

Sovereign Wealth Funds: the Norwegian Experience

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Sovereign wealth funds have rapidly become significant international institutions. The performance of funds varies substantially across countries, but comprehensive and systematic analyses of funds have been hampered by the lack of transparency of most funds. The relative transparency of the Norway Fund allows us to do an econometric analysis of the Fund's performance. The record resembles that of a mutual fund that has taken on greater risk over time. There is no evidence that the Fund has disrupted foreign financial markets more than mutual funds do. There remains a question as to whether the Fund and its Finance Ministry have been effective agents for the Norwegian citizens whose assets they are managing. JEL F21, F30, F33

Sovereign Wealth Funds (SWF) have rapidly become prominent international financial institutions. They are large relative to other types of institutional investors, they have grown rapidly over the last 10-15 years, and they are forecast to grow substantially in the future. Total assets held by SWFs have been estimated to be around \$3 trillion (Jen, 2007). This value is greater than the total assets of hedge funds (\$2 trillion) but less than total official monetary reserves of central banks (\$6 trillion). The IMF projects that assets held by SWFs could reach \$6-\$10 trillion by 2013 (IMF, 2008). Norway, Saudi Arabia, United Arab Emirates, and Kuwait have the largest national funds (See Table 1). Oil and gas revenue is the main source for most funds with the exception of China and some Asian exporters.

It is instructive to ask what are the economic implications of large and growing SWFs for world financial markets and for citizens of countries in which SWFs reside. Because information about many SWFs is extremely limited, it has not been possible to carry out systematic analyses of the actual behavior of the funds. The literature on SWFs is almost exclusively descriptive and anecdotal. Data limitations preclude a

comprehensive statistical analysis that would include all the large SWFs, but the openness of the Norway Fund provides an opportunity to study one of the largest funds. Monthly data on rates of return and risk allow us to analyze the dynamics of the Norway Fund's investment policy. SWFs continue to evolve as institutions, and better understanding of the effects of the Norway Fund, would provide valuable information about the possible economic effects of other SWFs, if they followed the behavior of the Norway Fund.

In this paper we analyze the performance of the Norwegian Fund and its effects on world capital markets and on Norwegian investors. Has the performance been different from that of a typical private mutual fund? How risky has the Fund been relative to alternative investors? The Fund managers downplay the risk of their actual portfolio by regularly comparing their portfolio with a benchmark portfolio chosen by the Finance Ministry. We find that the rate of return earned by the Fund was higher than the average return for the world stock market, but the Fund portfolio was also riskier than the world stock market. The benchmark portfolio is also riskier than the world stock market, so comparing the actual and benchmark portfolios does not provide useful information about risk relative to broader feasible portfolios. During the sample period for our econometric analysis (1998-2005), the Fund moved toward a riskier portfolio. This trend continued into 2008, and it may have contributed to the large losses suffered in October 2008 from investments in Lehman Brothers and Washington Mutual Bank.

Section I discusses sovereign wealth funds in general. Section II considers issues of transparency. Section III delves into specifics of the Norwegian Pension Fund. Section IV presents descriptive statistics for the Norwegian Fund for the sample period and compares the actual portfolio with a synthetic portfolio. It analyzes the evolution of returns through time by using threshold regression analysis. Technical details are presented in an Appendix.

I. Sovereign Wealth Funds: Definition and Functions

SWFs are government investment funds that differ from central banks and pension funds. They do not need short-term liquid assets that central banks require for foreign exchange market intervention. They do not have the same specific future liabilities as pension funds. SWFs are difficult to understand and analyze because some funds combine the functions of central banks and SWFs in a single institution. Goals may vary across SWFs, and many have failed to state clear goals. Norway has sought to provide clarity by creating a separate fund within the central bank and by assigning a clear goal to the fund. The goal is maximum income subject to a level of risk and certain portfolio constraints specified by its Ministry of Finance. The Norwegian government has acknowledged the transitory nature of oil revenue. Crude oil production in the North Sea has been declining steadily since 2001, and oil prices have been extremely erratic. One purpose of the Fund is to allow Norwegians to smooth the pattern of their spending relative to the volatile pattern of the nation's oil revenue. Some governments (Russia) have recently spun-off separate SWFs from their central banks and others (Japan, India) are considering establishing separate institutions (Farrell et al 2008). Not all oil exporters are saving part of current revenue for future uses. Mexico uses 80% of the revenue of its national oil company (Pemex) to finance 40% of the national government's current budget (Economist 2008).

Since oil and natural gas are important sources of revenue, the size and future growth of SWFs are contingent on prices for energy (Farrell et al 2008). Oil prices

fluctuated dramatically from \$20 per barrel (in 2008 prices) in 1998 to \$147 per barrel in July 2008 to less than \$80 in October 2008. The recent volatility followed a large and sustained price decrease from 1980 (price over \$100 per barrel in 2008 prices) to 1998 (Brown et al 2008). Fuel exporting countries experienced an increase in their collective balance on current account from approximately zero in 1997 to more than \$420 billion in 2006 (Cooper, 2008). Volatile prices have also produced volatile real incomes for specialized oil exporters. From the peak in oil prices in 1981, Saudi Arabia's real per capita income in 1987 fell to 70% of its 1980 value, and it did not return to its 1981 value again until 2003 (IMF 2008). Sovereign Wealth Funds can be used to stabilize the consumption patterns of oil exporters.

For non-oil exporters such as China and Japan, the future size of SWFs and monetary reserves depend on exchange rate policies. China's policy of resisting appreciation of the Yuan has resulted in total monetary reserves of \$1.81 trillion at the end of June 2008, an increase of \$1.6 billion per day in 2008 (Cheng and Batson 2008). Thus, the future importance of SWFs could diminish if oil prices fell, and if China and Japan adopted more freely floating exchange rates. The economic impact of SWFs derives from current account imbalances that are partially a result of extraordinarily high energy prices. If energy remained expensive and SWFs disappeared, one would have to ask how alternative institutions (central banks, mutual funds, etc) would allocate the same total assets.

Some critics claim that SWFs may carry out the policy goals of investing countries at the expense of host countries. Calls for protectionism against the influence of SWFs have been widespread. French President Nicolas Sarkozy told the European parliament that he did not want European companies to be acquired by non-European owners (New York Times 2008). Ownership of private firms by foreign government entities could adversely affect corporate governance. If government owners exercise their voting rights, they could introduce political considerations into business decisions. If owners refrain from voting their shares, they could strengthen the power of corporate managers relative to shareholders. To address these issues the IMF has formed a Working Group of Sovereign Wealth Funds that includes all the major SWFs. They established a voluntary code of best practices called the Santiago principles that appear on the website of the Working Group. Their emphasis is on avoiding adverse effects of SWF investments in host countries.

An alternative view would assign SWFs a stronger responsibility for promoting the interests of businesses and governments in host countries by investing in distressed firms that would not qualify for commercial loans. This role would partially substitute SWFs for traditional national and international dispensers of aid. However, managers of SWFs face an agency problem as the interests of their own citizens will sometimes conflict with those of host country residents. Recent large losses by SWFs from investments in distressed firms (Lehman Brothers, Washington Mutual) have provoked strong criticism in source countries such as Norway, China, and Kuwait (FT 2008), even though the investments have been described as "stabilizing" by some observers (IMF, 2008).

II. Transparency

Understanding the behavior of SWFs is difficult because many funds provide limited public information. Transparency ranges from the Norway Fund, which is a model of openness (Truman), to other funds that do not even give precise figures about the total assets of funds. For example, public estimates of the size of the United Arab Emirates Fund range from \$250 billion to \$875 billion (Table 1). Some funds do not clearly separate central bank and SWF assets, and others do not clearly separate government-owned assets from personal assets of private family members. Some funds provide little information about specific assets they own and about the rates of return and risk from holding them. The frequency and reliability of reports also vary substantially across funds. More than 30% of SWFs do not publish annual reports or submit to audits by reputable outsiders (Truman 2007). Certain direct loans from SWFs to prominent private firms (Merrill Lynch, General Electric, and Lehman Brothers) have received great attention in the press, but it is difficult to know whether these high profile anecdotes are typical investments by SWFs. However, there are limits to the transparency of SWFs. If SWF portfolio managers are required to provide more public information about their portfolios and trades than their private rivals, they may be unable to earn comparable rates of return relative to risk.

We do know from data on Norway and the more open funds that the composition of SWF portfolios is different from those of central banks. They hold fewer fixed income assets relative to equities, and their fixed income assets have longer maturities and a smaller share is denominated in US dollars. If portfolios of SWFs generally follow this pattern, continued growth of SWFs could contribute to a reduction in capital flows to the United States, real depreciation of the U.S. dollar, and an increase in U.S. interest rates. The staff of the IMF has done preliminary simulations on the possible magnitude of the effects of a portfolio shift of this type on dollar exchange rates and interest rates. (IMF 2008). Better information about investment practices of SWFs would allow comparison with other factors that influence capital flows, such as improvements in the efficiency of Asian capital markets (Forbes 2008, Cooper, 2008).

III. Norway Fund

Lack of transparency and incomplete data make it impossible to perform an objective analysis of most SWFs. However, the Norway Fund is a prominent exception. The Fund has publicly stated economic goals prescribed by its government, and it faces specific constraints on portfolio choice from its Ministry of Finance. The Fund provides rather comprehensive information about its activities that allows outsiders to objectively evaluate its practices. Thus, the Norway Fund provides an excellent opportunity to systematically evaluate the performance of one of the largest Sovereign Wealth Funds.

Norges Bank Investment Management (NBIM) was formed in 1998 as a separate agency within the Norwegian central bank (Norges Bank) responsible for investing the Fund's assets. It evolved from the Petroleum Fund that was established in 1990, and its current name is the Government Pension Fund-Global. Its goal is to earn the maximum income relative to the level of risk that the Finance ministry varied over time. The Fund was first authorized to invest in equities in 1998, and the allowable equity share was increased from 40% to 60% in 2007. The actual equity share was increased gradually, and it reached 50% in the second quarter of 2008. The Fund was authorized to hold non-government bonds in 2002 and real estate and private equity in April 2008. Finance

Minister Halvorsen publicly endorsed the movement toward a broader set of assets (Financial Times 4-20-08). Accountability is partially insured by requiring that the Fund's actual portfolio remain close to a benchmark portfolio specified by the Finance Ministry. Fund management regularly compares the performance of its portfolio with the benchmark portfolio, and it seems to interpret staying close to the benchmark portfolio to mean it is not taking excessive risks. This interpretation seems to ignore the fact that both actual and benchmark portfolios have become increasingly risky over time. Large losses associated with holdings of Lehman Brothers assets in 2008 are tangible evidence of the Fund's increased exposure to risk (Financial Times 2008, Aftenposten 2008). Recent losses also contradict the observation of an IMF spokesman that Fund strategy "ensures risk diversification and good financial returns (IMF 2008c).

NBIM faces other specific limits on its portfolio, such as the percentage of assets denominated in specific currencies and the maximum percentage (5%) of a single firm's shares that may be owned. The Fund is not allowed to make domestic investments. The Ministry of Finance restricts investments to socially responsible firms by publishing a list of ineligible firms and the reason for exclusion. For example, as of March 31, 2008 Walmart was excluded for breaches of human rights, Boeing was excluded for producing nuclear weapons, and Raytheon was excluded for producing cluster munitions (NBIM Quarterly Report 2008Q1). Certain "socially responsible" mutual funds have imposed similar restrictions on their funds.

To achieve transparency, The Fund makes quarterly reports of its activities and makes them available on specified dates on its website. Annual Reports provide more detail, and the Fund published its first Ten Year Report at the end of 2007. The NIMB hires both external and internal portfolio managers, and detailed management expenses are reported. At the end of the first quarter 2008, 15% of the assets were managed by external managers, and they accounted for 50% of the expenses. At the end of 2007 external managers from 25 firms managed equity funds, and external managers from 22 firms managed fixed income assets. External managers are identified by firm and responsibility (equities, fixed income, region, industry), and they are compensated on the basis of performance. Employees are not exclusively Norwegian nationals, and the Fund has offices in London and New York, as well as Oslo. The actual performance of the Fund is a result of decisions of many individual portfolio managers operating within general guidelines set by the government. Data reported are for the total portfolio of the Fund, not the portfolios of individual managers. Results for the aggregate portfolio may be quite different from the results for individual managers, as shown in a study of portfolio management by Swedish households (Calvet et al 2008). Top management of NBIM changed in 2008, as Yngve Slyngstad replaced Knut Kjaer, who had headed the Fund since its inception.

Quarterly reports give the percentage of equity and fixed income assets and the credit ratings of fixed income assets. For example, at the end of the first quarter 2008, 49% of the fixed income instruments were rated Aaa by Moodys. Annual reports provide more detail, including the value of equities and bonds by firm or borrower held by the Fund. Managers of SWFs are reluctant to give more frequent reports of specific asset holdings, because they may be at disadvantage relative to competing funds. This issue arose in September 2008 when the Financial Times (September 28) reported large losses by the NBIM on holdings of Lehman Brothers securities, but NBIM managers refused to reveal their specific holdings.

IV. Performance of the Norway Fund 1999-2005

Descriptive Statistics

The NBIM has been identified as the most transparent SWF (Truman 2007), and its transparency allows outsiders to do a systematic analysis of the Fund's performance. An analysis of Norway's experience could provide useful information about the economic effects of other SWFs, if they followed the Norwegian model. The NBIM has provided monthly data, 1999-2005, on rates of return and risk for its actual portfolio (AP) and for the benchmark portfolio (BP). It also provides separate rate of return and risk data for equity (AE) and fixed income assets (FA). The regular and timely reporting of the detailed data demonstrates that the NBIM has been transparent. The fact that the Fund has not violated the constraints imposed by its government demonstrates accountability. Analysis of the data will allow us to determine whether the Fund's behavior has been fundamentally different from that of other large institutional investors in international financial markets.

Table 2, lines one through six, shows the average rate of return per month and risk over the entire sample period (1999-2005) for actual and benchmark portfolios, actual and benchmark equity portfolios, and actual and benchmark fixed income portfolios. Since the NBIM has been authorized to hold a portfolio of 60% equity and 40% fixed income assets, Line seven shows the rate of return on a synthetic portfolio of 60% stock (Morgan Stanley World Index) and 40% fixed income (U.S. Treasury bills) that could have been selected without management expertise. Line eight shows the return on a representative "riskless asset", represented by U.S. Treasury bills. U.S. government Treasury bills are approximately riskless in USD. In addition to FX risk, the NBIM fixed assets are subject to interest rate risk from holding long-term bonds and default risk spread. Only half of fixed income assets are rated Aaa. Line nine is the return on the world stock market, represented by the Morgan Stanley All World Index (AWMSCI).

The timing for NBIM's entry into equity investment was not favorable for the Fund. The performance of world stock markets during the sample period, 1999-2005 was worse than their long-term average, and the period included one of the worst performing sub-periods (2000-2002) for stock in more than 100 years (Dimsum et al 2006). The average rate of return for the world stock market (0.24) was less than the rate of return on riskless assets (0.25 for US Treasury bills) for the same period. However, the NBIM's actual portfolio earned a higher rate of return (0.36% per month) than Treasury bills (0.25), the world stock market (0.24), the synthetic portfolio, and the benchmark portfolio (0.31). The actual portfolio earned 0.39% on the equity portion of its portfolio and 0.32% on the fixed asset portion. The monthly rates of return ranged from a minimum of -5.38% and a maximum of 7.80%.

For equity investments, both the actual (.39) and benchmark(.31) portfolios had higher rates of return than the world stock market (.24). However, actual and benchmark portfolios also had higher risk (4.71,4.63) than the world stock market (4.21). Rates of return relative to risk were similar to the world ratio, indicating that higher earnings were a reward for bearing greater risk. The fact that rates of return and risk for the actual and benchmark portfolios were similar to each other, reveals no information about their riskiness relative to other equity portfolios or the world stock market.

The total portfolios of the Fund can be compared with our synthetic portfolio of 60% equity and 40% Treasury bills. The actual Fund portfolio earned a higher rate of return (.36) than the synthetic portfolio (.25), but it also exhibited greater risk

(2.42>1.68). The rates of return relative to risk were equal for the actual and synthetic portfolios. Again the higher rate of return reflected vulnerability to greater risk. The benchmark portfolio had a lower return relative to risk.

Rates of return relative to risk (mean/standard deviation) are shown in the last column of Table 2. Since the period was unfavorable for equity investors all over the world, Treasury bills had the highest earnings relative to risk (1.78). In general, portfolios of fixed income assets outperformed equity portfolios. The actual Fund equity portfolio did earn a higher return relative to risk (.08) than the world stock market (.06) or the benchmark portfolio (.06). We also considered two other world stock market measures. One consists of the MSCI index that only includes members of the European Monetary Union. The other measure includes only the developed countries portion of the MSCI. The actual Fund portfolio was equal to or better than these two portfolios. For the total portfolio including fixed income assets, the Fund's actual portfolio had earnings relative to risk equal to the synthetic portfolio. During the sample period, Fund managers were as successful as other equity investors, but equity investments were dominated by safer investments, such as the traditional portfolios of central banks. Since 2005 equity investments have been even worse, as rates of return have been negative. Holding cash dominated holding equities.

Table 3a shows how the mean rates of return (average over twelve months) relative to standard deviations evolved over time for the actual and benchmark portfolios and their components. The maximum rate of return for the AP was 0.63 in 1999, and the negative returns in 2001 and 2002 reflect the extremely depressed world stock market in those years. In comparing the actual and benchmark portfolios, the AP has a more favorable ratio of earnings to risk in every year. The ratio of earnings to risk for AP is higher in positive years, and less negative than the BP in negative years. Table 2b shows that for rate of return relative to risk, Treasury bills dominated the AP and all portfolios containing equities in every year of the sample period, even though the AP had a higher rate of return.

Estimation and Inference

Growth in SWFs has generated much discussion about their potential economic effects, but there has been little systematic analysis of how they actually behave. What can be learned from data on realized rates of return and risk from the investment experience of the NBIM? Does the dynamic pattern show that rates of return in one month are related to returns in earlier months for the Fund's actual portfolio, or are they independent? Are the returns for the benchmark portfolio related to earlier returns for the same portfolio? Fund officials regularly compare the actual and benchmark portfolios without comparing either one with broader investment strategies. A paper done by the Fund staff (2006) claims that the difference between actual and benchmark portfolios is independent over time, but this does not imply that the Fund is avoiding risk. Both portfolios could be risky relative to financial markets as a whole. We find that the returns on the two portfolios are indistinguishable. Large losses incurred by the Fund in September 2008 demonstrate that imitating the benchmark portfolio does not rule out negative results (Wall Street Journal , Sept 29, pA1).

If returns are related over time, do they follow a momentum strategy? The existence of momentum in financial time series has been demonstrated for both equities and bonds for many countries (Asness et al 2008, Sagi and Seasholes 2007). It would be

informative to see if returns from the Norwegian Fund follow a similar pattern, even if we cannot distinguish between risk-based or behavioral explanations for momentum.

Are returns stationary in the sense of reverting back toward a mean value, or do they wander indefinitely in one direction? Is the relationship linear, or does it follow a threshold with one regime inside the threshold and a different regime outside the threshold? Is the dynamic relationship the same for equities and fixed income investments? If a threshold exists, what is its size, and are responses symmetrical for increases and decreases in rates of return in excess of the threshold? Is the dynamic relationship the same for the total portfolio and the equity portfolio? The transparency of the Norwegian Fund allows us to investigate these issues.

Analysis of Actual and Portfolio Returns

Since Table 7 shows that Actual Portfolio, and Benchmark Portfolio returns follow a linear model, the following linear model is estimated: The null of (3) is imposed on equation (2)), where the returns are represented by r_t and the change in returns is Δr_t ,

the dependent variable in the equation below, the other variables are explained in the appendix.

$$\Delta r_t = \rho r_{t-1} + \mu + \zeta' \Delta R_{t-1} + e_t, \quad (1)$$

We also test for unit roots in the equation above by $H_0: \rho=0$ with ADF unit root test. Table 4 shows that the returns in AP, BP follow a stationary pattern, and we provide the estimates and the standard errors of the coefficient estimates. This shows that since there is stationarity in monthly returns, it is feasible to forecast them. Furthermore, the benchmark and actual portfolio results seem almost indistinguishable. We also see that the coefficient on lagged returns plus one provides whether the returns follow momentum or contrarian strategy. In the case of a positive estimate this is labeled a momentum based investment strategy. It is clear from the tables that the actual and benchmark portfolios follow a momentum based investment strategy with 0.30 as the coefficient for the actual portfolio, and 0.27 for the benchmark portfolio. So positive returns follow positive returns, and the negative ones follow the negative returns. Evidence of momentum in financial market data is a common finding for both U.S. and international data (Sagi and Seasholes 2007, Asness, Moskowitz, and Pedersen 2008).

The analysis below for the Actual Equity returns and Benchmark Equity returns demonstrates that equity returns follow a different pattern from total returns.

The Analysis of Actual and Benchmark Equity Returns

Table 7 results show that there is a threshold as described in the model (2). In this section we provide several results. We first test whether each regime (monthly returns) follows a unit root or stationary process. These are described in equations (4)-(6). The results are reported in Table 5a. We basically run t-tests for each regime, and report the bootstrap p-values.

It is clear from Table 5a, that regime 1 follows stationary behavior whereas the second regime (above threshold value, change in returns larger than the estimated threshold) follows a unit root, we are not able to reject the null of unit root in this regime. Then we provide estimates for each regime (Table 5b) and threshold estimates

with the percentage of returns that follow each regime (Table 5c). This is done using equation (2). Tables 5 provide evidence that if the change in the actual equity returns in the previous quarter ($r_{t-3} - r_{t-4}$) is less than or equal to 3.84%, we are in regime 1, and follow a mean-reverting stationary process. Regime 2 is above that threshold of 3.84% (large positive momentum), and monthly returns then follow a unit root and are impossible to forecast. These two regimes capture almost equal proportions in the data. The results for the benchmark are very similar and the threshold value is slightly higher at 3.87%.

We see a very interesting pattern in these two regimes. In the regime below the threshold value (returns increase less than 3.84% in actual equity portfolio), the coefficient on lagged returns plus one is -0.15. This indicates that regime 1 follows a contrarian based strategy. However clearly, regime 2 has a unit root. The proportion of each regime is very similar to each other, regime 1 has 47.5% of the observations, and regime 2 has 52.5% of the observations. Benchmark equity is very similar in this respect to actual equity.

Analysis of Fixed Asset Returns

In this section we consider the fixed asset portion of the actual and benchmark portfolios. Table 7 clearly shows that both of the fixed asset returns follow a linear pattern with p-values of 0.37 and 0.25 for actual and benchmark portfolios respectively. Here we provide both unit root test results as well as estimation of the linear model in (1). Table 6 provides the results. Since estimation involves a large number of dynamic regressors, we provide the Augmented Dickey Fuller unit root test results here. For AFA, the test statistic is -2.43, and for BFA, this is -2.46. Both of them show non-rejection of the null of unit root at the 10% level. Table 6 provides estimation of (1). Clearly the fixed asset returns follow unit root behavior with no tendency to revert back to the mean.

V. CONCLUSION

Sovereign wealth funds have become significant financial institutions, and they may continue to grow rapidly if energy prices remain high or increase. Critics have expressed concern about possible adverse effects of SWFs, but there has been little systematic analysis of their performance. Lack of transparency by many funds has been a major barrier to serious research, but the openness of the Norwegian fund provides an excellent opportunity to replace anecdotal evidence with systematic analysis.

During its first ten years, the NBIM demonstrated accountability to its government by keeping its actual portfolio within the prescribed distance from the benchmark portfolio. It also satisfied portfolio restrictions on percentage of assets held as equities, the currency denomination of assets, and the percentage of shares held in a single company. The Fund demonstrated transparency by providing detailed and reliable information about its activities in a timely manner.

During our sample period, equity returns for the world as a whole were extremely low relative to their long-term average. Consequently fixed income assets outperformed equities during the period. However, the actual portfolio of the Norwegian fund performed well during the sample period relative to various portfolios that included equities. Based on average returns over the sample period and on the dynamic pattern of

monthly returns, the Norway Fund acted like a commercial investment fund dominated by profit motives, rather than political motives.

Total returns from the Fund's actual portfolio were not dramatically different from the returns of the benchmark portfolio. Both portfolios were linear and mean-reverting. However, returns from equity investments followed a different pattern from those of fixed income assets. Equity returns were non-linear, and a threshold value was estimated. For the regime within the threshold, returns were stationary. For the regime outside the threshold, returns were found to be non-stationary. Returns from fixed assets followed a unit root.

Not all Sovereign Wealth Funds currently behave like the Norway Fund. However, if the portfolio choices and rates of return of other SWFs followed those of the NBIM, it is difficult to see how they would be more disruptive to world markets than mutual funds, hedge funds, or other large, institutional investors. Evidence from rates of return and risk for the Norwegian Fund does not indicate that it is a destabilizing force in financial markets.

The Norwegian sovereign wealth fund has been a model of transparency, but whether it has performed effectively as an agent for Norwegian citizens depends on the risk preferences of citizens. With the permission of the Finance Ministry, the Fund has evolved toward an increasingly risky portfolio. From 1999-2005 the Fund had a higher rate of return than other equity investors, but it also accepted more risk. Since 2005 the Fund has increased the equity percentage of its portfolio and invested in riskier fixed income assets. The average rate of return in the world stock market has been negative since 2005, and the Fund suffered large losses in 2005. Knut Kjaer, former head of the Fund, has stated correctly that equity investments have earned a premium over safer investments over the last century (Financial Times 2007, Dimsun et al 2006). However, that century also included the 1930s and other multi-year periods when returns on equities were negative. Through the NBIM, Norwegian citizens have become de facto owners of a publicly managed mutual fund, with all the expected long-run earnings and short-run volatility.

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APPENDIX:

We estimate and conduct inference on the following model:

$$\Delta r_t = \rho_1 r_{t-1} 1_{\{r_{t-3}-r_{t-4} \leq \lambda\}} + \rho_2 r_{t-1} 1_{\{r_{t-3}-r_{t-4} > \lambda\}} + \mu_1 1_{\{r_{t-3}-r_{t-4} \leq \lambda\}} + \mu_2 1_{\{r_{t-3}-r_{t-4} > \lambda\}} + \zeta_1' \Delta R_{t-1} 1_{\{r_{t-3}-r_{t-4} \leq \lambda\}} + \zeta_2' \Delta R_{t-1} 1_{\{r_{t-3}-r_{t-4} > \lambda\}} + e_t, (2)$$

where e_t is iid errors with second moments that are bounded, r_t represents the returns as of today (current month) in each category such as AP, BP, AE, BE, AFA, BFA. The parameter vector for each regime ζ_1, ζ_2 are k dimensional vectors. The k dimensional vector R_{t-1} is $(\Delta r_{t-1}, \Delta r_{t-2}, \dots, \Delta r_{t-k})'$, λ is scalar and takes the values on a compact space, that is defined by the values of the threshold variable: $r_{t-3} - r_{t-4}$. This model is a threshold autoregressive model with the threshold variable being the change in returns a quarter ago.

We also tried statistically other threshold variables via a bootstrap Wald Test in Caner and Hansen (2001), and none of them produced nonlinearity, so they are not used.

This study also takes into account the critique of Caner and Hansen (2001) by Pitarakis (2008), and uses only bootstrap critical values rather than asymptotic ones.

The first step in this estimation/inference exercise is to see whether each of the categories

displays nonlinearity. This is achieved by using the following Wald test in Caner and Hansen (2001):

$$H_0: \rho_1 = \rho_2, \mu_1 = \mu_2, \zeta_1 = \zeta_2 \quad (3)$$

The limit for that test statistic is nonstandard as seen in Caner and Hansen (2001), the best way is to use the bootstrap approximation that is advocated in Caner and Hansen (2001). The next step is to test for unit roots (regardless of whether there is a threshold or not). Caner and Hansen (2001) (from now on CH (2001)) recommends a t-test

$$H_0: \rho_1 = \rho_2 = 0 \quad (4)$$

against a partial unit root

$$H_1: \rho_1 < 0, \rho_2 = 0, \text{ or } \rho_1 = 0, \rho_2 < 0 \quad (5)$$

and

$$H_2: \rho_1 < 0, \rho_2 < 0. \quad (6)$$

These t-tests distinguish between these three cases. The t-ratio test has a nonstandard distribution, and again a bootstrap approximation is recommended in CH (2001). So for both tests we report p-values. Depending on the Wald test for a threshold, we estimate a linear or nonlinear (threshold) model. These estimation are done in CH (2001) and depend on least squares estimation.

If the model is linear, an Augmented Dickey Fuller unit root test is run to see whether the series are stationary or nonstationary. If the model is nonlinear, then the threshold unit root tests described above (t-tests) are run.

Table 7 below provides Wald test results for each category of returns. Table 7 makes clear that at the 10% level, except for equity returns (actual and benchmark equity), the others are linear. In the next subsection given these results we start analyzing the actual portfolio and benchmark portfolio returns (AP, BP).

TABLE 1A.

Oil and Gas Exporting Countries	Value of Assets (Billion US\$)
United Arab Emirates	250-875
Norway	380
Saudi Arabia	289
Kuwait	213
Russia	125
Libya	50
Qatar	30-50
Algeria	43
USA (Alaska Permanent Fund)	40
Brunei	30
Kazakhstan	21
Malaysia	19
Canada (Alberta Heritage Fund)	16
Nigeria	11
Iran	9
Azerbaijan	2.5
Oman	2
Timor-Leste	1.4
Venezuela	0.8
Trinidad and Tobago	0.5

TABLE 1B.

Asian Exporters	Value of Assets (Billion US\$)
Singapore	208
China	200
South Korea	30
Taiwan	15
Other Countries	
Australia	54
Chile	14.9
Botswana	4.7
Kiribati	0.4
Total of Assets	2,093-2,968

Source: IMF (2008)

TABLE 2. Descriptive Statistics: Monthly Returns in %

Returns	MEAN	MIN	MAX	STD. DEV.	Mean/Std Dev.
AP	0.36	-5.38	7.80	2.42	0.14
BP	0.31	-5.47	7.77	2.39	0.13
AE	0.39	-12.61	9.85	4.71	0.08
BE	0.31	-12.76	9.88	4.63	0.06
AFA	0.32	-3.64	6.39	1.87	0.17
BFA	0.30	-3.70	6.32	1.87	0.16
OP	0.25	-4.36	3.55	1.68	0.14
T-BILL	0.25	0.07	0.51	0.14	1.78
AWMSCI	0.24	-11.12	8.63	4.21	0.06

Note: AP, BP, AE, BE, AFA, BFA represents Actual Portfolio, Benchmark Portfolio, Actual Equity, Benchmark Equity, Actual Fixed Asset, Benchmark Fixed Asset returns respectively. OP represents the portfolio that we constructed. T-Bill represents the monthly returns from US, Treasury bills (3 month). AWMSCI is the Morgan Stanley All World Index.

TABLE 3A. Mean/Std. Deviation Ratios of Returns

Years	AP	BP	AE	BE	AFA	BFA
1999	0.63	0.61	0.79	0.77	-0.004	-0.005
2000	0.27	0.26	-0.03	-0.04	0.71	0.70
2001	-0.21	-0.22	-0.25	-0.27	0.15	0.15
2002	-0.70	-0.71	-0.54	-0.54	-0.43	-0.45
2003	0.57	0.56	0.55	0.54	0.36	0.34
2004	0.13	0.11	0.20	0.19	0.05	0.04
2005	0.58	0.57	0.63	0.63	0.33	0.32

Note: AP, BP, AE, BE, AFA, BFA represents Actual Portfolio, Benchmark Portfolio, Actual Equity, Benchmark Equity, Actual Fixed Asset, Benchmark Fixed Asset returns respectively.

TABLE 3B. Mean/Std. Deviation Ratios of Returns

Years	OP	T-Bill	AWMSCI
1999	0.70	14.43	0.54
2000	-0.13	20.14	-0.31
2001	-0.19	2.86	-0.27
2002	-0.28	6.83	-0.31
2003	0.70	9.30	0.66
2004	0.51	2.93	0.44
2005	0.45	6.07	0.29

Note: OP represents the portfolio that we constructed. T-Bill represents the monthly returns from US, Treasury bills (3 month). AWMSCI is the Morgan Stanley All World Index.

TABLE 4. Estimation and Unit Root Tests For Actual Portfolio (AP) and Benchmark Portfolio (BP) Returns:

	ADF test	Intercept	Std. Err.	Γ_{t-1}	Std. Err.	$\Delta \Gamma_{t-1}$	Std. Err.	$\Delta \Gamma_{t-2}$	Std. Err.	$\Delta \Gamma_{t-3}$	Std. Err.
AP	-3.39*	0.26	0.28	-0.70	0.21	-0.18	0.18	-0.17	0.16	-0.17	0.12
BP	-3.45*	0.23	0.28	-0.73	0.21	-0.16	0.19	-0.16	0.16	-0.17	0.12

Note: The second column shows the results of Augmented Dickey Fuller unit root test. This is significance at 10% level. We have differences in returns as dynamic regressors. This is lagged one quarter. Simple model selection with t-ratio provides this specification out of possible 6 months (2 quarters) lagged.

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TABLE 5A. Bootstrap p-values for threshold unit root tests

Regimes	AE	BE
First, below or equal threshold	0.00	0.00
Second, above threshold	0.63	0.59

TABLE 5B. Estimates of Each Regime, and The Standard Errors

	AE, R1, Coeff. Estimate	AE, R1, Std. Err.	AE, R2 Coeff. Estimate	AE, R2 Std. Err.	BE, R1, Coeff, Estimate	BE, R1, Std. Err.	BE, R2 Coeff. Estimate	BE, R2 Std. Err.
Intercept	2.23	0.72	-1.46	0.68	1.83	0.69	-1.50	0.68
r_{t-1}	-1.15	0.25	-0.19	0.26	-1.14	0.25	-0.20	0.27
Δr_{t-1}	-0.01	0.23	-0.49	0.23	0.15	0.23	-0.49	0.23
Δr_{t-2}	-0.18	0.20	-0.40	0.21	-0.06	0.19	-0.37	0.22
Δr_{t-3}	-1.13	0.38	-0.19	0.13	-0.79	0.34	-0.17	0.14

Note: AE, R1 represents Actual Equity returns, regime 1 (below or equal threshold estimate in Table 5c). AE, R2 represents Actual Equity returns, regime 2 (above threshold estimate in Table 5c). BE, R1 and BE,R2 represents the benchmark counterparts respectively.

TABLE 5C. Proportion of Each Regime, and The Threshold Estimates

	R1, %	R2, %	Threshold Estimate, %
AE	47.5	52.5	3.84
BE	48.7	51.2	3.87

TABLE 6. Analysis of Fixed Asset Returns

	AFA Coe.	AFA Std.Er.	BFA Coe.	BFA Std. Er.
Intercept	0.35	0.24	0.32	0.22
r_{t-1}	-0.84	0.33	-0.83	0.33
Δr_{t-1}	-0.15	0.32	-0.15	0.32
Δr_{t-2}	-0.36	0.29	-0.36	0.29
Δr_{t-3}	-0.43	0.25	-0.43	0.25
Δr_{t-4}	-0.46	0.21	-0.46	0.21
Δr_{t-5}	-0.33	0.16	-0.33	0.16
Δr_{t-6}	-0.18	0.12	-0.18	0.13

TABLE 7. Wald test results, p-values, for each category of monthly returns:

AP	BP	AE	BE	AFA	BFA
0.26	0.27	0.01	0.06	0.37	0.25