

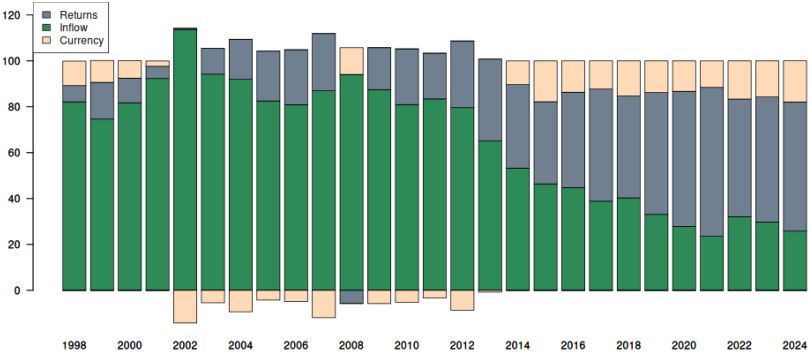
NBIM - empirics

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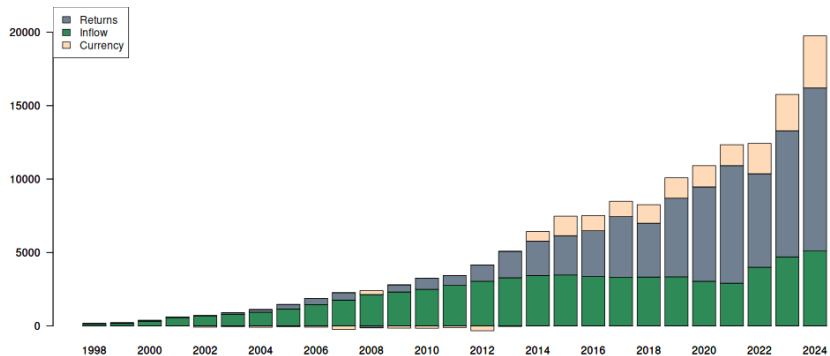
University of Stavanger

19 May 2025

Fund Value - by source - percent



Fund Value - by source

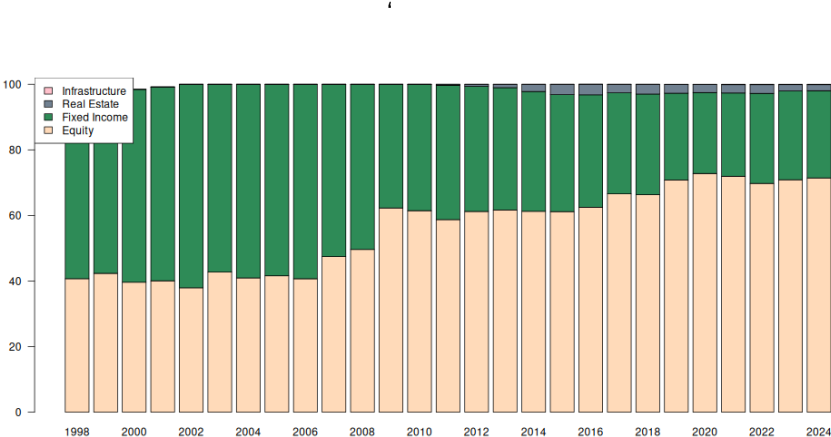


Market values in mill NOK

Fund value – Asset Distribution

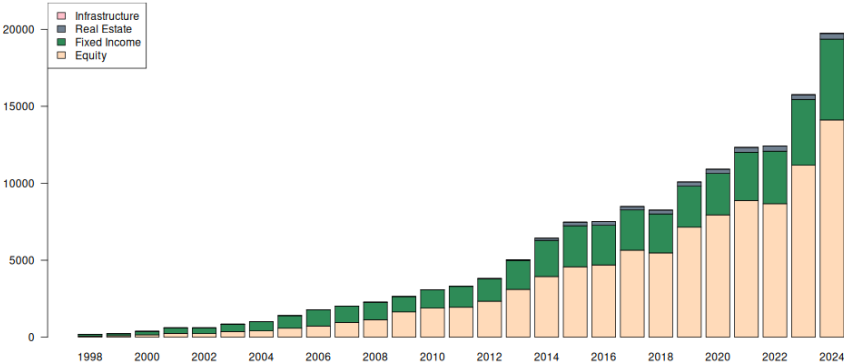
- ▶ 1998: 40% equity / 60% Fixed income
- ▶ 2007: 60% equity / 40% Fixed income
- ▶ then 60% equity / 40% Fixed income (some real estate)
- ▶ current: 70% equity / 30% Fixed income (some real estate, some infrastructure)

Market values by asset class, percent



Percentage of annual wealth by asset class.

Market values by asset class



Percentage of annual wealth by asset class.

Fund performance – wealth relatives

Evaluate performance using

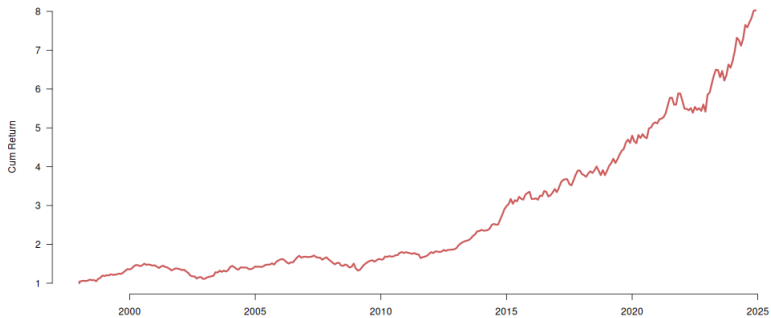
Cumulative return

how much one NOK will grow to if earning the return produced by the fund.

$$W_{p,T} = \prod_{t=1}^T (1 + r_{p,t})$$

($r_{p,t}$ – return)

Fund performance – wealth relatives - Total portfolio

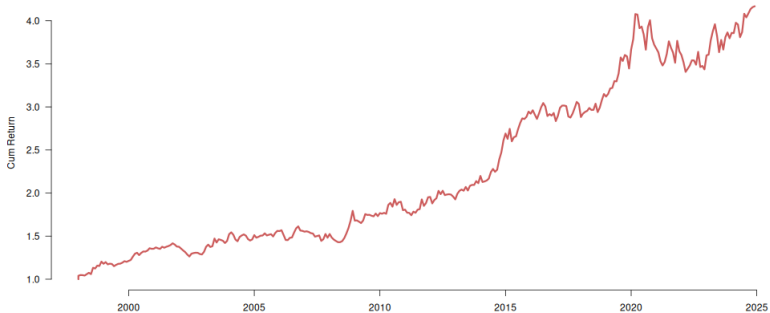


Fund performance – wealth relatives – Equity portfolio

4



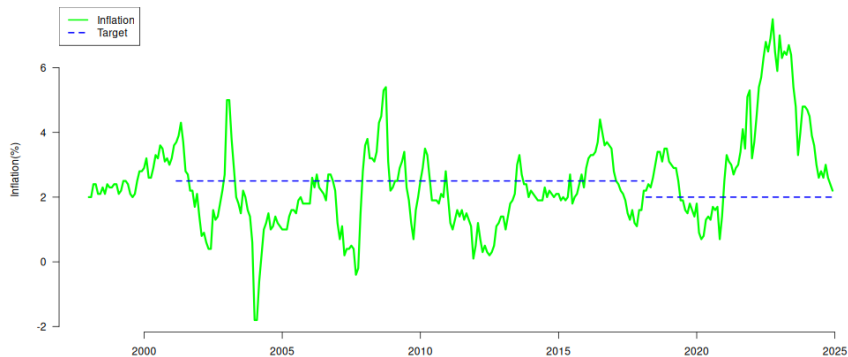
Fund performance – wealth relatives – Fixed income portfolio



Inflation adjusted returns

Return are meant to maintain value – one question – does it cover inflation?

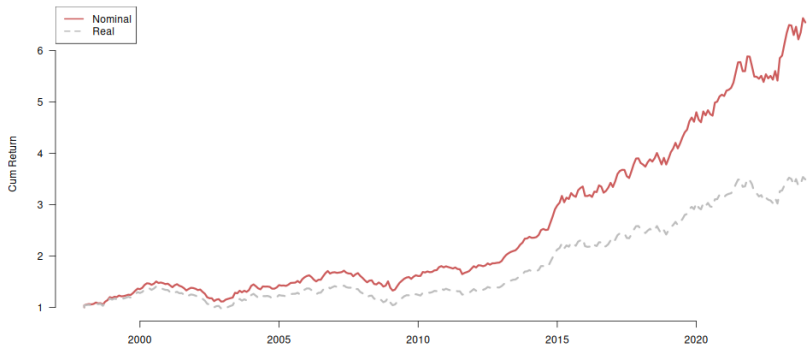
Inflation (with inflation target)



Annualized inflation. Source SSB. 12 month moving average.

Inflation adjusted returns

Wealth increase in Nominal and Real terms



Value increase of GPF total portfolio. Line in red in nominal terms. Line in grey in real terms.

Evaluation

Evaluate the fund's investment decisions.

Does the fund generate returns compatible with the risk it is taking on?

What would be an alternative? Invest in the target benchmark.

The investment decisions of the fund should be “beating” the benchmark.

Can evaluate that by looking at the *difference* return, the difference between the portfolio return and the benchmark return $r_{b,t}$

$$r_{diff,t} = r_{p,t} - r_{b,t}$$

Aggregate wealth, Total, USD

Evolution of portfolio and benchmark



Aggregate wealth, Difference portfolio, Total, USD

Evolution of difference portfolio



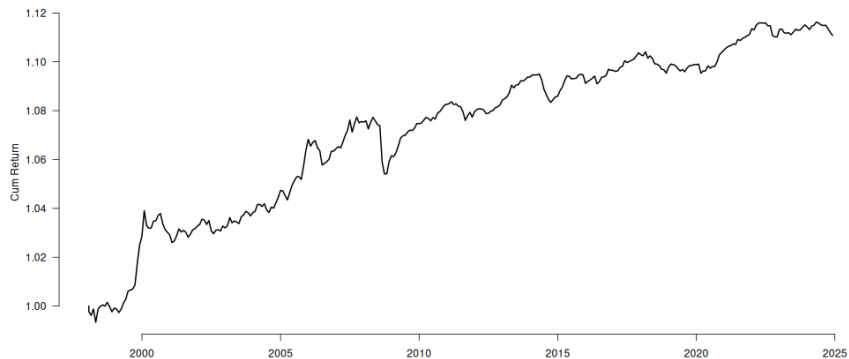
Aggregate wealth, Equity, USD

Evolution of portfolio and benchmark



Aggregate wealth, Difference portfolio, Equity, USD

Evolution of difference portfolio



Aggregate wealth, Fixed Income, USD

Evolution of portfolio and benchmark



Aggregate wealth, Difference portfolio, Fixed Income, USD

Evolution of difference portfolio



Difference portfolio visual representation of how good a job asset manager does in

- ▶ matching, and (preferably)
- ▶ beating

the reference portfolio (index).

How to ask if these asset managers are doing a good job?

The task of *Portfolio Performance Measurement*.

Methods for Measuring Portfolio Performance

There is no single, unambiguous measure that can be used to evaluate Portfolio Performance.

Instead, a menu of many different measures, all informative, but not guaranteed to agree.

Relating to this menu:

Enough material for a master's level course in Investments.

Some Examples

- ▶ Sharpe Ratio
- ▶ Treynor Ratio
- ▶ Jensen's Alpha
- ▶ Information Ratio
- ▶ Appraisal Ratio
- ▶ Fama French 3-factor model
- ▶ ...

Example – Alpha estimation

Alpha is an attempt to answer the question: Does the return on a portfolio/asset exceed its *required* return?

Jensens alpha is the difference between actual performance and required return

$$\alpha_p = r_p - \text{required return} = r_p - \hat{r}_p$$

To find an estimate of required return an asset pricing model is required.

The classical such asset pricing model is the CAPM, which is what Jensen used

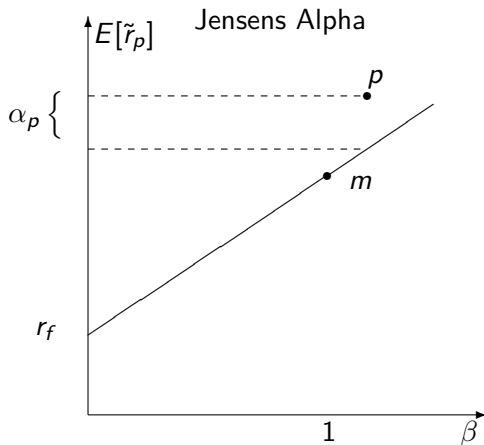
$$\hat{r}_p = (r_f + \beta_p(r_m - r_f))$$

Alpha is then

$$\alpha_p = r_p - (r_f + \beta_p(r_m - r_f))$$

Alpha estimation

Graphically:



The CAPM is not the only possible asset pricing model. Models such as the Fama-French three and five factor models are common alternatives.

If $\alpha_p > 0$, this is interpreted as positive performance.

Alpha estimation of difference portfolio

NBIM portfolio evaluated by asking whether it “outperforms” the benchmark b :

$$r_{pt} - r_{bt} = r_{diff,t} = \alpha + \beta(r_{mt} - r_{ft}) + \varepsilon_t$$

	<i>Dependent variable:</i>		
	One Factor	diffRp Three Factors	Five Factors
Constant	0.0003** (0.0001)	0.0003*** (0.0001)	0.0003*** (0.0001)
RMRF	0.017*** (0.002)	0.016*** (0.002)	0.012*** (0.003)
SMB		0.040*** (0.005)	0.038*** (0.006)
HML		-0.015*** (0.004)	-0.002 (0.006)
RMW			-0.002 (0.007)
CMA			-0.025*** (0.009)
Observations	293	293	293
Adjusted R ²	0.141	0.200	0.213

Magnus Dahlquist and Bernt Arne Ødegaard. A Review of Norges Bank's active management of the Government Pension Fund Global. Technical report, Report to Norwegian Ministry of Finance, January 2018. URL <https://www.regjeringen.no/no/aktuelt/ekspertrapporter-om-spu/id2585465/>.