

**Risk adjusted performance measurement of the stock-picking-activity in the Norwegian**

**Government Pension Fund Global**

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Author Note

This report is written on our own initiative on a pro bono basis. We have no economic incentives in writing it.

**Abstract**

In this report, we assess the performance of the stock picking portfolio of the Government Pension Fund Global (GPFG), hereafter SPP. The SPP is the most controversial part of Norges Bank Investment Management's (NBIM) mandate in managing the GPFG since it aims to ex ante identify winner and loser stock and hence outperform a passive benchmark. It has long been accepted in academia that this is very difficult, and the difficulty increases as a function of fund size (see, for example, Berk and Green (2004) and Fama and French (2010)). Given that NBIM is the largest sovereign wealth fund in the world, the aim to beat index strategies through stock picking, after costs, is ambitious. Given the costs of managing the SPP for NBIM are substantial, investigating the performance of the SPP is an interesting issue and an important public policy duty. Performance must be adjusted for the systematic risk taken. We highlight that in doing so, it is important to ensure that the set of risk factors and low-cost systematic trading strategies used in this adjustment span those of the benchmark of the portfolio manager being evaluated. We find no evidence that the SPP produces a positive alpha even before costs.

*Keywords:* Active Portfolio Management, Government Pension Fund Global, Norges Bank Investment Management, Passive Investing, Risk Adjusted Performance Measurement, Sovereign Wealth Funds, Stock Picking

## **Risk adjusted performance measurement of the stock-picking-activity in the Norwegian Government Pension Fund Global**

We are not the first to attempt to measure the performance of the SPP. Recent publications in this area have raised concerns regarding consistency in the findings of various reports. In particular, our current interest in the performance of this fund stems from the final report presented by Dahlquist and Ødegaard (2018), their interim report on the same subject and our earlier work on the same subject (see Hoddevik and Priestley (2017)).

With regard to the Dahlquist and Ødegaard (2018) report, we were surprised to see that the entire conclusion regarding the questions of whether the SPP provides value over and above its costs rests on the choice of a single reference portfolio from which to measure the relative return of the SPP. This extreme sensitivity of the results to the simple choice of a reference portfolio is worrisome and warrants further analysis. This is especially the case because *any* skill a fund manager might have should be present over and above *any* reference portfolio.

We start off with presenting performance measurement metrics that were recommended to Norges Bank Investment Management (NBIM) in the Dahlquist, Polk, Priestley and Ødegaard (2015) report. In particular, the report suggested the use of the five factor Fama and French (2015) model. The five factors are the excess return on the aggregate market portfolio, *erm*, the return on a high minus low book to market portfolio, *hml*, the return on a small minus big market capitalization portfolio, *smb*, the returns on a profitability portfolio, *rmw*, and the return on an investment portfolio, *cma*. A measure of performance is the alpha from the following regression:

$$r_t - r_{b,t} = \alpha + b_1 * erm_t + b_2 * hml_t + b_3 * smb_t + b_4 * rmw_t + b_5 * cma_t + u_t$$

This is a global, developed market, asset pricing model in the sense that it uses risk factors that are constructed from stock returns of companies listed in equity markets in the developed world. The factors exclude equity markets from developing countries.

Fama and French (2015) note that the model tends to perform better at a regional level in the sense that if you want to assess the risk and returns in a particular region in the world, it is necessary to use risk factors constructed using equities from that region. That is, the global model might leave unpriced some assets from particular regions because of, for example, a lack of regional or country level stock market integration. This is an important issue and will have important implications for the measurement of performance of the SPP because the benchmarks that are available internally in NBIM include equities from both developed and developing markets. We know that the five factors above, constructed from developed equity markets cannot price developing market equity returns (see Fama and French (2015)). Therefore, if the SPP has a benchmark that includes developing market equity and the equity manager invests in developing market equity, this return will be unpriced and potentially will end up in the alpha estimate above. In fact, if the benchmark included assets that are unpriced by the factors (say to, for example a lack of country specific or regional stock market integration) then there is a reasonable claim that the benchmark itself should be included as a factor when assessing performance measurement (see Fama and French (2010)). This is the very approach we took in Hoddevik and Priestley (2017) where we found a negative estimated alpha.

The issue of the role of the benchmark in terms of measuring fund management performance is very important for the SPP because we know, ex ante, that the benchmark portfolio (reference portfolio) includes assets not included in the Fama and French (2015) global five factors. From NBIM reporting we also know that while the benchmark portfolio contains

Chinese H- and N-shares (shares listed in New York and Hong Kong), NBIM invests in Chinese A-shares (onshore shares listed on the Shanghai and Shenzhen-exchanges) which are hardly part of the benchmark portfolio. We know that SPP managers invest in assets from these markets.

Given the construction of the five global Fama and French factors, the constituents of the reference portfolios and the universe of assets open to the managers of the SPP, we need to ask how do we provide a fair analysis of the performance of SPP? The first is to address the issue of what the mandate is for the SPP managers. We know that they are able to invest in emerging market equity. This makes up part of both the strategic equity benchmark (SEB) and the stock picking benchmark (SPB). Fund managers can always enhance expected returns relative to a benchmark through either leverage or investing in high beta stocks that are part of the benchmark. Whilst the former can be presumably ruled out from NBIM, the latter is open for NBIM's managers to exploit and could easily result in a higher average return than the benchmark. However, it should be noted that this does not mean that the manager has skill or should be rewarded for this. Thus, we need to make sure that we adjust the risk and return of the managed portfolio for such practices. We could achieve the same higher return at low cost, by adjusting the benchmark and then indexing to the new benchmark. It is important that policy makers always have in mind the fact that returns in themselves do not represent value creation or skill. It is naïve and wrong to assume that a fund adds value because it delivers some basis points higher return than the benchmark. These excess basis points can be achieved passively with a simple rewriting of the weights in the benchmark.

As mentioned, we know there are important aspects of the SEB not covered by the Fama and French factors. The SEB has an overweight to European stocks compared with the portfolio underlying the five factors, and importantly, it holds emerging markets exposure not covered by

the five factors. Regarding the SPB, we actually do not know much about its composition. We do not know how NBIM has chosen to tilt the SPB across dimensions such as industry, geography, size and other relevant dimensions both within and beyond the scope of the SEB in the universe of global stocks.

It is essential that the set of risk factors and low-cost systematic trading strategies span those of the benchmark of the portfolio manager being evaluated. One way to do this is to include the benchmark portfolio as a factor on the right-hand side of the regression to control for omitted factors. This is the approach taken in Hoddevik and Priestley (2017) and leads to negative estimated alphas. Empirically, to assess the extent of whether the benchmark portfolios are priced by the factors we can simply regress the return of the benchmark on the factors.

We use the same sample period as Dahlquist and Ødegaard (2018) to be able to make direct comparisons. Table 1 reports these results and shows that neither the stock picking benchmark nor the strategic equity benchmark are well explained by the five factors. In both cases the alpha is large, negative and statistically significant. This suggests one or more underlying omitted factors. In the case of the SEB, this is not surprising given that we know it includes assets from emerging markets.

NBIM have developed and publish factors for measuring exposure to the credit risk and interest rate risk in the GPFG's bond portfolios, termed DEF and TERM. These are included in Ø&D's analysis. We find however that they make little difference, suggesting they are not important. This finding supports the recommendations of the Dahlquist, Polk, Priestley, and Ødegaard (2016) report that when assessing equity returns, only equity factors should be used.

We then introduce two additional factors to catch developing market risk and return. One factor is the return on China A shares (MSCI China A index) and the other factor is the return on

a general emerging markets portfolio (MSCI Emerging Markets index). In both cases, we see that they are important in explaining the return on the benchmark portfolios. For the stock picking benchmark, the alpha falls from a statistically significant estimate of -0.397 to a statistically insignificant -0.118 and both the return on the China A factor and the return on the emerging market factor are statistically significant explanatory variables. This suggests we have found a reasonable model for the SPB by including these two factors.

For the strategic equity market benchmark, we find that the alpha falls from a statistically significant -0.232 to -0.113 which remains statistically significant. The return on the emerging market factor is highly statistically significant and the return on the China A factor is marginally statistically significant.

Overall, the results in Table 1 indicate that the two equity benchmarks are not spanned by the five Fama and French (2015) developed market factors. This finding leads to the question of how we should evaluate the performance of the fund's equity investments in general and the SPP in particular. Following Fama and French (2010), deciding on which factors to include on the right-hand side of a performance regression is not the same as choosing the set of factors that describe the cross section of expected returns in a rational asset pricing sense. These two questions are different. Performance evaluation is about asking whether a manager can produce alpha after considering any other mechanical trading portfolio. In this sense, any factor that is a low cost mechanical trading strategy can be used to provide a measure of alpha.

One solution is to include the reference portfolio as a factor on the right-hand side when the reference portfolio is not a traditional factor. The advantage of this is that it captures the simple technique that an active portfolio manager may employ of beating their benchmark by overweighting high beta stocks (with respect to the benchmark) and underweighting low beta

stocks. This entails no skill and hence including the benchmark would eliminate a false conclusion that the managers of the SPP can generate alpha.

The portfolio manager's benchmark is rarely included when assessing the performance of a portfolio manager. The reason for this is that the benchmark is usually the aggregate market portfolio and hence is already included as a factor. However, for NBIM the benchmark portfolio is not a market portfolio (as the results in Table 1 illustrate). Therefore, it is reasonable to include that benchmark.

An alternative to including the benchmark as an additional factor, is to identify and include those additional factors that explain the benchmark. In this case we should include the returns on the China A factor and the return on the emerging market factor. This approach seems less controversial since some commenters seem to confuse the market portfolio (*erm*) with the benchmark portfolio. Furthermore, the China A and emerging market portfolio can be easily bought at relatively low cost, and investment in these assets in accordance with their topical reference indices should not warrant skill<sup>1</sup>.

There is a further question that needs to be addressed and this is which benchmark should the returns on the SPP be made relative to? In one sense this does not matter. The whole point of a skillful fund manager is that he can beat any passive benchmark, as discussed above. It would not make sense to reward a fund manager simply for beating something that can be passively implemented. By definition, both the stock picking benchmark and the strategic equity benchmark are passive portfolios in the sense that they are ex ante known and replicable at low cost. Therefore, it is reasonable and perhaps instructive to compare the performance of the SPP relative to both passive portfolios.



Table 2 reports the results from estimating the 5 factor Fama and French model and a version of the model augmented with the return on the China A factor and the return on the emerging market factor. The second column presents the results when taking the return on the SPP relative to the stock picking benchmark and follows the methodology in the Dahlquist and Ødegaard final report. We also find a positive, although statistically insignificant alpha of 0.074 which is 0.89% per annum. When we include the return on the China A factor and the emerging market factor the alpha turns negative, although also statistically insignificant, to a value of 0.25% per annum. The fourth and fifth column report the results when measuring the return on the SPP relative to the strategic equity benchmark. The fourth column is the five factor results and produces a negative alpha of -1.1% per annum which is again statistically insignificant. These results mirror the findings in Dahlquist and Ødegaard's interim report. It is obvious that Dahlquist and Ødegaard cherry picked the positive alpha for the final report. There is no reason for doing this apart from being able to conclude that the SPP outperformed the market and added value to the fund. This is clearly not the case. An alternative and passive benchmark yields a negative alpha. In the final column we adjust for the return on the China A factor and the return on the emerging market factor, also producing a negative alpha.

Of the four models that we produce, three provide a negative alpha one a positive alpha. None are statistically significant, and all are before costs. There is only one conclusion to draw from this: the SPP does not outperform either passive benchmark. At best, we can say the alpha is zero before costs. Given costs are statistically significant and account for about 50% of the total cost of managing the GPFG (see NBIM (2017), p. 47), it is clear that this portfolio underperforms a passive strategy. The total cost of managing the GPFG was NOK 4,7 bn in 2017.

We also note (untabulated) that if we do not include the China A factor and the emerging market factor but include the benchmark portfolio on the right hand side of the five factor model, the alpha in column two becomes negative as it does if we include the benchmark portfolio that is orthogonal to the 5 factors, thus removing any concerns about potential collinearity between the benchmark and the factors.

Table 3 reports results from considering the estimation of the alphas from two other popular factor models. The first one is the international version of the Fama and French three factor model

$$r_t - r_{b,t} = \alpha + b_1 * erm_t + b_2 * hml_t + b_3 * smb_t + u_t$$

The second one is the Carhart model that includes a momentum factor (wml) along with the three Fama and French factors:

$$r_t - r_{b,t} = \alpha + b_1 * erm_t + b_2 * hml_t + b_3 * smb_t + b_4 * wml_t + u_t$$

Again, we find consistency across these factor models. For example, of the eight alphas in Table 3 all four of them that include the China A shares factor and the emerging market factor are negative and two that do not include them are also negative. None of the alphas are statistically significant and all of the alphas are reported before costs are subtracted.

It is clear from the results in Tables 2 and 3 that the SPP has not created value for the GPGF. The estimated alphas are negative and this is before costs are subtracted. Given that the costs of managing the SPP are substantial and this produces at best a zero additional return and at worst loses money, it is difficult to understand why the Ministry of Finance on behalf of the Norwegian public would continue to ask NBIM to use resources to finance this activity.

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Footnotes

<sup>1</sup>Note that trading in such securities historically has been hampered by the Chinese government allocating only limited quotas to foreign investors wanting to trade in mainland Chinese shares. However, NBIM has had such a quota and thus retained the ability for such trading over the entire history we are considering. Further, such restrictions have been significantly loosened over the years. Today, investing in such equities can be performed almost without friction through a system called "Stock Connect", with settlement in the offshore RMB (CNH) currency, as opposed to the domestic and controlled currency (CNY).

## Tables

Table 1

## Explaining Benchmark Portfolios

	SPB	SPB	SPB	SEB	SEB	SEB
alpha	-0.397*	-0.403*	-0.118	-0.232*	-0.231*	-0.113*
erm	1.088*	1.071*	0.863*	1.052*	1.043*	0.951*
hml	0.400*	0.439*	0.191*	0.164*	0.199*	0.069*
smb	0.063	0.028	-0.125*	0.046	0.012	-0.037
rmw	0.556*	0.435*	0.069	0.319*	0.232*	0.111*
cma	-0.384*	-0.455*	-0.308*	-0.213*	-0.283*	-0.169*
defadj		0.021			-0.009	
term		0.136**			0.093*	
chin			-0.029*			-0.099**
emg			0.220*			0.096*

*Note:* SPB indicates Stock Picking Benchmark. SEB indicates Strategic Equity Benchmark. The table shows results from explaining the monthly returns of these two benchmarks with varying sets of explanatory variables. erm, hml, smb, rmw, cma are all prof. Kenneth French's international research factors and were collected from his website during March 2018. defadj and term are factors as delivered by NBIM, chin is the MSCI China A-shares net index in USD, emg is the MSCI Emerging Markets net index in USD. All returns are monthly and in USD. Estimation period covers the interval Jan 2013 – Jun 2017. \*, \*\* indicate statistical significance at 5% and 10 % levels of confidence, respectively. Standard errors are adjusted for serial correlation with Newey-West/Bartlett Window and 1 Lags, following Newey and West (1987).

Table 2

## Performance

	SPB	SPB	SEB	SEB
alpha	0.074	-0.021	-0.090	-0.026
erm	0.036**	0.104*	0.072*	0.015
hml	-0.033	0.029	0.204*	0.151*
smb	0.014	0.073	0.031	-0.015
rmw	-0.181*	-0.018	0.054	-0.059
cma	-0.077	-0.080	-0.248*	-0.219*
chin		0.017*		-0.003
emg		-0.071*		0.053
R2	0.24	0.34	0.32	0.33

*Note:* SPB indicates Stock Picking Benchmark. SEB indicates Strategic Equity Benchmark. The table shows results from explaining the excess monthly return of the SPP over the respective benchmarks with varying sets of explanatory variables. erm, hml, smb, rmw, cma are all prof. Kenneth French's international research factors and were collected from his website during March 2018. defadj and term are factors as delivered by NBIM, chin is the MSCI China A-shares net index in USD, emg is the MSCI Emerging Markets net index in USD. All returns are monthly and in USD. Estimation period covers the interval Jan 2013 – Jun 2017. \*, \*\* indicate statistical significance at 5% and 10 % levels of confidence, respectively. Standard errors are adjusted for serial correlation with Newey-West/Bartlett Window and 1 Lags, following Newey and West (1987).

Table 3

## Alternative Factor Models.

	Alpha
SPB 3F	0.014
SPB 3F+2	-0.041
SPB 4F	0.033
SPB 4F+2	-0.021
SEB 3F	-0.113
SEB 3F+2	-0.084
SEB 4F	-0.075
SEB 4F+2	-0.055

*Note:* SPB indicates Stock Picking Benchmark. SEB indicates Strategic Equity Benchmark. The table shows the alpha-estimate from regressing the excess return of SPP over the indicated benchmark. 3F is the standard Fama French 3-factor model. 4F is this, compounded by Momentum (WML). “+2” means adding China and Emerging Markets. The table shows the alpha when explaining the excess monthly return of the SPP over the respective benchmarks with varying sets of explanatory variables. All other details are as specified for Table 2.