Ministry of Finance
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Please note that this is a translated version of the Norwegian letter. If there are any differences, the Norwegian letter applies.

The equity share in the benchmark index for the Government Pension Fund Global

The choice of equity share in the benchmark index for the Government Pension Fund Global is the single most important decision for the fund's overall return and risk. What the equity share in a fund such as the Government Pension Fund Global should be, depends on the owner's preferences. The choice of equity share will always represent a trade-off between expected return on the one hand and risk on the other.

In its letter of 12 February 2016, the Ministry asks Norges Bank to assess whether the relationship between expected return and risk for equities and bonds has changed since the equity share was last reviewed in 2006/07, and whether there is reason to adjust the equity share in the fund's benchmark index. In a separate letter of 20 June 2016, the Bank is asked to submit estimates of the fund's expected return over the next ten to 15 years given various assumptions for the equity share.

The fund's equity share has been assessed and revised several times before. It was decided in 1997 that 40 percent of the fund should be invested in equities.[1] The equity share was then reviewed but not altered in 2002 and 2004.[2] In 2006/07, the equity share was revisited, and it was decided to increase it to 60 percent.[3] The assessments in this letter are based on the analyses in four discussion notes published on the Bank's website. These publications will be sent to the Ministry separately.[4]

[1] Report to the Storting No. 1 (1997-1998).

[2] Report to the Storting No. 1 (2001-2002) and Report to the Storting No. 1 (2003-2004).

[3] Report to the Storting No. 24 (2006-2007).

[4] NBIM Discussion Note 1/2016: *The equity risk premium*, NBIM Discussion Note 2/2016: *Risk and return of different asset allocations*, NBIM Discussion Note 3/2016: *Global growth and equity returns*, and NBIM Discussion Note 4/2016: *Asset allocation with government revenues and spending commitments*.

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Developments since 2006 and key elements of the Bank's advice

The yield on inflation-linked bonds is a good indicator of the expected real return on virtually risk-free bonds. Since 2006, the yield on these bonds has fallen by almost 3 percentage points. The expected excess return of equities over bonds is slightly higher than in 2006, but the effect of this change is much smaller than the effect of lower real interest rates. The fund's expected real return is therefore much lower today than it was in 2006.

It was assumed in 2006, based on historical data, that the correlation between bond and equity returns would be positive. Since the turn of the millennium, however, the correlation has been negative. Bond investments have therefore reduced volatility in the fund's return to a greater extent than anticipated a decade ago. If this correlation remains low, which we do not consider an unreasonable assumption, a lower allocation to bonds than previously assumed will be needed to keep expected volatility in fund returns around the same level.

The fund is now much bigger than it was in 2006, both in absolute krone terms and relative to other economic yardsticks. In 2006, the value of the fund was approximately one-third of the state's total petroleum wealth. Today, it makes up two-thirds of this wealth.[5] Uncertain values on the Norwegian continental shelf therefore now constitute a much smaller share of the state's wealth. All else equal, this means that the owner can accept more risk in the fund than was the case in 2006 without this increasing the risk in the total petroleum wealth. The fiscal policy rule makes the fund an integral part of Norwegian fiscal policy. The share of the government budget that is financed through the fund is now around three times as high as it was a decade ago: around 20 percent in 2017 as opposed to 6 percent in 2006.[6]

Compared with 2006, the expected excess return of equities over bonds is slightly higher, bonds are reducing volatility in the value of the fund more effectively, and the risk in the state's overall petroleum wealth is much lower. All of these factors point towards a higher equity share and contribute to the Bank's conclusion in this letter that the equity share in the benchmark index should be increased to 75 percent. A higher equity share means that the expected return will increase. The realised return may, however, deviate considerably from expectations, and the owner's plans for the use of the fund must take this into account.[7]

A change in the equity share in line with the Bank's recommendation will not have any major operational consequences. The fund could largely be managed using existing systems and

[5] Estimates of remaining petroleum resources taken from Report to the Storting No. 1 (2006-2007) and Report to the Storting No. 1 (2015-2016). Based on the value of the fund on 1 January each year. Current prices.

[6] Report to the Storting No. 3 (2006-2007) and Report to the Storting No. 1 (2016-2017). Calculations based on the non-oil deficit, as this shows the amount actually transferred from the fund.

[7] The average realised geometric return will also be lower than the average realised arithmetic return for a portfolio of equities and bonds.

resources, and could still be managed within the current limit for management costs of 0.08 percent.[8]

The choice of equity share may have implications for other aspects of the investment strategy for the fund. The Ministry asks in its letter of 12 February many pertinent questions about the relationship between the equity share and other parts of the investment strategy. The answers to these questions will have little bearing on the Bank's advice concerning the equity share. The Bank intends to return to these questions once the decision about the equity share has been taken.

This letter first discusses the expected return on a portfolio of equities and bonds, and then considers the risk in this portfolio. After that, we look at the fund in the context of the state's other wealth and plans for the use of the fund. Finally, we sum up the Bank's advice on the equity share in the fund's benchmark index.

The expected real return

Expected real return based on analysis of historical data series

The most widely used data set for calculating historical real returns is that of Dimson, Marsh and Staunton,[9] which covers developments in equity and bond markets in 20 countries from 1900 to the present day. The average annual real return of a global portfolio of short-term government bills has been 1.0 percent during this period, while the corresponding real return of a global portfolio of government bonds has been 2.4 percent.[10] The difference in the returns on bills and bonds shows that investors have historically been compensated for making longer loans in the form of a so-called term premium.

The average annual real return of a global portfolio of equities since 1900 has been 5.7 percentage points higher than the corresponding return of a global portfolio of short-term government bills. Put another way, a krone invested in global equity markets at the start of this period would have produced a return more than 120 times higher than that of a krone invested in a portfolio of short-term government bills. This excess return has historically been higher in the US market than in the global market, but has generally been positive in all of the equity markets included in the data set from Dimson, Marsh and Staunton. The historical excess return is higher than can be explained by dividends and dividend growth over time. The market's valuation of corporate earnings thus appears to have changed during the period. If we allow for the effect of this repricing, the long-term average excess return of equities is just under 4 percent.[11]

[8] Equity management is generally slightly more expensive than bond management. Management costs may therefore increase somewhat if the Ministry decides to increase the equity share. See the report *Performance and Risk – Government Pension Fund Global*, NBIM Report 2015 for a more detailed presentation of management costs for different strategies.

[9] Dimson, E., Marsh, P. and Staunton, N. (2015): "Equity premia around the world", working paper, London Business School.

[10] The historical real return on bonds and excess return on equities are calculated in US dollars.

[11] Calculation based on data from MSCI for the period from 1970 to the present day as discussed in NBIM Discussion Note 1/2016.

The historical excess return of equities is one of several possible approaches to estimating the so-called equity risk premium – the compensation investors require for running the risk of investing in shares rather than risk-free fixed-income instruments. The equity premium is a key variable in the most widely used models for pricing financial instruments, such as the capital asset pricing model (CAPM) and various types of multifactor model (e.g. Fama-French).

Forward-looking estimates of expected real return

Historical returns say something about how things have been in the past, but there is no guarantee that history will repeat itself. The alternative to historical data is to employ various types of model that use market prices and assumptions about the relationship between current and future pricing to estimate expected returns.

The price of an investment can generally be formulated as the discounted value of expected future cash flows. For a bond investment with a fixed coupon, investors know the future cash flows, and the expected return can therefore be observed directly from the bond's effective yield.[12] For an investor concerned with the real return, it is the inflation-adjusted return that is relevant. The yield on inflation-linked bonds can therefore be a good starting point for estimating the expected real return on a bond portfolio. The yield on inflation-linked bonds with ten years to maturity in the main markets at the end of the third quarter of 2016 ranged from around -2 percent in the UK to around 0 percent in the US. For inflation-linked bonds with longer maturities than ten years, the yield at that time was slightly higher but still much lower than it has been historically.

Market expectations of persistently low interest rates are not solely a result of weak economic activity but can also be seen in the light of structural changes in the global economy. In a widely cited paper, the Bank of England estimates that almost 4 percentage points of the 4.5 percentage point decline in long-term real interest rates over the past 30 years can be explained by lower expected trend growth and shifts in saving and investment preferences.[13] The authors also expect only a small part of the decline in interest rates to reverse by 2030 and conclude that the new level of the global neutral rate will be 1 percent or slightly less in the medium to long run. This estimate fits well with market pricing of inflation-linked bonds with long maturities and is also in line with estimates from organisations such as the IMF and the OECD.[14]

While there is broad agreement that equity investors have historically been well-rewarded for bearing equity risk, there is less of a consensus on the factors that determine the magnitude and variability of the equity risk premium over time. The expected equity risk premium cannot be observed directly in financial markets. The most common approach to estimating the expected equity risk premium is based on expectations of future dividends. There are several

[12] We ignore here both bankruptcy risk and uncertainty about the rate at which coupons can be reinvested.

[13] Rachel and Smith, (2015): "Secular drivers of global interest rate", Bank of England Staff Working Paper No. 571.

[14] IMF (2016): *World Economic Outlook: Too slow for Too Long*; OECD (2014): *The long-term global outlook for interest rates* in Appendix 5 NOU 2015:9: *Fiscal policy in an oil economy*.

models for calculations of this type. We have assessed a number of different models and arrived at an expected equity risk premium today of just under 6 percent on average. In all of the models, the estimated equity risk premium is slightly higher now than it was a decade ago.

Such model-based estimates of the equity risk premium are uncertain and can change quickly. They are particularly sensitive to the assumptions made about dividend growth and the risk-free rate. Dividend growth has been high in the years since the financial crisis, and interest rates are record-low. Changes in interest rates and other factors may affect companies' ability to continue to pay high dividends. In the long run, growth in dividends and corporate cash flows is also affected by underlying economic growth. Global economic growth is expected to be lower in the coming years than it has been historically. Our analyses find a relatively clear relationship between global economic growth, global growth in corporate cash flows and global equity returns.[15] If we apply more cautious estimates of dividend growth, the estimate of the expected equity risk premium falls below 4 percent.

The Bank's assessments
Based on our analyses, we estimate an expected average annual real bond return of 0.25 percent on a ten-year horizon and 0.75 percent on a 30-year horizon. This estimate of the expected real return on bonds is based on market pricing for inflation-linked bonds in the main markets at the end of the third quarter of 2016, but is slightly higher than that because the fund is also invested in other markets. Our estimates assume that the expected term premium for bonds is virtually zero. Due to uncertainty about the estimate of the equity risk premium, we have chosen to assume an average annual equity risk premium of 3.0 percentage points over both the next ten years and the next 30 years. The expected excess return of equities over bonds is slightly higher now than a similar approach would have produced in 2006 because the expected term premium is now lower.

The expected average annual real return of a portfolio comprising 40 percent bonds and 60 percent equities is estimated at 2.1 percent on a ten-year horizon and 2.6 percent on a 30-year horizon. If the equity share is increased to 75 percent, the expected average annual real return rises to 2.5 percent on a ten-year horizon and 3.0 percent on *a 30-year horizon.*

The risk in a portfolio of equities and bonds

Volatility
Expected volatility, or standard deviation, is the most widely used measure of risk in financial markets. The standard deviation shows how much the return is expected to vary around the mean. Assuming that returns are normally distributed, a standard deviation of 10 percent signifies that the return can be expected to deviate from the mean by more than 10 percentage points in one out of three years, and by more than 20 percentage points in one out of 20 years. With the current size of the fund, one standard deviation corresponds to around 700 billion kroner, and two standard deviations to around 1,400 billion kroner.

[15] NBIM Discussion Note 3/2016.

Based on historical data from Dimson, Marsh and Staunton, the standard deviation of a portfolio of global bonds since 1900 is estimated at 9.7 percent. The corresponding figure for a global portfolio of equities is 17.1 percent. Over the past decade, the standard deviation of the fund's benchmark index for bonds has been 3.9 percent, measured in the fund's currency basket, whereas the standard deviation of the equity benchmark has been 14.6 percent. The standard deviation for bonds in the Dimson, Marsh and Staunton database is much higher than the estimated standard deviation for the fund's bond benchmark, whereas the difference for equities is smaller. This is because the bonds in the Dimson, Marsh and Staunton database have a longer maturity than those in the fund's bond benchmark, and because the standard deviation is calculated in US dollars rather than a basket of currencies. Currency fluctuations have less of an effect on the estimated historical standard deviation of equities.

The main objectives of the fund's bond investments are to reduce volatility in the fund's overall return, provide liquidity and reap any risk premiums in the bond market.[16] Bond investments help reduce return volatility if their return varies less or differently to the return on equities, especially in periods of falling share prices. Since 2006, volatility in the fund's benchmark index for bonds as measured by the standard deviation has been around one-third that of the equity benchmark. This relationship has been relatively stable over time and helps reduce volatility in the overall return on the fund whether returns on equities and bonds move together or not.

Expected volatility in a portfolio of equities and bonds is also affected by the degree to which the returns on equities and bonds move together.[17] In the period from the early 1960s to the late 1990s, this correlation was positive. Bond returns moved in the same direction as equity returns – bond prices fell when share prices fell.

Since the turn of the millennium, however, the relationship between returns on bonds and equities has changed – bond prices have risen when share prices have fallen. This shift in correlation is explained partly by changes in monetary policy regimes and by negative shocks in this period generally having been demand-driven. In periods of demand shocks, inflation will be procyclical. Inflation rises when economic growth is strong. When central banks pursue an inflation target, nominal interest rates will rise when inflation rises. When nominal interest rates rise, bond prices fall. Since equity prices normally rise in periods of strong economic growth, the correlation between equity and bond returns will be negative.[18]

The Bank's advice on the equity share in 2006 assumed that the correlation between equities and bonds would be around the same as during the three preceding decades. In practice, this meant that a positive correlation of around 0.4 was assumed. The return on a benchmark index comprising 60 percent equities and 40 percent bonds would then have an expected

[16] Report to the Storting No. 17 (2011-2012).

[17] NBIM Discussion Note 2/2016.

[18] Campbell, J.Y., Pflueger, C. and Viceira L. M. (2014): "Monetary policy drivers of bond and equity risks", NBER Working Paper No. 20070.

volatility of 10.8 percent, whereas the return on a benchmark index with 75 percent equities and 25 percent bonds would have an expected volatility of 12.7 percent. If we assume instead a correlation closer to the actual level over the past decade of -0.3, the expected volatility in this example falls to 9.2 percent for a 60 percent equity share and 11.6 percent for a 75 percent equity share.[19]

The example above illustrates how the sign of the correlation between returns on equities and bonds affects the expected volatility of the overall portfolio. All else equal, the change in correlation may mean that a lower allocation to bonds than assumed in 2006 is now needed to keep expected volatility in fund returns at a moderate level. We consider it not unreasonable to assume a negative correlation between returns on equities and bonds going forward. A more cautious assumption would be zero correlation. The argument that a lower allocation to bonds is needed than in 2006 still holds.

The return volatility of a portfolio of bonds depends on its sensitivity to interest rates, or duration. The duration of the government part of the fund's benchmark index for bonds has risen over the past decade from less than six years to more than eight years. In general, a lower duration will mean less variation in the bond benchmark. However, a higher duration can help reduce overall risk in the fund if the correlation with equities is strongly negative, and the reverse if the correlation is similarly strongly positive. As the correlation over the past decade has been negative, the longer duration of the benchmark index has helped further reduce volatility in the fund's overall return.

Other types of risk

Returns in financial markets are not normally distributed. Crises in financial markets are more frequent and more severe than a normal distribution would indicate. In the financial crisis year of 2008, equity markets fell by almost 40 percent. Based on the current size of the fund, this corresponds to a decrease in the value of equity investments of around 1,700 billion kroner for a 60 percent equity share and around 2,100 billion kroner for a 75 percent equity share.[20]

In the discussion of volatility, we looked at how the return can be expected to vary from one year to the next. The possibility of returns remaining low for long periods represents a different type of risk. Periods of higher-than-expected inflation have previously led to the real return on investments in nominal bonds being negative for several years in a row. For example, the real return on US treasuries was negative every year from 1977 to 1981. Since large parts of the fund's bond investments are in bonds issued with a nominal coupon, this is a risk to which the fund is exposed through its bond investments.

Our review of historical return data for US equities shows that the excess return over bonds

[19] The aim of this stylised example is to illustrate the effect of the shift in correlation on the overall volatility of a portfolio of equities and bonds. We have used US data, performed the calculations in US dollars and applied standard assumptions for volatility in US equity and bond markets of 16 and 6 percent respectively.

[20] The calculations do not take account of any effects of changes in the krone exchange rate.

has been negative for periods of up to ten years at a time. Measured as 20-year rolling averages, the annual excess return over bonds in the period from 1927 to 2015 varied between 2.5 percent and 15.9 percent. This excess return was particularly high in the 20-year windows following World War II, for large parts of the 1990s and in the years following the financial crisis. The excess return of equities over bonds was particularly low in the 20-year windows coinciding with the Great Depression in the US in the 1930s and in the years following the oil crisis in the early 1970s.[21] The considerable variation in the realised excess return of equities over bonds over ten- and 20-year periods goes to show that equity investments require a long investment horizon.

Global economic growth has been weak since the financial crisis and is expected to remain weak in the coming decade. Structural factors such as demographic changes, low productivity growth, high debt levels, increased inequality within countries and changes in trading patterns are often cited as explanations for these low growth expectations. Long-term investors may have grounds for concern if growth remains weak. It is one thing that interest rates can be expected to stay low. Persistently weak growth will also impact on long-term corporate earnings and hence possibly also returns on a global equity portfolio. At the same time, it is important to remember that it has proved difficult historically to produce good long-run forecasts of economic growth. There may also be reason to believe that expectations of lower growth are already discounted in market prices.[22]

The expected volatility of a portfolio comprising 75 percent equities and 25 percent bonds is currently lower than it was reasonable to assume in 2006, but slightly higher than would have been expected back then for a portfolio of 60 percent equities and 40 percent bonds ten years ago. A higher equity share will, however, also affect the fund's exposure to other types of risk. There will continue to be considerable fluctuations in the fund's value, and a high equity share will depend on it being possible to stick to the fund's investment strategy.

The fund's role

The fund accounts for a large part of the state's wealth and, through the fiscal rule, is an integral part of fiscal policy. The choice of equity share in the benchmark index for the fund should not therefore be made exclusively on the basis of an analysis of expected return and risk in financial markets.

In 2006, the value of the fund was approximately one-third of the state's total petroleum wealth. Today, it makes up two-thirds of this wealth.[23] Hence, a smaller share of total petroleum wealth is now directly exposed to movements in oil and gas prices and to specific risks relating to the production of oil and gas on the Norwegian continental shelf. The change

[21] See NBIM Discussion Note 1/2016.

[22] See NBIM Discussion Note 3/2016.

[23] Petroleum wealth is defined as the sum of the value of remaining petroleum resources and the Government Pension Fund Global. Estimates of remaining petroleum resources taken from Report to the Storting No. 1 (2006-2007) and Report to the Storting No. 1 (2015-2016). Based on the value of the fund on 1 January each year. Current prices.

in the composition of petroleum wealth has therefore helped reduce risk in the state's petroleum wealth as a whole. This implies that the owner can tolerate more risk in the fund than was the case in 2006, assuming that the state's tolerance for risk in its overall petroleum wealth is unchanged.

The fund is currently managed with a view to the best possible trade-off between return and risk in the fund in isolation. If the management of the fund instead is geared towards achieving the best possible trade-off between return and risk in the state's total petroleum wealth, it could in principle influence the composition of the equity and bond investments. A shift in investments away from securities where returns vary with changes in the value of remaining petroleum reserves could then help reduce the risk in overall petroleum wealth without influencing the fund's expected return. This is a matter that the Bank may return to.

The owner's plans for the use of the fund follows from the fiscal rule. Over time, spending of oil revenue will reflect the expected real return on the fund. This return will be affected by the choice of equity share. The choice of equity share also affects the fund's risk as expressed by fluctuations in its market value. These fluctuations present challenges for fiscal policy, because it is not desirable to have corresponding variations in other revenues and expenditures in the government budget. This problem is, however, first and foremost a consequence of the fund becoming so large. A change in the equity share will have only a limited impact on short-term fluctuations in government spending.[24]

The analysis of expected return and risk in financial markets supports an increased equity share in the fund. When the analysis is extended to include the relationship between return and risk in petroleum wealth as a whole, the conclusion is the same. Fluctuations in the fund's market value present challenges for fiscal policy, but this is first and foremost a consequence of the fund becoming so large.

The Bank's recommendation on the equity share in the benchmark index

In this letter, the Bank gives its advice on the equity share in a benchmark index consisting of equities and bonds. We assume that the issue of the equity share will be revisited in the event of significant changes in the premises for the decision on which the Bank is now being asked to advice.

The expected excess return of equities over bonds currently appears to be somewhat higher than in 2006. Changes in the correlation between bond and equity returns also support a slightly higher equity share, and the fund now accounts for a much larger proportion of total petroleum wealth. The Bank's recommendation is that the equity share in the benchmark index should be increased to 75 percent. Sound understanding and broad acceptance of the volatility and other types of risk associated with such a change is essential if it is to be possible to stick to the investment strategy for the fund. A higher allocation to equities means that the expected return on the fund will increase. The realised return may, however, deviate

[24] See NBIM Discussion Note 4/2016.

considerably from expectations, and the owner's plans for the use of the fund must take this into account.

The expected average annual real return on an index consisting of 75 percent equities and 25 percent bonds over the next ten years is estimated at 2.5 percent. In the longer term, it is reasonable to assume a slightly higher contribution from bond investments. The expected average annual real return rises to 3 percent when the horizon is extended to 30 years.

The equity share in the benchmark index consisting of only equities and bonds will serve as a limit for overall market risk in the fund. The equity share in such a benchmark index is currently 62.5 percent, cf. the Ministry's letter of 23 November 2016. The fund's investments in unlisted real estate mean that the fund will have a lower equity share than the benchmark index. The Bank's recommendation to increase the equity share in the benchmark index to 75 percent takes account of a further increase in unlisted real estate investments and the possible inclusion of investments in unlisted infrastructure, cf. the Bank's advice in its letters of 25 November and 2 December 2015.

Changes in the equity share need to be made over a period of time. The Bank assumes that it can come back to the Ministry with proposals for how the adjustment to a new strategic equity share should be implemented, including rules on the rebalancing regime during the transition period.

The Bank recommends that the equity share in the benchmark index for the fund is increased to 75 percent. The adjustment to the new strategic equity share will need to be carried out over a period of time.

Yours faithfully

Øystein Olsen Trond Grande