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Economic Policy Department  
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Your ref.

Our ref.  
SSK/SAB

Oslo  
10 February 2006

Dear Sirs,

### **Changes to the benchmark portfolio of the Government Pension Fund - Global**

In a letter dated 22 August 2005, Norges Bank recommended that the percentage of equities in the benchmark portfolio of the Government Petroleum Fund should be re-evaluated when the framework pertaining to the new Government Pension Fund had been established. As from

1 January 2006, the Petroleum Fund forms part of the Government Pension Fund, as its sub-portfolio Global. Under reference to the Advisory Agreement with Norges Bank, the Ministry of Finance has announced that the equity portion in the said portfolio shall be evaluated in 2006. As per the beginning of 2006, the Government Pension Fund – Global (the “GPF”) represents more than 85 percent of the Government Pension Fund, which percentage will increase over time.

The Storting has laid down a fiscal rule for the Government Pension Fund, to the effect that the spending of capital from the Fund shall normally correspond to the expected real return thereof. The Fund shall make its investments in foreign currency. If it is desirable for the real return to be subject to the minimum possible uncertainty, the investments of the Fund should be made in government inflation-linked bonds or in short-term fixed-income securities. However, one has chosen to assume somewhat more risk in order to increase the expected return. This has been achieved by, *inter alia*, investing in longer-term fixed-income securities, in bonds with credit risk, and in equities.

The percentage invested in equities is the main parameter in determining the risk assumed by the Fund. The equity portion should reflect the owner's trade-off between expected return and risk. Given that the Fund operates with a long investment horizon, it is the risk relating to the accumulated return over a longer period of time which is relevant.

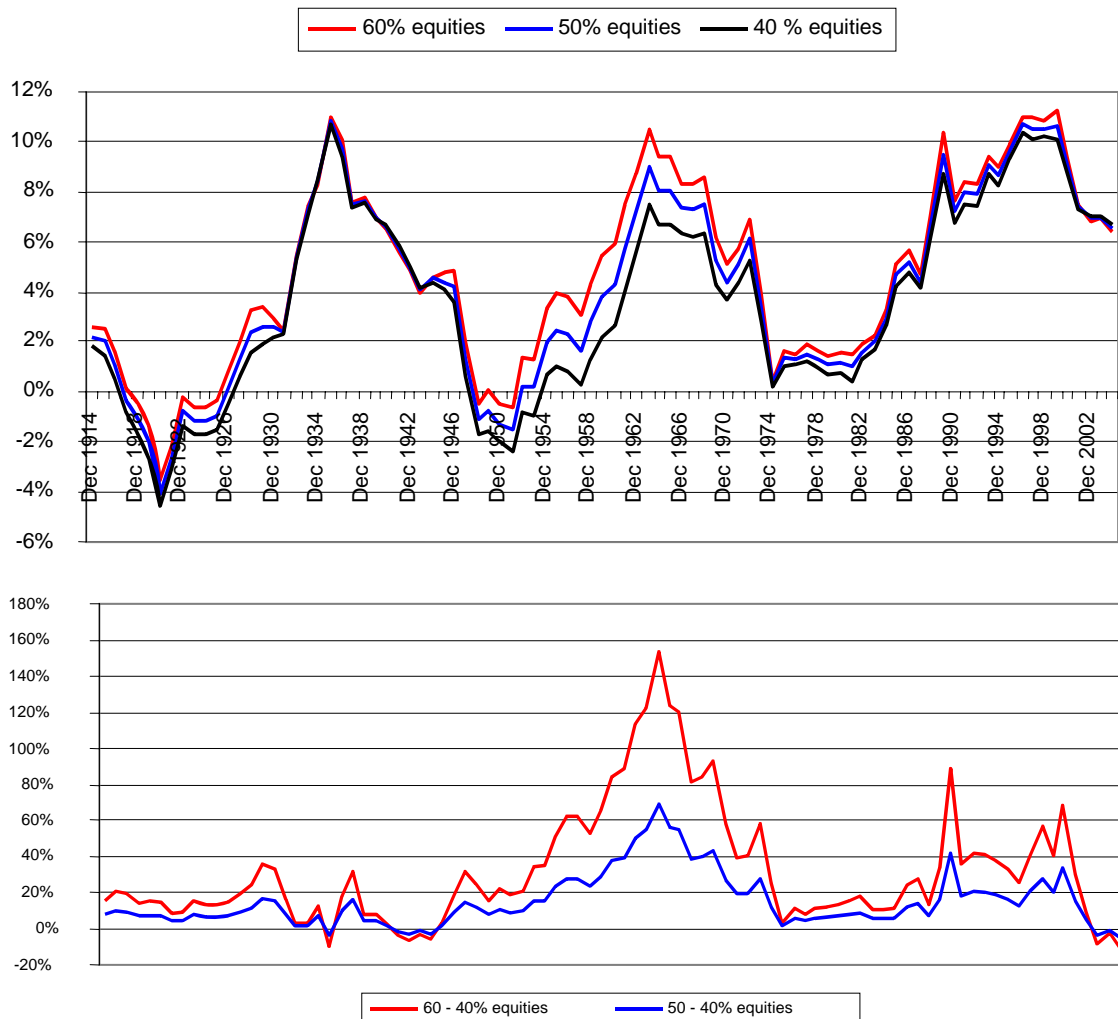
The 40-percent allocation to equities was established in 1997 (National Budget 1998), and then re-evaluated in 2001 (National Budget 2002). The underlying issue is how much risk the owner of the Fund wishes to assume in order to achieve a higher expected return. The experience garnered in 2002 may be of use when performing such evaluation. In 2002, the return on the Petroleum Fund was distinctly negative, when measured in both international currency and Norwegian kroner. Nevertheless, the fund construction was not seriously

questioned, and its long-term investment strategy was not re-examined. The Fund benefited from this by way of good returns on equities in subsequent years. Such experience provides a good foundation for accepting somewhat more risk of suffering weak return performance in individual years, whilst attaching more weight to the long-term purpose of the Fund.

### *Experience over the last 105 years*

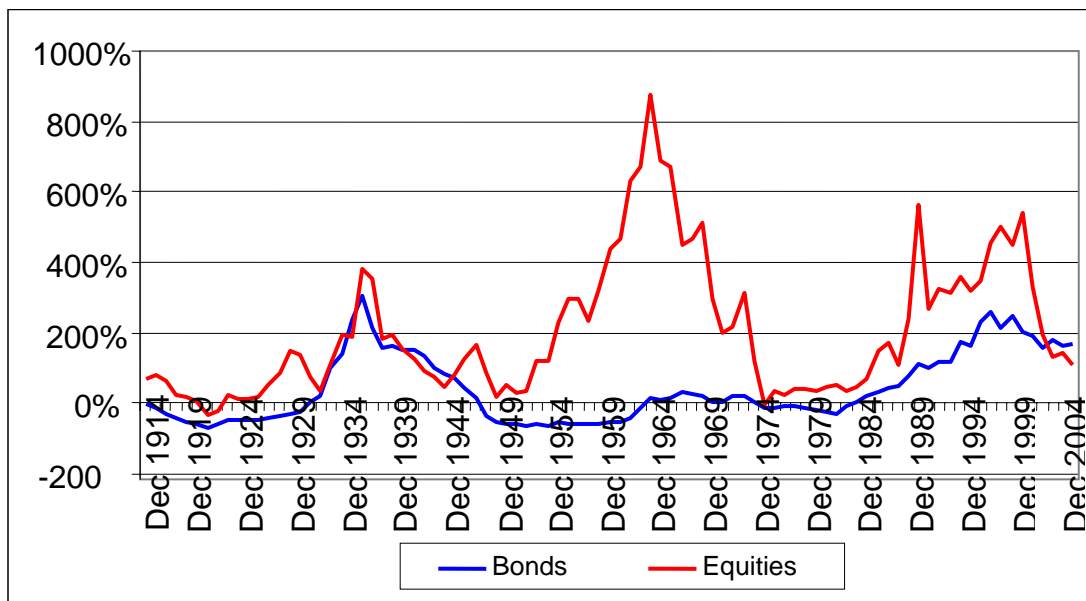
We have studied how a higher equity portion would affect the real return on a portfolio with the same regional distribution as the GPF, given the actual return figures from the global stock and bond markets over the last 105 years. We are first addressing the downside risk. The topmost panel in the below chart displays annualised real returns in overlapping 15-year periods. In no period would the loss from increasing the allocation to equities from 40 to 50 or 60 percent exceed 0.12 or 0.28 percentage points per annum, respectively. Said loss pertains to the 15-year period 1990-2004, when increasing the equity portion would have yielded an accumulated reduction in the return of 4.7 or 10.4 percentage points, respectively.

The bottom panel of the chart displays the difference in accumulated returns over the same 15-year periods. Amongst a total of 91 overlapping 15-year periods between 1900 and 2004, we can identify eight periods when increasing the percentage of equities would have resulted in a loss. All these eight periods include one of the two large stock market crashes, i.e. either the years in the wake of 1929 or those in the wake of 2000. During all remaining 15-year periods, a high percentage of equities would have been very profitable. However, the robustness of these findings is curtailed by the fact that the data sample only contains seven independent 15-year periods.



Returns on portfolios holding investments in the United States, Japan, United Kingdom, Germany and France, with the same regional weightings as the GPF, and with different percentages of equities. The topmost panel features annualised returns as measured in local currency over continuous 15-year periods during 1900-2004. The bottom panel illustrates the difference between accumulated returns over the 15-year periods from increasing the allocation to equities to 60 or 50 percent, respectively, from the current 40-percent allocation. Data source: Ibbotson Associates.

The maximum losses accumulated over 15 years would have been limited during the last 105 years, even if one had operated with a 60-percent allocation to equities instead of 40. This has to do with the assumption that the portfolio is at all times invested in the international capital markets, i.e. in either equities or bonds. The below chart shows that periods of weak returns on equities have often coincided with periods of weak returns on bonds.



Accumulated returns over continuous 15-year periods on bond and equity portfolios holding investments in the five main markets, and with the same regional distribution as the GPF. Data source: Ibbotson Associates.

The average real return over the years 1900-2004 would have been 5.4 percent per annum<sup>1</sup> with 60 percent equities, and 4.8 percent with 50 percent equities, in the portfolio, whilst an allocation of 40 percent would have yielded an average return of 4.2 percent per annum. The standard deviation of the annual return would have been 11.9, 11.1 and 10.5 percent, respectively. On average, the trade-off between increased return and increased risk from increasing the percentage of equities has been very favourable over the last 105 years.

We are not in favour of assuming that said experience is representative of what we can expect in the near future. Such caution is in conformity with the consensus view amongst large investors: The excess return realised on equities relative to bonds was significantly higher during the 20<sup>th</sup> century than investors had expected in advance. In particular, share prices increased so much during the second half of the century that these are now reflecting a lower level of expected excess return. Such a re-pricing cannot be expected in the near future.

<sup>1</sup> Calculated as an arithmetic mean.

### *Model simulations*

In order to supplement the impression garnered from the historical data, Norges Bank has undertaken a portfolio analysis, whereby which we have performed model simulations over a 15-year time horizon. Such analyses are based on a set of assumptions concerning expected real returns and risks in the stock and bond markets. These assumptions are explained in a separate report.<sup>2</sup> We have assumed that real interest rates and share prices are most likely to move towards long-term equilibrium levels over the course of the 15-year period. The most important assumption is that the equilibrium level of the expected excess return on equities relative to bonds (the equity premium) is 2.5 percentage points, which is about half of the average level from the historical data above. In respect of some stock markets we have assumed that the expected return over the next few years is somewhat lower even than this. Furthermore, we have assumed that market volatility and correlation between the markets are about the same as over the last thirty years. This implies that outcomes that are far from the equilibrium levels are also accorded a significant probability.

The simulations produce estimates as to how the probability distribution for accumulated real returns over 15 years are affected by changes to the benchmark portfolio. We measure the return by way of a currency basket where European currencies are accorded a weighting of about 60 percent, whilst American and Asian currencies are accorded a weighting of about 20 percent each. Said basket represents our expectations as to the currency composition of the future imports which the Fund will implicitly be financing. We expect that a higher proportion of imports will come from those regions that are currently experiencing the fastest growth, and from Asia in particular. As a result thereof, it is likely that the percentage of imports originating from Europe will be reduced from its present level.

A higher equity portion will increase the expected real return on the overall portfolio, but the volatility and the probability of a negative accumulated real return over a number of years will also increase. In the table below, we provide estimates for the magnitude of these changes<sup>3</sup>. In case of a modest increase of the current 40-percent allocation to 50 percent, we estimate the trade-off ratio between the increased expected annual overall return (arithmetic mean) and the increased annual standard deviation of the return at 0.31. However, such ratio becomes somewhat less favourable the higher is the percentage of equities. When the allocation to equities is increased beyond 50 percent, the marginal trade-off ratio is reduced to 0.28.

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<sup>2</sup> Long term outlook for fixed income and equity return. Norges Bank, Staff Memo 2005/10.

<sup>3</sup> The level of expected return in the table may be in the region of 30 basis points too high, because the probability distributions have been dealt with as if they were completely known. In reality, the distributions have been estimated. Reference is made to an article by Jacquier, et. al., in the *Financial Analyst's Journal*, Nov/Dec 2003, for a more detailed discussion. We have not attempted to adjust for this, as it does not affect the comparison of the alternatives.

<b>Alternative allocations to equities</b>	Annualised rate of return over 15 years	Annualised standard deviation over 15 years	Mean annual return (arithmetic)	Standard deviation of annual return	Probability of negative accumulated return
40%	4.15%	2.49%	4.62%	9.65%	4.57%
50%	4.39%	2.77%	4.96%	10.73%	5.25%
60%	4.59%	3.08%	5.30%	11.94%	6.33%

*Model simulations of the probability distributions for accumulated real returns under alternative allocations to equities. Each probability distribution is based on 6,000 simulations.*

The market risk of the portfolio does not increase much when the equity portion is increased somewhat. In our model computations, we find that the risk of an increase to a 60-percent allocation to equities being unprofitable, i.e. that the accumulated return becomes lower over the 15-year period, is about 25 percent. However, the difference in expected portfolio return in those cases where a higher percentage of equities is unprofitable is not large. Given that the Fund incurs a loss from holding a higher equity portion, the expected loss from holding 60 percent equities instead of 40 percent is about five percentage points in accumulated real return over 15 years.

On the other hand, there is a probability of about 75 percent that a 60-percent allocation to equities will yield a higher return. In these cases the expected gain from a 60-percent allocation instead of 40, is about 25 percentage points in accumulated return over 15 years.

The corresponding figures for an increase to a 50-percent allocation to equities would be a probability of gain just in excess of 75 percent, a conditional expected value of such gain of about 12 percentage points, and a conditional expected value of any loss of about two percentage points.

The model simulations are based on normally distributed rates of return. In practise, we know that the distributions will be somewhat more skewed towards the tail ends than is the normal distribution. This means that the probabilities of extreme outcomes, both negative and positive ones, are underestimated by the simulations. The best basis for assessing the tail-end probabilities can be found in the historical data material we have presented above. However, we are of the view that the model estimates we have presented as to how the probability of a negative accumulated return changes when the equity portion is increased, are more reliable than our estimates of actual levels.

#### *Strategic choices made by other funds*

In order to benchmark our own assessments, we have studied the strategic choices made by six of the largest pension funds in the world. The table shows that all of these funds hold at least 40 % of their investments in equities, whilst also holding investments in other asset classes than those held by the GPF. None of them hold more than 44% of their investments in bonds.

<b>Strategic portfolio allocations made by large pension funds as per 2005</b>	Equities (incl. private equity)	Bonds (incl. inflation-linked bonds)	Real estate and infrastructure	Other asset classes
ABP (Netherlands)	40%	44%	12%	4%
PGGM (Netherlands)	50%	30%	12%	8%
CalPERS (United States)	66%	26%	8%	0%
New York State (United States)	65%	30%	5%	0%
Ontario Teachers' (Canada)	49%	23%	13%	15%
Caisse des Depots (Canada)	45%	39%	12%	4%

*The composition of the portfolios of large pension funds.*

The designated pension funds have clearly defined obligations to make future payments. The risk relating to such payments is normally the lowest if the capital of the funds is invested in bonds. Consequently, the composition of the portfolios of these funds can provide an indication as to how they evaluate the risk associated with a higher percentage of equities. We do not have full knowledge of which expected equity risk premium the funds have assumed in undertaking such evaluation, but as far as three of the funds are concerned we know that it is in line with the consensus view of a 2-3 percentage point premium over and above the return on government bonds.

The expenditure that the Government Pension Fund is intended to finance in the long run is less precisely defined, and the duration thereof is at least the same as that of the obligations of the abovementioned funds. This implies that it is less straightforward to conclude that bond investments offer the lowest risk. Moreover, the Government Pension Fund is at least as well diversified in relation to the objective of the Fund in foreign currencies, as are the pension funds in relation to their obligations in their local currencies. This suggests that the ability of the Government Pension Fund to absorb risk is at least as good as that of the large pension funds.

Some countries have in recent years established reserve funds for their government pension schemes. The purpose thereof is to create a reserve for when pension expenditure becomes very high, which in these countries will happen around 2020-2025. In other words, these funds have a time horizon for their investments which is similar to that of the Government Pension Fund. The below table shows that none of these funds have chosen an equity portion below 50%, and some of the funds hold a much higher percentage in the form of equities. None of the funds hold more than 44 % of their investments in bonds.

The table also shows the asset allocation of two endowment funds, the purpose of which are to contribute to financing the operation of two of the pre-eminent universities in the United States. These two funds are recognised as managing their assets well. What they have in common with the Government Pension Fund is that they have no specifically defined obligations, whilst their objective is a high level of return over time. These two funds hold low bond allocations and high allocations in alternative asset classes.

<b>Strategic portfolio allocations in reserve funds as per 2005</b>	Equities (incl. private equity)	Bonds (incl. inflation-linked bonds)	Real estate and infrastructure	Other asset classes
AP1 – AP4 (Sweden)	54-61%	36-40%	0-9%	0-3%
Fonds de reserve pour les retraites (France)	56%	44%	0%	0%
National Pension Reserve Fund (Ireland)	77%	13%	8%	2%
Canada Pension Plan <sup>4</sup>	61%	35%	4%	0%
NZ Super (New Zealand)	60%	20%	12%	8%
<b>- in endowment funds as per 2004</b>				
Harvard Endowment	43%	22%	10%	25%
Yale Endowment	47%	13%	20%	25%

*Composition of the portfolios of government reserve funds and endowment funds in other countries.*

The main impression from other funds that are facing more or less the same choice parameters as the Government Pension Fund is that these have chosen to assume more risk, both by way of a higher percentage of equities and by way of investments in other asset classes which involve more risk than bonds. The low percentage of equities and the high percentage of bonds held by the Government Pension Fund are indicative of more risk aversion than is common on the part of comparable funds.

*The role of new asset classes*

Later, the question will arise of whether part of the capital of the Government Pension Fund should be invested in new asset classes, such as, for example, private equity and real estate. We do not know what the conclusion will be in that respect, but it is evident that real estate would under any circumstance contribute to reducing the risk associated with the portfolio. It would be reasonable to include private equity in the equity portion, as has been done in the above tables. It follows from this that the percentage of equities will remain the most important decision-parameter as far as the level of risk assumed by the Fund is concerned, and we are of the view that the equity portion can in practise be evaluated independently from investments in new asset classes.

A practical observation is that any subsequent phase-in of investments in new asset classes would have to take place over a long period of time, thus implying that it is likely that such investments could be funded by new inflows to the Fund. In such case, investments in new asset classes would not trigger a need to sell equities or bonds.

*Summary*

The equity portion chosen must depend on the owner's attitude towards risk. The owner must weigh the expected gain from a higher percentage of equities against the risk that such a higher allocation to equities will result in a loss. The question which needs to be answered is whether the increase in the expected return is deemed to be sufficiently large to justify the increased risk associated with the portfolio.

2002 was the worst year for equities in the last hundred years. That year a 60-percent

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<sup>4</sup> Actual asset composition

allocation to equities instead of 40 would have reduced the return on the Fund by about 7.4 percentage points, or about 107 billion kroner given the current size of the portfolio. The best year for equities was 1975, when a 60-percent allocation to equities would have increased the return by 7.9 percentage points, or about 114 billion kroner.

A higher percentage of equities results in more volatile annual returns. Our model simulations, based on a lower expected equity premium than the historical average, indicate a probability of about 25 percent that a higher percentage of equities will result in a loss over a 15-year period. The conditional expected value of the loss is relatively modest. We estimate that the conditional expected value of the accumulated loss over 15 years is about five percentage points, if the allocation to equities is fixed at 60 instead of 40 percent. Based on current portfolio values, and without any new inflows, that would correspond to about 70 billion kroner.

On the other hand, we estimate in the model computations that there is a probability of about 75 percent that a higher percentage of equities will result in increased accumulated returns over a 15-year period. Under these outcomes, the expected gain from operating with 60 percent in equities instead of 40 percent is about 25 percentage points. Based on current portfolio values, that would correspond to about 350 billion kroner. Expected gains during favourable 15-year periods are significantly higher than the expected loss during unfavourable 15-year periods.

When calculating the expected excess return from a higher equity portion, we are weighting together the negative and positive outcomes. If we adopt the consensus view amongst large fund managers of an expected equity premium of no less than 2 percentage points ahead, an increase in the equity portion from 40 to 60 percent will increase the expected return on the Fund by at least 0.4 percentage point a year. This corresponds to about 6 billion kroner in the first year with the current portfolio, and about 135 billion kroner accumulated over 15 years.

Norges Bank is of the view that an overall assessment of historical evidence and our present market perception suggests that the percentage of equities held by the Government Pension Fund – Global should be increased. The Ministry of Finance should weigh the expected gain from a 50 or 60-percent allocation to equities against the increase in risk.

Yours faithfully,

Svein Gjedrem

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