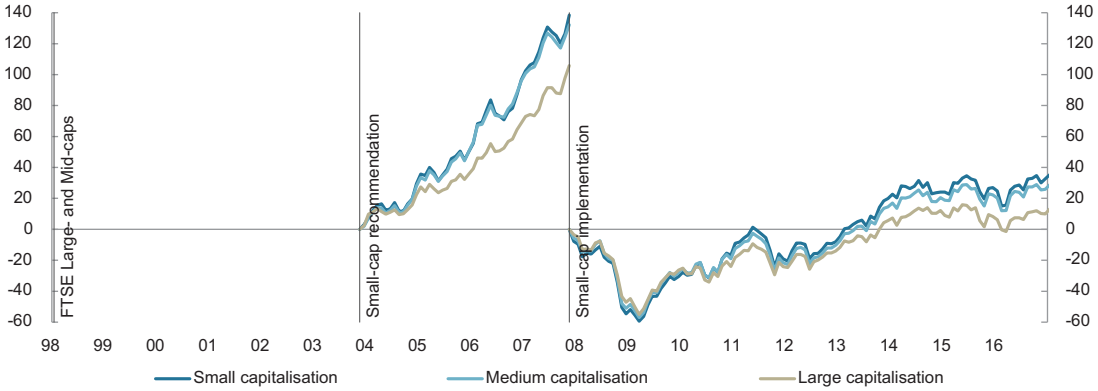
We find that an early inclusion of the small-cap segment in the benchmark index could have added more than 3 percentage points higher return on the equity benchmark index. The subsequent inclusion of the segment have been profitable, adding close to 2 percentage points to the return on the equity benchmark index over the last nine years.

Chart 8 Capitalisation segments as share of the strategic equity benchmark index. Calculations are based on monthly constituent level data from FTSE. Percent



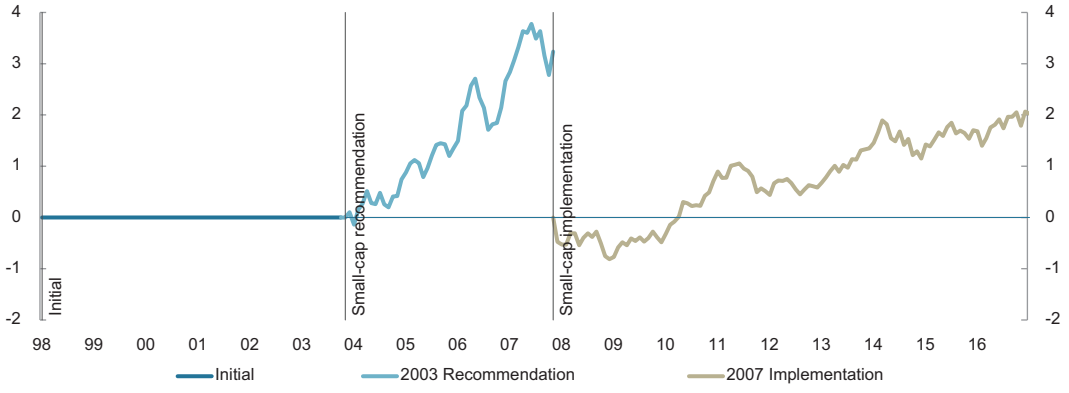
Sources: FTSE, FactSet

Chart 9 Return per capitalisation segment of the strategic equity benchmark index. The small capitalisation return in the period March 2003 to October 2007 is as if the segment was included in the equity benchmark index in March 2003. Return series are reset for each of the capitalisation segment decisions. Calculations are based on monthly constituent level data from FTSE. Percent



Sources: FTSE, FactSet

Chart 10 Return of the strategic equity benchmark index including the small capitalisation segment relative to the original alternative having large and mid-capitalisation segments only (bold lines). Return series are reset for each of the capitalisation segment decisions. Calculations are based on monthly constituent level data from FTSE. Percentage points



Sources: FTSE, FactSet

Ethical exclusions

The Ministry first issued guidelines for the observation and exclusion of companies from the Government Pension Fund Global in November 2004. The Ministry appointed a Council on Ethics to research and evaluate companies, and to make recommendations on exclusions based on the criteria set out in the guidelines. When companies are excluded from the fund they are in effect also excluded from the benchmark index.

Two types of criteria were set out in the guidelines. One set related to specific product types and excluded companies that produced tobacco, sold or produced weapons or military materials to certain countries, or produced weapons that through its normal use violated fundamental humanitarian principles. A separate set of criteria excluded companies where there was an unacceptable risk of grossly unethical corporate conduct that contribute to serious or systematic human rights violations, serious violations of the rights of individuals in situations of war or conflict, severe environmental damage, gross corruption or other serious violations of fundamental ethical norms.

These guidelines were revised in December 2015 following the Storting's consideration of the 2014 white paper on the management of the fund. The Storting chose to retain a Council on Ethics, but Norges Bank was now to propose candidates for membership of the Council to the Ministry, and was delegated the authority previously held by the Ministry to make the final decisions on exclusions based on recommendations from the Council.

The Ministry further revised the guidelines in February 2016, now based on the Storting's consideration of the 2015 white paper on the management of the fund. Two new criteria were introduced. First, the corporate conduct criterion was broadened to cover companies that are responsible for acts or omissions that on an aggregated company level lead to unacceptable greenhouse gas emissions. Second, a product-based coal criterion was introduced. Mining companies and power producers that derive 30 percent or more of their revenue from thermal coal or base 30 percent or more of their operations on thermal coal may now be excluded. Norges Bank can exclude companies under this criterion without a prior recommendation from the Council on Ethics.

Impact of ethical exclusions

We find that the product-based exclusions have reduced the return on the equity index by close to 1.9 percentage points. Both the exclusion of tobacco companies and certain weapons manufacturers have reduced returns. This effect has to some extent been mitigated by the positive contribution of the conduct-based exclusions, primarily the environmentally based exclusions of mining companies. The other exclusion criteria have had only a minor effect on the return on the benchmark index.

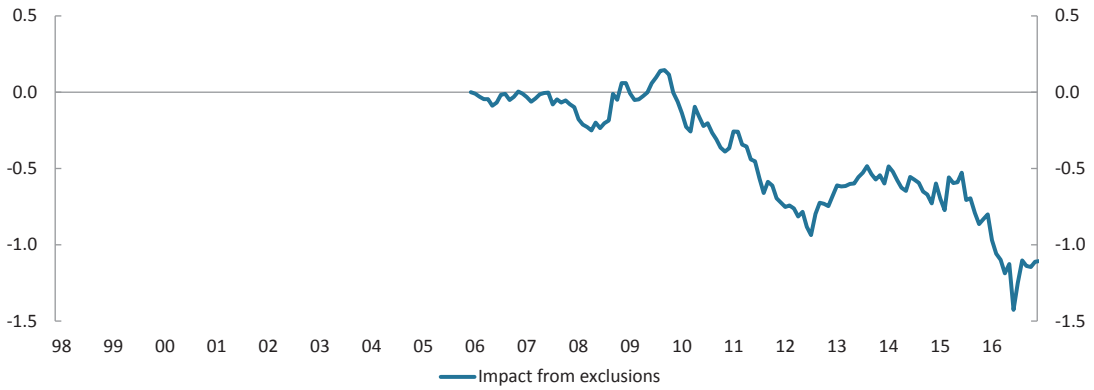
Over the last eleven years, the equity benchmark index have returned 1.1 percentage points less than an index which is unadjusted at constituent level.

Table 5 Return impact of equity benchmark index exclusions by year and exclusion criterion. Percentage points

Criterion	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2006–2016
Product-based exclusions	**-0.01**	**-0.06**	**-0.04**	**0.11**	**-0.09**	**-0.48**	**0.10**	**-0.06**	**-0.07**	**-0.35**	**-0.04**	**-1.90**
Production of specific weapon types	-0.01	-0.06	-0.04	0.17	0.03	-0.04	-0.01	-0.25	0.02	-0.14	-0.07	-0.75
Production of tobacco				-0.05	-0.12	-0.44	0.11	0.19	-0.09	-0.21	0.02	-1.16
Thermal coal mining or coal based power production											0.00	0.01
Conduct-based exclusions	**0.00**	**-0.01**	**0.12**	**-0.30**	**-0.18**	**0.16**	**0.06**	**0.25**	**0.08**	**0.22**	**-0.11**	**0.80**
Serious or systematic human rights violations	0.01	0.03	-0.15	0.19	0.05	-0.04	0.01	0.03	-0.02	0.05	0.00	-0.05
Serious violations of the rights of individuals in situations of war or conflict					0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Severe environmental damage	0.01	-0.04	0.27	-0.48	-0.22	0.20	0.03	0.19	0.10	0.15	-0.11	0.78
Gross corruption										0.00	0.00	0.00
Other particularly serious violations of fundamental ethical norms	-0.02			-0.01	0.00	0.01	0.02	0.03	0.00	0.02	0.00	0.07
Total	-0.01	-0.07	0.08	-0.18	-0.27	-0.32	0.16	0.18	0.01	-0.13	-0.16	-1.11

Source: Norges Bank Investment Management

Chart 11 Return impact of equity benchmark index exclusions relative to an unadjusted index at constituent level. Percentage points



Source: Norges Bank Investment Management

THE FIXED-INCOME BENCHMARK INDEX

The primary decision for the fixed-income benchmark index has been the regional allocation across the same broad geographical regions as the equity benchmark index.

Regional allocation

When the Ministry implemented the inaugural 1998 benchmark index, the macroeconomic reasoning was applied to both asset classes and the same regional distribution was adopted. Compared to market capitalisation the weights of 50 percent Europe, 30 percent Americas and 20 percent Asia and Oceania, were skewed towards Europe.

This allocation was maintained until January 2002. In a letter of December 2001, Norges Bank described the declining credit worthiness of Japan and asked the Ministry to reassess the allocation. The Ministry responded with a decision in January 2002 to decrease Asia and Oceania allocation by 10 percentage points and to increase the allocations to the Americas and Europe by 5 percentage points each.

The next change took place in April 2005, based on Norges Bank's advice of August 2004 to move exposure in Asia and Oceania from fixed income to equity. The 5 percentage points reduction in Asia and Oceania allocation was balanced by an increase in the European share to 60 percent.

In March 2011, Norges Bank outlined a new framework for the fixed-income benchmark index construction. The proposal was a combination of 70 percent GDP-weighted government bonds and 30 percent market weighted credit. The implied effect on the regional distribution of the fixed-income benchmark index was a clear reduction in the European share of the benchmark index. The 60 percent allocation was reduced to an implied 40 percent share, which was matched by a sizeable increase in the shares of both the Americas and Asia and Oceania regions.

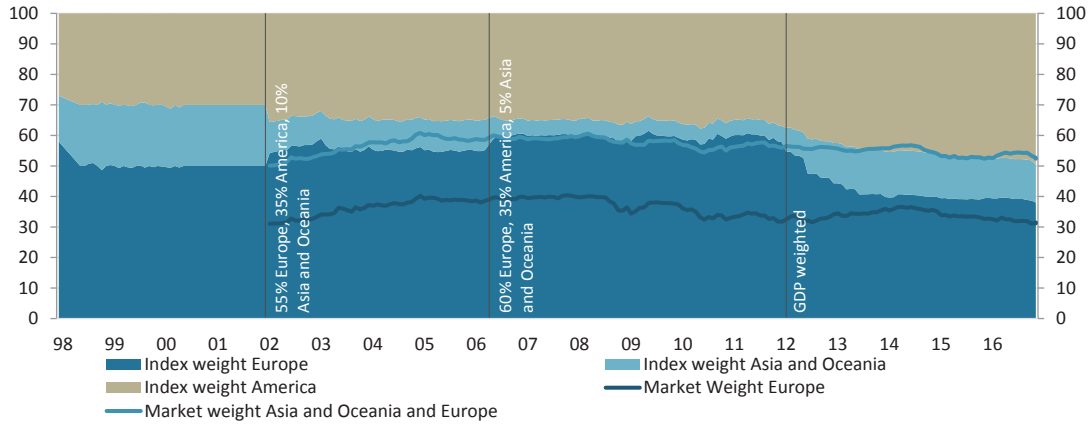
The Ministry received parliamentary consent following their consideration of the 2011 white paper on the management of the fund. The reconstitution of the benchmark index was implemented from January 2012. The overall regional distribution was closer to the market weight distribution after the 2012 decision.

Regional return

The European index has had higher returns than the Americas index during two distinct periods. First the 2002 to 2008 period and secondly the period from mid-2012 to mid-2014.

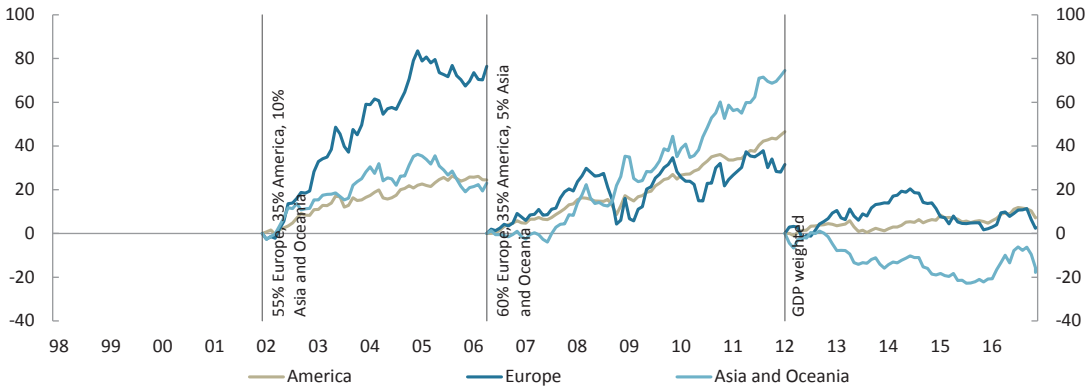
The return on fixed-income investments at a regional level can be decomposed into the local market return, which is dominated by the level of, and change in yields and a currency effect, from translating the local returns to a common currency. The euro appreciated more than 60 percent against the US dollar during the 2002–2008 period. We can attribute much of the excess performance of the European fixed-income markets measured in US dollars to this effect.

Chart 12 The regional allocation of the fixed-income benchmark index compared to global fixed-income markets as represented by Bloomberg Barclays Global Aggregate. Percent



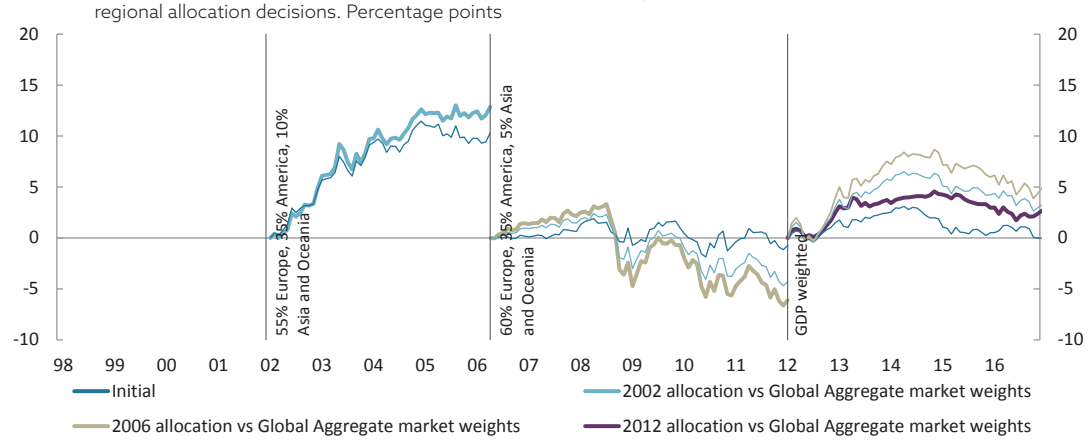
Sources: Bloomberg Barclays Indices and Norges Bank Investment Management

Chart 13 Return per region based on the strategic fixed-income benchmark index. Return series are reset for each of the regional allocation decisions. Percent



Source: Bloomberg Barclays Indices

Chart 14 Return based on the strategic fixed-income benchmark index with the chosen regional allocation relative to global fixed-income markets represented by Bloomberg Barclays Global Aggregate (bold lines). The thin lines show how continuations of earlier decisions would have performed in later periods. Return series are reset for each of the regional allocation decisions. Percentage points



Source: Bloomberg Barclays Indices


NORGES BANK
INVESTMENT MANAGEMENT

The primary risk characteristic of the fixed-income benchmark index is the sensitivity of the market value to changes in interest rates. The analytical duration approximates this sensitivity. The difference in analytical duration between the benchmark index and the Global Aggregate market representation was positive, but stable until the 2012 reconstitution. This implies that any substantial return differentials between the various regional allocations were not due to different exposure to changes in the global yield level.

A prolonged decline in global interest rates have been a defining characteristic of the lifetime of the fund. The consistently higher duration level of the benchmark index have contributed to the higher returns for the fixed-income benchmark index over the market proxy. We can estimate this effect at approximately 2 percentage points for the fixed-income benchmark index since inception.

From 2012, there was a substantial divergence in yields between the Americas and Europe. The drop in European yields reflected a period where risk premiums on the European periphery issuers were high and where European monetary policy were adapting to sustain the currency union. The European fixed-income markets consequently outperformed the US.

Overall, we find that the return of the regional allocations in the benchmark index have been 15 percentage points higher, incorporating the aforementioned effect of higher average duration, compared to the alternative where the regional indices are held at market weights.

The fixed-income benchmark index benefited substantially from the 2002–2008 performance of the European index. The 2012 reconstitution of the benchmark index reduced exposure to regional return differentials, and the benchmark index benefited to a lesser extent from the drop in European yields. The US dollar strength worked in the other direction, for an overall neutral impact of the 2012 decision.

Emerging market bonds

A broadening of the fixed-income benchmark index to include local currency debt from emerging market sovereigns has been assessed on several occasions.

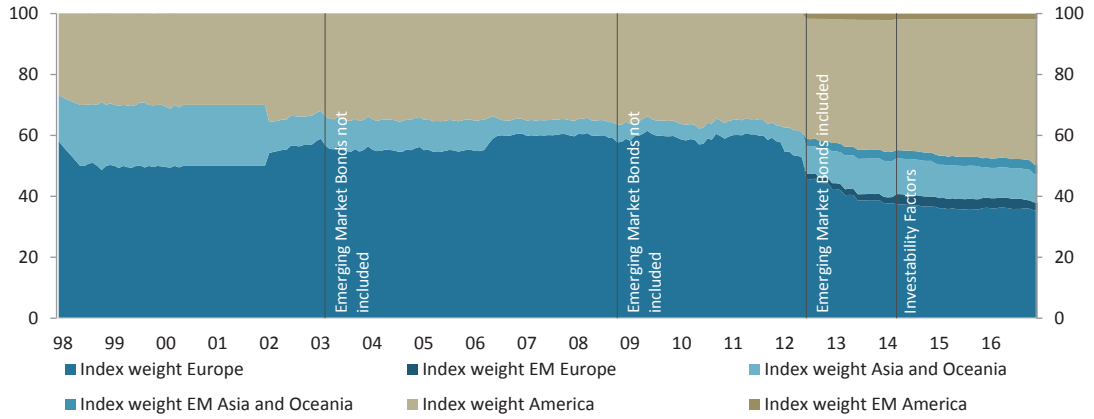
The Ministry announced their intention to expand the fixed-income benchmark index in the 2012 white paper on the management of the fund and implemented the decision from the end of June 2012.

In March 2014 Norges Bank advised the Ministry to apply investability factors to currencies were the fund would have ended up owning an unreasonably large share of outstanding debt. The Ministry adopted the change thereby reducing the benchmark index weights given to emerging market economies with a relatively low ratio of outstanding local government debt to GDP.

Emerging market bond returns

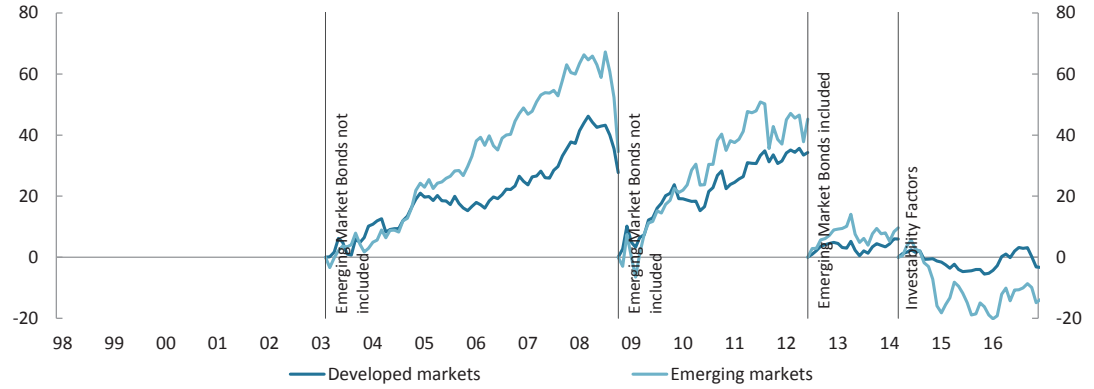
The inclusion of emerging market currencies in the benchmark index had only a small effect on the return on the fixed-income benchmark index. The inclusion of investability factors in the fixed-income benchmark index construction has limited the recent drawdown.

Chart 15 The regional allocation of emerging markets as share of the fixed-income benchmark index. Percent



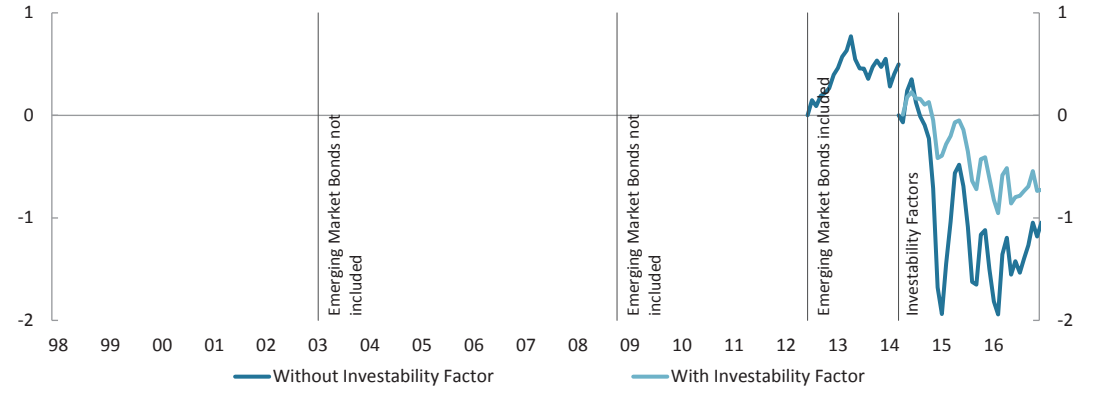
Source: Bloomberg Barclays Indices

Chart 16 Return of developed versus emerging markets based on the strategic fixed-income benchmark index. The distribution between sectors and countries within developed and emerging markets is based on the GDP weighed allocation introduced in 2012. Return series are reset for each of the market allocation decisions. Percent



Source: Bloomberg Barclays Indices

Chart 17 Relative return of the strategic fixed-income benchmark index against an index without emerging markets. The distribution between sectors and countries is based on the GDP weighted allocation introduced in 2012. From April 2014 the excess returns both with and without investability factors are drawn. Return series are reset for each of the decisions. Percentage points



Source: Bloomberg Barclays Indices

THE EFFECT OF ASSET CLASS BENCHMARK INDICES

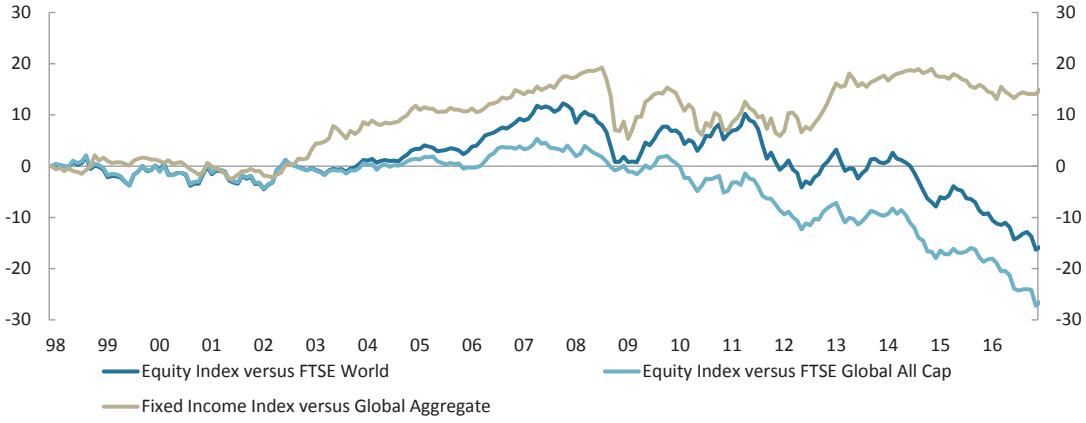
Substantial accumulated return differences have developed between the benchmark index of the fund and the broad publicly available alternatives. The broad indices are meant to be market proxies and the gains or losses relative to these proxies can be seen as the benefits, or costs associated with the decision to custom build benchmark indices for the fund.

Up until the financial crisis both the equity and the fixed-income benchmarks had higher returns than the respective market proxies did. Over the last ten years, the equity benchmark has lagged for the reasons we have discussed.

The Global Aggregate has been the broadest commonly used representation of the fixed-income market throughout the period. In the equity market, FTSE has gradually broadened its coverage in terms of markets and segments and improved the representativeness of its offering. The broader FTSE All World and FTSE All Cap market representations, have had a higher return than the FTSE World.

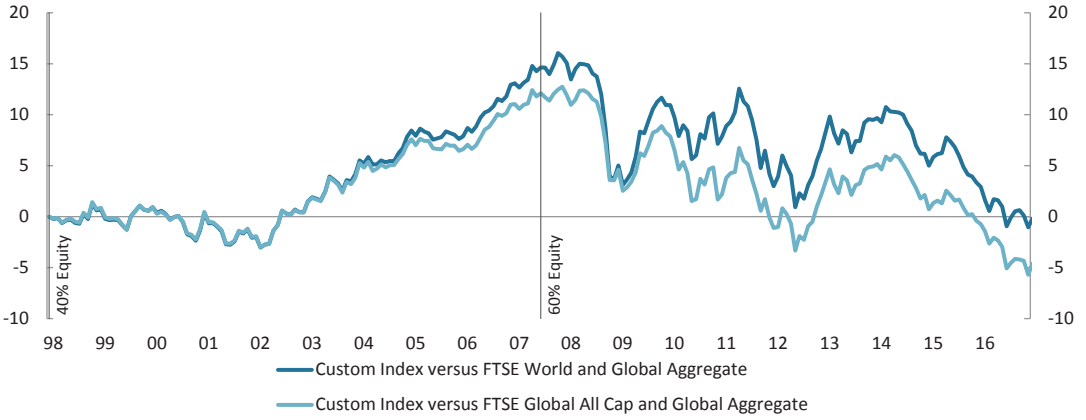
If we combine the two asset classes we can assess the accumulated return of the chosen allocation. The aggregated time-weighted return on the combined strategic benchmark index is broadly in line with an alternative based on the Global Aggregate and FTSE World, but lags the alternative based on the broadest commonly used available alternative at the time, in practice the FTSE All World up until the introduction of FTSE All Cap in 2003.

Chart 18 Return of the equity benchmark index relative to global equity markets as represented by FTSE World, or a combination of FTSE All World until September 2003 and FTSE All Cap afterwards. Return of the fixed-income benchmark relative to global fixed-income markets as represented by Bloomberg Barclays Global Aggregate. Constant 40% equity share from 1998, 60% equity share from June 2007. Percentage points



Sources: FTSE, Bloomberg Barclays Indices

Chart 19 Return of the benchmark index relative to a combined market index consisting of FTSE World, or a combination of FTSE All World until September 2003 and FTSE All Cap afterwards for equity, and Bloomberg Barclays Global Aggregate for fixed income. Percentage points



Sources: FTSE, Bloomberg Barclays Indices

Investments

The fund's investments are diversified across asset classes, regions and sectors. The goal is to have well diversified investments that spread risk and generate high long-term return.

The fund is invested in three major asset classes, equities, fixed income and real estate. At the end of 2016, the fund's asset allocation was 62.5 percent equity investments, 34.3 percent fixed-income investments and 3.2 percent real estate investments. 42.3 percent of the fund's investments were in North America, 36.0 percent in Europe and 17.9 percent in Asia and Oceania. Emerging markets accounted for 10.0 percent of the fund's investments.

EQUITY INVESTMENTS

The fund had equity investments in 70 countries at the end of 2016. 39.5 percent of our equity portfolio was invested in North America, 36.3 percent in Europe and 21.1 percent in Asia and Oceania. 90.5 percent of our equity investments were in developed markets and 9.2 percent in emerging markets, including 0.3 percent in frontier markets. Financials were the fund's largest equity sector and accounted for 23.3 percent of our equity investments. Industrials were our second largest sector at 14.1 percent, and consumer goods the third largest at 13.7 percent. The equity portfolio was invested in 8,985 companies at the end of the year. Our largest equity investment was in Nestlé, where we had 51.0 billion kroner invested. The fund's average holding in the world's listed companies, measured as its share of the benchmark index for equities, was 1.3 percent at the end of 2016.

FIXED-INCOME INVESTMENTS

Our bond holdings were spread across 31 currencies. Holdings in the G4 currencies made up 81.7 percent of our fixed-income investments, 43.8 percent issued in US dollars, 25.7 percent in euros, 6.8 percent in Japanese yen and 5.3 percent in British pounds. Bond investments in emerging market currencies accounted for 13.5 percent of our fixed-income investments. 56.7 percent of our fixed-income investments were in government bonds, 13.0 percent in government-related bonds, 5.5 percent in inflation-linked bonds, 22.9 percent in corporate bonds and 5.7 percent in securitised bonds. Our fixed-income portfolio had an average duration of 6.2 years and an average yield of 2.1 percent. The fund's average holding in fixed-income markets, measured as its share of the benchmark index for bonds, was 0.8 percent.

Table 6 Regional composition of the fund's equity holdings

Region	Millions of kroner[1]	Percent
North America	**1 854 474**	**39.5**
United States	1 753 171	37.4
Canada	101 302	2.2
Europe	**1 703 821**	**36.3**
United Kingdom	465 231	9.9
Germany	253 830	5.4
France	241 615	5.1
Switzerland	228 271	4.9
Sweden	93 943	2.0
Spain	77 382	1.6
Netherlands	74 886	1.6
Italy	72 552	1.5
Denmark	47 866	1.0
Belgium	45 247	1.0
Finland	31 359	0.7
Asia	**885 426**	**18.9**
Japan	428 895	9.1
China	126 771	2.7
South Korea	77 766	1.7
Taiwan	71 250	1.5
Hong Kong	61 928	1.3
India	45 513	1.0
Oceania	**104 565**	**2.2**
Australia	99 312	2.1
Latin America	**62 811**	**1.3**
Brazil	36 505	0.8
Africa	**31 515**	**0.7**
South Africa	27 138	0.6
Middle East	**19 751**	**0.4**

[1] Does not sum up to total market value due to cash and derivatives.

Table 7 Sector composition of the fund's equity holdings

Sector	Millions of kroner[1]	Percent
Financials	**1 093 314**	**23.3**
Banks	502 511	10.7
Insurance	238 331	5.1
Financial services	179 824	3.8
Real estate	172 649	3.7
Industrials	**660 923**	**14.1**
Industrial goods and services	556 167	11.9
Construction and materials	104 757	2.2
Consumer goods	**640 525**	**13.7**
Personal and household goods	242 864	5.2
Food and beverage	229 447	4.9
Automobiles and parts	168 214	3.6
Consumer services	**482 318**	**10.3**
Retail	240 677	5.1
Travel and leisure	129 372	2.8
Media	112 268	2.4
Health care	**477 203**	**10.2**
Health care	477 203	10.2
Technology	**445 798**	**9.5**
Technology	445 798	9.5
Oil and gas	**301 339**	**6.4**
Oil and gas	301 339	6.4
Basic materials	**264 518**	**5.6**
Chemicals	160 620	3.4
Basic resources	103 898	2.2
Telecommunications	**152 347**	**3.2**
Telecommunications	152 347	3.2
Utilities	**144 078**	**3.1**
Utilities	144 078	3.1

[1] Does not sum up to total market value due to cash and derivatives

Table 8 Currency composition of the fund's bond holdings

Currency	Millions of kroner[1]	Percent
US Dollar	1 129 957	43.8
Euro	661 710	25.7
Japanese Yen	175 900	6.8
British Pound	137 423	5.3
Canadian Dollar	85 536	3.3
Australian Dollar	53 909	2.1
South Korean Won	53 712	2.1
Mexican Peso	52 089	2.0
Indian Rupee	30 848	1.2
Swedish Krona	30 272	1.2
Brazilian Real	27 843	1.1
Polish Zloty	20 444	0.8
Indonesian Rupiah	20 428	0.8
Chinese Yuan	19 736	0.8
Russian Ruble	19 012	0.7
Swiss Franc	18 905	0.7
Danish Krone	15 681	0.6
Turkish Lira	14 335	0.6
South African Rand	13 972	0.5
Thai Baht	11 172	0.4
Israeli Shekel	10 933	0.4
Malaysian Ringgit	10 636	0.4
Chilean Peso	10 187	0.4
Singapore Dollar	10 042	0.4
Taiwanese Dollar	7 966	0.3
Colombian Peso	7 624	0.3
Czech Koruna	7 407	0.3
New Zealand Dollar	6 707	0.3
Philippine Peso	5 142	0.2
Hong Kong Dollar	4 035	0.2
Hungarian Forint	1 451	0.1

[1] Does not sum up to total market value due to cash and derivatives

Table 9 Sector composition of the fund's bond holdings

Sector	Millions of kroner[1]	Percent
Government bonds	**1 461 357**	**56.7**
Government bonds	1 461 357	56.7
Government-related bonds	**334 138**	**13.0**
Agencies	164 578	6.4
Local authorities	98 677	3.8
Supranational	58 474	2.3
Sovereign	12 408	0.5
Inflation-linked bonds	**140 814**	**5.5**
Inflation-linked bonds	140 814	5.5
Corporate bonds	**591 143**	**22.9**
Industrials	319 741	12.4
Financials	227 800	8.8
Utilities	43 602	1.7
Securitized bonds	**147 565**	**5.7**
Covered	147 237	5.7
CMBS	327	0.0

[1] Does not sum up to total market value due to cash and derivatives

Table 10 Largest holdings of equities and bonds excluding sovereigns as at 31 December 2016. 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	50,985	710	51,696
Apple Inc	Technology	44,965	4,648	49,613
Royal Dutch Shell PLC	Oil and gas	46,153	3,287	49,440
Bank of America Corp	Financials	18,153	20,291	38,444
JPMorgan Chase & Co	Financials	23,211	14,998	38,209
Microsoft Corp	Technology	34,665	2,947	37,612
Alphabet Inc	Technology	36,566	955	37,521
Novartis AG	Health care	32,349	2,675	35,024
Roche Holding AG	Health care	32,896	2,110	35,005
Kreditanstalt für Wiederaufbau	Government-related		34,529	34,529
HSBC Holdings PLC	Financials	25,501	7,843	33,344
Wells Fargo & Co	Financials	22,559	9,884	32,443
Anheuser-Busch InBev SA/NV	Consumer goods	22,786	7,314	30,100
BlackRock Inc	Financials	27,762	1,238	29,000
Lloyds Banking Group PLC	Financials	13,746	14,594	28,339
Johnson & Johnson	Health care	25,971	1,478	27,449
Exxon Mobil Corp	Oil and gas	26,391		26,391
AT&T Inc	Telecommunications	19,355	6,948	26,303
Citigroup Inc	Financials	15,627	10,301	25,929
UBS Group AG	Financials	16,959	8,868	25,827
Berkshire Hathaway Inc	Financials	17,411	7,326	24,737
General Electric Co	Industrials	18,917	5,261	24,178
Prudential PLC	Financials	23,614	475	24,089
Credit Suisse Group AG	Financials	12,760	10,775	23,536
Amazon.com Inc	Consumer services	21,988	239	22,227
Sanofi	Health care	17,723	4,287	22,009
Verizon Communications Inc	Telecommunications	13,539	8,382	21,920
TOTAL SA	Oil and gas	17,367	2,694	20,060
BP PLC	Oil and gas	17,458	2,441	19,898
Samsung Electronics Co Ltd	Consumer goods	17,755	622	18,378
SAP SE	Technology	16,246	2,080	18,326
European Investment Bank	Government-related		18,189	18,189
Canada Housing Trust No 1	Government-related		17,936	17,936
Nordea Bank AB	Financials	7,801	10,071	17,872
Chevron Corp	Oil and gas	17,561	303	17,864
Barclays PLC	Financials	12,123	5,646	17,770
Banco Santander SA	Financials	11,326	6,416	17,742
Toyota Motor Corp	Consumer goods	16,732	911	17,643
Daimler AG	Consumer goods	16,667	841	17,508
Prudential Financial Inc	Financials	15,545	1,637	17,182

Global investments

NORTH AMERICA

2,268 companies
2,071 bonds from
582 issuers
400 properties [1]

EUROPE

1,881 companies
1,584 bonds from
489 issuers
358 properties [1]

LATIN AMERICA

262 companies
173 bonds from
36 issuers

AFRICA

196 companies
16 bonds from
2 issuers

[1] Investments in unlisted real estate. A property can consist of several buildings.

MIDDLE EAST

152 companies
33 bonds from
12 issuers

ASIA

3,898 companies
617 bonds from
78 issuers

INTERNATIONAL ORGANISATIONS

128 bonds from
15 issuers

OCEANIA

328 companies
159 bonds from
36 issuers

Return

The fund's investment return was 6.92 percent in 2016 and has been 5.70 percent since inception.

The fund's total market value rose 35 billion kroner to 7,510 billion kroner in 2016. The investment return for the year was 447 billion kroner. However, the krone strengthened against the main currencies the fund invests in, reducing the fund's net asset value by 306 billion kroner. Withdrawals of capital amounted to 101 billion kroner.

Net of management costs, a total of 3,363 billion kroner has been transferred to the fund since the first inflow of capital in May 1996. The cumulative investment return since inception has been 3,123 billion kroner. Changes in the value of the krone against the currencies we invest in account for the remaining 1,025 billion kroner of the fund's market value.

PERCENTAGE RETURN

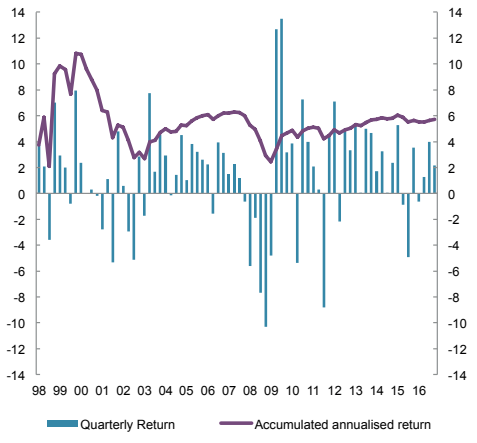
In 2016, the fund returned 6.92 percent. The return on equity investments was 8.72 percent, while fixed-income investments returned 4.32 percent and real estate investments 0.78 percent.

Over the last five years, the fund's annualised return has been 9.22 percent. Equity investments returned 12.67 percent , fixed-income investments 3.62 percent and real estate investments 7.67 percent.

Since inception, the fund's investment return has been 5.70 percent. The return on equity investments has been 5.46 percent and the return on fixed-income investments 4.84 percent.

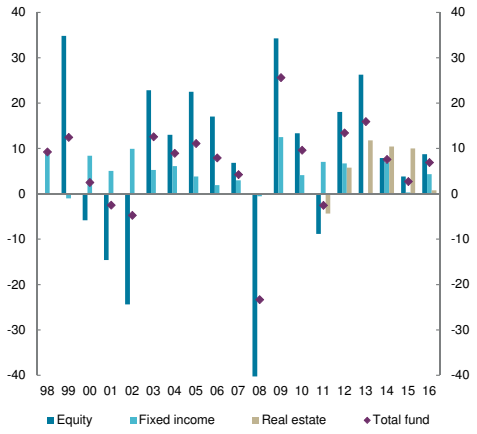
The fund has had a positive annual return in 15 out of 19 years since inception. Equity investments have had a positive return in 13 out of 18 years, and fixed-income investments in 17 out of 19 years. The real estate asset class has had positive returns in five out of six years.

Chart 20 The fund's quarterly and accumulated annualised return. Percent



Source: Norges Bank Investment Management

Chart 21 Annual return for equity, fixed income, real estate investments and total fund. Percent



Source: Norges Bank Investment Management

Table 11 Absolute return per year. Measured in the fund's currency basket. Percent

Year	Equity	Fixed income	Real estate[1]	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	9.99	2.74
2016	8.72	4.32	0.78	6.92

[1] Measurement starts in 31/03/2011.

Table 12 Absolute return key figures. Measured in the fund's currency basket. Annualised. Percent

	Since 01.01.1998	Last 10 years	Last 5 years	Last 3 years	2016
Return on equity investments[1]	5.46	4.78	12.67	6.80	8.72
Return on fixed-income investments	4.84	4.37	3.62	3.81	4.32
Return on real estate investments	-	-	7.67	6.97	0.78
Return on fund	5.70	5.25	9.22	5.72	6.92

[1] Since 01.01.1999.

Table 13 Absolute return, 5-year buckets. Measured in the fund's currency basket. Annualised. Percent

	1998–2002	2003–2007	2008–2012	2013–2016	2016
Return on equity investments[1]	-4.85	16.28	-0.59	11.37	8.72
Return on fixed-income investments	6.26	4.00	5.87	2.87	4.32
Return on real estate investments	-	-	-	8.15	0.78
Return on fund	3.19	8.92	3.14	8.19	6.92

[1] Since 01.01.1999.

Table 14 The fund's real return. Measured in the fund's currency basket. Annualised. Percent

	Since 1998	Last 10 years	Last 5 years	Last 3 years	2016
Fund return (nominal)	5.70	5.25	9.22	5.72	6.92
Annual inflation	1.76	1.77	1.31	1.06	1.52
Annual management fees	0.09	0.08	0.06	0.06	0.05
Real return	3.79	3.33	7.74	4.56	5.27

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 34 currencies at the end of 2016. Unless otherwise stated in the text, results are measured in the fund's currency basket.

BENCHMARK RETURN

The fund's equity benchmark returned 8.58 percent in 2016. Over the last three years the annualised investment return has been 6.73 percent.

The best performing region in 2016 was Latin America with a 36.50 percent investment return. With its much greater benchmark weight, North America, however, contributed the most to the benchmark's positive performance in 2016 with a return of 15.31 percent. European stocks underperformed most of the other regions in 2016, with the region returning 1.79 percent. Asian stocks had a return of 6.12 percent.

The benchmark returns are shown in both the fund's currency basket and in local currency in order to show the impact of exchange rate movements on investment returns. Emerging market currencies generally strengthened in 2016 against the fund's currency basket with the Brazilian real, the Russian ruble and the South African rand the most notable appreciating currencies. For Brazil, this meant that a local currency investment performance of 37.93 percent in 2016 translated into a 71.00 percent gain when measured in the currency basket. Exchange rate fluctuations can also impact developed markets returns in a material way. With the British pound depreciating in 2016, the local currency investment return of 16.45 percent for the UK translated into a return of -0.43 percent when measured in the fund's currency basket.

After poor performances in recent years, the oil and gas sector had a good year and performed the best in 2016 with a return of 30.42 percent. The second best equity sector in 2016 was basic materials at 24.77 percent. However, even after their recent gains, these two sectors still have the lowest annualised sector returns over the last five years.

The return for the fixed-income benchmark was 4.16 percent in 2016. Despite Europe having the highest overall local currency return of the three major regions with 5.25 percent in 2016, it underperformed with a 2.20 percent investment return when measured in the fund's currency basket, compared with North America's overall return of 5.48 percent and Asia's 6.46 percent in 2016.

Currency movements also impact on the fund's bond investment returns. Bonds denominated in British pounds performed particularly well in local currency with a return of 13.89 percent, but when translated into the fund's currency basket, the return turns negative to -2.62 percent. The best-performing bond markets in the benchmark in 2016 were bonds denominated in Russian ruble and South African rand, at 40.05 percent and 32.30 percent, respectively, with positive currency gains contributing to the high investment returns.

Corporate bonds performed better than government bonds in 2016. The return on the corporate bonds in the benchmark was 5.51 percent compared with 3.57 percent for government bonds. The best performing sub-sector within corporate bonds was industrials with a 7.66 percent return, while inflation-linked bonds returned the most within the government segment at 6.06 percent.

Table 15 Equity benchmark return by region and country. Annualised. Percent

	The fund's currency basket			Local currency		
	2016	3-Year	5-Year	2016	3-Year	5-Year
North America	**15.31**	**12.65**	**16.86**	**12.86**	**8.17**	**14.09**
United States	14.65	13.27	17.73	12.42	8.25	14.54
Canada	27.85	3.68	5.93	21.02	7.08	8.89
Europe	**1.79**	**1.97**	**10.25**	**7.29**	**6.36**	**11.70**
United Kingdom	-0.43	0.06	8.01	16.45	5.43	10.01
Switzerland	-1.46	4.29	12.00	-1.90	4.20	10.80
Germany	5.08	2.02	12.85	6.12	6.58	14.45
France	7.88	4.09	12.33	8.94	8.75	13.92
Spain	1.46	-3.17	4.58	2.45	1.16	6.06
Italy	-9.43	-1.06	6.67	-8.54	3.36	8.18
Netherlands	8.16	5.08	12.05	9.23	9.78	13.64
Denmark	-10.55	10.49	19.03	-10.00	15.30	20.72
Belgium	-3.73	7.82	16.75	-2.78	12.64	18.40
Finland	3.08	5.59	14.52	4.09	10.31	16.14
Austria	9.92	-0.41	8.39	11.00	4.04	9.92
Ireland	-10.46	8.57	20.93	-9.58	13.42	22.64
Portugal	-2.29	-7.69	1.45	-1.33	-3.56	2.89
Greece	-6.73	-29.99	-10.84	-5.81	-26.86	-9.58
Sweden	3.50	2.59	11.69	9.36	10.06	14.96
Russia	62.48	0.06	2.51	35.50	14.10	11.33
Hungary	37.62	14.45	13.64	35.83	21.13	14.82
Czech Republic	1.94	-1.88	-2.51	2.93	2.07	0.02
Poland	6.42	-7.40	3.01	10.30	-1.39	4.21
Turkey	-5.59	-5.22	1.27	11.56	6.76	11.58
Asia	**6.12**	**6.63**	**9.65**	**2.94**	**4.73**	**11.31**
Japan	5.24	8.22	11.60	0.05	7.08	18.00
China	3.29	5.55	8.49	1.32	0.87	5.51
South Korea	5.75	1.11	5.19	6.81	1.07	3.31
Taiwan	18.70	7.89	10.31	14.20	5.84	8.67
Hong Kong	4.55	4.62	9.86	2.55	-0.02	6.85
Singapore	4.26	-0.24	5.74	4.09	-0.35	5.08
India	1.58	13.98	11.51	2.18	12.35	13.94
Thailand	28.02	9.66	10.31	24.58	7.75	9.99
Malaysia	-2.16	-7.46	-0.66	0.23	-1.78	3.59
Indonesia	22.63	10.56	1.72	17.51	9.30	7.12
Philippines	-1.16	7.43	10.99	2.38	6.63	10.72
Pakistan	45.16	18.35	25.06	41.84	12.81	25.35
Oceania	**13.99**	**4.21**	**7.14**	**12.15**	**6.78**	**11.59**
Australia	13.95	3.94	6.89	12.27	6.58	11.48
New Zealand	14.43	11.93	15.27	10.15	13.05	14.69
Latin America	**36.50**	**-3.47**	**-3.23**	**26.12**	**3.76**	**3.86**
Mexico	-6.04	-7.09	1.42	9.89	3.27	6.66
Chile	21.60	0.18	-2.49	12.70	3.81	-0.19
Brazil	71.00	-1.86	-4.24	37.93	4.41	4.14
Colombia	30.23	-11.70	-6.23	20.75	-2.26	-0.43
Peru	81.47	10.79	-1.56	77.93	5.88	-4.32
Africa	**22.12**	**2.65**	**4.43**	**8.96**	**7.91**	**13.17**
South Africa	23.77	2.99	4.40	7.10	7.57	12.86
Egypt	-15.68	-4.53	6.92	89.94	25.05	29.04
Middle East	**-9.59**	**5.92**	**9.86**	**-12.25**	**3.71**	**6.72**
Israel	-19.77	4.35	6.20	-22.19	3.22	3.45
United Arab Emirates	14.56	7.23	26.08	12.32	2.47	22.66

Table 16 Equity benchmark return by sector. Annualised. Percent

	The fund's currency basket			Local currency		
	2016	3-Year	5-Year	2016	3-Year	5-Year
Financials	**8.30**	**6.05**	**14.05**	**8.47**	**6.39**	**14.32**
Banks	10.03	3.08	11.45	10.39	4.41	12.43
Nonlife insurance	9.49	10.69	18.78	9.02	10.61	18.15
Life insurance	2.43	5.73	17.52	5.46	6.40	17.50
Real estate investment and services	1.55	3.99	10.88	0.88	3.26	11.57
Real estate investment trusts	6.96	13.25	13.71	6.73	11.71	12.71
Financial services	9.12	9.00	18.55	8.43	7.75	18.15
Consumer goods	**3.29**	**7.10**	**13.43**	**3.92**	**7.72**	**13.84**
Automobiles and parts	0.81	3.61	14.60	-0.79	4.09	16.15
Beverages	-1.34	7.06	12.66	1.84	8.90	13.30
Food producers	4.02	8.25	11.63	3.00	7.89	10.96
Household goods and home construction	2.23	10.83	17.82	4.90	10.90	17.73
Leisure goods	24.21	13.82	10.63	22.50	12.43	11.57
Personal goods	2.65	4.87	12.90	4.13	6.25	13.36
Industrials	**14.12**	**6.52**	**13.49**	**14.44**	**6.73**	**13.74**
Construction and materials	13.78	7.67	13.33	14.62	9.36	14.35
Aerospace and defense	11.03	3.02	13.36	15.70	3.35	12.94
General industrials	14.94	7.33	14.79	14.55	6.89	14.34
Electronic and electrical equipment	13.31	7.86	14.78	11.21	7.14	15.22
Industrial engineering	21.26	4.62	10.91	20.70	5.00	11.37
Industrial transportation	15.59	6.74	13.62	14.26	6.72	13.81
Support services	7.52	7.35	14.87	10.12	7.42	15.05
Consumer services	**2.76**	**7.75**	**15.53**	**2.98**	**7.05**	**15.25**
Food and drug retailers	-0.51	3.41	9.55	-0.69	3.30	9.42
General retailers	3.48	9.88	16.65	2.50	8.49	16.22
Media	5.20	7.14	18.02	6.30	7.06	17.66
Travel and leisure	1.20	8.26	15.38	2.38	7.44	15.37
Health care	**-5.23**	**9.81**	**16.11**	**-4.92**	**8.89**	**15.17**
Health care equipment and services	7.33	16.42	19.58	6.22	14.28	18.18
Pharmaceuticals and biotechnology	-9.06	7.74	14.96	-8.34	7.18	14.16
Technology	**14.40**	**14.69**	**17.74**	**12.70**	**11.70**	**15.83**
Software and computer services	9.80	14.47	19.27	8.38	11.34	17.23
Technology hardware and equipment	19.92	14.98	16.62	17.89	12.10	14.81
Oil and gas	**30.42**	**-0.48**	**2.83**	**32.38**	**0.18**	**2.95**
Oil and gas producers	31.92	0.64	3.34	34.72	1.75	3.73
Oil equipment, services and distribution	29.35	-6.06	0.07	27.34	-7.60	-1.10
Alternative energy	-8.62	2.66	10.37	-8.82	3.39	9.97
Basic materials	**24.77**	**2.51**	**4.64**	**24.84**	**3.90**	**5.51**
Chemicals	11.29	5.59	12.69	10.69	6.76	13.04
Forestry and paper	19.84	11.45	17.27	19.96	13.96	18.85
Industrial metals and mining	48.29	-1.69	0.07	45.92	-0.90	1.19
Mining	71.55	-4.43	-8.16	78.19	-1.49	-6.03
Telecommunications	**2.32**	**3.65**	**8.54**	**3.64**	**4.90**	**9.19**
Fixed line telecommunications	5.18	7.33	8.32	5.43	7.76	8.19
Mobile telecommunications	-0.98	-0.11	8.43	1.42	1.98	9.89
Utilities	**6.24**	**6.64**	**7.30**	**7.55**	**7.44**	**7.59**
Electricity	8.93	9.73	8.00	8.15	9.53	7.92
Gas, water and multiutilities	2.78	2.93	6.24	6.63	4.92	7.04

Table 17 Fixed-income benchmark return by region and currency. Annualised. Percent

	The fund's currency basket			Local currency		
	2016	3-Year	5-Year	2016	3-Year	5-Year
North America	**5.48**	**7.26**	**4.85**	**3.15**	**3.12**	**2.44**
US Dollar	5.38	7.82	5.28	3.32	3.04	2.43
Canadian Dollar	6.57	0.70	-0.21	0.88	4.01	2.58
Europe	**2.20**	**0.95**	**3.94**	**5.25**	**5.71**	**5.54**
Euro	2.59	0.45	4.07	3.60	4.94	5.54
British Pound	-2.62	3.80	4.36	13.89	9.38	6.30
Swiss Franc	1.84	3.84	3.49	1.39	3.76	2.38
Swedish Krona	-1.90	-2.90	-0.07	3.65	4.17	2.85
Danish Krone	4.63	0.60	1.71	5.27	4.98	3.16
Polish Zloty[1]	-3.13	-2.51	-	0.40	3.81	-
Czech Koruna[1]	0.64	0.66	-	1.62	4.71	-
Russian Ruble[2]	40.05	-	-	14.77	-	-
Asia	**6.46**	**3.95**	**-1.28**	**2.82**	**3.38**	**2.86**
Japanese Yen	8.53	4.02	-3.04	3.18	2.92	2.52
South Korean Won[1]	0.66	5.11	-	1.66	5.07	4.08
Hong Kong Dollar[1]	1.59	6.02	-	-0.35	1.32	0.75
Singapore Dollar	3.15	2.50	2.07	3.00	2.46	1.47
Thai Baht[1]	3.96	7.46	-	1.16	5.59	4.32
Malaysian Ringgit[1]	0.83	-2.14	-	3.30	3.86	2.73
Oceania	**4.44**	**2.92**	**0.71**	**2.61**	**5.33**	**4.47**
Australian Dollar	3.99	2.66	0.21	2.45	5.28	4.51
New Zealand Dollar	7.89	4.70	4.67	3.86	5.75	4.14
Latin America	**-13.82**	**-5.89**	**-**	**-0.42**	**4.43**	**-**
Mexican Peso[1]	-15.16	-6.04	-	-0.77	4.43	-
Chilean Peso[1]	14.92	2.05	-	6.50	5.75	-
Africa	**32.30**	**2.37**	**-**	**14.48**	**6.93**	**-**
South African Rand[1]	32.30	2.37	-	14.48	6.93	-
Middle East	**4.76**	**5.83**	**-**	**1.60**	**4.68**	**-**
Israeli Shekel[1]	4.76	5.83	-	1.60	4.68	-

[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 was introduced to the benchmark index on 1 April 2014.

Table 18 Fixed-income benchmark return by sector[1]. Annualised. Percent

	The fund's currency basket			Local currency		
	2016	3-Year	5-Year	2016	3-Year	5-Year
Government (including supranationals)	**3.57**	**3.67**	**2.91**	**3.25**	**4.25**	**3.55**
Treasuries	3.33	3.57	2.81	2.80	4.19	3.56
Inflation-linked bonds	6.06	5.03	3.67	7.97	5.05	3.27
Supranational	2.81	2.89	3.38	2.51	3.69	3.67
Corporate (including covered bonds)	**5.51**	**4.97**	**5.80**	**5.35**	**4.26**	**4.81**
Financials	4.52	5.25	7.11	4.20	4.19	5.97
Industrials	7.66	6.53	5.66	6.92	4.38	3.98
Utilities	5.38	6.29	6.01	7.15	5.93	5.24
Covered	0.70	-0.53	3.34	2.16	3.25	4.50

[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 investment return was 15 basis points higher than the return on the fund's benchmark in 2016 and has been 26 basis points higher since inception.

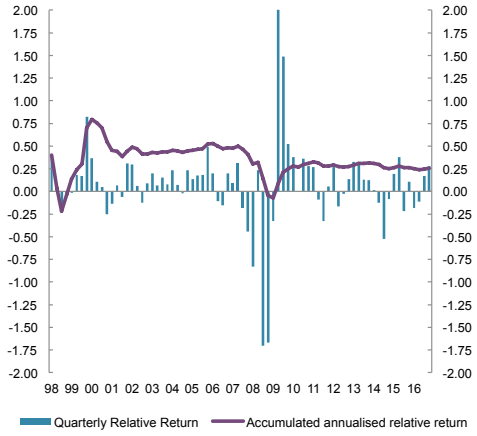
The investment returns on the fund's equity and fixed-income investments can be compared with the returns on global benchmark indices for equities and bonds set by the Ministry of Finance, based on indices from FTSE Group and Bloomberg Barclays Indices.

The overall return on the fund's equity and fixed-income investments was 15 basis points higher than the return on the benchmark index in 2016. 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 15 basis points more than the benchmark index in 2016. Since 1 January 1999, the annualised relative return for equity investments has been 49 basis points. The relative return on the fixed-income investments was 16 basis points in 2016 and has been 14 basis points annualised since the fund's inception.

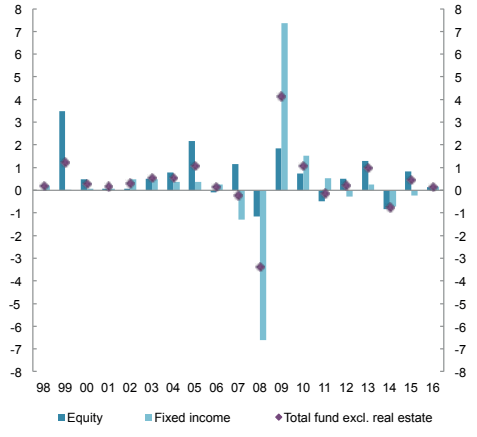
The aggregated portfolio of equity and fixed-income investments has produced positive relative returns in 15 out of 19 years since 1 January 1998, equity investments in 14 out of 18 years, and fixed-income investments in 14 out of 19 years.

Chart 22 The fund's quarterly and accumulated annualised relative return. Percentage points



Source: Norges Bank Investment Management

Chart 23 Annual relative return for equity and fixed-income investments and total fund excluding real estate. Percentage points



Source: Norges Bank Investment Management

Table 19 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
2016	0.15	0.16	0.15

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	2016
Return on equity and fixed-income investments (percent) [1]	5.70	5.24	9.21	5.70	7.12
Return on equity and fixed-income benchmark (percent) [1]	5.44	5.19	9.01	5.75	6.97
Relative return on equity and fixed-income investments (percentage points)	**0.26**	**0.06**	**0.20**	**-0.05**	**0.15**

[1] Equity investments since 01.01.1999

	Since 01.01.1999	Last 10-years	Last 5-years	Last 3-years	2016
Return on equity investments (percent)	5.46	4.78	12.67	6.80	8.72
Return on equity benchmark (percent)	4.97	4.54	12.30	6.73	8.58
Relative return on equity investments (percentage points)	**0.49**	**0.24**	**0.37**	**0.06**	**0.15**

	Since 01.01.1998	Last 10-years	Last 5-years	Last 3-years	2016
Return on fixed-income investments (percent)	4.84	4.37	3.62	3.81	4.32
Return on bond benchmark (percent)	4.70	4.34	3.78	4.06	4.16
Relative return on fixed-income investments (percentage points)	**0.14**	**0.03**	**-0.16**	**-0.26**	**0.16**

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

	1998–2002	2003–2007	2008–2012	2013–2016
Return on equity and fixed-income investments (percent) [1]	**3.19**	**8.92**	**3.15**	**8.18**
Return on equity and fixed-income benchmark (percent) [1]	2.78	8.52	3.14	7.98
Relative return on equity and fixed-income investments (percentage points)	**0.41**	**0.40**	**0.01**	**0.20**

[1] Equity investments since 01.01.1999

	1999–2002	2003–2007	2008–2012	2013–2016
Return on equity investments (percent)	**-4.85**	**16.28**	**-0.59**	**11.37**
Return on equity benchmark (percent)	-5.63	15.37	-0.59	11.03
Relative return on equity investments (percentage points)	**0.78**	**0.90**	**0.01**	**0.33**

	1998–2002	2003–2007	2008–2012	2013–2016
Return on fixed-income investments (percent)	**6.26**	**4.00**	**5.87**	**2.87**
Return on bond benchmark (percent)	6.09	3.97	5.44	2.99
Relative return on fixed-income investments (percentage points)	**0.17**	**0.03**	**0.43**	**-0.13**

INVESTMENT STRATEGIES

The management of the fund is index close, but the contribution from all the investment strategies are a result of active management and decisions.

Fund allocation decisions are made when rebalancing the benchmark portfolio's exposure to a number of return drivers, the fund's exposure to emerging markets and various factor strategies. For these markets and strategies, it is necessary to adapt the benchmark portfolio to achieve the desired exposure for the fund.

Security selection is about company-specific investment management based on long-term, qualitative and quantitative analysis of sectors and companies. Stocks and corporate bonds are part of this strategy, as well as specialist sector mandates, and a few broad cross-sector mandates. We also award external management mandates to managers with specialist expertise in clearly defined investment areas where it is not appropriate to build up in-house expertise. This applies particularly to small- and mid-cap companies and emerging markets. Managers look to generate an excess return for the fund through analysis of specific markets and companies.

Asset management is about achieving the desired market and risk exposure as cost effectively as possible. This strategy covers responsibility for managing the broad equity and fixed-income portfolios, executing securities trades and managing cash, currencies and securities lending. We aim to avoid making purchases and sales that coincide with changes in the benchmark index. We also aim to generate a return from systematic risk factors and pricing differences between securities with the same characteristics, and to minimise overall transaction costs.

CONTRIBUTIONS FROM INVESTMENT STRATEGIES

The overall relative return for equity and fixed-income investments of 15 basis points for 2016 can be broken down into respective contributions from the equity and fixed-income asset classes as well as contributions from different investment strategies. In 2016, equity investments contributed 10 basis points to the aggregate relative return while fixed-income investments contributed 5 basis points.

The introduction of the internal reference portfolios has changed how the fund is managed. The first full year with internal reference portfolios for both asset classes was 2013. Since then, the annualised relative return for the equity and fixed-income mandates has been 20 basis points. In this period, equity investments have contributed 21 basis points to the aggregate equity and fixed-income portfolio's relative return, fixed-income investments -6 basis points, and cross-asset allocation 4 basis points.

External investment managers are primarily utilised for security selection strategies within specific regions and markets, such as emerging and frontier markets. The external equity mandates contributed 2 basis points of the total relative return of 15 basis points for the fund in 2016. In the period from 2013 to 2016, 11 basis points of the fund's annualised relative return of 20 basis points can be attributed to external management.

Table 22 Contributions to relative return on equity and fixed-income investments from investment strategies in 2016. Percentage points

	Equity	Fixed income	Cross-asset allocation	Total
Fund allocation	-0.04	-0.04	-0.02	-0.10
Internal reference portfolio	0.01	-0.05	0.00	-0.04
of which systematic factors	0.19			0.19
of which universe expansion	-0.10	0.17		0.06
Allocation decisions	-0.05	0.01	-0.02	-0.07
Security selection	-0.02	-0.03		-0.06
Internal security selection	-0.04	-0.03		-0.07
External security selection	0.01			0.01
Asset management	0.16	0.13	0.02	0.31
Asset positioning	0.11	0.12	0.02	0.25
Securities lending	0.05	0.01		0.06
Total	**0.10**	**0.05**	**0.00**	**0.15**

Table 23 Contributions to relative return on equity and fixed-income investments from investment strategies from 2013–2016. Annualised. Percentage points

	Equity	Fixed income	Cross-asset allocation	Total
Fund allocation	-0.03	-0.14	0.04	-0.13
Internal reference portfolio	-0.01	-0.14	0.00	-0.15
of which systematic factors	0.02			0.02
of which universe expansion	0.00	-0.09		-0.09
Allocation decisions	-0.02	0.00	0.04	0.02
Security selection	0.07	0.00		0.07
Internal security selection	-0.02	0.00		-0.02
External security selection	0.09			0.09
Asset management	0.17	0.08	0.00	0.25
Asset positioning	0.12	0.08	0.00	0.20
Securities lending	0.05	0.00		0.06
Total	**0.21**	**-0.06**	**0.04**	**0.20**

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. Internal management strategies 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 affected by the approach used when transitioning the external mandates into the internal fixed-income portfolio.

Table 24 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 25 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.

Return and costs

Norges Bank maintains a high level of cost awareness in the management of the fund. Total management costs as a share of assets under management have been trending downwards for a number of years, despite the inclusion of additional markets, currencies and unlisted real estate.

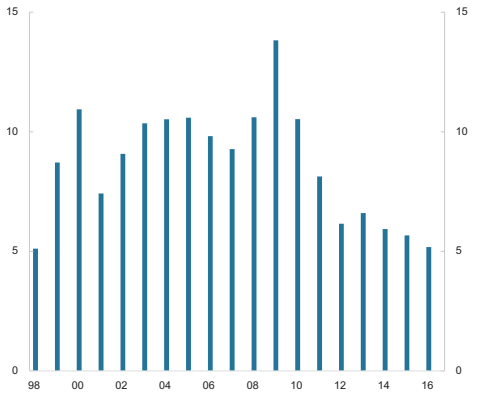
The overall goal is to seek highest possible return after costs, and manage the fund in a cost-efficient manner.

The Ministry of Finance has delegated responsibility for the management of the fund to Norges Bank. The Ministry reimburses Norges Bank for costs incurred in the management of the fund, within an annual limit for overall management fee. Performance based fees to external managers are reimbursed separately. Management costs are also incurred in real estate subsidiaries of Norges Bank in relation to unlisted real estate investments. These costs are also measured against the annual limit, but they are not reimbursed or included in the management fee, since they are expensed directly in the investment portfolio. Norges Bank maintains a high level of cost awareness in the management of the fund. Total management costs as a share of assets under management have been trending downwards for a number of years, despite the inclusion of additional markets, currencies and unlisted real estate.

Management costs by strategy

We pursue a variety of investment strategies in our management of the fund. These strategies complement and influence one another, and cost synergies arise between them. For example, costs related to a specific system or data feed might be utilised in multiple strategies. We split the costs between the different strategies based on number of employees, usage or volume. Costs related to salary, personnel, analysis, consultants and legal services are allocated to the relevant strategy based on usage. Costs related to office premises and IT infrastructure are allocated to the relevant strategy based on headcount. Custody costs consist of safekeeping, transaction and performance measurement costs. Safekeeping costs are allocated to the asset management strategy, while transaction and performance measurement costs are split between the relevant strategies based on transaction volumes. Costs allocated to the external security selection strategy consist of a base fee and a performance fee to external

Chart 24 Total management cost versus total market value of fund. Cost as reimbursed by the Ministry of Finance. Basis points



Source: Norges Bank Investment Management

managers, as well as costs related to the internal team managing the external managers. Costs related to ownership strategies are allocated to internal security selection. Specific system costs are allocated to each strategy based on usage.

Table 26 Management cost per investment strategy in 2016. 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	0.3	
Security selection	2.1	9.8
Internal	0.8	4.7
External[1]	1.3	30.2
Asset management	2.2	2.9
Real estate	0.6	19.6
Total	5.2	

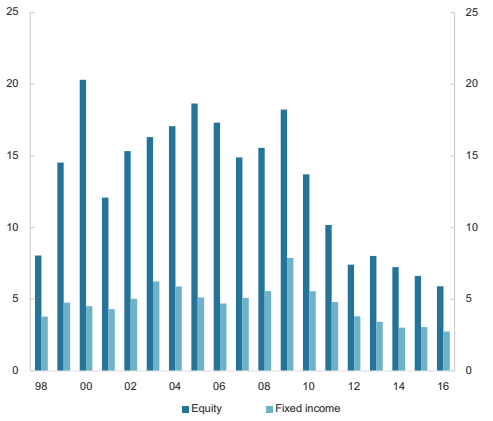
[1] Includes all externally managed capital.

Table 27 Management cost per investment strategy 2013–2016. 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	
Security selection	2.6	18.3
Internal	0.7	6.8
External[1]	1.9	48.0
Asset management	2.4	2.9
Real estate	0.4	25.8
Total	5.8	

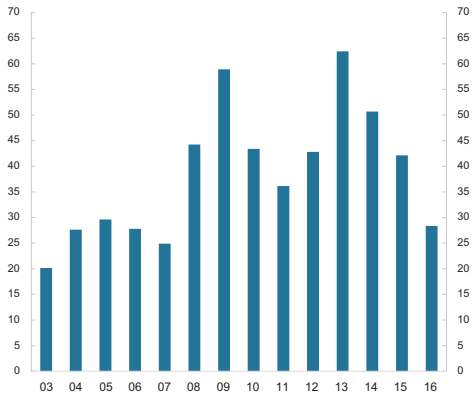
[1] Includes all externally managed capital.

Chart 25 Management cost per asset class. Cost as reimbursed by the Ministry of Finance. Basis points



Source: Norges Bank Investment Management

Chart 26 Fees to external equity managers. Basis points



Source: Norges Bank Investment Management

COST-ADJUSTED RELATIVE RETURN

The fund's relative return after management fees 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 revenues from securities lending, transaction costs related to inflows and extraordinary benchmark changes, transaction costs related to replication of a benchmark index, and management costs of a passive strategy.

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 last three years has been -9 basis points. Measured over the last five years and since inception, the difference is estimated at 18 and 25 basis points, respectively.

Table 28 The fund's relative return after management costs

	3 years	5 years	Since inception
The fund's relative return before management costs	-5	20	26
The fund's management costs	-5	-6	-8
The fund's relative return after management costs	**-10**	**14**	**17**

Table 29 Estimated relative return of a passive strategy

	3 years	5 years	Since inception
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	-3	-4
Transaction costs related to inflows and extraordinary benchmark changes	-1	-3	-5
Estimated relative return of a passive strategy	**-1**	**-4**	**-8**

Table 30 Cost-adjusted relative return comparison

	3 years	5 years	Since inception
The fund's relative return after management costs	-10	14	17
Estimated relative return of a passive strategy	-1	-4	-8
Estimated relative return difference	**-9**	**18**	**25**

Risk

The fund's absolute risk is largely driven by its asset allocation. The expected absolute volatility of the fund was 10.6 percent at the end of 2016.

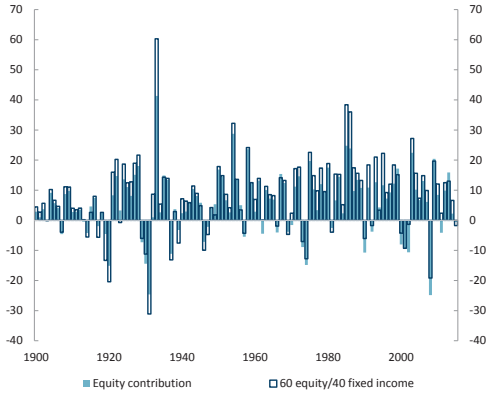
Market risk is defined as the risk of a decrease in the market value of the portfolio as a result of changes in financial market variables such as equity prices, exchange rates, interest rates, credit spreads and real estate prices. As no single measure or analysis can fully capture the fund's overall 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.

ASSET CLASS ALLOCATION

The strategic benchmark index in the management mandate laid down by the Ministry of Finance largely dictates the fund's asset class allocation, which is the main driver of the fund's overall risk. This can be demonstrated by plotting the returns of a hypothetical portfolio made up of a fixed allocation of 60 percent equities and 40 percent fixed income. Since 1900, the maximum loss of such a portfolio in a single year has been around 30 percent. The analysis shows that the majority of the return fluctuations in such a portfolio have been driven by equity volatility. If returns are viewed over periods of five and ten-years, the vast majority of these periods have had a positive return. However, this asset allocation also results in both five and ten-year periods with negative returns.

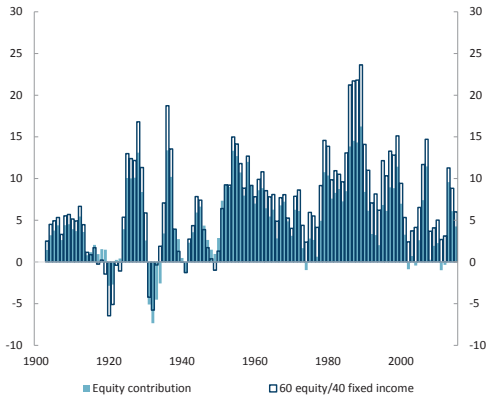
The management mandate requires the fund's equity exposure to be in the range of 50–70 percent. From 2007 to 2009, the fund's equity exposure increased gradually from 40 to 60 percent, mirroring the increase in the equity allocation in the strategic benchmark. The actual equity allocation at the end of 2016 was 62.5 percent.

Chart 27 Annual return of 60 equity/40 fixed income. Measured in dollars. Percent



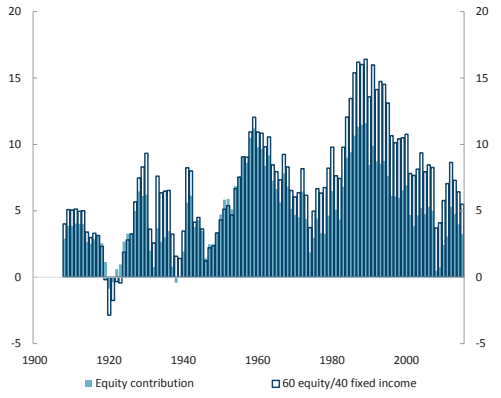
Source: Dimson-Marsh-Staunton Global Return Data

Chart 28 Annualised 5-year rolling return of 60 equity/40 fixed income. Measured in dollars. Percent



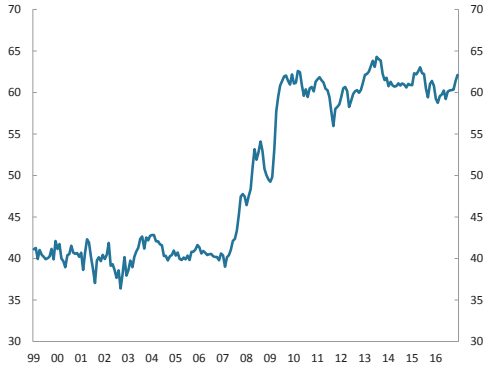
Source: Dimson-Marsh-Staunton Global Return Data

Chart 29 Annualised 10-year rolling return of 60 equity/40 fixed income. Measured in dollars. Percent



Source: Dimson-Marsh-Staunton Global Return Data

Chart 30 The fund's absolute equity exposure. Percent



Source: Norges Bank Investment Management

EXPECTED ABSOLUTE VOLATILITY

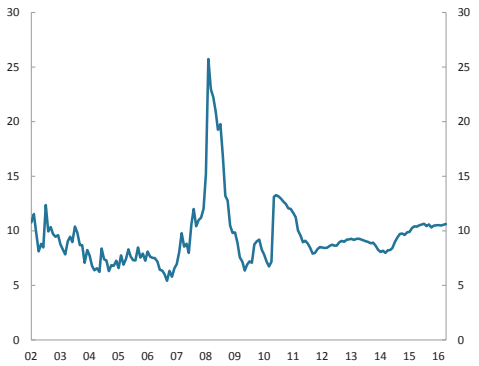
The fund's expected absolute volatility, based on the statistical concept of standard deviation, shows how much the annual return on the fund's investments can be expected to fluctuate and takes into account the correlation between different investments in the portfolio. Volatility is annualised using the square root of time rule, which assumes independence of returns over time and that return properties are consistent.

At the end of 2016, expected absolute volatility was 10.6 percent using a three-year price history, nearly unchanged from 10.4 percent at the end of 2015. This means that annual value fluctuations of approximately 800 billion kroner can be expected for the portfolio. The expected absolute volatility of the equity portfolio increased by 1.1 percentage points from the end of 2015 to 14.0 percent at the end of 2016, while the volatility of the fixed-income portfolio decreased by 0.4 percentage point over the same period.

The absolute volatility of the fund in 2016 was higher than the average for the last 14 years, which was 9.5 percent at the fund level at year end. The average absolute volatility for the equity and fixed-income asset classes was 15.1 and 9.2 percent respectively.

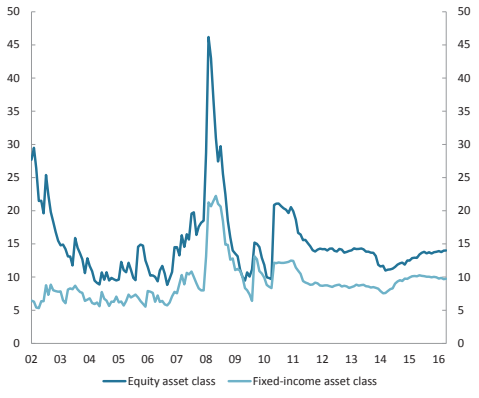
Estimated by means of historical simulations of the current portfolio, the expected volatility has been 11.2 percent using a ten-year sampling history. Within this ten-year period, the highest expected volatility of a consecutive three-year period is 14.1 percent and the lowest 8.0 percent.

Chart 31 The fund's expected absolute volatility. Percent



Source: Norges Bank Investment Management

Chart 32 Expected absolute volatility per asset class. Percent



Source: Norges Bank Investment Management

BREAKDOWN OF EXPECTED ABSOLUTE VOLATILITY

The expected volatility of equity investments was 14.0 percent at the end of 2016. A decomposition of the portfolio by industry shows that investments in financials contributed the most to the volatility in the portfolio, with 3.6 percentage points. This was, however, also the largest sector, representing 23.3 percent of equity investments at the end of 2016. Measured in the fund's currency basket, the expected volatility of equity investments was 13.2 percent at the end of the year.

The expected volatility of the fund's fixed-income investments was 9.7 percent at the end of 2016. Government bonds were the largest sector and contributed 5.6 percentage points of the total volatility. Volatility in the fixed-income portfolio was largely due to fluctuations in the value of the krone against the fund's currency basket. Measured in the fund's currency basket, the expected absolute volatility of fixed-income investments was 3.1 percent at the end of 2016.

Table 31 Risk contribution to equity investments as at 31 December 2016. Volatility measured in Norwegian Kroner. Percent

Sector	Weight	Absolute volatility contribution
Financials	23.3	3.6
Industrials	14.1	2.0
Consumer goods	13.7	1.7
Consumer services	10.3	1.4
Health care	10.2	1.4
Technology	9.5	1.4
Oil and gas	6.4	0.9
Basic materials	5.6	0.8
Telecommunications	3.2	0.4
Utilities	3.1	0.3
Cash and derivatives	0.6	0.0
Total equities	**100.0**	**14.0**

Table 32 Risk contribution to fixed-income investments as at 31 December 2016. Volatility measured in Norwegian Kroner. Percent

Sector	Weight	Absolute volatility contribution
Government bonds	56.7	5.6
Government-related bonds	13.0	1.1
Inflation-linked bonds	5.5	0.5
Corporate bonds	22.9	2.4
Securitised bonds	5.7	0.5
Cash and derivatives	-3.8	-0.4
Total fixed income	**100.0**	**9.7**

Relative risk

Deviations from the benchmark are sources of relative risk. This section looks at different approaches to measuring 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 scope for 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 2016, the fund was to aim for an expected relative volatility of no more than 1.25 percentage points. The limit for expected relative volatility was increased from 1.00 to 1.25 percentage points with effect from 1 February 2016. The expected relative volatility at the end of 2016 was 0.28 percentage point using a three-year price history. Estimated by historical simulations of the current portfolio, the expected relative volatility using a ten-year price history was 0.33 percentage point. Within this ten-year period, the highest expected relative volatility of a consecutive three-year period is 0.44 percentage point and the lowest 0.24 percentage point. The average expected relative volatility over the last 17 years is 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 0.37 and 0.44 percentage point respectively at the end of 2016. The average expected relative volatility over the last ten years for these two asset classes was 0.54 and 0.59 percentage point, 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.

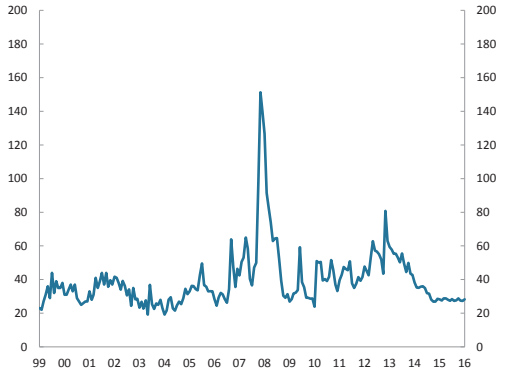
The mandate from the Ministry of Finance requires Norges Bank to take fiscal strength into account in its government bond investments. The mandate also requires Norges Bank to establish environment-related mandates with a market value that is normally in the range of 30–60 billion kroner. The expected relative volatility of these requirements at the end of 2016 was estimated to be 0.02 and 0.03 percentage point respectively, measured at fund level, and 0.06 and 0.05 percentage point, respectively, when measured at asset class level.

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 equity and fixed-income investments can be expected to deviate from the benchmark indices.

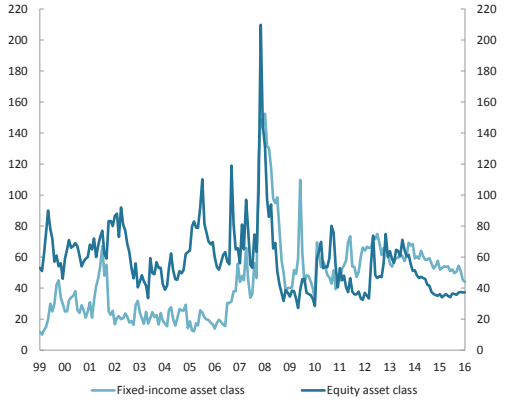
From 1 January 2011, the method for calculating expected volatility, both absolute and relative, was revised to make it better suited to the fund's long-term investment horizon. Until the end of 2010, expected volatility was calculated using daily price observations, with observations from recent days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

Chart 33 The fund's expected relative volatility. Basis points



Source: Norges Bank Investment Management

Chart 34 Expected relative volatility per asset class. Basis points



Source: Norges Bank Investment Management

Table 33 Relative risk contribution to equity investments as at 31 December 2016. Basis points

Sector	Relative volatility contribution
Financials	11
Oil and gas	5
Consumer goods	4
Industrials	4
Basic materials	4
Consumer services	3
Health care	2
Technology	2
Telecommunications	2
Utilities	0
Cash and derivatives	0
Total equities	**37**

Table 34 Relative risk contribution to fixed-income investments as at 31 December 2016. Basis points

Sector	Relative volatility contribution
Government bonds	35
Government-related bonds	-20
Inflation-linked bonds	11
Corporate bonds	13
Securitised bonds	-3
Cash and derivatives	8
Total fixed income	**44**

Table 35 Expected relative volatility of investment strategies as at 31 December 2016. 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	16	13	1	18
Internal reference portfolio	14	8	1	15
of which systematic factors	7			7
of which universe expansion	10	11		12
Allocation decisions	6	8	1	10
Security selection	17	3		17
Internal security selection	16	3		15
External security selection	5			5
Asset management	6	5	3	7
Asset positioning	6	5	3	7
Total	**24**	**16**	**4**	**28**

EXPECTED SHORTFALL

Expected relative volatility is an estimate of what happens under normal market conditions, but provides no information about the distribution and magnitudes of less probable outcomes (tail risk). Expected shortfall, also called conditional value at risk, is widely used as a tail risk measure. It shows the average expected loss in the worst q percent of observations, where q is the tail probability and equivalent to one 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 0.87 percentage point annually. The calculations are based on simulated relative returns in the currency basket over the last ten years. The Executive board has set a limit of 3.75 percent for expected shortfall for the aggregated equity and fixed-income asset classes with effect from 1 March 2016.

Table 36 Expected relative volatility and expected shortfall of equity investments and fixed-income investments versus benchmark indices as at 31 December 2016. 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	37	40	111
Fixed income	44	50	131
Equity and fixed income combined	28	33	87

Table 37 Expected relative volatility and expected shortfall relative to benchmark of investment strategies as at 31 December 2016. 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	18	21	58
Internal reference portfolio	15	19	51
of which systematic factors	7	7	21
of which universe expansion	12	14	47
Allocation decisions	10	11	31
Security selection	17	20	55
Internal security selection	15	19	55
External security selection	5	6	16
Asset management	7	10	31
Asset positioning	7	10	31
Total	**28**	**33**	**87**

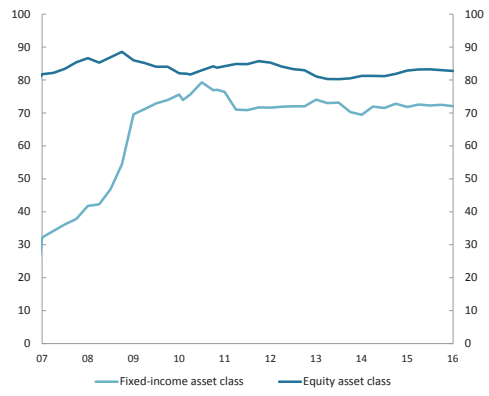
BENCHMARK OVERLAP

Benchmark overlap is an important relative risk measure part of relative risk and shows 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 limit for minimum overlap between the equity and fixed-income portfolios and the corresponding benchmark indices of 60 percent. At the end of 2016, the benchmark overlap was 82.8 percent at security level for equities and 72.0 percent at issuer level for fixed income. Over the last ten years, the equity benchmark overlap has been relatively stable and varied between 80 and 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

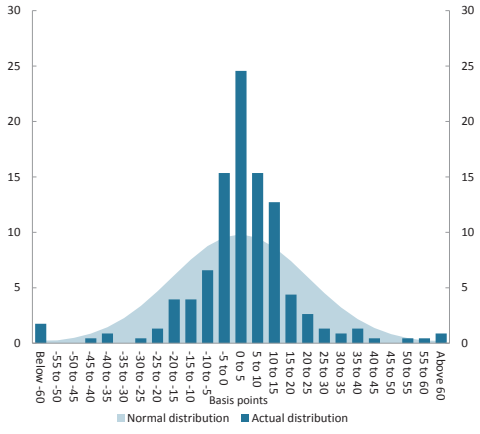
Another approach to relative risk is to analyse the distribution of the fund's realised relative return. Measured in the currency basket, the standard deviation of realised monthly relative returns has been 0.11 percent over the last five years, and less over longer sample periods. Excess kurtosis has also been lower over the last 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 35 The fund's benchmark overlap. Percent



Source: Norges Bank Investment Management

Chart 36 The fund's monthly relative return distribution. Percent



Source: Norges Bank Investment Management

Table 38 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)	0.20	0.26	0.11	0.11
Skewness relative return of equity and fixed-income investments	-2.25	-1.97	-0.17	-0.56
Excess kurtosis relative return of equity and fixed-income investments	16.64	10.62	0.87	-0.29
Standard deviation relative return of equity investments (percent)	0.23	0.21	0.13	0.15
Skewness relative return of equity investments	-0.74	-3.10	-0.90	-0.84
Excess kurtosis relative return of equity investments	9.48	19.36	1.34	0.41
Standard deviation relative return of fixed-income investments (percent)	0.30	0.42	0.13	0.14
Skewness relative return of fixed-income investments	-0.56	-0.36	0.13	-0.10
Excess kurtosis relative return of fixed-income investments	16.05	7.67	0.03	-0.28

[1] Equity investments since 01.01.1999.

Table 39 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	2013–2016
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	-0.18
Excess kurtosis relative return of equity and fixed-income investments	2.44	4.47	6.18	0.54
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	-0.88
Excess kurtosis relative return of equity investments	3.10	0.54	20.37	0.94
Standard deviation relative return of fixed-income investments (percent)	0.09	0.11	0.57	0.15
Skewness relative return of fixed-income investments	-0.55	-3.48	-0.45	0.08
Excess kurtosis relative return of fixed-income investments	11.49	13.73	3.56	-0.37

[1] Equity investments since 01.01.1999.

Return and risk

This section looks at various risk-adjusted performance measures and factor-adjusted regression analysis of returns.

The returns discussed in the previous sections of this report are useful for assessing the fund's achievements against its long-term targets. However, it is not appropriate to rely only on the figures presented so far when evaluating the fund's achievements as an asset manager or when comparing performance to other similar institutions in the industry. It is important to recognise that the fund's returns 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 returns. Risk-adjusted performance measures aim to standardise performance results by accounting for the risks taken when obtaining these returns. Even when using risk-adjusted performance measures to compare asset managers, the differences in their investment mandates should be kept in mind.

Monthly returns

The risk-adjusted performance measures are estimated using monthly returns and then annualised. The annualised mean returns reported here are therefore estimates of average returns as opposed to the time-weighted return figures reported in previous sections.

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

	Since 01.01.1998	Last 10 years	Last 5 years	Last 3 years
Sharpe ratio equity and fixed-income investments	0.52	0.54	1.37	0.85
Sharpe ratio equity and fixed-income benchmark index	0.51	0.56	1.37	0.88
Sharpe ratio difference equity and fixed-income investments versus benchmark index	0.01	-0.02	0.00	-0.02
Information ratio equity and fixed-income investments	0.39	0.12	0.52	-0.10
Jensen's alpha equity and fixed-income investments (percent)	0.08	-0.20	0.03	-0.13
Appraisal ratio equity and fixed-income investments	0.14	-0.28	0.10	-0.34

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

	1998–2002	2003–2007	2008–2012	2013–2016
Sharpe ratio equity and fixed-income investments	-0.12	1.51	0.30	1.22
Sharpe ratio equity and fixed-income benchmark index	-0.19	1.47	0.31	1.21
Sharpe ratio difference equity and fixed-income investments versus benchmark index	0.07	0.03	-0.01	0.00
Information ratio equity and fixed-income investments	0.96	0.91	0.09	0.48
Jensen's alpha equity and fixed-income investments (percent)	0.43	0.16	-0.15	0.04
Appraisal ratio equity and fixed-income investments	1.03	0.41	-0.17	0.11

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 returns. 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 has been 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 have had a higher volatility in returns than the benchmark, the average fund return has also tended to be higher, resulting in a similar reward-to-variability ratio.

Since periods that include the financial turmoil of 2008–2009 are characterised by both a lower average return and a higher volatility of returns, the Sharpe ratios for both the fund and the benchmark in these periods are 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 returns on the fund's investments and the benchmark index.

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

Table 42 Risk-adjusted measures for equity investments. Before management costs. Annualised

	Since 01.01.1999	Last 10 years	Last 5 years	Last 3 years
Sharpe ratio equity investments	0.32	0.34	1.20	0.67
Sharpe ratio equity benchmark index	0.29	0.33	1.19	0.68
Sharpe ratio difference equity investments versus benchmark index	0.03	0.01	0.01	-0.01
Information ratio equity investments	0.66	0.41	0.78	0.16
Jensen's alpha equity investments (percent)	0.43	0.17	0.12	-0.06
Appraisal ratio equity investments	0.59	0.28	0.29	-0.12

Table 43 Risk-adjusted measures for equity investments. Before management costs. Annualised

	1999–2002	2003–2007	2008–2012	2013–2016
Sharpe ratio equity investments	-0.44	1.38	0.05	1.10
Sharpe ratio equity benchmark index	-0.50	1.32	0.04	1.09
Sharpe ratio difference equity investments versus benchmark index	0.06	0.05	0.00	0.01
Information ratio equity investments	0.87	1.07	0.13	0.67
Jensen's alpha equity investments (percent)	1.03	0.53	0.09	0.08
Appraisal ratio equity investments	1.06	0.72	0.13	0.19

Although fixed-income investments have often had lower average returns than equity investments, the returns have also been less volatile resulting in higher Sharpe ratios in periods such as 2008–2012, which includes the financial crisis. Comparing fixed-income investments with the benchmark, the relative performance again depends on the evaluation period, although the Sharpe ratios tend to move closely together.

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 by using deviations from the benchmark.

The information ratio for fixed-income investments is lower than the information ratio for equity and total investments in almost all periods. This is both due to a lower mean of relative returns and to a greater volatility of relative returns. For the last five years and last three years, the information ratio for fixed-income investments is negative and quite large in absolute magnitude due to a combination of negative relative returns and the low volatility of the relative returns. Note that fixed-income investments have 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.

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

	Since 01.01.1998	Last 10 years	Last 5 years	Last 3 years
Sharpe ratio fixed-income investments	0.84	1.02	1.28	1.30
Sharpe ratio fixed-income benchmark index	0.84	1.09	1.24	1.28
Sharpe ratio difference fixed-income investments versus benchmark index	0.01	-0.07	0.05	0.02
Information ratio fixed-income investments	0.13	0.03	-0.34	-0.54
Jensen's alpha fixed-income investments (percent)	0.15	0.05	0.17	0.10
Appraisal ratio fixed-income investments	0.14	0.03	0.43	0.26

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

	1998–2002	2003–2007	2008–2012	2013–2016
Sharpe ratio fixed-income investments	0.67	0.36	1.27	0.98
Sharpe ratio fixed-income benchmark index	0.62	0.34	1.38	0.93
Sharpe ratio difference fixed-income investments versus benchmark index	0.05	0.02	-0.11	0.04
Information ratio fixed-income investments	0.52	0.08	0.22	-0.26
Jensen's alpha fixed-income investments (percent)	0.16	0.05	0.15	0.15
Appraisal ratio fixed-income investments	0.52	0.13	0.08	0.36

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 returns in excess of the risk-free rate on the benchmark excess returns. 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 is positive for almost all periods shown in the table. For equity and fixed-income investments combined, the sign of Jensen's alpha depends more on the evaluation period. The periods containing the financial crisis in 2008–2009 stand out in particular. The differences between total investments and equity and fixed-income investments viewed alone suggest a change in the degree of co-movement between the two markets in these periods.

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 removing 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.

The sign of the appraisal ratio is naturally the same as the sign of Jensen's alpha. In the earliest periods, the appraisal ratio is higher for equity investments than for fixed-income investments while the reverse is true for the most recent periods. However, as indicated above, care should be taken when evaluating risk using the CAPM for fixed-income investments.

FACTOR-ADJUSTED RETURN

The analyses introduced here involve multivariate regressions of relative returns against sets of historical factor return series. Estimated regression coefficients are interpreted as active exposures to systematic factors over the historical period. Regression intercepts can be 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 returns before management costs and factor returns in dollars. Additional regressions can be found in the appendix.

For equity investments, the factor set used is the five-factor model of Fama and French (2015)[1] and the factor-return data are global research factors downloaded from Kenneth French's website. In these regressions, factors explain between 33 and 45 percent of the variability in the relative returns of equity investments for the three periods, since inception, last ten years and last five years. The relative returns of equity investments are estimated to have had positive active exposures to the market factor (MKT) and the small firm factor (SMB), and a negative active exposure to the investment factor (CMA) both for the full sample period and for the last ten-year period. In the last five-year period, only the market factor is significant at conventional statistical confidence levels.

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 Bloomberg Barclays Indices 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 28 and 38 percent of the variability in the relative returns. The relative returns of fixed-income investments are estimated to have had exposure to the default premium factor over the full sample period and the last ten-year period. Over the last five-year period, only the regression coefficient for the negative term premium is significant at conventional statistical confidence levels.

For equity and fixed-income investments combined, the factor set is the combination of the factors used for each asset class. In these regressions, factors explain 54 to 66 percent of the variability in relative returns and the signs of the estimated exposures are qualitatively in line with the results for the asset classes. However, the profitability (RMW) coefficient is positive for the last five and ten years, and the value (HML) coefficient is positive since inception.

[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 before management costs

Sample period	Intercept, bps annualised	Regression coefficients: Market (MKT)	Small vs large (SMB)	Cheap vs expensive (HML)	Profitable vs unprofitable (RMW)	Conservative vs aggressive investment (CMA)	Variance explained in percent (R squared)
Since 01.01.1999	38	**0.02**	**0.05**	-0.01	0.01	**-0.02**	45
Last 10 years	32	**0.02**	**0.03**	0.00	-0.01	**-0.04**	45
Last 5 years	27	**0.01**	0.02	0.01	-0.02	-0.02	33

Source: Norges Bank Investment Management, Kenneth French. Bold indicates significant at 5 percent confidence level.
Note: After management cost regressions are available in the appendix.

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

Sample period	Intercept, bps annualised	Regression coefficients: Default (duration adjusted)	Term	Variance explained in percent (R squared)
Since 01.01.1998	11	**0.08**	-0.01	28
Last 10 years	-4	**0.09**	-0.02	36
Last 5 years	5	0.00	**-0.04**	38

Source: Norges Bank Investment Management, Bloomberg Barclays Indices. Bold indicates significant at 5 percent confidence level.
Note: After management cost regressions are available in the appendix.

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

Sample period	Intercept, bps annualised	Regression coefficients: Market (MKT)	Small vs large (SMB)	Cheap vs expensive (HML)	Profitable vs unprofitable (RMW)	Conservative vs aggressive investment (CMA)	Default (duration adjusted)	Term	Variance explained in percent (R squared)
Since 01.01.1998	7	**0.02**	**0.03**	0.01	0.02	**-0.02**	**0.03**	**-0.01**	55
Last 10 years	0	**0.02**	**0.04**	**0.02**	0.02	**-0.04**	**0.03**	-0.01	66
Last 5 years	14	**0.01**	**0.03**	0.00	0.01	0.01	0.01	**-0.03**	54

Source: Norges Bank Investment Management, Kenneth French, Bloomberg Barclays Indices. Bold indicates significant at 5 percent confidence level.
Note: After management cost regressions are available in the appendix.

Appendix

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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 "Return and risk" section.

We present results from several factor regressions using alternative model specifications and 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 affects the results. For fixed income, we show how adjusting for duration differences in one of the fixed-income factors impacts 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 equity and fixed-income investments combined. 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 our website: 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

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 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 equity and fixed-income investments combined, the specification used is the global Fama and French (2015) five-factor model augmented with the two fixed income factors (Equation 1.1c).

Below is a list of the model specifications that are considered in this appendix. 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. The description of the factor abbreviations used in the right-hand side of the equations can be found in table 3.

Main model specifications:

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

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

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

Additional specifications used to assess robustness of results:

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

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

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

Regressions are estimated using Newey and West (1987) adjusted standard errors (using 3-month lag). For the equity return factors, two sources are used: Fama and French (F-F) and AQR Capital Management (AQR). For our base-line specification, factor data from Kenneth French's web site have been used, while the AQR data is included to provide further sensitivity and robustness

analysis of the results. For the fixed income factors, relevant data is sourced from Barclays in order to construct the factor returns. Table 3 provides a summary of all the factor abbreviations and data sources used.

The data sourced from Fama and French, AQR and Barclays were downloaded on 2.February 2017[1]. Monthly US dollar 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 US dollars.

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.

Table 1
Time period for regressions

			Average %-USD relative returns		
	Start	End	Since inception	Last 10 years	Last 5 years
Equity investments	Jan 1999	Dec 2016	0.40	0.20	0.28
Fixed-income investments	Jan 1998	Dec 2016	0.10	0.02	-0.19
Equity and fixed-income investments	Jan 1998	Dec 2016	0.20	0.05	0.14

Note: Average relative returns are based on the annualised arithmetic average of monthly US dollar 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.[2] 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 have 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 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 have been downloaded from AQR's 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 at 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), BAB in Frazzini and Pedersen (2010) and HML in Asness and Frazzini (2011). The factor returns for

[1] Since Norges Bank last reported on the fund's factor-adjusted performance, some factor return series published by Kenneth French have been restated. The change mainly influences the SMB factor positively.
[2] 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.
[3] The data is available from https://www.aqr.com/library/data-sets

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

In order to interpret an alpha estimate as a performance measure, it is necessary that the factors used in the regressions are investable for the portfolio manager. As a robustness check, the factor regressions are adjusted for investability 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. [4] The small portfolios as defined by Fama and French (2015) represent only the bottom 10 percent of market capitalisation, 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 result 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. 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-cap companies in the upper 30th and the lower 30th percentile for the respective characteristic has been calculated.

Fixed income data

For the fixed income factors, we use a default factor 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 Barclays Point (Point being used to complement historical data), and are US dollar 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 Bloomberg Barclays Global Aggregate Treasury 10+Y index (more than 10 years to maturity) and the returns from the Bloomberg 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 are applied in this analysis due to data availability (a similar approach is taken by Ilmanen (1996) and Ilmanen et al. (2004)), as historically consistent global returns for bonds with 1-3M to maturity were 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 US dollar treasury bonds are included in Section 1.3.

[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.

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

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 2 summarises the sources that have been used to create the default premium factor return. Since 1999, data from the Bloomberg Barclays Global Aggregate have been used, where the return is calculated as the return from bonds in the Bloomberg Barclays Global Aggregate Corporate 10+Y index less Bloomberg Barclays Global Aggregate Treasury 10+Y index. For the period before 1999 Bloomberg Barclays Global Aggregate data is not available, and we have used equivalent data for the Bloomberg 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 bond returns for the period from January 1999 to December 2000 have been sourced from Barclays Point using the Bloomberg Barclays Global Aggregate Corporate 10+Y return universe.

Table 2
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 2016	Global Aggregate Corporate 10+Y (Barclays Live)	Global Aggregate Treasury 10+Y (Barclays Live)

Note: Source of data in parentheses

The issue of 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 US dollar-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 a lower duration than government bonds. This mismatch in duration should be corrected for in order to better isolate the default premium, allowing more reliable estimates of sensitivity to the default factor. The duration of the corporate bond series is matched to that of the government bond series using 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 Bloomberg 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.

[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 3
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 2016
		AQR	Jan 1998 to Dec 2016
SMB	Small Minus Big, return spread between small cap and large cap stocks	F-F	Jan 1998 to Dec 2016
		AQR	Jan 1998 to Dec 2016
HML	High Minus Low, return spread between high book-to-market and low book-to-market stocks[a]	F-F	Jan 1998 to Nov 2016
		AQR	Jan 1998 to Dec 2016
WML	Winners Minus Losers, return spread between past winners and losers (labelled UMD by AQR)	F-F	Jan 1998 to Dec 2016
		AQR	Jan 1998 to Dec 2016
RMW	Robust Minus Weak, return spread between high and low profitability stocks	F-F	Jan 1998 to Dec 2016
CMA	Conservative Minus Aggressive, return spread between stocks with low and high investment ratios	F-F	Jan 1998 to Dec 2016
HML-big	Same as HML, constrained to only large cap stocks	F-F	Jan 1998 to Dec 2016
WML-big	Same as RMW, constrained to only large cap stocks	F-F	Jan 1998 to Dec 2016
RMW-big	Same as RMW, constrained to only large cap stocks	F-F	Jan 1998 to Dec 2016
CMA-big	Same as CMA, constrained to only large cap stocks	F-F	Jan 1998 to Dec 2016
QMJ	Quality Minus Junk, return spread between quality and junk stocks as defined in Asness et al. (2014)	AQR	Jan 1998 to Dec 2016
BAB	Betting Against Beta, return spread between low and high beta stocks as defined in Frazzini and Pedersen (2010)	AQR	Jan 1998 to Dec 2016
DEF	Default premium, excess returns from long term corporate bonds to long-term government bonds (10Y+)	Barclays	Jan 1998 to Dec 2016
DEF Adj	Adjusted default premium, default premium adjusted for differences in duration between corporates and treasuries	Barclays	Jan 1998 to Dec 2016
TERM	Term premium, return spread between long term government bonds (10Y+) and short term bonds (1-3 years)	Barclays	Jan 1998 to Dec 2016

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

1.3 Results

In the next sections, separate regression results for the fund's equity and fixed-income investments are presented, followed by regression results for the equity and fixed-income investments combined. Regression results are shown using relative returns after management costs, comparing the results from different model specifications and sample periods.

Equity investments

Table 4 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, but none of the alpha estimates are significantly different from zero at conventional significance levels[8].

Table 4
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	0.25	0.21	0.20
	(1.34)	(1.05)	(0.71)
F-F MKT	0.02	0.02	0.01
	(4.48)	(4.14)	(2.08)
F-F SMB	0.05	0.03	0.02
	(6.77)	(3.36)	(1.31)
F-F HML	−0.02	−0.00	0.01
	(−1.66)	(−0.32)	(1.30)
F-F RMW	0.01	−0.01	−0.02
	(1.16)	(−0.54)	(−1.62)
F-F CMA	−0.02	−0.04	−0.02
	(−1.98)	(−2.67)	(−1.01)
Observations	216	120	60
Adjusted R^2	0.44	0.43	0.27

Table 5 summarises 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.

[8] In the Performance and Risk Report for 2015, the alpha estimate for the 10-year period was 0.03. The increase in alpha estimate to 0.21 is mainly due to a change in the time window, and partially a consequence of the restatement of Fama-French factor returns since the publication of last year's report.

Table 5
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 large-cap companies only, model (3) using a profitability factor constrained to large-cap companies only, model (4) using an investment factor constrained to large-cap companies only, and model (5) using value, profitability and investment factors constrained to large-cap companies only. 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	0.25	0.23	0.25	0.21	0.18
	(1.34)	(1.19)	(1.41)	(1.14)	(1.07)
F-F MKT	0.02	0.02	0.02	0.02	0.02
	(4.48)	(4.06)	(4.44)	(4.37)	(4.13)
F-F SMB	0.05	0.05	0.05	0.05	0.05
	(6.77)	(6.43)	(6.96)	(6.89)	(6.56)
F-F HML	−0.02		−0.01	−0.01	
	(−1.66)		(−1.34)	(−1.77)	
F-F RMW	0.01	0.01		0.01	
	(1.16)	(0.83)		(1.19)	
F-F CMA	−0.02	−0.03	−0.02		
	(−1.98)	(−2.62)	(−2.07)		
F-F HML Big		−0.01			−0.01
		(−1.73)			(−1.17)
F-F RMW Big			0.01		0.01
			(1.47)		(1.28)
F-F CMA Big				−0.02	−0.02
				(−2.50)	(−2.85)
Observations	216	216	216	216	216
Adjusted R^2	0.44	0.44	0.44	0.45	0.44

Table 6 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, through 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 6
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	0.40	0.29	0.26	0.18	0.25
	(1.79)	(1.52)	(1.50)	(1.10)	(1.34)
F-F MKT		0.02	0.02	0.02	0.02
		(4.89)	(5.20)	(5.45)	(4.48)
F-F SMB			0.05	0.04	0.05
			(7.40)	(7.22)	(6.77)
F-F HML			−0.03	−0.02	−0.02
			(−3.22)	(−3.48)	(−1.66)
F-F WML				0.01	
				(2.53)	
F-F RMW					0.01
					(1.16)
F-F CMA					−0.02
					(−1.98)
Observations	216	216	216	216	216
Adjusted R^2	0.00	0.19	0.42	0.45	0.44

Table 7 presents 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 there is a fall in estimated alpha when using size-constrained factor returns, for both the three- and four-factor models.

Table 7
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 large-cap companies, model (5) is the Fama-French 4-factor model using a momentum factor constrained to only large-cap companies, and model (6) uses both value and momentum factors constrained to only large-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	0.26	0.16	0.18	0.10	0.21	0.13
	(1.50)	(0.99)	(1.10)	(0.64)	(1.32)	(0.86)
F-F MKT	0.02	0.02	0.02	0.03	0.02	0.03
	(5.20)	(5.56)	(5.45)	(5.74)	(5.43)	(5.76)
F-F SMB	0.05	0.05	0.04	0.04	0.04	0.04
	(7.40)	(6.71)	(7.22)	(6.79)	(6.82)	(6.50)
F-F HML	−0.03		−0.02		−0.02	
	(−3.22)		(−3.48)		(−3.58)	
F-F WML			0.01	0.01		
			(2.53)	(2.32)		
F-F HML Big		−0.02		−0.02		−0.02
		(−3.04)		(−3.05)		(−3.17)
F-F WML Big					0.01	0.01
					(2.55)	(2.37)
Observations	216	216	216	216	216	216
Adjusted R^2	0.42	0.42	0.45	0.44	0.45	0.44

Tables 8 to 10 present regression results for the three-, four- and five-factor models for selected time periods, using the original factor returns and size-constrained factor returns. These tables give some indication of the sensitivity of the estimated parameters to varying time periods and model specifications.

Table 8
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 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	0.26	0.16	0.05	−0.02	0.07	0.10
	(1.50)	(0.99)	(0.27)	(−0.08)	(0.31)	(0.44)
F-F MKT	0.02	0.02	0.02	0.03	0.02	0.02
	(5.20)	(5.56)	(4.46)	(3.61)	(4.40)	(4.16)
F-F SMB	0.05	0.05	0.04	0.04	0.03	0.02
	(7.40)	(6.71)	(4.67)	(4.38)	(3.27)	(2.74)
F-F HML	−0.03		−0.02		0.01	
	(−3.22)		(−1.51)		(1.65)	
F-F HML Big		−0.02		−0.02		0.01
		(−3.04)		(−1.35)		(1.92)
Observations	216	216	120	120	60	60
Adjusted R^2	0.42	0.42	0.38	0.39	0.25	0.27

Table 9
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 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	0.18	0.13	0.05	−0.02	0.10	0.12
	(1.10)	(0.86)	(0.24)	(−0.08)	(0.42)	(0.50)
F-F MKT	0.02	0.03	0.02	0.03	0.02	0.01
	(5.45)	(5.76)	(4.15)	(3.60)	(3.70)	(3.51)
F-F SMB	0.04	0.04	0.04	0.04	0.03	0.02
	(7.22)	(6.50)	(4.58)	(4.43)	(3.12)	(2.77)
F-F HML	−0.02		−0.02		0.01	
	(−3.48)		(−1.54)		(1.14)	
F-F WML	0.01		0.00		−0.00	
	(2.53)		(0.27)		(−0.55)	
F-F HML Big		−0.02		−0.02		0.01
		(−3.17)		(−1.41)		(1.39)
F-F WML Big		0.01		−0.00		−0.00
		(2.37)		(−0.69)		(−0.62)
Observations	216	216	120	120	60	60
Adjusted R^2	0.45	0.44	0.37	0.38	0.24	0.26

Table 10
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 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	0.25	0.18	0.21	0.07	0.20	0.11
	(1.34)	(1.07)	(1.05)	(0.34)	(0.71)	(0.44)
F-F MKT	0.02	0.02	0.02	0.02	0.01	0.01
	(4.48)	(4.13)	(4.14)	(3.78)	(2.08)	(2.09)
F-F SMB	0.05	0.05	0.03	0.03	0.02	0.02
	(6.77)	(6.56)	(3.36)	(3.80)	(1.31)	(1.70)
F-F HML	−0.02		−0.00		0.01	
	(−1.66)		(−0.32)		(1.30)	
F-F RMW	0.01		−0.01		−0.02	
	(1.16)		(−0.54)		(−1.62)	
F-F CMA	−0.02		−0.04		−0.02	
	(−1.98)		(−2.67)		(−1.01)	
F-F HML Big		−0.01		−0.02		0.00
		(−1.17)		(−1.34)		(0.07)
F-F RMW Big		0.01		−0.01		−0.02
		(1.28)		(−0.94)		(−2.28)
F-F CMA Big		−0.02		−0.03		−0.01
		(−2.85)		(−2.24)		(−0.30)
Observations	216	216	120	120	60	60
Adjusted R^2	0.44	0.44	0.43	0.42	0.27	0.28

Table 11 compares regression results for the five-factor model using equity relative returns since inception before and after management costs.

Table 11
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	0.38	0.25	0.32	0.18
	(2.04)	(1.34)	(1.83)	(1.07)
F-F MKT	0.02	0.02	0.02	0.02
	(4.49)	(4.48)	(4.14)	(4.13)
F-F SMB	0.05	0.05	0.05	0.05
	(6.80)	(6.77)	(6.58)	(6.56)
F-F HML	−0.01	−0.02		
	(−1.63)	(−1.66)		
F-F RMW	0.01	0.01		
	(1.17)	(1.16)		
F-F CMA	−0.02	−0.02		
	(−2.00)	(−1.98)		
F-F HML Big			−0.01	−0.01
			(−1.13)	(−1.17)
F-F RMW Big			0.01	0.01
			(1.30)	(1.28)
F-F CMA Big			−0.02	−0.02
			(−2.86)	(−2.85)
Observations	216	216	216	216
Adjusted R^2	0.44	0.44	0.44	0.44

Finally, we present in Tables 12 and 13 the regression results for 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 returns to the value premium. Table 12 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 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.

Table 12
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, and 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	0.30	0.29	0.13	0.23	0.20	0.29
	(1.70)	(1.90)	(0.81)	(1.40)	(0.98)	(1.48)
AQR MKT	0.02	0.02	0.02	0.02	0.02	0.02
	(4.24)	(4.89)	(5.17)	(5.06)	(3.17)	(3.14)
AQR SMB	0.04	0.04	0.04	0.04	0.04	0.04
	(4.30)	(6.42)	(6.20)	(6.82)	(4.73)	(4.92)
AQR HML lag	−0.02		−0.01		−0.02	
	(−2.12)		(−2.23)		(−2.45)	
AQR HML cur		−0.02		−0.02		−0.02
		(−4.08)		(−3.10)		(−3.43)
AQR UMD			0.01	0.00	0.01	0.00
			(3.81)	(1.12)	(3.05)	(0.51)
AQR QMJ					−0.01	−0.01
					(−1.14)	(−1.12)
AQR BAB					0.00	0.01
					(0.56)	(0.74)
Observations	216	216	216	216	216	216
Adjusted R^2	0.35	0.44	0.42	0.44	0.42	0.43

Table 13 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 over the last 10 years, but has a limited impact on the momentum factor estimated using the last 5 years of data[9].

Table 13
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	0.20	0.29	0.24	0.38	0.49	0.51
	(0.98)	(1.48)	(1.09)	(1.66)	(1.43)	(1.46)
AQR MKT	0.02	0.02	0.02	0.02	0.01	0.01
	(3.17)	(3.14)	(2.84)	(2.79)	(2.40)	(2.35)
AQR SMB	0.04	0.04	0.02	0.02	0.03	0.03
	(4.73)	(4.92)	(1.75)	(2.43)	(2.35)	(2.28)
AQR HML lag	−0.02		−0.03		0.00	
	(−2.45)		(−1.70)		(0.35)	
AQR HML cur		−0.02		−0.03		−0.00
		(−3.43)		(−2.12)		(−0.00)
AQR UMD	0.01	0.00	0.00	−0.01	0.01	0.00
	(3.05)	(0.51)	(0.74)	(−1.57)	(0.86)	(0.48)
AQR QMJ	−0.01	−0.01	−0.03	−0.03	−0.01	−0.01
	(−1.14)	(−1.12)	(−2.24)	(−2.23)	(−0.88)	(−0.99)
AQR BAB	0.00	0.01	0.01	0.00	−0.03	−0.03
	(0.56)	(0.74)	(1.06)	(0.57)	(−1.67)	(−1.62)
Observations	216	216	120	120	60	60
Adjusted R^2	0.42	0.43	0.38	0.40	0.26	0.26

Fixed-income investments

Table 14 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 statistically significant 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 statistically significant negative exposure to the term premium.

[9] When comparing the AQR factor loadings for the last 10 years and 5 years, we notice that BAB factor loadings change from weakly positive to negative. This larger negative loading contributes to the increase in the alpha estimate, since the BAB factor has had positive returns over the last five years.

Table 14
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	0.06	−0.09	0.02
	(0.22)	(−0.17)	(0.15)
DEF Adj	0.08	0.09	−0.00
	(3.10)	(3.66)	(−0.71)
TERM	−0.01	−0.02	−0.04
	(−1.17)	(−1.30)	(−5.33)
Observations	228	120	60
Adjusted R^2	0.27	0.35	0.36

Table 15 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, using both the unadjusted version and the duration adjusted one (for the duration adjusted version t-statistics increase).

Table 15
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	0.08	0.02	0.16	0.08	0.06
	(0.26)	(0.07)	(0.41)	(0.24)	(0.22)
DEF	0.08			0.08	
	(2.86)			(2.75)	
DEF Adj		0.08			0.08
		(3.19)			(3.10)
TERM			−0.02	0.00	−0.01
			(−1.48)	(0.18)	(−1.17)
Observations	228	228	228	228	228
Adjusted R^2	0.23	0.27	0.00	0.23	0.27

The global fixed-income factors have different currency compositions between long term treasuries and short term treasuries. Table 16 reports regression results for the same specifications as in Table 15, but with the factors consisting only of US dollar denominated bonds. Changes are minor for most of the specifications with increased estimates of alpha for the one-factor models, and lower estimates for the two-factor models. None of the alpha estimates are significantly different from zero at conventional significance levels.

Table 16
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	0.11	0.06	0.18	0.05	0.04
	(0.35)	(0.19)	(0.46)	(0.19)	(0.13)
DEF	0.07			0.08	
	(3.08)			(3.12)	
DEF adj		0.06			0.07
		(2.97)			(2.87)
TERM			−0.02	0.01	0.00
			(−2.72)	(1.27)	(0.47)
Observations	228	228	228	228	228
Adjusted R^2	0.29	0.27	0.02	0.30	0.27

Finally Table 17 shows the regression results for fixed-income relative returns before and after management costs since inception using default- and term premium factors.

Table 17
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	0.11	0.06
	(0.38)	(0.22)
DEF Adj	0.08	0.08
	(3.10)	(3.10)
TERM	−0.01	−0.01
	(−1.17)	(−1.17)
Observations	228	228
Adjusted R^2	0.27	0.27

Equity and fixed-income investments

Table 18 presents the regression results for the relative return on equity and fixed-income investments combined 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. 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 equity investments and fixed-income investments. The relative returns are estimated to have a statistically significant positive loading to the market, size, profitability and default premia since inception, while the investment factor (CMA) exhibits a statistically significant negative loading.

Table 18
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 (−0.10)	−0.08 (−0.46)	0.08 (0.54)
F-F MKT	0.02 (5.57)	0.02 (5.02)	0.01 (2.41)
F-F SMB	0.03 (7.12)	0.04 (5.15)	0.03 (3.14)
F-F HML	0.01 (1.27)	0.02 (2.02)	−0.00 (−0.09)
F-F RMW	0.02 (2.81)	0.02 (1.17)	0.01 (0.99)
F-F CMA	−0.02 (−2.54)	−0.04 (−2.48)	0.01 (0.95)
DEF Adj	0.03 (2.87)	0.03 (2.91)	0.01 (1.33)
TERM	−0.01 (−1.99)	−0.01 (−1.72)	−0.03 (−4.63)
Observations	228	120	60
Adjusted R^2	0.54	0.64	0.47

Table 19 presents regression results using original and size-constrained factor returns. The alpha estimates are close to zero for both the model incorporating only original factors and the model incorporating all of the size-constrained factors. The fund's equity and fixed-income investments combined have positive loadings to the market, small-cap, profitability and default premia, but a negative loading to the investment factor. The introduction of size-constrained factor returns has little impact on the estimated factor exposures for the relative returns.

Table 19
Fund (ex-real estate) size-constrained factor regressions

Full period regression results with a 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) adjusts the value factor to only include large-cap companies, model (3) adjust the profitability factor to only include large-cap companies, model (4) adjust the investment factor to only include large-cap companies, and model (5) adjust the value, investment and profitability factor to only include large-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	−0.00	0.03	−0.07	0.00
	(−0.10)	(−0.03)	(0.17)	(−0.39)	(0.00)
F-F MKT	0.02	0.02	0.02	0.02	0.02
	(5.57)	(5.30)	(5.28)	(5.55)	(5.34)
F-F SMB	0.03	0.03	0.03	0.03	0.03
	(7.12)	(7.11)	(7.25)	(7.32)	(7.40)
F-F HML	0.01		0.01	0.01	
	(1.27)		(1.81)	(0.95)	
F-F RMW	0.02	0.02		0.02	
	(2.81)	(2.90)		(2.91)	
F-F CMA	−0.02	−0.02	−0.02		
	(−2.54)	(−2.81)	(−2.58)		
DEF Adj	0.03	0.03	0.03	0.03	0.03
	(2.87)	(2.79)	(2.90)	(2.90)	(2.83)
TERM	−0.01	−0.01	−0.01	−0.01	−0.01
	(−1.99)	(−2.08)	(−1.67)	(−1.90)	(−1.65)
F-F HML Big		0.01			0.01
		(1.33)			(1.85)
F-F RMW Big			0.01		0.02
			(2.09)		(2.48)
F-F CMA Big				−0.02	−0.02
				(−2.26)	(−2.53)
Observations	228	228	228	228	228
Adjusted R^2	0.54	0.54	0.53	0.54	0.53

Table 20 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 Fama-French factor returns.

Table 20
Fund (ex-real estate) size-constrained factor regressions for selected time periods

Regression results with a global 7-factor model for selected time periods. Factor return series are based on Fama-French and Barclays data, with equity factors constrained to large-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	0.00 (0.00)	−0.10 (−0.51)	0.12 (0.85)
F-F MKT	0.02 (5.34)	0.02 (5.16)	0.01 (2.46)
F-F SMB	0.03 (7.40)	0.04 (5.38)	0.02 (3.18)
F-F HML Big	0.01 (1.85)	0.01 (0.64)	−0.00 (−0.60)
F-F RMW Big	0.02 (2.48)	0.01 (0.75)	0.01 (0.46)
F-F CMA Big	−0.02 (−2.53)	−0.02 (−1.46)	0.01 (1.15)
DEF Adj	0.03 (2.83)	0.03 (3.40)	0.01 (1.43)
TERM	−0.01 (−1.65)	−0.01 (−1.65)	−0.03 (−4.79)
Observations	228	120	60
Adjusted R^2	0.53	0.62	0.48

Table 21 presents the regression results since inception before and after costs using original and adjusted factors.

Table 21
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 large-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	0.09	0.00
	(0.44)	(−0.10)	(0.55)	(0.00)
F-F MKT	0.02	0.02	0.02	0.02
	(5.59)	(5.57)	(5.35)	(5.34)
F-F SMB	0.03	0.03	0.03	0.03
	(7.15)	(7.12)	(7.43)	(7.40)
F-F HML	0.01	0.01		
	(1.29)	(1.27)		
F-F RMW	0.02	0.02		
	(2.82)	(2.81)		
F-F CMA	−0.02	−0.02		
	(−2.56)	(−2.54)		
DEF Adj	0.03	0.03	0.03	0.03
	(2.87)	(2.87)	(2.83)	(2.83)
TERM	−0.01	−0.01	−0.01	−0.01
	(−2.01)	(−1.99)	(−1.66)	(−1.65)
F-F HML Big			0.01	0.01
			(1.87)	(1.85)
F-F RMW Big			0.02	0.02
			(2.49)	(2.48)
F-F CMA Big			−0.02	−0.02
			(−2.54)	(−2.53)
Observations	228	228	228	228
Adjusted R^2	0.54	0.54	0.52	0.53

1.4 Factor return statistics

To inform the interpretation of the previous results, we now 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 material. All the following figures use cumulative compounded monthly returns.

Figure 1
Cumulative returns, global Fama-French factors, 1998-2016

The global Fama-French factors are a simple average of the factors constructed in small cap stocks and large-cap stocks. As seen in Figures 2 through 5 the cumulative return is different for small-cap and large-cap stocks for the value, momentum, profitability and investment factors.

Figure 2
Cumulative returns, global HML factor along with Big and Small versions, 1998-2016

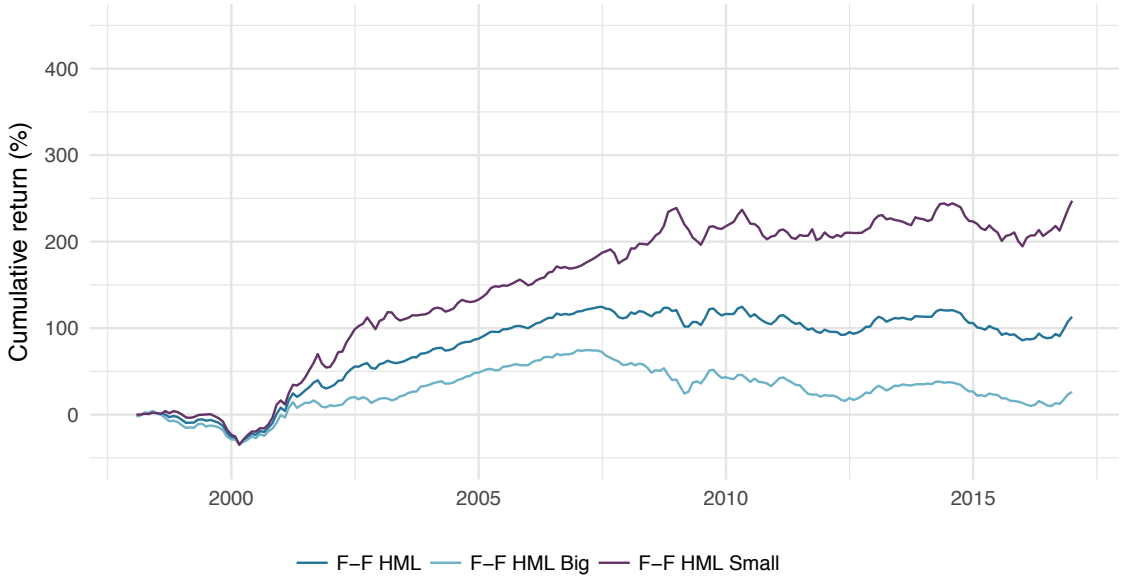

Figure 3
Cumulative returns, global WML factor along with Big and Small versions, 1998-2016

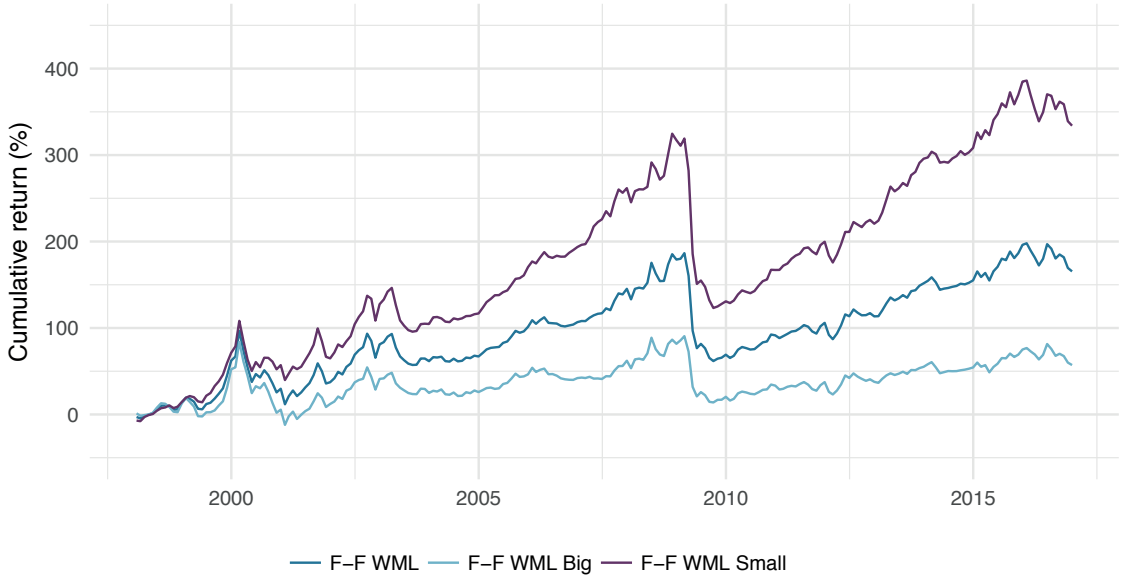

Figure 4
Cumulative returns, global RMW factor along with Big and Small versions, 1998-2016

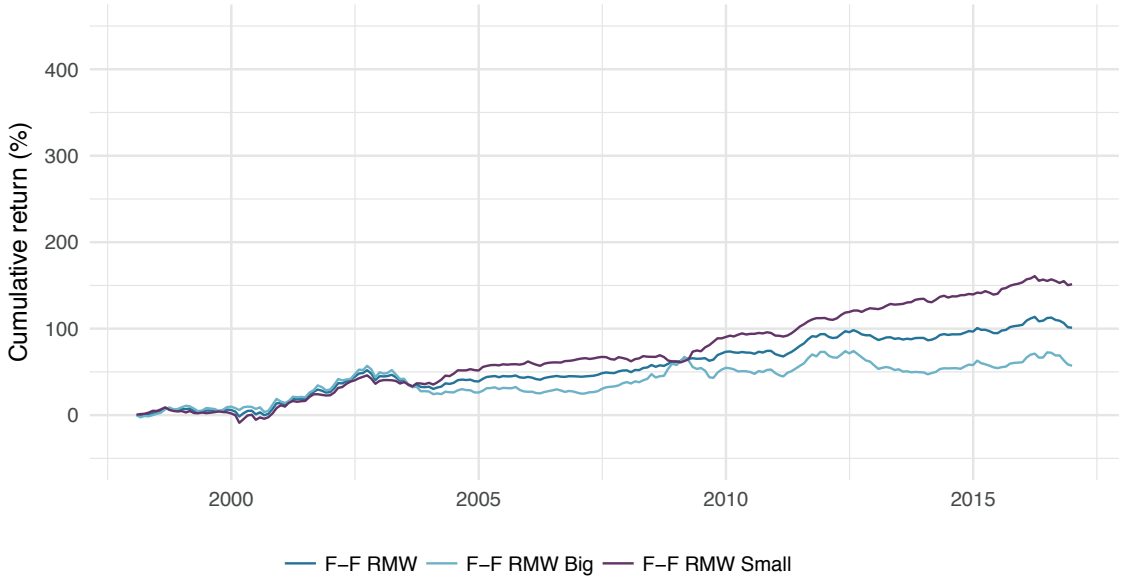

Figure 5
Cumulative returns, global CMA factor along with Big and Small versions, 1998-2016

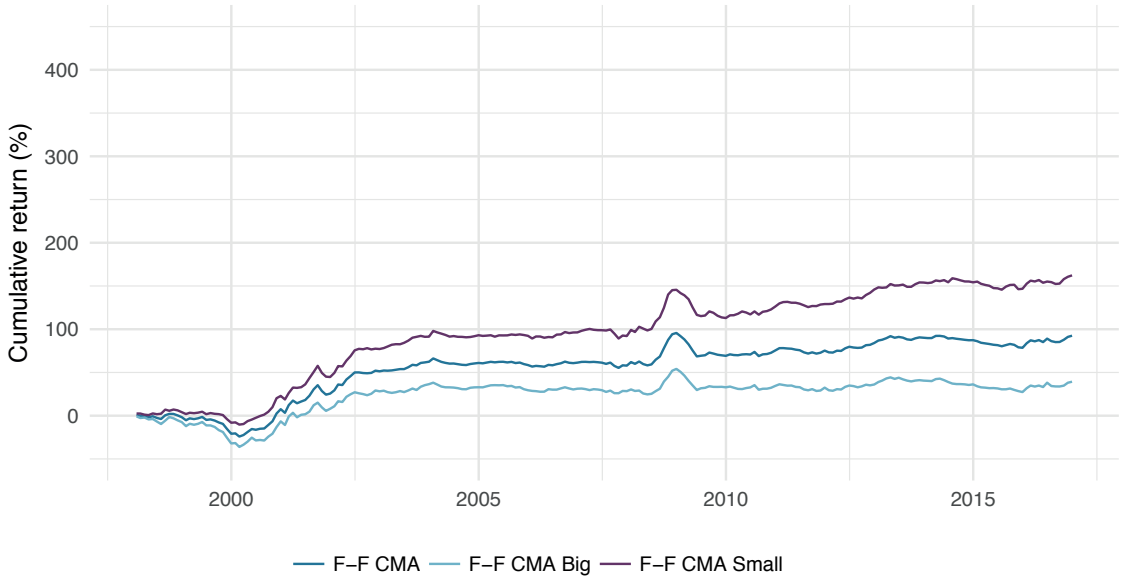

Figure 6 shows the cumulative returns of the factors from AQR Capital Management.

Figure 6
Cumulative returns, global AQR factors, 1998-2016

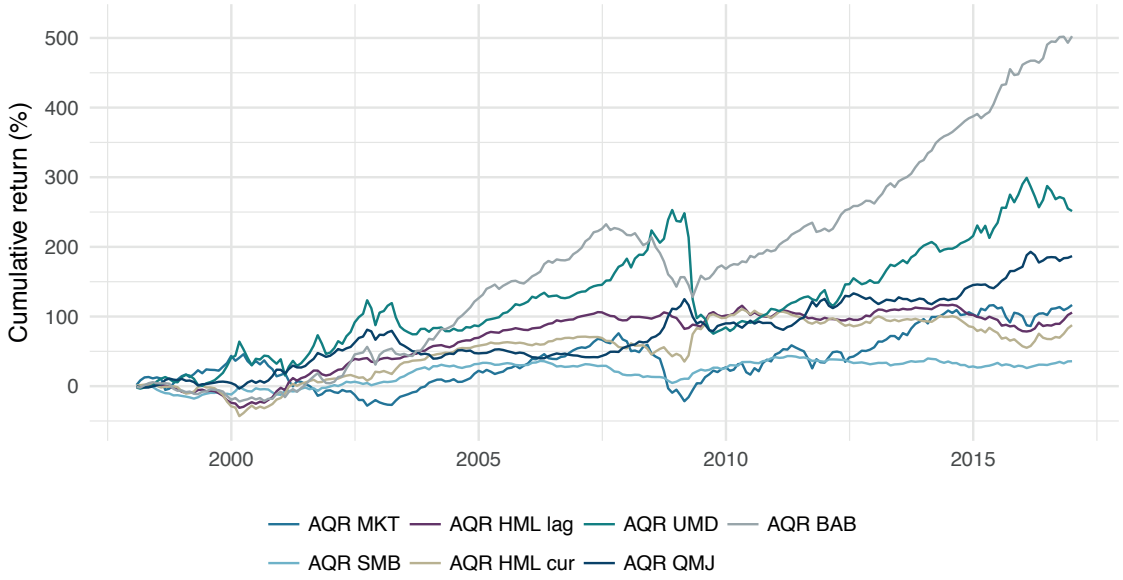

Figure 7 shows the cumulative return of the fixed-income factors of Fama and French (1993) replicated with global and US Barclays indices, including versions of the Default factor adjusted for term effects.

Figure 7
Cumulative returns, global fixed income factors, 1998-2016

Tables 22 to 24 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 at the small and micro cap end of the universe.

Table 22
Factor return statistics since 1998

Arithmetic average return and volatility of monthly returns (annualised) over the period 1998-2016 for all factors. Figures are annualised with simple distributional assumptions of independence and stationarity.

Factor	Average return	Volatility	Return-to-volatility
AQR BAB	10.06	10.72	0.94
AQR HML lag	4.12	8.10	0.51
AQR HML cur	4.02	11.91	0.34
AQR MKT	5.40	16.10	0.34
AQR QMJ	5.94	8.74	0.68
AQR SMB	1.83	6.69	0.27
AQR UMD	7.92	15.67	0.51
F-F CMA	3.71	7.19	0.52
F-F CMA Big	2.12	8.74	0.24
F-F CMA Small	5.30	6.56	0.81
F-F HML	4.38	8.87	0.49
F-F HML Big	1.68	9.65	0.17
F-F HML Small	7.08	10.16	0.70
F-F MKT	5.40	15.76	0.34
F-F RMW	3.83	5.42	0.71
F-F RMW Big	2.64	7.26	0.36
F-F RMW Small	5.02	5.55	0.90
F-F SMB	2.52	6.81	0.37
F-F WML	6.37	15.44	0.41
F-F WML Big	3.88	17.19	0.23
F-F WML Small	8.86	14.65	0.60
DEF	0.26	6.46	0.04
DEF Adj	1.10	7.30	0.15
TERM	3.55	5.93	0.60
DEF US	-0.05	8.22	-0.01
DEF Adj US	0.72	8.50	0.08
TERM US	3.90	9.71	0.40

Table 23
Factor return statistics for the last 10 years

Arithmetic average return and volatility of monthly returns (annualised) over the period 2006-2016 for all factors. Figures are annualised with simple distributional assumptions of independence and stationarity.

Factor	Average return	Volatility	Return-to-volatility
AQR BAB	7.50	7.52	1.00
AQR HML lag	0.50	5.84	0.09
AQR HML cur	1.47	10.59	0.14
AQR MKT	4.88	17.09	0.29
AQR QMJ	7.25	8.27	0.88
AQR SMB	0.73	5.60	0.13
AQR UMD	5.24	14.62	0.36
F-F CMA	1.90	5.07	0.37
F-F CMA Big	0.76	5.81	0.13
F-F CMA Small	3.03	5.14	0.59
F-F HML	-0.10	6.09	-0.02
F-F HML Big	-2.89	8.35	-0.35
F-F HML Small	2.69	6.21	0.43
F-F MKT	5.05	16.80	0.30
F-F RMW	3.37	3.87	0.87
F-F RMW Big	2.43	6.58	0.37
F-F RMW Small	4.31	3.63	1.19
F-F SMB	0.69	5.05	0.14
F-F WML	3.42	13.17	0.26
F-F WML Big	2.03	13.98	0.15
F-F WML Small	4.82	13.01	0.37
DEF	1.05	7.85	0.13
DEF Adj	1.94	9.08	0.21
TERM	3.57	6.37	0.56
DEF US	0.08	10.42	0.01
DEF Adj US	1.09	10.77	0.10
TERM US	5.07	11.44	0.44

Table 24
Factor return statistics for the last 5 years

Arithmetic average return and volatility of monthly returns (annualised) over the period 2011-2016 for all factors. Figures are annualised with simple distributional assumptions of independence and stationarity.

Factor	Average return	Volatility	Return-to-volatility
AQR BAB	12.42	4.26	2.91
AQR HML lag	0.88	5.39	0.16
AQR HML cur	-0.13	7.60	-0.02
AQR MKT	10.31	11.40	0.90
AQR QMJ	5.03	6.45	0.78
AQR SMB	0.22	4.64	0.05
AQR UMD	8.34	10.33	0.81
F-F CMA	1.94	3.40	0.57
F-F CMA Big	1.11	4.59	0.24
F-F CMA Small	2.76	3.11	0.89
F-F HML	1.62	5.76	0.28
F-F HML Big	0.83	7.16	0.12
F-F HML Small	2.40	5.79	0.41
F-F MKT	10.92	11.31	0.97
F-F RMW	0.82	3.80	0.22
F-F RMW Big	-1.78	5.66	-0.31
F-F RMW Small	3.42	2.94	1.16
F-F SMB	0.48	4.65	0.10
F-F WML	5.52	9.45	0.58
F-F WML Big	3.25	10.72	0.30
F-F WML Small	7.79	8.69	0.90
DEF	3.66	5.93	0.62
DEF Adj	4.55	6.35	0.72
TERM	4.43	6.54	0.68
DEF US	2.50	6.81	0.37
DEF Adj US	3.83	7.01	0.55
TERM US	2.51	10.56	0.24

Tables 25 to 28 show the linear correlation between monthly factor returns.

Table 25
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							
F-F SMB	-0.01	1.00						
F-F HML	-0.15	0.03	1.00					
F-F WML	-0.27	0.20	-0.27	1.00				
F-F RMW	-0.47	-0.22	0.25	0.16	1.00			
F-F CMA	-0.46	-0.04	0.73	-0.03	0.31	1.00		
DEF Adj	0.47	0.09	-0.07	-0.21	-0.16	-0.34	1.00	
TERM	-0.13	0.00	-0.04	0.09	0.25	0.06	-0.04	1.00

Table 26
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						
AQR SMB	0.23	1.00					
AQR HML lag	-0.14	-0.10	1.00				
AQR HML cur	0.14	0.07	0.70	1.00			
AQR UMD	-0.36	-0.19	-0.13	-0.74	1.00		
AQR QMJ	-0.80	-0.53	0.12	-0.20	0.44	1.00	
AQR BAB	-0.30	-0.03	0.46	0.04	0.36	0.40	1.00

Table 27
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	0.21	-0.12	0.16	-0.37
F-F SMB	0.01	0.83	0.11	-0.04	0.12
F-F HML	-0.17	-0.16	0.95	0.68	-0.14
F-F WML	-0.25	-0.08	-0.23	-0.78	0.97

Table 28
Correlations between global and USD fixed-income factors

	US DEF	US DEF Adj	US TERM
DEF	0.74	0.76	-0.21
DEF Adj	0.75	0.79	-0.07
TERM	-0.32	-0.21	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 "Return and risk" 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 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 website 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.

2.1 Methodology

In the following section, the methods used for calculating risk-adjusted measures and confidence intervals are described. r_t, rb_t and rf_t are defined as 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

rx_t denotes the portfolio excess return $r_t - rf_t$ in month t. The formula for the monthly Sharpe ratio is[10]

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

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 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[11]

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

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

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

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

[10] See Sharpe (1966, 1994).
[11] See Lo (2002).

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.[12] That is,

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

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 as R^2_{rrel}.

Appraisal ratio

The monthly appraisal ratio is computed as[13]

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

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.

[12] See Jensen (1968).
[13] See Treynor and Black (1973).

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 29 to 32 report Sharpe ratios along with confidence intervals before and after management costs.

Table 29
Sharpe ratio before management costs for various sample sizes

Annualised Sharpe ratio estimates before cost 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	0.32 (-0.15, 0.78)	0.34 (-0.28, 0.96)	1.20 (0.30, 2.11)
	Fixed income	0.84 (0.39, 1.30)	1.02 (0.39, 1.65)	1.28 (0.38, 2.19)
	Equity and fixed income	0.52 (0.07, 0.97)	0.54 (-0.09, 1.16)	1.37 (0.46, 2.28)
Benchmark	Equity	0.29 (-0.18, 0.75)	0.33 (-0.29, 0.95)	1.19 (0.29, 2.09)
	Fixed income	0.84 (0.38, 1.29)	1.09 (0.45, 1.72)	1.24 (0.33, 2.14)
	Equity and fixed income	0.51 (0.06, 0.96)	0.56 (-0.06, 1.18)	1.37 (0.46, 2.28)

Table 30
Sharpe ratio before management costs for moving sample periods

Annualised Sharpe ratio estimates before costs 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	2013-2016
Portfolio	Equity	-0.44 (-1.43, 0.54)	1.38 (0.46, 2.29)	0.05 (-0.83, 0.92)	1.10 (0.10, 2.11)
	Fixed income	0.67 (-0.22, 1.55)	0.36 (-0.52, 1.24)	1.27 (0.37, 2.18)	0.98 (-0.02, 1.98)
	Equity and fixed income	-0.12 (-1.00, 0.75)	1.51 (0.59, 2.43)	0.30 (-0.58, 1.18)	1.22 (0.21, 2.23)
Benchmark	Equity	-0.50 (-1.49, 0.48)	1.32 (0.41, 2.23)	0.04 (-0.84, 0.92)	1.09 (0.09, 2.10)
	Fixed income	0.62 (-0.27, 1.50)	0.34 (-0.54, 1.22)	1.38 (0.47, 2.29)	0.93 (-0.06, 1.93)
	Equity and fixed income	-0.19 (-1.07, 0.68)	1.47 (0.56, 2.39)	0.31 (-0.57, 1.19)	1.21 (0.20, 2.22)

Table 31
Sharpe ratio after management costs for various sample sizes

Annualised Sharpe ratio estimates after costs 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	0.31 (-0.16, 0.77)	0.33 (-0.29, 0.95)	1.20 (0.29, 2.10)
	Fixed income	0.83 (0.37, 1.28)	1.01 (0.38, 1.64)	1.27 (0.37, 2.18)
	Equity and fixed income	0.51 (0.06, 0.96)	0.53 (-0.10, 1.15)	1.37 (0.46, 2.28)
Benchmark	Equity	0.29 (-0.18, 0.75)	0.33 (-0.29, 0.95)	1.19 (0.29, 2.09)
	Fixed income	0.84 (0.38, 1.29)	1.09 (0.45, 1.72)	1.24 (0.33, 2.14)
	Equity and fixed income	0.51 (0.06, 0.96)	0.56 (-0.06, 1.18)	1.37 (0.46, 2.28)

Table 32
Sharpe ratio after management costs for moving sample periods

Annualised Sharpe ratio estimates after costs 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	2013-2016
Portfolio	Equity	-0.45 (-1.44, 0.53)	1.36 (0.45, 2.27)	0.04 (-0.84, 0.92)	1.10 (0.09, 2.10)
	Fixed income	0.65 (-0.23, 1.54)	0.34 (-0.54, 1.22)	1.26 (0.36, 2.17)	0.97 (-0.03, 1.97)
	Equity and fixed income	-0.14 (-1.02, 0.74)	1.48 (0.57, 2.40)	0.29 (-0.59, 1.17)	1.21 (0.20, 2.22)
Benchmark	Equity	-0.50 (-1.49, 0.48)	1.32 (0.41, 2.23)	0.04 (-0.84, 0.92)	1.09 (0.09, 2.10)
	Fixed income	0.62 (-0.27, 1.50)	0.34 (-0.54, 1.22)	1.38 (0.47, 2.29)	0.93 (-0.06, 1.93)
	Equity and fixed income	-0.19 (-1.07, 0.68)	1.47 (0.56, 2.39)	0.31 (-0.57, 1.19)	1.21 (0.20, 2.22)

Information ratio

Tables 33 through 36 report information ratios along with confidence intervals before and after management costs.

Table 33
Information ratio before management costs for various sample sizes

Annualised information ratio estimates before costs 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	0.66 (0.19, 1.12)	0.41 (-0.21, 1.03)	0.78 (-0.11, 1.66)
Fixed income	0.13 (-0.32, 0.58)	0.03 (-0.59, 0.65)	-0.34 (-1.22, 0.53)
Equity and fixed income	0.39 (-0.06, 0.84)	0.12 (-0.50, 0.74)	0.52 (-0.36, 1.40)

Table 34
Information ratio before management costs for moving sample periods

Annualised information ratio estimates before costs 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	2013-2016
Equity	0.87 (-0.12, 1.87)	1.07 (0.17, 1.97)	0.13 (-0.75, 1.00)	0.67 (-0.32, 1.66)
Fixed income	0.52 (-0.36, 1.41)	0.08 (-0.80, 0.96)	0.22 (-0.65, 1.10)	-0.26 (-1.24, 0.72)
Equity and fixed income	0.96 (0.06, 1.85)	0.91 (0.02, 1.80)	0.09 (-0.79, 0.97)	0.48 (-0.51, 1.46)

Table 35
Information ratio after management costs for various sample sizes

Annualised information ratio estimates after costs 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	0.49 (0.02, 0.95)	0.26 (-0.36, 0.88)	0.62 (-0.26, 1.50)
Fixed income	0.09 (-0.36, 0.54)	0.00 (-0.62, 0.62)	-0.41 (-1.29, 0.47)
Equity and fixed income	0.27 (-0.18, 0.72)	0.03 (-0.59, 0.65)	0.37 (-0.51, 1.25)

Table 36
Information ratio after management costs for moving sample periods

Annualised information ratio estimates after costs 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	2013-2016
Equity	0.72 (-0.27, 1.71)	0.85 (-0.04, 1.74)	-0.03 (-0.90, 0.85)	0.52 (-0.46, 1.51)
Fixed income	0.38 (-0.50, 1.26)	-0.06 (-0.94, 0.81)	0.20 (-0.68, 1.07)	-0.32 (-1.30, 0.66)
Equity and fixed income	0.76 (-0.12, 1.65)	0.67 (-0.21, 1.56)	0.01 (-0.87, 0.88)	0.34 (-0.64, 1.32)

Jensen's alpha

Tables 37 through 40 report Jensen's alpha along with confidence intervals and relative return R-squared before and after management costs.

Table 37
Jensen's alpha before management costs for various sample sizes

Annualised Jensen's alpha estimates before costs (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	0.43 (0.09, 0.77) $R^2_{rrel} = 0.17$	0.17 (-0.21, 0.55) $R^2_{rrel} = 0.29$	0.12 (-0.26, 0.50) $R^2_{rrel} = 0.19$
Fixed income	0.15 (-0.34, 0.63) $R^2_{rrel} = 0.00$	0.05 (-0.89, 0.99) $R^2_{rrel} = 0.00$	0.17 (-0.19, 0.52) $R^2_{rrel} = 0.32$
Equity and fixed income	0.08 (-0.19, 0.35) $R^2_{rrel} = 0.29$	-0.20 (-0.65, 0.25) $R^2_{rrel} = 0.38$	0.03 (-0.30, 0.37) $R^2_{rrel} = 0.10$

Table 38
Jensen's alpha before management costs for moving sample periods

Annualised Jensen's alpha estimates before costs (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	2013-2016
Equity	1.03	0.53	0.09	0.08
	(0.07, 1.99)	(-0.16, 1.22)	(-0.51, 0.68)	(-0.37, 0.54)
	$R^2_{rrel} = 0.09$	$R^2_{rrel} = 0.08$	$R^2_{rrel} = 0.35$	$R^2_{rrel} = 0.20$
Fixed income	0.16	0.05	0.15	0.15
	(-0.11, 0.44)	(-0.28, 0.38)	(-1.70, 2.01)	(-0.27, 0.57)
	$R^2_{rrel} = 0.00$	$R^2_{rrel} = 0.03$	$R^2_{rrel} = 0.01$	$R^2_{rrel} = 0.35$
Equity and fixed income	0.43	0.16	-0.15	0.04
	(0.06, 0.79)	(-0.21, 0.53)	(-0.92, 0.62)	(-0.36, 0.44)
	$R^2_{rrel} = 0.06$	$R^2_{rrel} = 0.13$	$R^2_{rrel} = 0.48$	$R^2_{rrel} = 0.09$

Table 39
Jensen's alpha after management costs for various sample sizes

Annualised Jensen's alpha estimates after costs (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	0.30	0.06	0.05
	(-0.04, 0.63)	(-0.32, 0.44)	(-0.33, 0.43)
	$R^2_{rrel} = 0.17$	$R^2_{rrel} = 0.29$	$R^2_{rrel} = 0.19$
Fixed income	0.10	0.01	0.13
	(-0.39, 0.59)	(-0.93, 0.94)	(-0.23, 0.49)
	$R^2_{rrel} = 0.00$	$R^2_{rrel} = 0.00$	$R^2_{rrel} = 0.32$
Equity and fixed income	0.00	-0.28	-0.02
	(-0.27, 0.27)	(-0.73, 0.16)	(-0.36, 0.31)
	$R^2_{rrel} = 0.29$	$R^2_{rrel} = 0.38$	$R^2_{rrel} = 0.10$

Table 40
Jensen's alpha after management costs for moving sample periods

Annualised Jensen's alpha estimates after costs (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	2013-2016
Equity	0.87 (-0.08, 1.83) $R^2_{rrel} = 0.09$	0.36 (-0.33, 1.05) $R^2_{rrel} = 0.08$	-0.04 (-0.64, 0.55) $R^2_{rrel} = 0.35$	0.01 (-0.44, 0.47) $R^2_{rrel} = 0.20$
Fixed income	0.12 (-0.16, 0.39) $R^2_{rrel} = 0.00$	0.00 (-0.33, 0.32) $R^2_{rrel} = 0.03$	0.10 (-1.75, 1.95) $R^2_{rrel} = 0.01$	0.12 (-0.30, 0.54) $R^2_{rrel} = 0.35$
Equity and fixed income	0.34 (-0.02, 0.71) $R^2_{rrel} = 0.06$	0.06 (-0.31, 0.43) $R^2_{rrel} = 0.13$	-0.25 (-1.01, 0.52) $R^2_{rrel} = 0.48$	-0.01 (-0.41, 0.39) $R^2_{rrel} = 0.09$

Appraisal ratio

Tables 41 to 44 report appraisal ratios along with confidence intervals before and after management costs.

Table 41
Appraisal ratio before management costs for various sample sizes

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

Asset class	Since inception	Last 10 years	Last 5 years
Equity	0.59 (0.12, 1.06)	0.28 (-0.35, 0.90)	0.29 (-0.64, 1.22)
Fixed income	0.14 (-0.32, 0.60)	0.03 (-0.61, 0.68)	0.43 (-0.50, 1.37)
Equity and fixed income	0.14 (-0.32, 0.59)	-0.28 (-0.91, 0.34)	0.10 (-0.85, 1.04)

Table 42
Appraisal ratio before management costs for moving sample periods

Annualised appraisal ratio estimates before costs for moving sample periods, along with 95 percent confidence intervals (parentheses). The estimates are based on monthly returns on the 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	2013-2016
Equity	1.06 (0.05, 2.08)	0.72 (-0.23, 1.67)	0.13 (-0.75, 1.00)	0.19 (-0.84, 1.22)
Fixed income	0.52 (-0.37, 1.42)	0.13 (-0.75, 1.01)	0.08 (-0.86, 1.02)	0.36 (-0.66, 1.38)
Equity and fixed income	1.03 (0.13, 1.92)	0.41 (-0.54, 1.37)	-0.17 (-1.05, 0.71)	0.11 (-0.93, 1.15)

Table 43
Appraisal ratio after management costs for various sample sizes

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

Asset class	Since inception	Last 10 years	Last 5 years
Equity	0.41 (-0.06, 0.87)	0.10 (-0.52, 0.72)	0.12 (-0.81, 1.05)
Fixed income	0.09 (-0.37, 0.56)	0.00 (-0.65, 0.65)	0.35 (-0.59, 1.28)
Equity and fixed income	-0.01 (-0.46, 0.45)	-0.40 (-1.03, 0.23)	-0.06 (-1.00, 0.88)

Table 44
Appraisal ratio after management costs for moving sample periods

Annualised appraisal ratio estimates after costs for moving sample periods, along with 95 percent confidence intervals (parentheses). The estimates are based on monthly returns on the 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	2013-2016
Equity	0.90 (-0.10, 1.91)	0.49 (-0.45, 1.43)	-0.07 (-0.94, 0.81)	0.03 (-1.00, 1.06)
Fixed income	0.38 (-0.51, 1.27)	-0.01 (-0.89, 0.87)	0.05 (-0.89, 0.99)	0.29 (-0.73, 1.31)
Equity and fixed income	0.83 (-0.06, 1.72)	0.15 (-0.80, 1.11)	-0.28 (-1.17, 0.60)	-0.03 (-1.07, 1.01)

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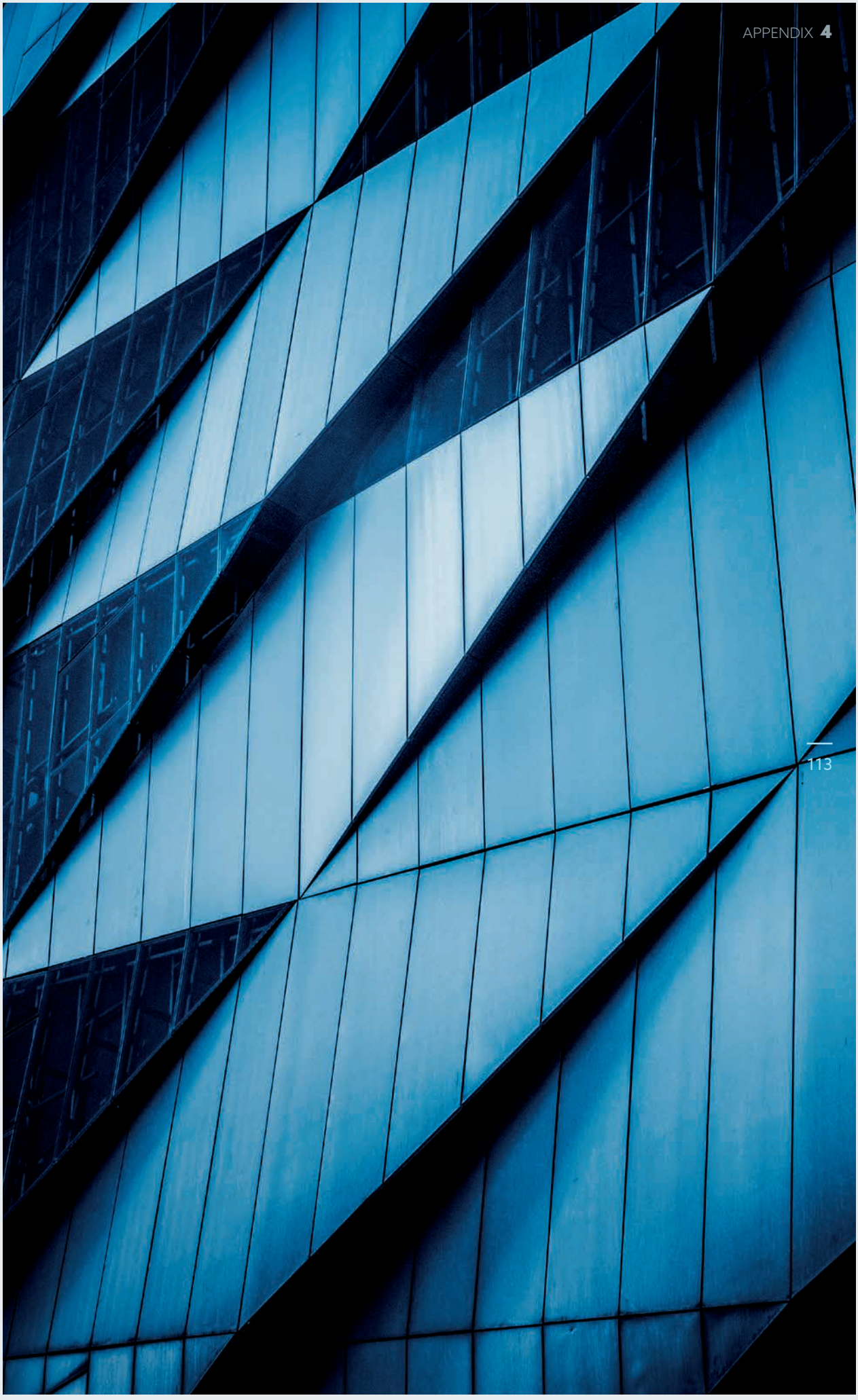

Table 49 Risk-adjusted measures for equity and fixed-income investments. Before and after management costs. Annualised

	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)	5.84	5.76	5.54	5.46	9.06	9.00	5.77	5.72
Mean return equity and fixed-income benchmark index (percent)	5.57	5.57	5.43	5.43	8.87	8.87	5.81	5.81
Mean relative return equity and fixed-income investments (percentage points)	0.28	0.19	0.11	0.03	0.19	0.14	-0.04	-0.09
Mean risk-free rate (percent)	1.95	1.95	0.67	0.67	0.06	0.06	0.07	0.07
Risk measures								
Standard deviation return of equity and fixed-income investments (percent)	7.51	7.51	9.08	9.08	6.55	6.55	6.67	6.67
Standard deviation return of equity and fixed-income benchmark index (percent)	7.11	7.11	8.49	8.49	6.43	6.43	6.55	6.55
Standard deviation relative return of equity and fixed-income investments (percent)	0.71	0.71	0.90	0.90	0.37	0.37	0.39	0.39
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	0.60	0.60	0.71	0.71	0.35	0.35	0.38	0.38
Risk-adjusted measures								
Sharpe ratio equity and fixed-income investments	0.52	0.51	0.54	0.53	1.37	1.37	0.85	0.85
Sharpe ratio equity and fixed-income benchmark index	0.51	0.51	0.56	0.56	1.37	1.37	0.88	0.88
Sharpe ratio difference equity and fixed-income investments versus benchmark index	0.01	0.00	-0.02	-0.03	0.00	-0.01	-0.02	-0.03
Information ratio equity and fixed-income investments	0.39	0.27	0.12	0.03	0.52	0.37	-0.10	-0.23
Jensen's alpha equity and fixed-income investments (percent)	0.08	0.00	-0.20	-0.28	0.03	-0.02	-0.13	-0.18
Appraisal ratio equity and fixed-income investments	0.14	-0.01	-0.28	-0.40	0.10	-0.06	-0.34	-0.48

Table 50 Risk-adjusted measures for equity and fixed-income investments. Before and after management costs. Annualised

	1998–2002		2003–2007		2008–2012		2013–2016	
	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	8.10	8.05
Mean return equity and fixed-income benchmark index (percent)	2.92	2.92	8.27	8.27	3.63	3.63	7.91	7.91
Mean relative return equity and fixed-income investments (percentage points)	0.41	0.32	0.38	0.28	0.11	0.01	0.19	0.14
Mean risk-free rate (percent)	4.09	4.09	2.88	2.88	0.37	0.37	0.06	0.06
Risk measures								
Standard deviation return of equity and fixed-income investments (percent)	6.13	6.13	3.82	3.82	11.31	11.31	6.62	6.62
Standard deviation return of equity and fixed-income benchmark index (percent)	6.02	6.02	3.66	3.66	10.46	10.46	6.48	6.48
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	0.38	0.38
Risk-adjusted measures								
Sharpe ratio equity and fixed-income investments	-0.12	-0.14	1.51	1.48	0.30	0.29	1.22	1.21
Sharpe ratio equity and fixed-income benchmark index	-0.19	-0.19	1.47	1.47	0.31	0.31	1.21	1.21
Sharpe ratio difference equity and fixed-income investments versus benchmark index	0.07	0.06	0.03	0.01	-0.01	-0.02	0.00	0.00
Information ratio equity and fixed-income investments	0.96	0.76	0.91	0.67	0.09	0.01	0.48	0.34
Jensen's alpha equity and fixed-income investments (percent)	0.43	0.34	0.16	0.06	-0.15	-0.25	0.04	-0.01
Appraisal ratio equity and fixed-income investments	1.03	0.83	0.41	0.15	-0.17	-0.28	0.11	-0.03

Table 51 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)	6.41	6.28	5.86	5.75	12.52	12.45	7.13	7.06
Mean return equity benchmark index (percent)	5.89	5.89	5.56	5.56	12.17	12.17	7.05	7.05
Mean relative return equity investments (percentage points)	0.52	0.39	0.30	0.19	0.35	0.28	0.08	0.02
Mean risk-free rate (percent)	1.79	1.79	0.67	0.67	0.06	0.06	0.07	0.07
Risk measures								
Standard deviation return of equity investments (percent)	14.62	14.62	15.25	15.25	10.36	10.36	10.50	10.50
Standard deviation return of equity benchmark index (percent)	14.27	14.27	14.85	14.85	10.16	10.16	10.29	10.29
Standard deviation relative return of equity investments (percent)	0.80	0.80	0.72	0.72	0.45	0.45	0.51	0.51
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)	0.73	0.73	0.61	0.61	0.41	0.41	0.48	0.48
Risk-adjusted measures								
Sharpe ratio equity investments	0.32	0.31	0.34	0.33	1.20	1.20	0.67	0.67
Sharpe ratio equity benchmark index	0.29	0.29	0.33	0.33	1.19	1.19	0.68	0.68
Sharpe ratio difference equity investments versus benchmark index	0.03	0.02	0.01	0.00	0.01	0.00	-0.01	-0.01
Information ratio equity investments	0.66	0.49	0.41	0.26	0.78	0.62	0.16	0.03
Jensen's alpha equity investments (percent)	0.43	0.30	0.17	0.06	0.12	0.05	-0.06	-0.12
Appraisal ratio equity investments	0.59	0.41	0.28	0.10	0.29	0.12	-0.12	-0.26

Table 52 Risk-adjusted measures for equity investments. Before and after management costs. Annualised

	1999–2002		2003–2007		2008–2012		2013–2016	
	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	11.33	11.26
Mean return equity benchmark index (percent)	-4.42	-4.42	14.78	14.78	1.15	1.15	11.00	11.00
Mean relative return equity investments (percentage points)	0.88	0.72	0.81	0.64	0.11	-0.02	0.33	0.26
Mean risk-free rate (percent)	3.93	3.93	2.88	2.88	0.37	0.37	0.06	0.06
Risk measures								
Standard deviation return of equity investments (percent)	16.88	16.88	9.24	9.24	19.11	19.11	10.23	10.23
Standard deviation return of equity benchmark index (percent)	16.55	16.55	9.00	9.00	18.60	18.60	10.00	10.00
Standard deviation relative return of equity investments (percent)	1.00	1.00	0.76	0.76	0.84	0.84	0.49	0.49
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	1.10	1.10
Sharpe ratio equity benchmark index	-0.50	-0.50	1.32	1.32	0.04	0.04	1.09	1.09
Sharpe ratio difference equity investments versus benchmark index	0.06	0.05	0.05	0.03	0.00	0.00	0.01	0.00
Information ratio equity investments	0.87	0.72	1.07	0.85	0.13	-0.03	0.67	0.52
Jensen's alpha equity investments (percent)	1.03	0.87	0.53	0.36	0.09	-0.04	0.08	0.01
Appraisal ratio equity investments	1.06	0.90	0.72	0.49	0.13	-0.07	0.19	0.03

Table 53 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)	4.79	4.74	4.35	4.30	3.60	3.57	3.78	3.75
Mean return fixed-income benchmark index (percent)	4.65	4.65	4.31	4.31	3.76	3.76	4.04	4.04
Mean relative return fixed-income investments (percentage points)	0.14	0.09	0.04	-0.01	-0.16	-0.19	-0.26	-0.29
Mean risk-free rate (percent)	1.95	1.95	0.67	0.67	0.06	0.06	0.07	0.07
Risk measures								
Standard deviation return of fixed-income investments (percent)	3.38	3.38	3.61	3.60	2.76	2.76	2.85	2.85
Standard deviation return of fixed-income benchmark index (percent)	3.24	3.24	3.35	3.35	2.99	2.99	3.10	3.10
Standard deviation relative return of fixed-income investments (percent)	1.06	1.05	1.44	1.44	0.46	0.46	0.47	0.47
CAPM beta fixed-income investments	1.00	1.00	1.00	1.00	0.91	0.91	0.91	0.91
Standard deviation residuals of CAPM regression for fixed-income investments (percent)	1.06	1.06	1.44	1.44	0.39	0.39	0.39	0.39
Risk-adjusted measures								
Sharpe ratio fixed-income investments	0.84	0.83	1.02	1.01	1.28	1.27	1.30	1.29
Sharpe ratio fixed-income benchmark index	0.84	0.84	1.09	1.09	1.24	1.24	1.28	1.28
Sharpe ratio difference fixed-income investments versus benchmark index	0.01	-0.01	-0.07	-0.08	0.05	0.04	0.02	0.01
Information ratio fixed-income investments	0.13	0.09	0.03	0.00	-0.34	-0.41	-0.54	-0.60
Jensen's alpha fixed-income investments (percent)	0.15	0.10	0.05	0.01	0.17	0.13	0.10	0.07
Appraisal ratio fixed-income investments	0.14	0.09	0.03	0.00	0.43	0.35	0.26	0.18

Table 54 Risk-adjusted measures for fixed-income investments. Before and after management costs. Annualised

	1998–2002		2003–2007		2008–2012		2013–2016	
	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	2.87	2.84
Mean return fixed-income benchmark index (percent)	5.97	5.97	3.95	3.95	5.37	5.37	3.00	3.00
Mean relative return fixed-income investments (percentage points)	0.16	0.12	0.03	-0.02	0.44	0.38	-0.13	-0.16
Mean risk-free rate (percent)	4.09	4.09	2.88	2.88	0.37	0.37	0.06	0.06
Risk measures								
Standard deviation return of fixed-income investments (percent)	3.06	3.06	3.04	3.04	4.27	4.27	2.88	2.88
Standard deviation return of fixed-income benchmark index (percent)	3.05	3.05	3.10	3.10	3.62	3.62	3.15	3.15
Standard deviation relative return of fixed-income investments (percent)	0.31	0.31	0.37	0.37	1.96	1.96	0.51	0.51
CAPM beta fixed-income investments	1.00	1.00	0.98	0.98	1.06	1.06	0.90	0.90
Standard deviation residuals of CAPM regression for fixed-income investments (percent)	0.31	0.31	0.37	0.37	1.96	1.96	0.41	0.41
Risk-adjusted measures								
Sharpe ratio fixed-income investments	0.67	0.65	0.36	0.34	1.27	1.26	0.98	0.97
Sharpe ratio fixed-income benchmark index	0.62	0.62	0.34	0.34	1.38	1.38	0.93	0.93
Sharpe ratio difference fixed-income investments versus benchmark index	0.05	0.04	0.02	0.00	-0.11	-0.12	0.04	0.03
Information ratio fixed-income investments	0.52	0.38	0.08	-0.06	0.22	0.20	-0.26	-0.32
Jensen's alpha fixed-income investments (percent)	0.16	0.12	0.05	0.00	0.15	0.10	0.15	0.12
Appraisal ratio fixed-income investments	0.52	0.38	0.13	-0.01	0.08	0.05	0.36	0.29

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