Norges Bank

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The Government Pension Fund Global – analyses and assessments of the investment strategy for bonds

We refer to the Ministry of Finance's letter of 25 February 2026. In this letter, we answer the questions relating to the investment strategy for bonds in the Government Pension Fund Global (GPFG). The questions on geopolitical risk and concentration risk in the equity index are answered in a separate letter dated 1 September 2026. In both letters, Norges Bank emphasises the importance of broad diversification as a strategy in a changing world.

The Ministry raises two main questions about the investment strategy for bonds. First, the Bank is asked to assess whether the three defined roles of the bond investments – reducing fluctuations in the overall portfolio, providing liquidity and earning risk premiums – still appear appropriate, including how the various considerations should be weighted. Second, the Bank is asked to assess the composition of the benchmark index for bonds, including which markets and segments should be included and the associated weighting principles. The Ministry points to three matters that should form part of the assessments: whether GDP weighting still provides satisfactory diversification of risk with respect to sovereigns' debt-servicing capacity, whether the consideration of simplicity implies that large bond markets should be kept outside the index, and whether duration should follow automatically from the maturities determined by issuers.

The expert group appointed by the Ministry of Finance in 2025 has been given a similar, but somewhat broader, remit. The expert group is also to assess the fund's purpose and the owner's risk tolerance, and is to deliver its report by 25 January 2027. Norges Bank's advice in this letter takes today's framework as its starting point. Different assumptions regarding the owner's risk tolerance or the fund's purpose could affect how the bond index should be composed.

Summary of the advice

The Ministry of Finance has defined three roles for the fund's bond investments: to reduce fluctuations in the overall portfolio, to provide liquidity and to earn risk premiums in the bond market. We consider that the three roles remain appropriate, but that they

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can be weighted somewhat differently in the composition of the benchmark index than they are today.

The analyses in this letter indicate that a reduction in the share of government bonds does not necessarily materially weaken the bond portfolio's ability to reduce fluctuations in the fund. The split between government bonds and the other segments reflects the trade-off between the three roles and should therefore remain fixed over time. We recommend that the government subindex of the bond index be reduced from 70 to 50 percent. A government share of 50 percent will be sufficient to cover the liquidity needs, including in periods of turbulence in financial markets. We further recommend that the government subindex be weighted by market value instead of GDP, since high government debt is now a general feature of developed economies rather than a distinctive feature of a few countries.

The remaining part of the bond index should provide exposure to more sources of risk premiums in the bond market than it does today. The fund's long investment horizon makes it well suited to earning such risk premiums over time. Norges Bank's advice is that securitized bonds (including mortgage-backed securities, so-called agency MBS) and government-related bonds should be included in the bond index. A broad market index provides exposure to more risk premiums and gives a more diversified benchmark index than today.

Norges Bank recommends that the benchmark index for bonds be aligned more closely with the broader market represented by the Bloomberg Global Aggregate. The new benchmark index should be composed on the basis of the markets currently in the included segments and thereafter held fixed until the next major review of the bond index. We recommend that the duration of the benchmark index follow the market, as it does today, and that emerging markets continue to be kept outside.

The advice in this letter has a different orientation from Norges Bank's earlier advice on the bond index, in which the Bank recommended a substantial simplification of the index with fewer currencies and segments. In Report to the Storting No. 20 (2018-2019), the Ministry of Finance took as its premise that risk factors to which the fund wishes to be exposed should as a general rule be reflected in the benchmark index. The Bank's advice in this letter is based on that assessment.

Background

The benchmark index and the investment universe today

The management mandate sets out the fund's overall investment strategy. The mandate specifies what the fund may be invested in and defines a benchmark index against which the management of the fund is measured. The investment universe for the bond portfolio comprises tradable debt instruments, as well as depositary receipts for such debt instruments. The investment universe is broader than the bond index, which is tailor-

made on the basis of sub-indices from Bloomberg. The index consists of a government subindex (70 percent) and a corporate subindex (30 percent).

The government subindex includes nominal and inflation-linked government bonds issued by developed markets, as well as bonds issued by supranationals.[1] The government subindex is weighted by gross domestic product (GDP), not market value. This means that countries with large economies relative to the size of their government debt receive a higher weight than market weights would imply, and vice versa. The corporate subindex includes corporate bonds and covered bonds. The corporate subindex is limited to seven currencies,[2] which are weighted by market value. The duration of the bond index is determined by the maturity structure of the market.

Emerging markets, high-yield bonds, mortgage-backed securities (agency MBS)[3], commercial mortgage-backed securities (CMBS), asset-backed securities (ABS) and government-related bonds, with the exception of bonds issued by supranationals, are not included in the bond index. The fund may nevertheless invest in these segments within the limits that apply under the management mandate.

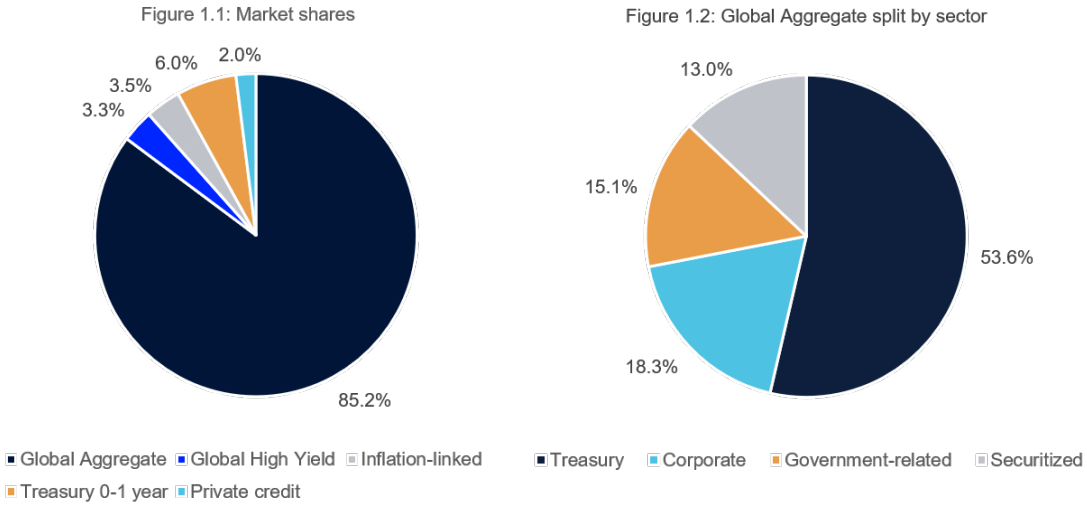
The fixed income market

The Bloomberg Global Aggregate is often used to define the investable global bond market for institutional investors. The index includes government bonds, corporate bonds, securitized bonds and government-related bonds from 27 currencies.

The Bloomberg Global Aggregate represents by far the most significant part of the investable bond market (see Figure 1) despite certain exclusions. Inflation-linked government bonds, high-yield bonds and private credit are all outside it. Bonds with less than one year of remaining maturity are not included in the standard index. The rationale is that bonds close to maturity have close to zero interest-rate risk and behave more like money market instruments than like bonds.

[1] Supranationals include, among others, bonds issued by the European Investment Bank, the World Bank and regional development banks.
[2] US dollars, euros, British pounds, Canadian dollars, Swiss francs, Danish kroner and Swedish kronor.
[3] By mortgage-backed securities we mean agency MBS in accordance with Bloomberg's classification in the remainder of this letter.

Figure 1: Market shares in the global bond market



Sources: Bloomberg and Burgiss MSCI as of 31 December 2025.

Figure 1.1 shows the market shares of the Bloomberg Global Aggregate, Bloomberg Global Treasury 0-1 Year, Bloomberg Global High Yield, Bloomberg Global Inflation-Linked and private credit. Data on assets under management in private credit are from Burgiss MSCI. The value represents the total amount of committed capital in the funds, including uninvested capital (so-called 'dry powder'). Figure 1.2 shows the market shares of the sectors within the Bloomberg Global Aggregate.

Comparable funds

The bond indices of other large funds vary considerably, and several have not disclosed their approach. A review based on publicly available information is provided in Appendix D. This review shows, among other things, that the funds that build on broad market indices typically include mortgage-backed securities.

The choice of bond index depends on the role bonds have in the portfolio. Defined-benefit pension funds, for example, use bonds to match future pension payments, so that the bond index is largely governed by the structure of the liabilities. The GPFG differs from these in that the fund has no explicit liabilities to be covered. For the GPFG, bonds are held for the three roles the Ministry of Finance has defined, and the benchmark index should reflect these.

On the three roles of the bond investments

The Ministry of Finance has defined three roles for the fund's bond investments: to reduce fluctuations in the overall portfolio, to provide liquidity and to increase the return through earning risk premiums in the bond market. Our assessment is that the three

roles remain appropriate, but that they can be weighted somewhat differently in the composition of the benchmark index compared to today.

Reduce fluctuations

The first and most important role of bonds in the fund is to reduce fluctuations in the fund's overall return. Bonds' ability to reduce fluctuations in an overall portfolio has two sources. First, bonds have lower volatility than equities, so that any element of bonds reduces overall fluctuations regardless of which bonds are held. Second, bond prices tend to rise when equity prices fall, so that the bonds reduce the total fall in the value of the fund. All bonds with high credit quality help to reduce fluctuations, but to somewhat differing degrees.

In normal periods, the volatility of bonds is the most important source of reduced fluctuations in the fund's overall return, which means that the choice between government bonds and corporate bonds matters little for the fluctuations in a portfolio with 70 percent equities and 30 percent bonds. Our analyses show that a 70/30 portfolio had annualised volatility of between 10.7 and 11.5 percent in the period 1995–2025, depending on whether the bond component consisted of government bonds, corporate bonds or mortgage-backed securities.[4] A pure equity portfolio had annualised volatility of 15.3 percent over the same period. The large contribution to the reduction of volatility in normal periods comes from holding bonds at all, not from the choice between segments of the bond market.

This changes somewhat in crises. Over the period we examine, government bonds have had a negative co-movement with equities of 0.34 in crisis periods and have thus reduced fluctuations more when the need is greatest. Corporate bonds move in the same direction as equities in crises, with a positive co-movement of 0.42.[5] For mortgage-backed securities, the co-movement with equities is slightly positive in normal periods, but has historically turned negative in crises, so that they have provided an additional reduction of volatility in crisis periods which resembles government bonds more than corporate bonds.

The degree to which bonds will contribute to dampening volatility in future crises, will depend on the nature of the crisis. For example, one might expect government bonds to not have the same volatility-dampening effects in a government bond crisis.

[4] See Appendix A.

[5] Co-movement is measured here as the correlation between monthly returns on bonds and equities respectively in crisis periods. In Appendix A, the same relationship is expressed through equity beta, which in addition to the correlation takes into account the ratio between the volatilities of the two asset classes. The two measures describe the same underlying property, but equity beta indicates how much the bond return changes on average when the equity market moves by one percent, and is therefore better suited to quantifying the contribution to the portfolio's overall fluctuations.

Liquidity

The second role of bonds in the fund is to provide liquidity, mainly in connection with rebalancing.[6] When the equity share falls more than two percentage points below the strategic share of 70 percent, the rebalancing rule requires the fund to sell bonds and buy equities. The more liquid and stable the bonds are, the more easily this can be executed without affecting market prices. Nominal government bonds issued by large developed markets are a natural source of liquidity for the fund, as trading volumes in these markets are stable, often also in periods of turbulence in financial markets. The size of the fund makes liquidity particularly important.

Simulations of the rebalancing rule over the period 1973–2025 indicate that the fund on average needs to sell bonds equivalent to around 5.5 percent of the value of the fund over a rebalancing episode. In the five percent most demanding periods, simulations show that the fund must sell bonds amounting to up to 11 percent of the value of the fund. In the most demanding periods, this corresponds to just under 40 percent of the bond portfolio given an equity share of 70 percent. Government bonds issued by developed markets currently account for around 70 percent of the bond index, or 21 percent of the fund's benchmark index. The simulations in Appendix B show that there is a comfortable margin to the estimated liquidity needs, including in periods of turbulence in financial markets.

Risk premiums in the bond market

The third role of bonds in the fund is to earn risk premiums in the bond market. Investors hold types of bonds other than government bonds to earn risk premiums. The most important segments are corporate bonds, government-related bonds and securitized bonds,[7] of which mortgage-backed securities are the largest part. Each of these segments offers distinct risk premiums with different characteristics.

Investors in corporate bonds expect a credit premium as compensation for the risk of default and for these bonds being less liquid than government bonds. In a similar manner, mortgage-backed securities are expected to provide a so-called prepayment premium. The premium arises because borrowers have the right to refinance their loans at a lower interest rate, which means that investors bear an option that is in the borrower's favour. Government-related bonds, that is, bonds issued by supranationals, federal institutions and municipalities, can be expected to provide a liquidity premium and a small credit premium over pure sovereign risk. These issuers have implicit or explicit government support and high credit quality, but are somewhat less liquid than government bonds from the largest markets.

[6] Here and in Appendix B, we focus on rebalancing rather than on outflows from the fund. This is because outflows are taken from the whole fund, not only from the bond portfolio.
[7] By securitized bonds we mean the securitized segment in accordance with Bloomberg's classification.

In Appendix C, we show how all three of these segments have delivered higher average annual returns than government bonds over the period 1995–2025, as well as higher risk-adjusted returns.

The fund's long investment horizon makes it well suited to earning such risk premiums, which will vary over time. As described at the outset, we take as our premise that the risk premiums to which the fund wishes to be exposed should as a general rule be reflected in the benchmark index. The consideration of risk premiums must be weighed against the first two roles. Corporate bonds have historically moved in the same direction as equities in crisis periods, which weakens the ability to reduce fluctuations precisely when the need is greatest. Mortgage-backed securities, by contrast, have shown volatility-reducing properties in crisis periods, but at a lower level than government bonds.

Overall assessment

The review of the three roles indicates that they can be weighted somewhat differently in the composition of the benchmark index than they are today. The most important factor for reducing fluctuations in an overall portfolio is the inclusion of bond investments, not which segments are included in the index. In addition, our analyses show that the fund's liquidity needs may imply a lower government share than today. The fund's distinctive features also make it well suited to earning risk premiums over time. This may suggest that the bond index should be expanded to other segments. Mortgage-backed securities are of particular interest here, because they over time have provided a risk premium while at the same time contributing to reduced volatility in crisis periods.

Assessment of the composition of the benchmark index

A lower share of government bonds

Norges Bank recommends that the government subindex of the bond index be reduced from 70 to 50 percent. The analysis above shows that a reduction in the share of government bonds does not necessarily materially weaken the ability to reduce fluctuations. Simulations further indicate that a government subindex of 40 percent would be sufficient to cover the liquidity needs, including in periods of turbulence in financial markets.

A share of government bonds that is higher than the liquidity needs does, however, represent an implicit cost in the form of somewhat lower expected return. At the same time, it is important that government bonds account for a substantial share of the bond portfolio and help to reduce volatility also in the most demanding market periods. Norges Bank's assessment is that a government share of 50 percent provides a comfortable margin to the estimated upper limit for the liquidity needs and reduces the risk of significant market impact in the event of a liquidity event. Future periods of stress may deviate from historical patterns, for example if equities are more volatile, the value of the fund is considerably higher, or the rebalancing rule triggers sales over shorter periods

than previously. A government share of 50 percent is also more in line with the market, represented by the Bloomberg Global Aggregate.[8]

We recommend that a fixed share of government bonds in the benchmark index be maintained, with monthly rebalancing as today. The split between government bonds and the other segments reflects a trade-off between the three roles. This trade-off should remain fixed over time, independently of market developments.

Inflation-linked bonds
Since 2005, the government subindex of the current bond index has included inflation-linked government bonds issued by developed markets. In 2012, Norges Bank proposed removing them.[9] The Ministry of Finance chose to retain them, on the grounds that diversification of risk weighed more heavily than the need to simplify the index, and that the fund as a long-term investor could earn a liquidity premium in this market.

Norges Bank recommends that inflation-linked government bonds be retained in the benchmark index. Unlike nominal bonds, they provide exposure to real interest rates and protection against unexpected inflation. In periods of unexpectedly high inflation, nominal bonds will lose real value, while inflation-linked bonds can help to preserve purchasing power. Since the Bloomberg Global Aggregate does not include this segment, it is recommended that inflation-linked government bonds be retained as an additional segment.

Emerging markets
It was decided in 2019 to remove emerging markets from the government subindex of the bond index.[10] The Ministry noted that upgrades and downgrades of issuing countries' credit quality appeared to be more of a challenge for emerging markets than for developed markets. Norges Bank still shares this assessment and recommends that emerging markets continue to be kept outside the benchmark index.

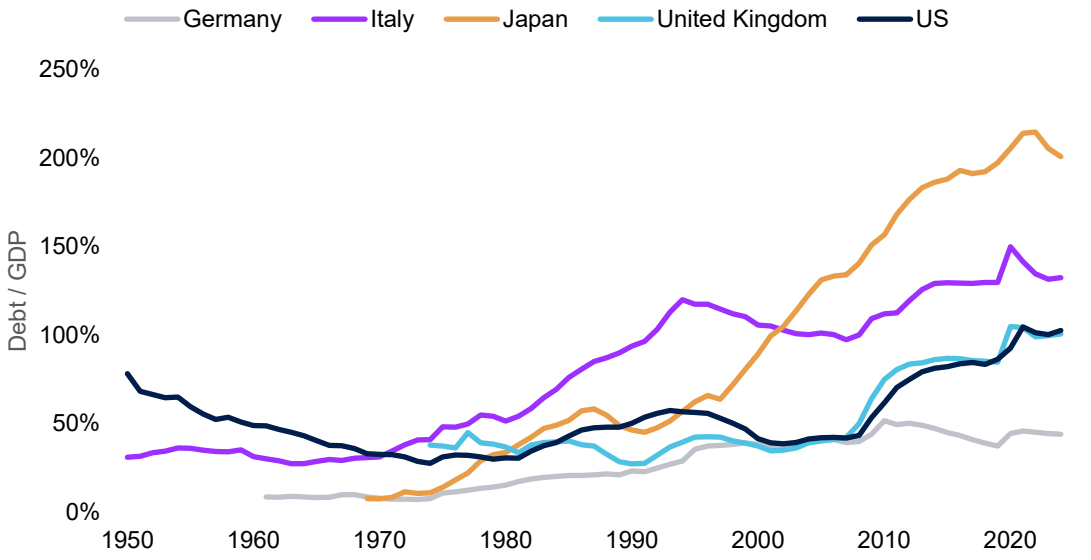
Weighting principle for the government subindex: market weights
The Ministry asks for an assessment of whether GDP weighting still provides satisfactory diversification of risk with respect to sovereigns' debt-servicing capacity, and of whether the consideration of fiscal strength should be addressed through active management or in the benchmark index.

The rationale for introducing GDP weights in 2012 was that GDP weights could provide better diversification of risk than market weights. Norges Bank's assessment is that GDP weights no longer provide diversification of risk with respect to sovereigns' debt-servicing

[8] As of 30 June 2026, government bonds account for slightly more than half of the Bloomberg Global Aggregate, also if emerging markets are excluded.
[9] Letter to the Ministry of Finance of 9 August 2012.
[10] For more information, see Report to the Storting No. 20 (2018-2019).

capacity that is necessarily better than market weights. Since GDP weights were introduced, high government debt has gone from being a distinctive feature of individual countries, particularly Japan and some euro area countries, to becoming a more general characteristic of developed economies (see Figure 2). In Appendix F, we show that GDP weights have delivered higher returns than market weights over the period 2001 to 2025. The historical excess return is largely driven by the underweighting of Japan and the depreciation of the yen over recent years. That the underweighting of Japan has in hindsight delivered excess return is thus a result of one country's distinctive features over a particular period, and not an argument that GDP is a good measure of fiscal risk.

Figure 2: Government debt as a share of GDP



Sources: IMF Global Debt Database.

Government debt as a percentage of GDP. Annual data from 1950 to 2024.

The principle of market weighting means that borrowers issuing large volumes of bonds receive an increased weight in the benchmark index. The principle is self-adjusting in that the market continuously prices fiscal risk and other macroeconomic factors such as growth and inflation. Countries with weak public finances must pay a higher interest rate to borrow, which over time limits the weight in the index.

At the same time, there are features of the government bond market that raise questions about the pricing of government bonds. The investor composition and the regulation of institutional investors, central banks' large securities purchases and the role of government bonds as a safe haven are factors that may affect pricing in ways that deviate from what fundamentals would imply. Over long time horizons, our assessment is that government bond yields largely reflect macroeconomic trends, and NBIM's analyses show that most of the variation in long government bond yields can be explained by

changes in long-term inflation prospects and the equilibrium real interest rate.[11] Any mispricing of government bonds over shorter horizons, for example related to buyers that are not price-sensitive, can be captured by active management.[12]

Norges Bank's assessment is that market weights are a natural starting point for the government bond index. This is also in line with the recommendation from the expert group that assessed the same question in 2018-2019.[13] The most widely used bond indices are based on market weights. Our assessment is that high government debt in several developed markets weakens the argument that GDP weights contribute to risk reduction by correcting for individual countries' high market weight. GDP weighting is in addition the most important source of complexity and operational risk in the composition of the benchmark index.

Regardless of whether government bonds are weighted by GDP or by market value, a situation could arise in which Norges Bank holds the government debt of a country with debt problems. As a creditor, Norges Bank could be expected to take a position on debt relief, restructuring or sanctions. These situations should be handled as part of the operational management.

A broader benchmark index that earns more risk premiums

The fund's distinctive features make it well suited to earning risk premiums in the bond market that vary over time. We recommend that the other half of the bond index provide exposure to more sources of risk premiums than it does today. In addition to the corporate bonds that are included in the index today, it is the Bank's assessment that securitized bonds and government-related bonds should be included in the bond index. Both of these segments are included in the broad bond index Bloomberg Global Aggregate. This would mean that the benchmark index moves from being dominated by the term premium on government bonds to providing a more balanced and diversified exposure to several sources of return.

Securitized bonds

Securitized bonds are a large segment of the Bloomberg Global Aggregate. The segment consists mainly of mortgage-backed securities (agency MBS). The segment was removed from the bond index in 2012. During the financial crisis, Norges Bank had exposure to private mortgage-backed securities through external mandates. These became illiquid and difficult to manage in that period.

Agency MBS is today a standardised and liquid segment with an outstanding amount of around 7,500 billion dollars at the end of 2025. This is around half of the outstanding

[11] NBIM Discussion Note #1-2023.
[12] In Appendix F, we review the literature on factors that may give rise to mispricing in the government bond market.
[13] van Binsbergen, Jules H. and Ralph S.J. Koijen, “Benchmarking Global Fixed Income Portfolios”, report to the Ministry of Finance, November 2018.

corporate bonds in developed markets. Average daily turnover in agency MBS is around 350 billion dollars, considerably higher than for US corporate bonds. The bonds are guaranteed by Fannie Mae, Freddie Mac and Ginnie Mae, and the credit quality is close to that of US government bonds. The segment has historically provided a risk premium related to prepayment risk. This premium differs from the credit premium in corporate bonds and represents a source of additional diversification. As discussed earlier, this segment has had a negative co-movement with equities in periods of turbulence in financial markets. A more detailed analysis is provided in Appendix C.

Securitized bonds in the Bloomberg Global Aggregate also include commercial mortgage-backed securities (CMBS) and asset-backed securities (ABS). These segments are considerably smaller than agency MBS and together account for less than one percent of the Bloomberg Global Aggregate. The rationale for including them is not based on a separate analysis of these segments' characteristics, but that they form a natural part of a broad market index.

Government-related bonds

Government-related bonds, that is, bonds issued by federal institutions, municipalities, supranationals, and sovereigns in foreign currency, are included in the Bloomberg Global Aggregate, but largely kept outside the current benchmark index. These issuers have high credit quality and several operate with implicit or explicit government support. Historical return figures in Appendix C show that government-related bonds have delivered higher risk-adjusted returns than nominal government bonds, and thus represent a source of additional risk premiums that the benchmark index does not capture today. We recommend that these segments also be included in the benchmark index.[14] Bonds issued by supranationals, which are already included in the current index, are recommended to be moved from the government subindex to the non-government subindex in line with the classification in the Bloomberg Global Aggregate. These bonds account for 3.7 percent of the current benchmark index.

Duration

The Ministry asks for an assessment of whether the duration of the benchmark index should be set explicitly or follow automatically from the maturities determined by issuers, as it does today. Duration is a measure of sensitivity to interest rates and varies over time both as a result of the level of interest rates and of the maturity profile issuers choose. The average duration of the index is currently around six to seven years.

Norges Bank recommends that duration continue to follow the maturity structure of the market. Bonds enter the index when they are issued and leave it when the remaining

[14] In the current benchmark index, bonds issued by supranationals are included in the government subindex. In the Bloomberg Global Aggregate, these are classified as government-related bonds. In the recommendation for a new benchmark index, supranational issuers will therefore not be included in the government subindex, but in the other half of the 50/50 split.

maturity falls below one year. Although it could make sense for a long-term investor to have an index that holds bonds all the way to maturity, we are not proposing to include bonds with a maturity of less than one year at this time. This is because there is currently no index product that covers all the segments we propose to include in the bond index. Longer duration provides a higher term premium and stronger reduction of volatility in crises,[15] which is favourable seen from the perspective of the primary role of bonds in the portfolio. Shorter duration provides lower interest-rate risk and higher liquidity. Many pension funds will choose the duration of the bond portfolio on the basis of the duration of their liabilities. The fund has no explicit liabilities, and it therefore seems natural to take the market's pricing of interest-rate risk as the starting point. Changes to the assumptions regarding the owner's risk tolerance or the fund's purpose could affect how the bond index should be composed, and in particular what duration profile it should have.

A benchmark index based on the Bloomberg Global Aggregate

The analyses of the roles of bonds indicate that these should be weighted somewhat differently than today in the composition of the bond index.

Norges Bank recommends that the benchmark index for bonds be aligned more closely with a broad market index (Bloomberg Global Aggregate). Our analyses show that all investment-grade bonds dampen volatility in the overall portfolio, and that the liquidity needs are well covered with a government subindex of 50 percent. Moving closer to a broad market index will provide increased exposure to risk premiums in the bond market and a more diversified composition than today. Taken together, this means that the bond portfolio can deliver a somewhat higher expected risk-adjusted return without materially weakening the ability of the bond investments to reduce volatility or to cover the liquidity needs.

We recommend that all segments of the Bloomberg Global Aggregate be included, with the exception of bonds issued by emerging markets.[16] Inflation-linked government bonds should be included in the government subindex in line with current practice. The strategic split is proposed to be set at 50 percent government bonds and 50 percent other bonds. Within both parts, market weights should be used.

At the same time as the transition to market weights in both parts of the bond index, we recommend that the currency composition on the corporate side be expanded from a list of seven currencies to include all currencies in the Bloomberg Global Aggregate for developed markets[17] and that the freeze on new markets in the government subindex be lifted temporarily at the transition. This means that the new index will consist of the

[15] Assuming negative co-movement between equities and bonds.
[16] Including nominal government bonds, government-related bonds, securitized bonds, and corporate bonds.
[17] In total, Japanese yen, Australian dollars, New Zealand dollars, and Singapore dollars will be added to the corporate sector.

markets that are currently included in the Bloomberg Global Aggregate and that the market composition is thereafter held fixed until the next major review of the bond index. Duration should follow the maturity structure of the market, as it does today.

The Ministry asks for an assessment of whether the consideration of simplicity in itself implies that large bond markets should be kept outside the index, and mentions US mortgage-backed securities as an example. Today's index involves a high degree of customisation, with, for example, the use of GDP weights and fewer segments than the broad market index. Fewer segments make the management of the fund simpler, while customisation contributes to increased operational risk. Customisation also makes the index harder to verify. Aligning more closely with a standard index will make the fund's benchmark index more transparent and verifiable. It does, however, require somewhat more resources to manage since it includes more types of segments. Norges Bank's assessment is that this additional burden is manageable, and that the gain from reduced customisation weighs more heavily.

Change in risk in the recommended benchmark index

In Appendix G, we show the composition of the current benchmark index, the Bloomberg Global Aggregate for developed markets and the proposed new benchmark index broken down by segment, currency and country. The most important changes from today's index are a considerably lower share of government bonds and the inclusion of mortgage-backed securities, which account for around 13 percent of the recommended index against zero today. Government-related bonds increase from around 4 to around 11 percent. The currency distribution is close to unchanged, with the exception of the Japanese yen, which increases from around 5 to 8 percent. The US dollar is by far the largest currency, with a weight of just over 50 percent. The largest difference in the dollar market is that the share of US government bonds falls, which is offset by a roughly corresponding increase in other US bonds. In the appendix, we compare the return and risk characteristics of the current and the recommended benchmark index. The largest difference is that the recommended index provides better diversification of risk across more sources of return rather than being dominated by government bonds.

A broader benchmark index will mean that the fund takes on risk different from the risk it takes today. Mortgage-backed securities have prepayment risk, and although this has historically been compensated with a premium, the return may fluctuate or fail to materialise. Mortgage-backed securities are closely linked to the US government through an implicit or explicit government guarantee, but they are also secured by collateral. A lower government share reduces the liquidity of the portfolio. The effects of the proposal on expected return and risk for the fund are small, with a marginally higher expected return and marginally lower volatility. Overall, Norges Bank assesses that the advantages of a broader index that is closer to the market weigh more heavily than the changes in risk.

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Conclusion

The Ministry of Finance asks for an assessment of how the recommended benchmark index should be reflected in the management mandate. Norges Bank will revert with a specific proposal for how the bond index should be specified in the mandate once the Ministry has taken a position on the advice. We consider that the other limits and requirements for the bond portfolio, including the limit on the exposure to high-yield bonds and emerging markets in the active management, should be continued as today.

A broader index does at the same time place somewhat greater demands on the ongoing management of the fund. Norges Bank already has experience with several of the segments we propose to include. At the same time, any inclusion of mortgage-backed securities requires that we develop expertise in this area with a few dedicated resources. A broader bond index will have very limited significance for the transaction costs of managing it.[18] The adjustment to any new benchmark index should be made gradually out of consideration for market impact and transaction costs.[19] Norges Bank assumes that we will be able to present a proposal for an implementation plan once the Ministry has taken a position on the advice.

Yours faithfully

Ida Wolden Bache Nicolai Tangen

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[18] The recommended index gives an estimated additional cost of 6.6 million kroner per year, but the additional costs are smaller than the uncertainty in the model estimates. Overall, the ongoing costs of the two indices are so similar that the difference should not be given weight.

[19] The one-off cost of the transition is estimated at around 750 million kroner as an upper limit. This can be reduced considerably through gradual implementation that makes use of the natural reinvestment of maturing bonds, netting against existing active positions and other capital flows in the fund.

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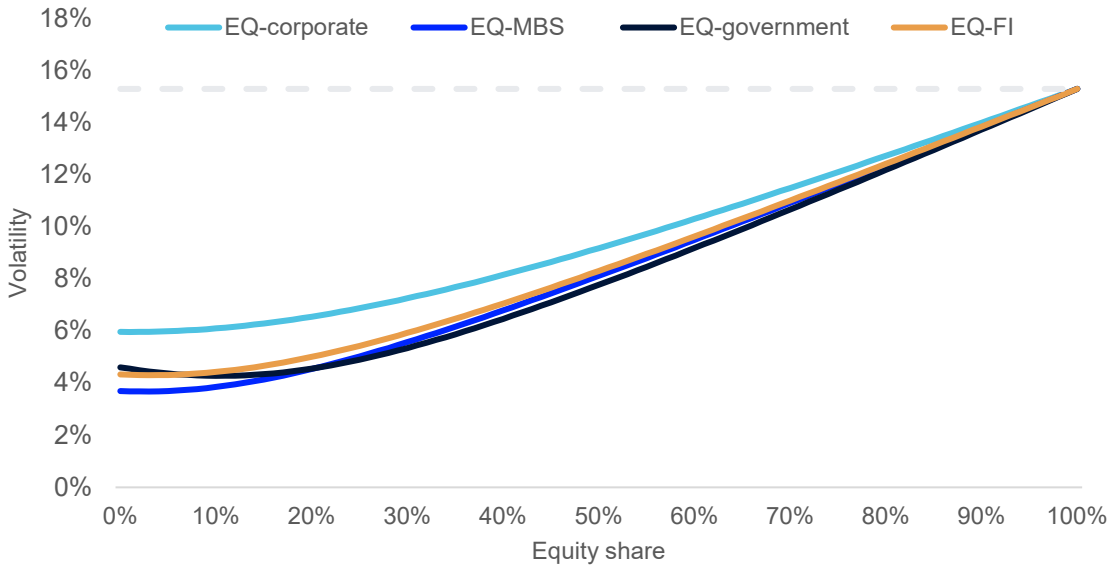
Appendices:

Appendix A Volatility reduction

The primary role of fixed income in the fund is to dampen volatility. For a fund with 70/30 equity-fixed income, all investment grade bonds contribute to dampening volatility. The differences between fixed income segments in dampening volatility are modest in normal times.

Figure A1 shows portfolio volatility when three different bond segments are combined with a broadly diversified equity portfolio for different equity shares.

Figure A1: Volatility of a portfolio of equities and bonds: full sample

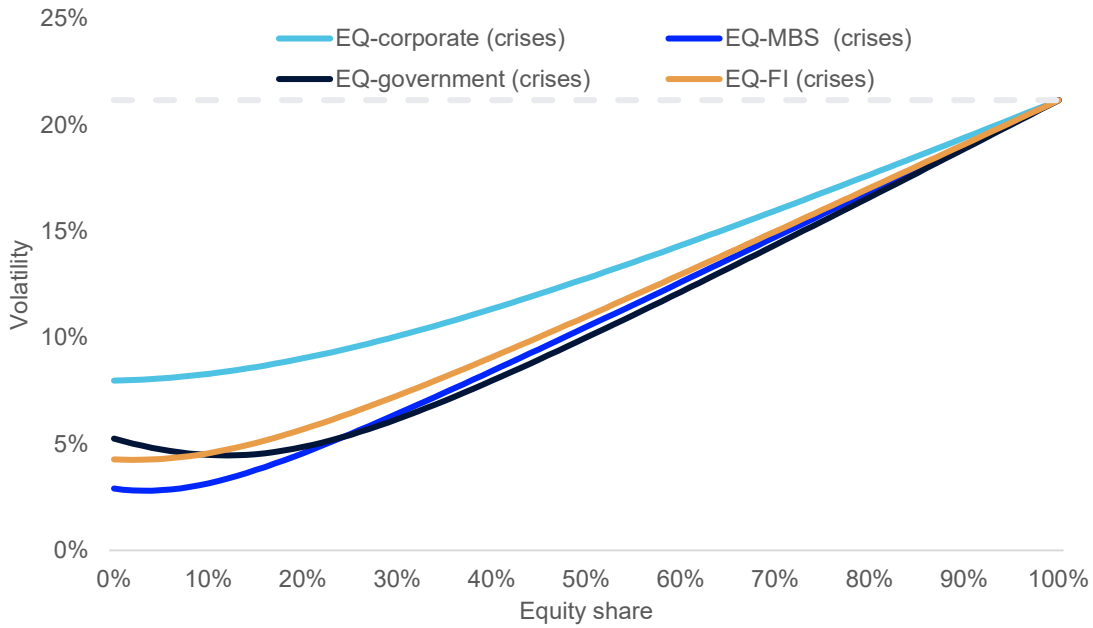


Sources: Bloomberg, FTSE, and NBIM's calculations.

Volatility of a portfolio of equities and bonds with an equity share of x percent. The grey dashed line is the volatility of equities. Corporate is corporate bonds. MBS is mortgage-backed securities. Government is government bonds. FI is a bond index consisting of equal shares of corporate, MBS and government. The period covers 1995–2025.

Figure A2 shows the same as Figure A1, but is calculated using data from only crisis periods.

Figure A2: Volatility of a portfolio of equities and bonds: crisis periods

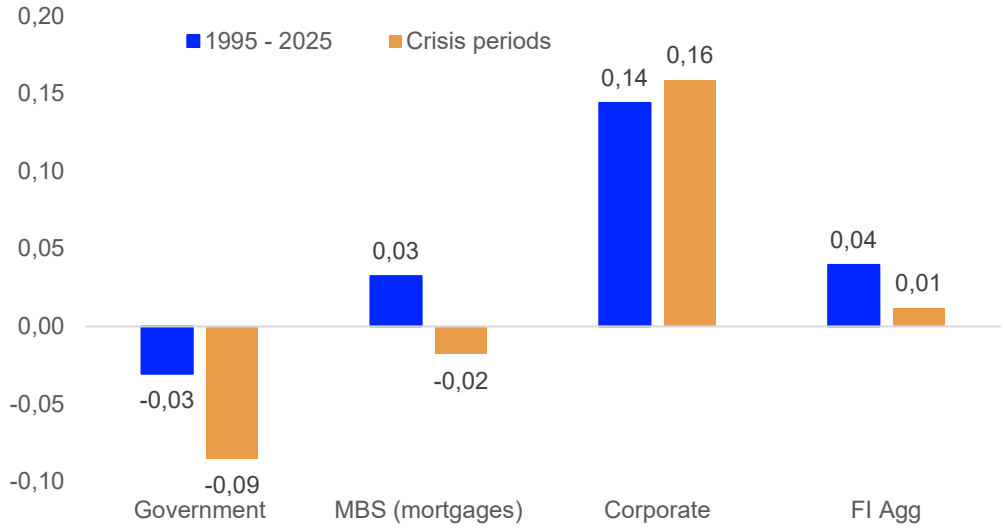


Sources: Bloomberg, FTSE, and NBIM calculations.

Volatility of a portfolio of equities and bonds with an equity share of x percent, calculated over crisis periods only. FI is a bond index consisting of equal shares of corporate, MBS and government. The crises comprise the dotcom bubble, the financial crisis and the coronavirus pandemic. The grey dashed line is the volatility of equities.

Figure A3 shows how different types of bonds co-move with equities in normal periods and in crisis periods.

Figure A3: Bonds' equity exposure: full sample (1995-2025) and crisis periods



Sources: Bloomberg, FTSE, St. Louis FRED, and NBIM's calculations.

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Equity betas for US government bonds (TSY), mortgage-backed securities (agency MBS), corporate bonds with high credit quality (IG) and the Bloomberg US Aggregate (measured in excess of the risk-free rate). Crisis periods: the dotcom bubble, the financial crisis and the coronavirus pandemic, shown with dark bars. The full period January 1995–December 2025, shown with light blue bars.

Appendix B Liquidity needs

In this appendix, we investigate how much of the fund's value ought to be held in liquid instruments to be able to reliably execute the equity share rebalancing rule.

To quantify the liquidity needs, we simulate 2,000 return paths over 50 years by drawing at random (bootstrapping) from historical monthly returns for US equities and bonds over the period 1973–2025. For each path, we apply the current rebalancing rule and identify the largest cumulative net liquidity need in a single rebalancing episode.[20,21] When we calculate the liquidity needs, we account for the fact that maturities provide a steady cash flow for bonds. With an average maturity of 7.6 years, this amounts to around 33 basis points of the value of the fund per month.[22]

Across the 2,000 simulated paths, we find that the average worst-spell requires 5.5 percent of the value of the fund, with the 90th and 95th percentiles at 9.4 and 10.7 percent respectively. A typical episode lasts on average 7.3 months.[23]

Mean worst-spell	90th percentile	95th percentile	Avg. spell length
5.5% of NAV	9.4% of NAV	10.7% of NAV	7,3 months

As a robustness check, we have carried out the analysis ignoring bond redemptions entirely. In this case, the average worst episode roughly doubles, to 11.1 percent of the value of the fund. This indicates that the cash flows from maturities cover around half of the monthly liquidity needs in a typical rebalancing episode.

To illustrate the liquidity needs estimated above, we consider the "AI correction" scenario described in NBIM's stress test report from 2025. In this scenario, the fund could lose around 35 percent of its value. To map this scenario into our simulation framework, we select the simulated paths whose maximum drawdown falls in the range of –34% to –36% and compute the average lower-bound liquidity need across those paths. This

[20] We look here at extreme liquidity events. That is, for each simulated path we take the single episode with the largest cumulative turnover, instead of taking the average across all rebalancing episodes in the path.
[21] Under the current rebalancing rule, an episode starts when the actual equity share breaches the no-trade band (±2 percentage points around the strategic equity share). When rebalancing is triggered, the equity share is brought gradually back to the strategic equity share. The exact specification of the rule is not public.
[22] 7.6 years is the average maturity of the Bloomberg US Treasury index (LUATTRUU) over the period 1975:01–2026:04. In practice, this index excludes bonds with less than one year to maturity. Index-near managers therefore typically sell bonds as they approach the one-year threshold. The term "maturing principal" is used here as a modelling simplification: the formula approximates the cash flow rate implied by the index's duration, and the analysis is valid as an illustration of the liquidity a rolling bond exposure can generate relative to the rebalancing need. We use the average maturity instead of the index's average duration of around 5.6 years in order to be conservative, which gives a higher estimated liquidity need per month.
[23] Two consecutive rebalancing episodes at the lower band are treated as one episode unless they are separated by more than six months or interrupted by a rebalancing at the upper band. This ensures that episodes close in time are not counted as independent, which would have underestimated the maximum liquidity need.

results in a liquidity requirement of 6.5% of NAV, closely in line with the cross-path mean of 5.5%. Notably, a drawdown of this magnitude is not an outlier in our simulations: it occurs in roughly 7.7% of the 2,000 bootstrapped paths and ranks among the 25% most severe drawdowns across all simulated histories, meaning our framework already contemplates scenarios more severe than the AI correction.

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Letter from Norges Bank to the Ministry of Finance of 28 August 2018: “Rule for rebalancing the equity share of the Government Pension Fund Global.”

Appendix C Mortgage-backed securities

Mortgage-backed securities (MBS) are debt instruments that represent claims on the cash flows from a pool of mortgage loans, most often secured on residential property. There are several types of MBS, but here we concentrate on agency MBS.[24] These are bonds where the cash flows are linked to the principal and interest payments on a pool of underlying mortgage loans. They are issued and guaranteed by one of three US housing agencies: Ginnie Mae, which carries the full faith and credit of the US government, and the two government-sponsored enterprises (GSEs) Fannie Mae and Freddie Mac, which carry an implicit federal guarantee.

Prepayment risk

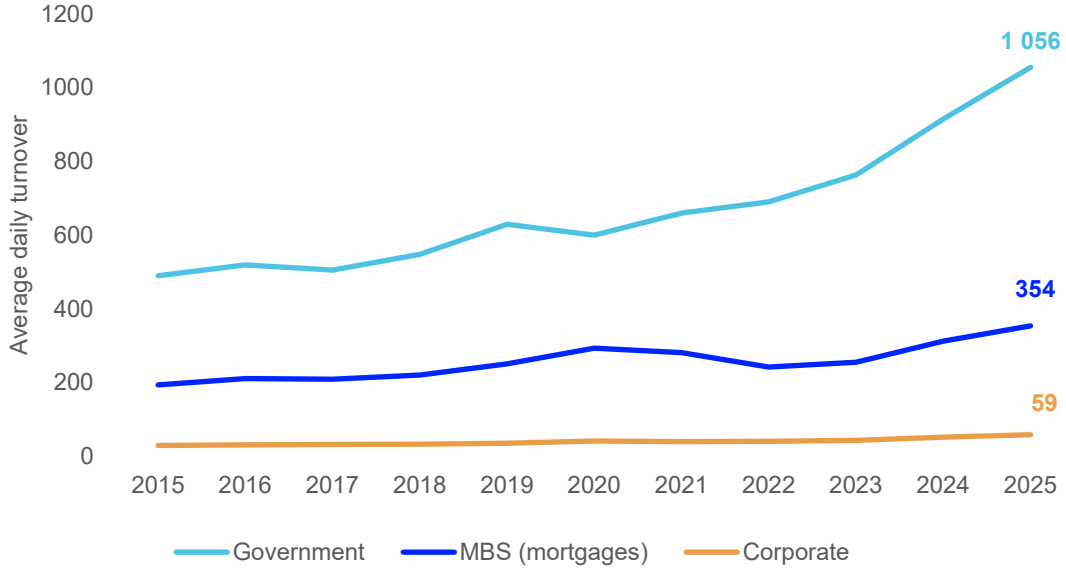
Because of the agency guarantee, agency MBS are essentially free of credit risk and are widely treated as quasi-sovereign debt. Like Treasuries, they carry interest rate risk but differ in one fundamental respect: U.S. mortgage borrowers can prepay their loan at par at any time and without penalty. This typically occurs when interest rates fall, forcing the bondholders who receive the principal back to reinvest that capital at a lower expected return. Unlike interest rate movements that can be hedged using Treasury derivatives, these prepayment shocks do not have corresponding traded derivatives. As a result, MBS investors require a prepayment risk premium as compensation. This is, as we show below, the principal source of the spread that agency MBS earn over duration-matched Treasuries.

Liquidity and market structure

Trading of agency MBS is concentrated in a small number of standardised, fungible forward contracts via the to-be-announced (TBA) market. This market design has made agency MBS one of the deepest and most liquid fixed-income markets in the world: as of end 2025, the universe amounts to about $7.5 trillion outstanding, corresponding to 10 percent of the entire Bloomberg Global Aggregate. As illustrated in Figure C1 below, average daily turnover was around 350 billion dollars in 2025, well above US corporate bonds.

[24] As of December 2025, agency MBS accounts for around 77 percent of the entire securitized sector in the Bloomberg Fixed Income Aggregate Index, while covered bonds account for a further 17 percent, and ABS and CMBS together for the remaining 7 percent.

Figure C1: Average daily turnover in segments of the US fixed-income market



Sources: SIFMA.

The figure shows average daily turnover in US government bonds, agency MBS and corporate bonds, in billions of dollars, at annual frequency, for the period 2015–2025.

Risk-adjusted return and the prepayment risk premium

In Table C1, we show that agency MBS stands out in the fixed-income universe over the period 1995–2025 with a higher Sharpe ratio than US government bonds, corporate bonds and the US Fixed Income Aggregate Index. A large part of this risk-adjusted advantage comes not from the return, but from lower volatility.

Table C1: Risk and return for segments of the US fixed-income market

1995 - 2025	FI Agg	Corp	MBS	TSY	GREL	EQ
Avg. return	4.6%	5.5%	4.5%	4.3%	4.7%	11.8%
Volatility	4.1%	6.0%	3.7%	4.6%	4.0%	15.3%
Sharpe	0.55	0.53	0.57	0.41	0.58	0.62

Sources: Bloomberg, FTSE, and NBIM's calculations.

Return and volatility in percent p.a. FI Agg is the Bloomberg US Aggregate. Corp is US corporate bonds. TSY is US government bonds. MBS is US mortgage-backed securities. GREL is US government-related bonds. Monthly return figures for the US from January 1995 to December 2025, taken from Bloomberg. Sharpe ratios are calculated as the ratio of excess return over the risk-free rate to volatility. EQ is the Russell 1000.

The next natural question is whether this asset class delivers excess returns and where this excess return comes from. To address these questions, we first estimate the MBS prepayment risk premium (PRP). We then assess whether this premium is distinct from, or merely a reflection of, the equity risk premium and the term premium. We compute the

PRP as the difference between MBS returns and US Treasury bond returns, after adjusting for any duration differences between the two asset classes. This premium reflects the part of the MBS returns that cannot be explained by interest rate movements alone. For comparison, we apply the same approach to corporate bonds, computing the credit risk premium (CRP) as the duration-adjusted excess return of corporate bonds over Treasuries. The CRP is usually interpreted as the compensation required by investors for bearing default risk.

Table C2 shows annualised prepayment and credit risk premiums between 1995 and 2025. Over this period, agency MBS had an average annual return (in excess of duration-matched Treasury returns) of 2.3 percent, while corporate bonds had an average annual excess return of 0.6 percent.

Table C2: Excess return for agency MBS and corporate bonds between 1995 and 2025

1995-2025	Prepayment risk premium	Credit risk premium
Average return	2.3%	0.6%
Volatility	1.4%	4.5%
Sharpe	1.64	0.13

Sources: Bloomberg, FTSE, St. Louis FRED, and NBIM's calculations.

The table shows annualised measures (mean, standard deviation and Sharpe ratio) for the prepayment risk premium in agency MBS and for the credit risk premium in corporate bonds, measured monthly over the period 1995:01–2025:12.

In Table C3, we show the results from regressions of these two measures of excess return on the returns on US equities and US government bonds (both expressed in excess of the risk-free rate) over the sample period 1995 to 2025.[25] We ask whether PRP and CRP are any different from the equity risk premium and the term premium. In other words, we examine whether they provide a premium beyond what can be explained by exposure to equity and interest-rate risk.

Table C3: Equity and interest-rate risk exposure for agency MBS and corporate bonds

	(a) Prepayment	(b) Credit risk
intercept	**1.92*** **	-0.47
	(0.25)	(0.65)
Equities	0.03***	0.17***
	(0.005)	(0.01)
Government	0.05***	-0.19***

[25] We start the analysis in January 1995, since the market for agency MBS only took its modern form in the early 1990s, following the introduction of REMIC-structured CMOs in 1986, Freddie Mac's conversion into a listed GSE in 1989 and the gradual standardisation of TBA forward trading (Fuster et al., 2022). The sample covers 30 years and comprises the dotcom bubble, the global financial crisis, the COVID-19 pandemic and the inflation cycle after 2022.

	(0.02)	(0.04)
No. obs.	372	372
Adj. R^2	0.12	0.39

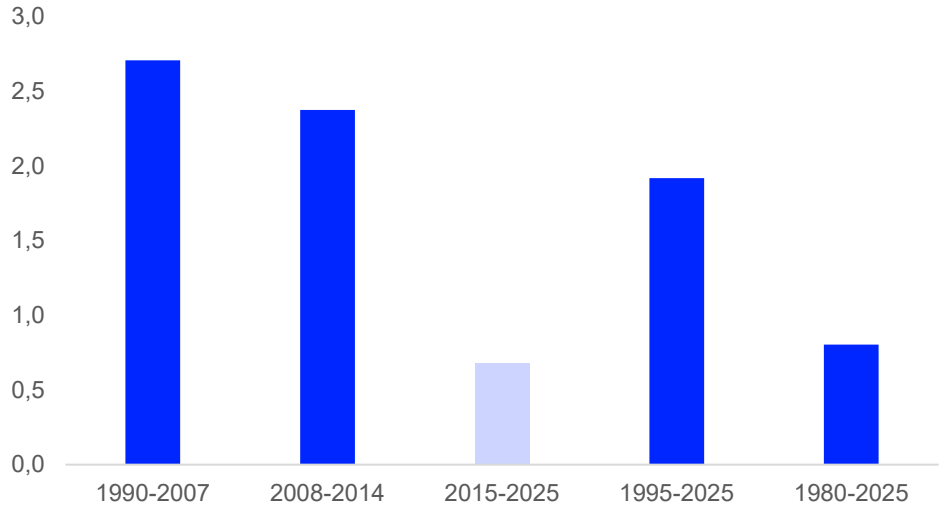
Sources: Bloomberg, FTSE, St. Louis FRED, and NBIM's calculations.

The table shows the results from regressions of (a) the prepayment risk premium in agency MBS and (b) the credit risk premium on US equities and US government bonds measured in excess of the risk-free rate (3-month US Treasury bill). The return on government bonds is based on the Bloomberg US Treasury Index. For equities, we use the Russell 1000 Index. Monthly return figures are annualised and in percent, observed over the sample period 1995:01 to 2025:12.

Panel (a) of table C3 shows the results for the agency MBS prepayment risk premium. The equity and Treasury betas of the prepayment risk are low in magnitude and explain very little of the variation in prepayment risk, with an R squared of about 10%. These findings strongly indicate that the prepayment risk premium is a distinct and independent source of return. The alpha of 1.92% per annum is highly statistically significant, meaning that after stripping out equity and interest rate exposure, MBS investors earned a substantial excess return for bearing prepayment risk over the sample period considered. In contrast, as shown in panel (b), the credit risk premium has a statistically significant equity beta of 0.17, retaining meaningful exposure to equity market conditions after duration hedging. This may reflect the sensitivity of credit spreads to the economic cycle. The R squared of 39% is considerably higher than for prepayment risk, indicating that equity and Treasury factors together capture a much larger share of credit risk premium variation.

Finally, we see in Figure C2 that the intercept for prepayment risk has fallen over time. The premium was large and significant in the 1990s and up until 2014, but has weakened over the past decade. One possible explanation is that the Federal Reserve's MBS purchases after the financial crisis pushed MBS yields down (Fuster et al., 2022). Another explanation is the considerable growth and increasing liquidity in the market for agency MBS over time, which may be related to tighter pricing of risk premiums (Rizova et al., 2023; Fuster et al., 2022). Regardless, there is still a positive and meaningful premium also in the later part of the sample.

Figure C2: Declining unexplained return for prepayment risk



Sources: Bloomberg, FTSE, St. Louis FRED, and NBIM's calculations.

Intercept estimated by regressing the prepayment risk premium on US equity and government bond returns in excess of the risk-free rate plus an intercept, for different sample periods. Intercepts are annualised and in percent. Dark (light) blue bars indicate intercepts that are statistically significant at the 5 (10) percent level.

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Appendix D – Other large funds

We have reviewed the approach to bond investments among other large funds. A summary is shown in Table D1. There is a natural distinction between funds that structurally resemble the GPFG and funds that are not directly comparable. Defined-benefit pension funds, such as ATP in Denmark, USS in the United Kingdom and OTPP in Canada, use bonds primarily to match future liabilities, a purpose that is fundamentally different from that of the GPFG. For these funds, the need for a bond index is smaller, since the bond investments are governed by the structure of future liabilities.

The most comparable funds are those without explicit liabilities, such as GIC in Singapore, GPIF in Japan and New Zealand Super. In order to assess the specific index choices the Ministry asks about, however, we depend on the funds disclosing the composition of their benchmark index. This determines the selection of funds in Table D2. One liability-driven fund, ABP, is included because its broad and publicly available indices are informative about segment choices. Other funds, such as GIC, are omitted because their benchmark index is not disclosed.

Diversification is the most common rationale for investing in bonds among funds without explicit liabilities. In several cases, bonds are part of a reference portfolio that expresses risk appetite and risk exposure, rather than a target for the investment strategy for bonds in isolation. The overview of indices used across segments shows considerable variation, but a consistent feature is that the funds adapt the indices to their own needs. This is done through combinations of standard indices, custom weights and their own inclusion criteria. The use of tailor-made bond indices is thus widespread among other large funds, and the GPFG's current index is not unusual in that respect. The variation illustrates that there is no single established market standard for bond indices in the way there is for equities.

Table D1: Bond index and portfolio share

Fund	Benchmark index for bonds	Share	Role of bonds
ABP (Netherlands)	Custom indices and segment weights. Bloomberg Global Scaled Treasury ex-Italy, Euro Govt Related and a custom Long Duration index for government bonds in developed markets. JP Morgan Diversified Emerging Market Bond for emerging markets. Bloomberg indices for IG and HY credit and securitized bonds, with exclusions for energy, tobacco and high-yield financials.	41% target, derivative overlay hedging 50% of interest-rate risk against liabilities	Liability hedging
ATP (Denmark)	No traditional bond index. Hedging portfolio: Danish/German government bonds and interest rate swaps (no credit, no MBS).	80% hedging portfolio. 31% risk allocation to fixed income.	Liability hedging and return

Fund	Benchmark index for bonds	Share	Role of bonds
CalPERS (US) – TPA from July 2026	Standard index. Bloomberg U.S. Treasury Index.	25% benchmark	Total portfolio approach
CDPQ / La Caisse (Canada)	Standard indices, custom weights. FTSE Canada (government bonds, credit) + ICE BofA ML (US credit).	34% target	Hedging and return
CPP Investments (Canada)	Standard index. Canadian government bonds.	15% benchmark	Risk reduction
Future Fund (Australia)	No bond index.	8% actual	Diversification via interest rate derivatives
GIC (Singapore)	Not disclosed.	22% actual	Total portfolio approach
GPIF (Japan)	Standard indices, custom weights. Domestic: Nomura-BPI (excl. ABS). Foreign: FTSE World Government Bond Index (excl. China).	50% target	Buffer and return
Keva (Finland)	Indices not disclosed.	31% actual[26]	Diversification
NZ Super Fund	Standard index. Bloomberg Global Aggregate Total Return Index (hedged to NZD).	20% benchmark	Diversification
OTPP (Canada)	Custom/internal.	34% target	Liability hedging
AP2 (Sweden)	Standard indices for government bonds, custom weights. SHB Swedish All Bond and J.P. Morgan GBI EM Global Diversified. Credit: Bloomberg Credit with climate adjustments.	33% target	Diversification and green transition
AP3 (Sweden)	Index not disclosed.	22% actual	Diversification and green transition
AP4 (Sweden)	Custom. ICE GDP-weighted global bond index with 5-year fixed duration. ICE Swedish bond index with 4-year fixed duration.	25% target	Diversification

[26] Risk-adjusted, including derivatives. Bond share without adjustment: 24%.

Fund	Benchmark index for bonds	Share	Role of bonds
USS (United Kingdom)	Not fully disclosed. 87.5% index-linked gilts, 12.5% TIPS. Credit: UK, EM and global IG and HY.	37% hedging, 20% credit, 17% leverage	Liability hedging and return
VER (Finland)	Indices not disclosed.	39% actual (min. 30% required)	Diversification

Table D2 compares the composition of the GPFG's bond index with the benchmark indices of four other established public funds: GPIF (Japan), NZ Super (New Zealand), AP2 (Sweden) and ABP (Netherlands). The funds have been selected because their global investment mandate makes them relevant for comparison with the GPFG, and because they disclose the benchmark indices for their bond portfolios at a level of detail that makes it possible to compare the choices the Ministry asks about: the weighting principle for government bonds, the split between government bonds and other segments, the treatment of mortgage-backed securities, exposure to emerging markets, and duration.

Table D2: Comparison on the questions from the Ministry of Finance

Question	GPFG (current)	GPFG (recommended)	GPIF	NZ Super	AP2	ABP
Weighting principle, government bonds	GDP weights	Market weights	Fixed domestic share, market weights within segments	Market weights	Fixed EM share, partly market weights	Mainly market weights[27]
Government/non-government split	70/30 fixed	50/50 fixed	~90/10 (market for domestic)	~54/46 (market)	55/45 fixed	56/44 fixed
US MBS in index	No	Yes	No	Yes	No	No
Invested in US MBS	No	Yes	No	Yes	No	Yes
Emerging markets in index	No	No	Limited (excl. China)	Yes	Yes	Yes

[27] The main benchmark index for government bonds includes emerging markets with market weights. In addition, there is a separate mandate for emerging markets in which the market weights are capped. Italy and countries subject to an arms embargo from the EU or the UN are excluded, and Chinese government debt in local currency also has a reduced weight.

Question	GPFG (current)	GPFG (recommended)	GPIF	NZ Super	AP2	ABP
Duration management	Market-driven	Market-driven	Market-driven	Market-driven	Market-driven	Fixed long duration with deviation bands, interest rate hedging

The government shares in the row "Government/non-government split" refer to the composition of the funds' benchmark index or to the weights in the strategic asset allocation to which the benchmark index applies. For NZ Super and GPIF, these are standard indices (FTSE WGBI / Bloomberg Global Aggregate). For AP2 and ABP, they are strategic weights in a custom composite benchmark index (AP2 annual report 2025, ABP ABTN 2026).

In its letter, the Ministry asks whether the weighting principle for government bonds in the GPFG's current index differs from that of comparable funds. The GPFG uses GDP weights for government bonds, while GPIF, NZ Super, AP2 and ABP all use market weights as their main principle. Norges Bank's recommendation to move to market weights would bring the GPFG into line with peers.

The split between government bonds and other segments varies between 54 and 90 percent. As regards mortgage-backed securities, these are included by NZ Super, and ABP is in addition invested in them even though they are not part of the fund's main benchmark indices.

Exposure to emerging markets varies between the funds. Broad, global indices such as the Bloomberg Global Aggregate include a share of around 15 percent. Where investors use an explicit segment weight and a separate benchmark index for emerging markets, this may result in a higher share. GPIF stands out by excluding one emerging market, China. The rationale is that Chinese government bonds cannot be settled in the international settlement systems used for other large government bond markets, that liquidity is limited relative to GPIF's size, and that foreign investors do not have access to futures trading.[28]

Duration follows the maturity structure of the market at the majority of the comparable funds. The exception is AP4, which appears to use custom bond indices with fixed duration, but there is insufficient public information about its approach for a full comparison. ABP has an explicit allocation to long-term bonds, but also manages duration risk against liabilities with derivatives.

The funds manage risk in different ways. The GPFG and the funds that use a market index manage risk by setting limits on how far the portfolio may deviate from the index.

[28] See Reuters, 29 September 2021, "Japan's GPIF to shun Chinese govt bonds even after benchmark inclusion".

The liability-driven funds, by contrast, measure risk against the future pension payments they are to cover, with market indices as guidance for the composition.

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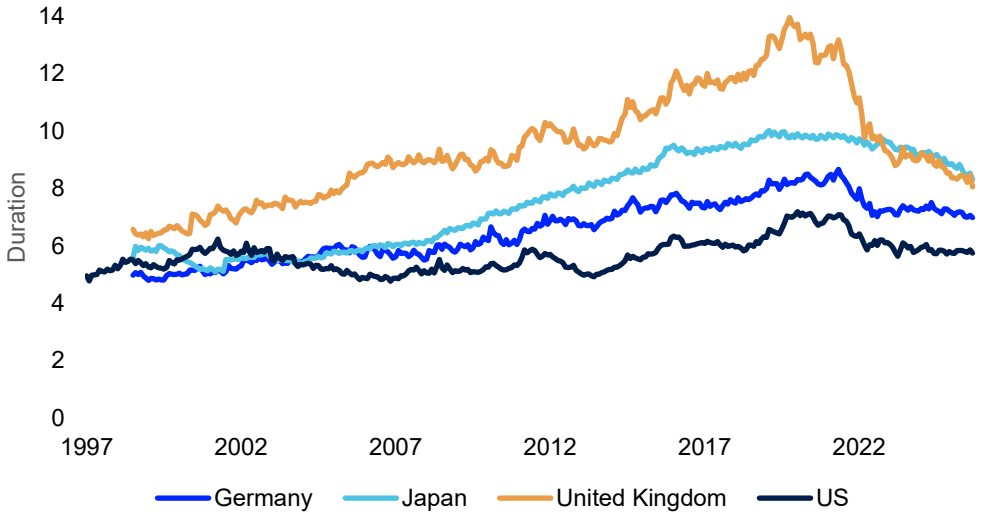
Appendix E Duration

What drives the duration of a government bond index?

Duration measures how sensitive a bond price is to changes in interest rates. Figure E1 shows modified duration for government bond indices for Germany, Japan, the UK and the US.

Figure E1: Modified duration for government bond indices over time



Sources: Bloomberg.

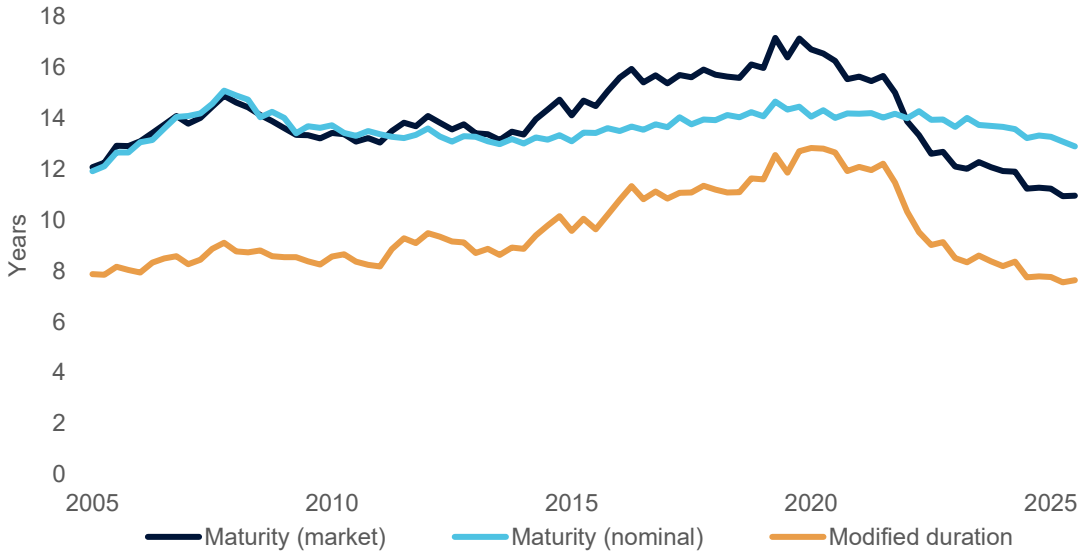
The figure shows option-adjusted duration (OAD) at index level for Germany, Japan, the United Kingdom and the US. Monthly frequency from July 1997 to March 2026.

The duration of a market-weighted government bond index changes over time through three channels. First, duration rises mechanically when interest rates fall. This is because the present value of distant cash flows rises relative to near-term ones and hence they will weigh more heavily, lengthening the duration for every bond in the index. Second, falling yields cause long-duration bonds to appreciate more than short-duration ones, increasing their market-value weight and pushing index duration higher. Third, sustained low yields lead governments to issue bonds with lower coupons, which will reduce the duration of newly issued bonds. At the same time, some governments may wish to take the opportunity to issue at longer maturities to lock in lower interest rates.

The first two effects dominate at short horizons and account for the tight co-movement between yield changes and duration changes, while the third is typically slower moving. To look more closely at which of these effects dominate over time, Figure E2 examines the UK more closely, as it offers a particularly informative case: it has the longest average debt maturity among advanced economies and has seen the largest variation in index duration over the past 25 years. The figure shows the average maturity of outstanding UK government debt under two weighting schemes, market value and nominal value, together with modified duration. Even though the average maturity of UK government debt has remained broadly stable over the past two decades, modified duration rose substantially between 2005 and 2020 before falling sharply after 2022. This

pattern suggests that changes in yields rather than deliberate maturity extension by the UK Debt Management Office were the dominant driver of duration over this period.

Figure E2: Average maturity of outstanding UK government debt



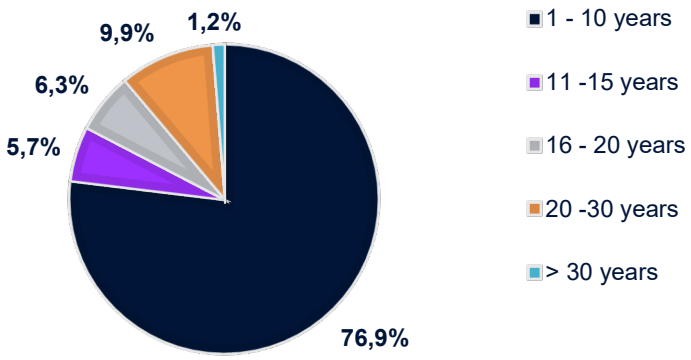
Sources: UK DMO.

The figure shows the average maturity of outstanding UK nominal government bonds (conventional gilts), weighted by nominal value and by market value. The average modified duration is calculated using market value weights.

The role of duration in a bond portfolio

The duration in the current fixed income benchmark is determined mechanically by the market's maturity structure and pricing. This means that the interest rate risk of the bond portfolio can vary over time, although, as seen in Figure E1, this variation tends to be gradual and within a relatively bounded range, particularly in the US. We start by noting that ultra-long bonds with maturities beyond 30 years represent a very small share of the current fixed income benchmark. As Figure E3 shows, as of end-2025 this segment accounted for only 1.2% of the total, suggesting that any cap on maximum maturity would have a limited impact on the overall portfolio. The bulk of the portfolio sits in shorter maturities, with bonds in the 1–10 year bucket accounting for more than three quarters of the total.

Figure E3: Maturity composition of the bond index as of 31 December 2025

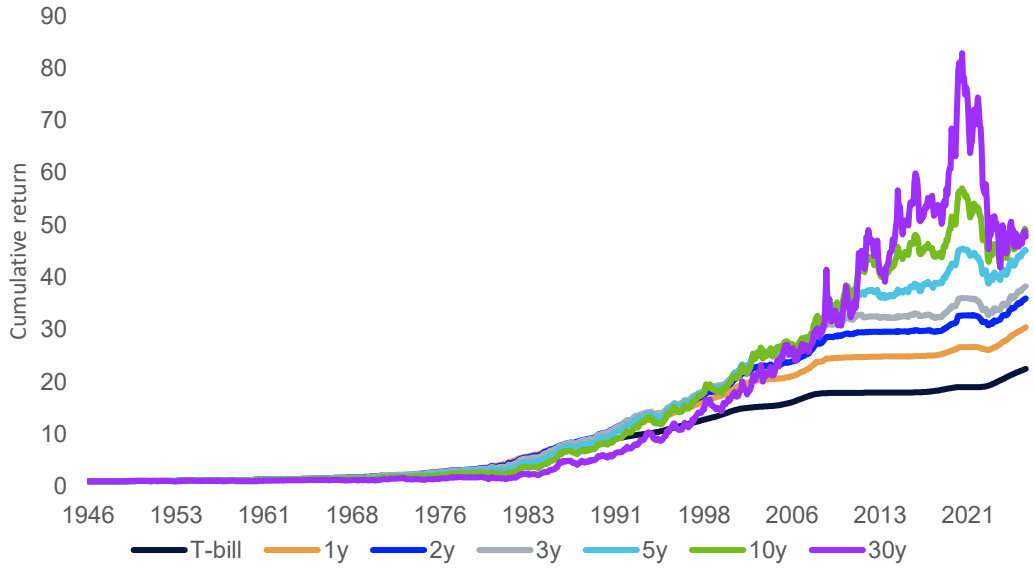


Sources: NBIM's calculations.

The figure shows the maturity composition of the Ministry of Finance's benchmark index for bonds as of 31 December 2025, broken down by maturity band.

Long-term bonds have at least two different roles in a bond portfolio. First, they provide a term premium, the additional return investors receive for tying up capital over longer horizons instead of rolling over a sequence of short-term bonds. Historically, this premium has been positive on average, meaning that long-term bonds have delivered higher cumulative returns than short-term bonds over extended periods. In Figure E4, we show cumulative returns for US government bonds with different maturities over the period 1946–2025.

Figure E4: Cumulative returns for US government bonds with different maturities

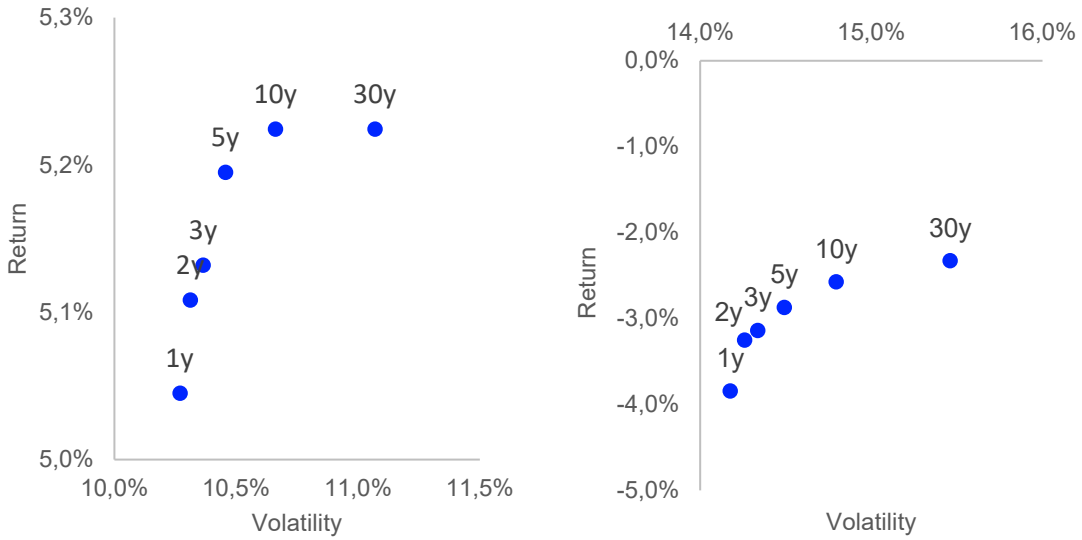


Sources: Finaeon's Global Financial Database.

The figure shows cumulative returns for US government bonds with different maturities over the period January 1946 to December 2025.

Second, bonds with long duration provide diversification against reinvestment risk: when interest rates fall, the price gains on long-term bonds offset the lower return from reinvesting coupons at lower interest rates, and vice versa. As discussed in NBIM (2023), these diversification gains are particularly clear in a portfolio with several asset classes. Figure E5 illustrates this with historical data. The left panel shows return and risk for a 70/30 portfolio of equities and bonds in the post-war period, where the maturity of the bond component is varied. Moving from short to longer maturities increases both return and volatility, but the gain in return is not commensurate with the increase in risk. The right panel, which looks only at recessions, tells a different story: bonds with longer duration deliver considerably better returns in downturns, despite higher volatility.[29] This suggests that the case for higher duration is strongest precisely when it matters most for a long-term investor, in periods of economic stress.

Figure E5: Average volatility of a US 70/30 portfolio of equities and bonds, over the full period and in recessions



Sources: Finaeon's Global Financial Database.

The figure shows the average volatility of a US 70/30 portfolio of equities and bonds, where the bond component consists exclusively of government bonds with n years to maturity. US nominal returns are measured in excess of the risk-free rate (Treasury bills). The left panel uses monthly return data for the period January 1946 to December 2025. The right panel looks exclusively at post-Second World War recessions, more specifically US downturns as defined by the NBER. Recessions begin in the month after a cyclical peak and end in the month of the cyclical trough.

[29] The higher volatility of bonds with long duration in recessions reflects greater price sensitivity to changes in interest rates and works in the investor's favour. In recessions, interest rates tend to fall, and the higher duration then produces price gains, so that the additional volatility becomes a source of return rather than of risk in these episodes.

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Appendix F Weighting principles

Pricing in the government bond markets

A central question is whether government bonds are efficiently and correctly priced, or whether structural forces cause observed yields and market values to deviate from their fundamental values. In this appendix, we review the relevant literature to answer these questions.

Investor composition and regulation

A strand of the literature demonstrates that institutional investor composition and regulatory frameworks are important drivers of demand for government bonds, with implications for yield dynamics. Greenwood and Vayanos (2010) show that shifts in clientele demand and bond supply driven by institutional investors seeking to match long-duration liabilities can move term spreads substantially and independently of macroeconomic expectations. Greenwood and Vissing-Jorgensen (2018), drawing on data from 26 countries, confirm that the size of the pension and insurance sector is a causal driver of long-end yield compression, operating through regulation-induced preferred-habitat demand for long-duration assets. Jansen (2025) analyse the Dutch regulatory reform of 2012, showing that a change in discount rate methodology caused pension funds to shift their bond holdings away from ultra-long bonds towards the 20-year segment, compressing 20-year yields and raising 30-year yields. Taken together, these papers establish that government bond yields, particularly at longer maturities, can be shaped by regulatory requirements, and therefore reflect forces beyond fiscal fundamentals alone. At the same time, Kotronis et al. (2026) document that despite QE and Solvency II, insurance companies' demand for European government bonds fell by 10 percentage points between 2015 and 2024. This suggests that market dynamics and investor preferences can ultimately dominate regulatory interventions. NBIM (2024) corroborates these findings at the aggregate level, showing that investor demand and composition are key determinants of how bond supply affects yields, and that the effectiveness of central bank asset purchases itself depends on the presence of price-inelastic investors.

Quantitative easing

A related literature examines the effects of quantitative easing (QE) on government bond yields. The evidence across major economies is broadly consistent: QE reduces long-term yields. Dell'Ariccia et al. (2018) find that QE reduced euro area 10-year yields by an estimated 155 basis points since 2013, with particularly pronounced effects in peripheral countries, while Kuttner (2018) estimates that the four rounds of US Fed QE cumulatively reduced 10-year Treasury yields by approximately 150 basis points. Du et al. (2024) show that quantitative tightening (QT) can reverse some of these effects, with active QT having larger impacts than passive runoff. At the same time, QE can be a meaningful stabilisation tool that reduces borrowing costs and preserves policy space. For instance, Christensen and Gillan (2022) document that QE improved market liquidity. Reis (2017)

argues that QE can reduce the welfare costs of fiscal adjustment and make the transition more orderly, but it does not alter the underlying fiscal fundamentals that determine whether a country's debt is sustainable in the long run. Finally, it is worth noting that the effects of QE are not confined to the purchased assets, with significant spillover to broader financial conditions and stock prices (e.g., Caballero and Simsek (2024), and Kashyap and Stein (2023)).

Convenience yield and “exorbitant privilege”

A separate literature focuses on the convenience yield, the yield discount enjoyed by the dominant global safe asset supplier, as a structural feature of government bond pricing. Chen, Jiang et al. (2025), studying three centuries of fiscal history across the Dutch Republic, the UK, and the US, show that the dominant safe asset issuer in each era sustained debt well in excess of its expected future primary surpluses, supported by a yield discount, the convenience yield, that investors accepted in exchange for the safety and liquidity of the dominant sovereign's bonds. Choi et al. (2024) notes that thanks to its safe-haven status, the US was able to increase its maximal sustainable debt by approximately 22% of GDP, primarily through the collateral and liquidity services that Treasuries provide. At the same time, Jiang et al. (2025) document that the large expansion of US Treasury supply over the past two decades has substantially eroded this privilege: the US convenience yield is now close to zero for short-term Treasuries and negative for long-term ones, suggesting that current market prices already reflect the erosion of this premium. Chien et al. (2025) explains how Japan has been able to sustain elevated debt-to-GDP ratios and sluggish growth without facing a crisis. They argue that the government acts as a sovereign wealth fund, keeping its funding costs low thanks to QE and favourable regulatory treatment for financial institutions that hold government debt, while investing in higher-yielding foreign assets. This approach has supported debt sustainability but involves significant interest rate, exchange rate, and equity price risks. They also argue that the US cannot replicate this model because it owns fewer financial assets.

Debt supply, market dynamics and sovereign credit risk

The final strand of the literature addresses how debt supply dynamics, the market pricing of duration risk, and sovereign default risk interact to shape government bond yields and returns. Greenwood and Vayanos (2014) document that a higher maturity-weighted-debt-to-GDP ratio raises both bond yields and expected excess returns, with effects concentrated at longer maturities. This indicates that markets require additional premium when the maturity of debt supply increases. Berk and van Binsbergen (2026) challenge the conventional debt sustainability narrative by constructing three alternative measures of indebtedness across 19 countries over 125 years: debt-to-GDP, interest-to-GDP, and debt-to-equity. They show that while the first has reached historically unprecedented peacetime levels, the other two measures are at or below their long-run averages. They argue that assertions of unsustainability based on debt-to-GDP alone are premature. Reinhart et al. (2003) introduce the concept of debt intolerance, showing that emerging

markets with histories of serial default face financial distress at debt levels that would be manageable for advanced economies, implying that market-based sovereign risk pricing reflects institutional credibility and historical track records. Gilchrist et al. (2022) demonstrate that sovereign spreads across more than 50 countries are substantially driven by global financial risk.

Summary of the literature

The literature reviewed in this Appendix highlights that government bond yields are shaped by a broad range of forces beyond expected short-term interest rates and inflation: investor composition and demand, regulatory requirements, debt supply dynamics, safe-asset convenience yields, and global financial conditions all play a role. For QE in particular, it is worth noting that its effects are not confined to the government bonds directly purchased by central banks but spill over across asset classes, including equities, where market-cap weights are also commonly used. That said, market prices also reflect a wide array of information, including market sentiment, liquidity preferences, and investors' collective assessment of a country's capacity to service its debt. Finally, as noted in NBIM (2023), over long horizons, most of the variation in government bond yields can be explained by changes in long-term inflation and growth expectations, referred to as macro trends. This can be seen in figure F1, where we focus on the US.

Figure F1: Ten-year nominal US government bond yield and macro trends

Sources: Consensus Economics, FRED, Federal Reserve and NBIM's calculations.

The figure shows the nominal ten-year yield on US government bonds together with its macro trends, given by the sum of long-term inflation expectations and the neutral real interest rate. Quarterly data from Q3 1971 to Q3 2025.

GDP weights and market weights

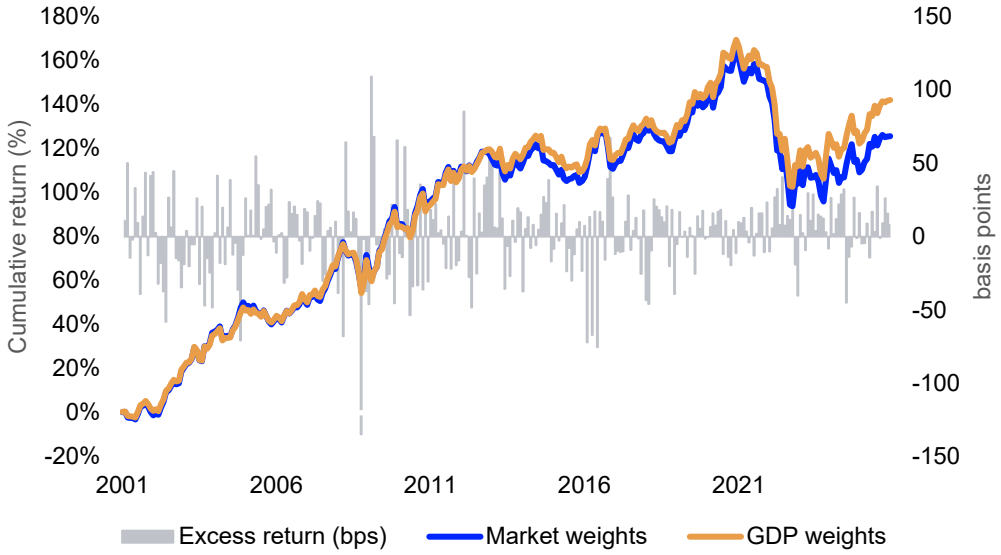
In Figure F2, we compare the historical performance of a GDP-weighted and a market-weighted global bond index. The figure shows cumulative returns in US dollars for the two indices over the period January 2001 to December 2025. Figure F3 shows the difference in country weights between the two indices. Over this horizon, the GDP-weighted index delivered a cumulative return of 142 percent, against 126 percent for the market-weighted one. The excess return was not evenly distributed. The two indices tracked each other closely in the first part of the period and in the years after the financial crisis. The gap widened in the low-yield environment of the 2010s and particularly when the yen weakened after 2022. It should be emphasised that these results reflect a particular historical period and should not be interpreted as a prediction of future relative returns.

Table F1 compares country weights between a market-weighted and a GDP-weighted government bond index as of 30 June 2026. The largest difference is Japan and the US, where a GDP-weighted index gives the US a higher weight and Japan a lower weight. We also include fiscal-strength-weighted and float-adjusted government bond indices. The index weighted by fiscal strength takes into account a country's debt relative to GDP, deficit relative to GDP and current account balance.[30] This results in the US having a lower weight because of high debt relative to GDP, a high deficit and net imports. But as noted earlier with Berk and van Binsbergen (2026), it is not theoretically obvious which measure should be used to gauge a country's debt burden. The float-adjusted index takes into account central bank holdings in more countries than the Bloomberg Aggregate.[31] This results in Japan having a lower weight compared with a market-weighted index. The float-adjusted index is not, however, adjusted for all central banks. Among other things, it does not adjust for the ECB's bond holdings.

[30] The Global Treasury Fiscal Strength Weighted Index I27630US assigns each country a score for debt/GDP, deficit/GDP and current account/GDP. The debt/GDP score is given a weight of 50%, while each of the two remaining scores is given a weight of 25%. For more information, see the Bloomberg Fiscal Strength Weighted Index.

[31] Holdings are adjusted for the following institutions: the Bank of Japan, the Bank of England, the Bank of Canada and the Government of Canada. The Fed's holdings are already adjusted for in the Bloomberg Global Aggregate, but the float index also takes into account the Fed's holdings of MBS (mortgages).

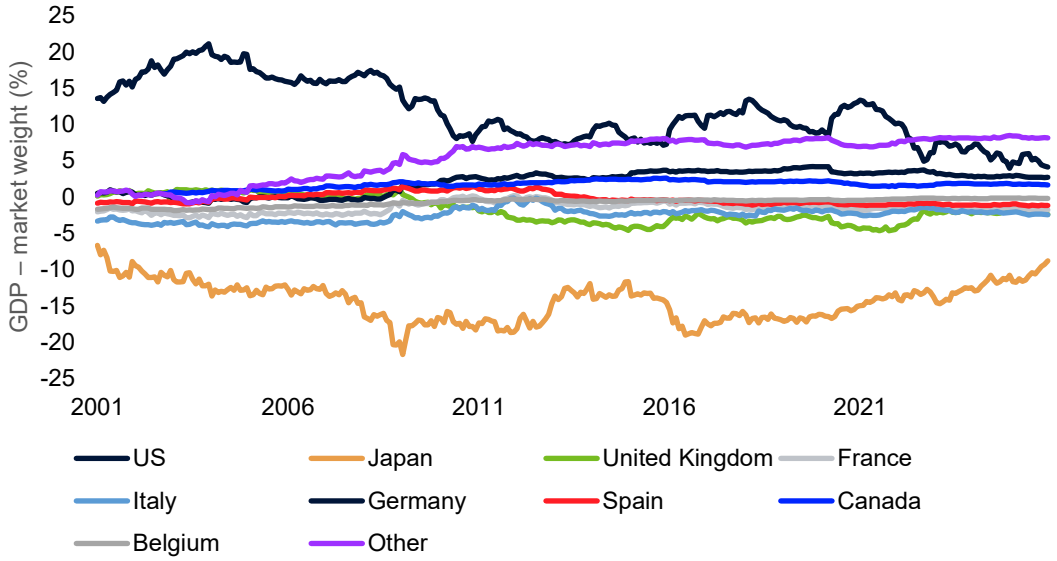
Figure F2: Return for GDP-weighted and market-weighted global bond index



Sources: Bloomberg and the World Bank.

Cumulative monthly total return (USD) for two global bond indices over the period January 2001–December 2025. Both indices have 70 percent government bonds and 30 percent corporate bonds. The corporate bonds include emerging markets. The GDP-based index weights the countries in the government and inflation-linked segment by the previous year's GDP (World Bank, nominal USD). The 30 percent corporate bonds are identical in the two indices. The bars on the right show the difference in monthly return between the GDP-weighted and the market-weighted index in basis points.

Figure F3: GDP weight minus market weight



Sources: Bloomberg and the World Bank.

A positive value means that the GDP weight is higher than the market weight, and vice versa. Top 9 = the US, Japan, the United Kingdom, France, Italy, Germany, Spain, Canada and Belgium, ranked by average market weight over the period; Other = the sum of the remaining developed markets. Comprises nominal and inflation-linked bonds from developed markets. GDP weights use a three-year weighted average of nominal GDP (½ weight on the most recent year, ⅓ on the year before, ⅙ on the year before that).

Table F1: Weighting principles for government bonds

Region	Market weights	GDP-weighted	Fiscal strength	Float-adjusted
US	43.4%	48.1%	28.7%	47.6%
Euro area	28.5%	26.9%	40.1%	31.2%
Japan	15.9%	7.0%	15.1%	9.6%
UK	6.9%	5.9%	7.2%	6.1%
Other DM	5.2%	12.0%	9.0%	5.4%

Sources: Bloomberg as of 30 June 2026.

The table shows shares for four government bond indices by region. All indices are limited to developed markets and developed market currencies. Norwegian bonds and bonds denominated in NOK are excluded. Market weights are the Bloomberg Global Aggregate. GDP-weighted is the I32402US Index. Float-adjusted is the I38855US Index.[32] Fiscal strength is the I27630US Index limited to developed markets (excl. Norway), rescaled to 100 percent.

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Appendix G Comparison of the recommended benchmark index and the current benchmark index

Table G1 shows the composition of the current benchmark index, the Bloomberg Global Aggregate for developed markets, and the recommended new benchmark index broken down by segment. The most important changes are a considerably lower share of government bonds and the inclusion of mortgage-backed securities, which account for around 13 percent of the recommended index against zero today. Government-related bonds increase from around 4 to around 11 percent.

Table G2 shows the currency composition for the same indices. The total exposure to bonds issued in US dollars is close to unchanged at around 50 percent in both the current benchmark index and the proposed new benchmark index. Table G3 shows, however, that the exposure to US government bonds falls from 34.1 to 21.9 percent as a result of the lower share of government bonds and the transition from GDP weights to market weights, while the exposure to Japanese government bonds rises from 4.6 to 7.4 percent.

Table G1: The benchmark index and the Bloomberg Global Aggregate - sectors

Sector	Subsetor	Current benchmark index	Bloomberg Global Aggregate DM	Proposed index
Corporate	Industrials	13.8%	10.7%	11.5%
	Financial institutions	10.7%	8.3%	9.0%
	Utilities	2.3%	1.8%	1.9%
Government-related	Supranationals	3.7%	3.3%	3.6%
	Agencies	-	3.3%	3.5%
	Local authorities	-	3.7%	4.0%
	Sovereign	-	0.1%	0.1%
Securitized	Covered bonds	3.2%	2.4%	2.6%
	ABS	-	0.2%	0.2%
	CMBS	-	0.7%	0.8%
	MBS passthrough	-	11.9%	12.8%
Treasury	Nominal	60.6%	53.5%	45.7%
	Inflation-linked	5.7%	-	4.3%

Sources: Bloomberg and NBIM's calculations as of 30 June 2026.

The table shows shares of the respective benchmark indices by sector and sub-sector. Bloomberg Global Aggregate developed markets is the Bloomberg Global Aggregate limited to developed markets and developed market currencies. Norwegian bonds and bonds denominated in NOK are excluded. The proposed benchmark index consists of the Bloomberg Global Aggregate developed markets expanded to include inflation-linked government bonds and with a fixed 50% weight to government bonds (incl. inflation-linked) and 50% to all other segments. Within government bonds and within non-government bonds, market weights are used. All calculations include exclusions in accordance with the mandate from the Ministry of Finance. MBS stands for “Mortgage Backed Securities”. These are bonds secured on a portfolio of mortgage loans. ABS stands for “Asset Backed Securities”. These are bonds secured on various receivables, for example car loans or credit card debt. CMBS stands for “Commercial Mortgage Backed Securities”.

Table G2: Benchmark indices and the Bloomberg Global Aggregate - currency

Currency	Current benchmark index	Bloomberg Global Aggregate DM	Proposed index
USD	52.9%	51.7%	52.5%
EUR	28.1%	27.4%	27.2%
JPY	4.6%	8.9%	7.8%
GBP	5.4%	4.9%	5.5%
Other DM	8.9%	7.0%	7.1%

Sources: Bloomberg and NBIM's calculations as of 30 June 2026.

The table shows shares of the respective benchmark indices by currency. Bloomberg Global Aggregate developed markets is the Bloomberg Global Aggregate limited to developed markets and developed market currencies. Norwegian bonds and bonds denominated in NOK are excluded. The proposed benchmark index consists of the Bloomberg Global Aggregate developed markets expanded to include inflation-linked government bonds and with a fixed 50% weight to government bonds (incl. inflation-linked) and 50% to all other segments. Within government bonds and within non-government bonds, market weights are used. All calculations include exclusions in accordance with the mandate from the Ministry of Finance.

Table G3: Benchmark indices and the Bloomberg Global Aggregate – countries

Type	Region	Current benchmark index	Bloomberg Global Aggregate DM	Proposed index
Government	US	34.1%	23.2%	21.9%
	Euro area	16.8%	15.3%	14.1%
	Japan	4.6%	8.5%	7.4%
	UK	4.2%	3.7%	4.2%
	Other DM	6.6%	2.8%	2.5%
Non-government	US	16.2%	25.7%	27.6%
	Euro area	7.1%	8.6%	9.3%
	Japan	0.7%	0.9%	1.0%
	UK	1.9%	1.6%	1.7%
	Supranationals	3.7%	3.3%	3.6%
	Other DM	4.1%	6.3%	6.8%

Sources: Bloomberg and NBIM's calculations as of 30 June 2026.

The table shows shares of the respective benchmark indices by country. Bloomberg Global Aggregate developed markets is the Bloomberg Global Aggregate limited to developed markets and developed market currencies. Norwegian bonds and bonds denominated in NOK are excluded. The proposed benchmark index consists of the Bloomberg Global Aggregate developed markets expanded to include inflation-linked government bonds and with a fixed 50% weight to government bonds (incl. inflation-linked) and 50% to all other segments. Within government bonds and within non-government bonds, market weights are used. All calculations include exclusions in accordance with the mandate from the Ministry of Finance.

Historical return and volatility (2015–2026)

Table G4 shows average annualised return and volatility as well as the Sharpe ratio for the period January 2015 to June 2026. The comparison is limited to developed markets. The figures do not reflect the exact historical return of the current benchmark index, but a what-if version with a fixed investment universe.[33]

[33] Currencies included: AUD, CAD, CHF, DKK, EUR, GBP, HKD, JPY, NZD, SEK, SGD and USD. For both indices, the same bond exclusions that are apply to the current benchmark index over time have also been applied.

Table G4: Return and volatility (2015–2026)

2015:01 - 2026:06	Returns (%, p.a.)	Volatility (%, p.a.)	Sharpe
Proposed index	0.76	5.57	0.14
Current benchmark index	0.97	5.67	0.17

Sources: Bloomberg and NBIM's calculations.

The table shows annualised average return and volatility based on daily total returns in USD. Sharpe is the ratio of return to volatility. Both indices are calculated on a fixed universe of developed markets. Exclusions in accordance with the mandate have been applied to the benchmark index over the whole period. Data are daily from January 2015 to June 2026.

The current benchmark index has somewhat higher return and volatility over the period. The difference in return can mainly be attributed to the use of GDP weights rather than market weights in the government subindex. The lower volatility of the recommended benchmark index reflects partly the reduced share of corporate bonds and partly the inclusion of agency MBS.

Expected return and duration (2015–2026)

Table G5 shows expected return (measured as the average annual yield to maturity), yield volatility, and average modified duration for the period 2015–2026.

Table G5: Expected return and modified duration (2015–2026)

2015:01 - 2026:06	Yield (%, p.a.)	Yield volatility (%, p.a.)	Mod. Dur.
Proposed index	2.26	0.55	6.60
Current benchmark index	2.22	0.56	6.73

Sources: Bloomberg and NBIM's calculations.

The table shows yield to maturity, yield volatility and modified duration. Yield to maturity is the market-weighted average yield to maturity of the bonds in the index. The table shows the average of daily observations over the period. Both indices are calculated on a fixed universe of developed markets. Exclusions in accordance with the mandate have been applied to the benchmark index over the whole period. Daily data from January 2015 to June 2026.

Over the period, the recommended benchmark index consistently had a higher expected return and lower yield volatility. The average modified duration is somewhat lower. The recommended benchmark index had an average expected return 4 basis points above the current benchmark index, equivalent to 5 basis points after adjusting for duration differences.

Expected return as of 30 June 2026

Table G6 shows yield to maturity and modified duration as of 30 June 2026.

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Table G6: Expected return and modified duration as of 30 June 2026

As of 30 June 2026	Yield (%)	Mod. dur.
Proposed index	4.04	6.21
Current benchmark index	3.99	6.28

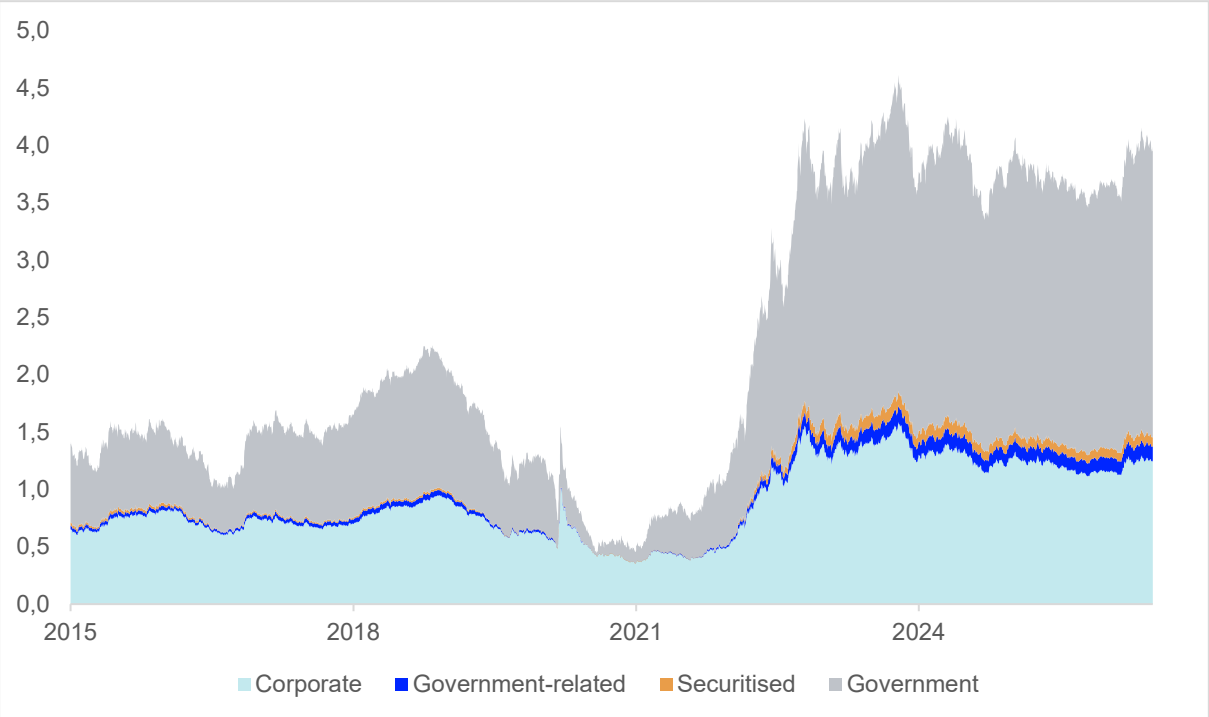
Sources: Bloomberg and NBIM's calculations.

The table shows yield to maturity and modified duration as of 30 June 2026. Yield to maturity is the market-weighted average of the bonds' yield to maturity in the index. Both indices are calculated on a fixed universe of developed markets. Exclusions in accordance with the mandate have been applied to the benchmark index over the whole period. Data as of 30 June 2026.

As of 30 June 2026, the recommended benchmark index has an expected return of 4.04 percent against 3.99 percent for the current benchmark index, equivalent to a difference of 5 basis points. After adjusting for duration differences, the expected return of the recommended benchmark index exceeds that of the current benchmark index by 10 basis points. The main driver is the inclusion of agency MBS.

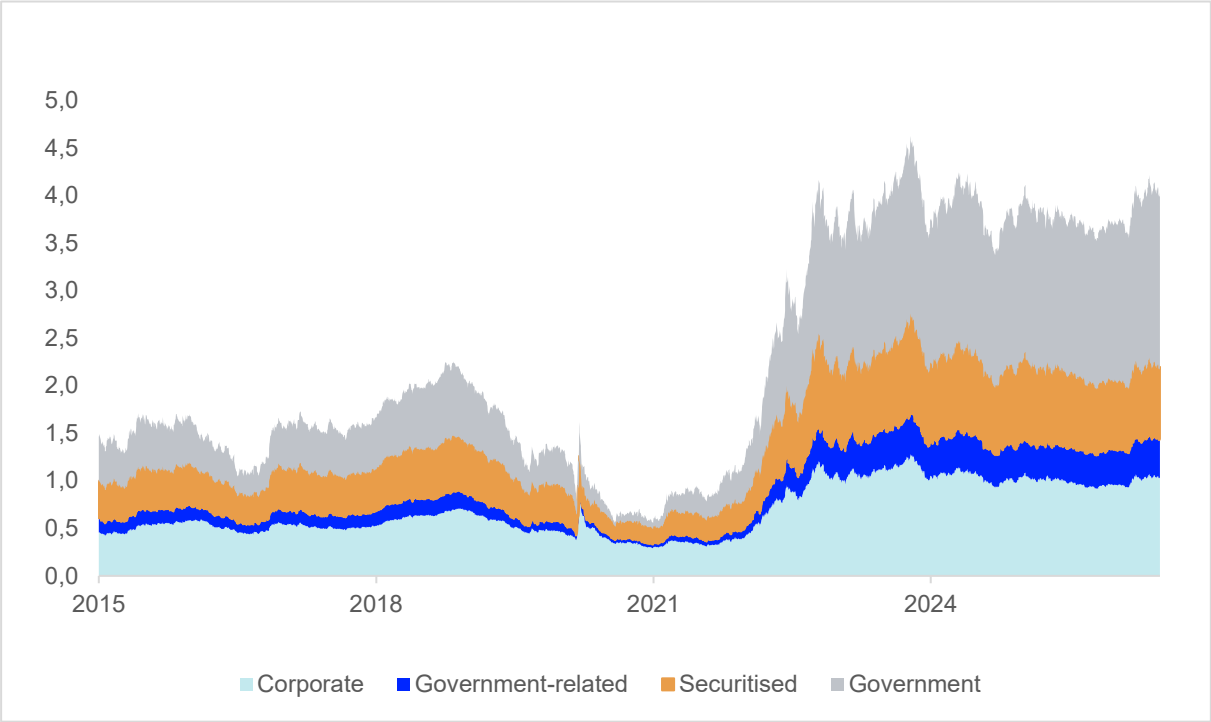
Figures G1 and G2 show the expected return contribution per asset class for the recommended benchmark index and the current benchmark index.

Figure G1: Expected return contribution per asset class for the current index



Sources: Bloomberg and NBIM's calculations.

Figure G2: Expected return contribution per asset class for the recommended index



The figures show the yield to maturity for both the recommended benchmark index and the current benchmark index, decomposed by asset class. The total yield to maturity is a weighted average in which each asset class contributes in line with its weight. The differences between the indices reflect both differences in weights and in the yields of the respective asset classes. Yield to maturity is the market-value-weighted average of the bonds' yield to maturity in the index.