



Unlisted Assets in the Government Pension Fund Global

*Can private equity and infrastructure improve the Fund's
profitability and stability?*

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Executive summary

Is the stock market overpriced? Is it time to sell? Most of the asset pricing research has been directed towards stochastic discount factors, without definitive answer. We study the case of the Norwegian Government Pension Fund Global, a large institutional investor that cannot easily undertake large strategy shifts, hindered by market depth. However, the fund can enjoy diversification benefits and seek alternative allocations. We review the Fund's management performance and analyse two asset classes: Private Equity and Infrastructure. Private Equity describes a range of companies to be acquired but also a managerial and capitalistic structure. Infrastructure only refers to a category of real assets to be targeted, some of which are managed as private equity.

Our findings indicate that deep structural reforms are needed to enable efficient internal active management of the Fund. The buyout and growth segments of private equity could then be quickly added to the GPFG's investment universe and invested through Separately Managed Accounts. The SMAs model provides much flexibility and can be adapted as the GPFG's management acquires more experience and seek to internally manage the assets. Renewable electricity production is the most attractive segment within infrastructure. Internal competence could be quickly more acquired than for private equity, and the class seems suitable for SMAs.

We exclude other infrastructure categories because of their exposure to political risk and return profile. Emerging markets should be included in the investment universe for both private equity and infrastructure. Despite the high level of risk linked to frontier markets, we suggest letting in the not-so-distant future the GPFG seize opportunities in these markets and review mitigation strategies proposals.

Finally, we argue that the fund's active management strategy should be shifted from asset selection towards value-adding ownership.

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Abbreviations and terms in a foreign language

AIRR: Average Internal Rate of Return

AUM: Assets Under Management

Finansdepartementet: Norwegian Ministry of Finance

GDP: Gross Domestic Product

GP: General Partner

GPFG: Government Pension Fund Global

Handlingsregelen: Norwegian budgetary rule

IPO: Initial Public Offering

IRR: Internal Rate of Return

LBO: Leveraged Buyout

LCOE: Levelized Cost Of Energy

LP: Limited Partner

MIGA: Multilateral Investment Guarantee Agency

NBIM: Norges Bank Investment Management

NBREM: Norges Bank Real Estate Management

OECD: Organization for Economic Co-operation and Development

PE: Private Equity

PIDG: Private Infrastructure Development Group

PME: Public Market Equivalents

SMA: Separately Managed Accounts

1. Introduction

1.1 A long way towards the Oil Fund

The Norwegian *oljeeventyr* is commonly perceived as a fairy tale. A country poorer than Greece¹ is blessed by the unexpected discovery of oil by the American company Phillips in 1969, and reaches the highest level of prosperity in a few decades.

Oil exports alone are nevertheless insufficient to explain a country's development. The Arabic peninsula went through difficult times when barrels were quoted at 30\$ in 2016. Expenses had to be cut, and the situation could have been much worse without their large buffer funds. Venezuela has seen its economy completely collapse, and it will take many years from the start of a hypothetic recovery to reach again a living standard comparable to its neighbours. Africa is extremely rich in natural resources, both hydrocarbons and precious metals, but also houses many least advanced economies, such as Congo-Kinshasa.

The literature coined the term "resource curse", which signals an inverse correlation between growth in GDP per capita and commodity exports, and is thoroughly studied by Sachs and Warner (2001).

If we ellipse and get closer to the North Sea, the discovery in 1959 of Europe's largest gas field around the city of Groningen should be discussed. The Netherland's exchange rate appreciated, therefore harming Dutch exports in traditional industries and also stimulating imports, further increasing the toll on the pre-existing economic structure. Labour and capital demand in the commodity sector increased, as well as government spending, shrinking even more the competitive economy. *The Economist* came with the expression "Dutch disease" to describe the curse's manifestation in a developed country.

Before the Ekofisk discovery in 1969, there had been multiple unsuccessful oil prospection campaigns off the Norwegian shores. While Saudi Arabia could for a long time have the illusion that its income stream was almost perpetual because of the size and

¹ OECD, Figures per capita, 1970 compared to 2016.

availability of their reserves, the difficulty to assess and access Norwegian fields is likely to have contributed to the feeling of a unique opportunity.

Ryggvik and Smith-Solbakken (2018) explain that the ten “oil commandments” from 1971 have become symbols for the early Norwegian oil policy, that sought to establish national control over the resource and to build a specific industry instead of relying on the foreign “supermajors²”. Norway sought to establish an ownership model, inspired by its management of hydropower. Not only the State preserved an income source by restricting private actors to time-limited concessions, but the economy benefitted from flourishing energy-intensive industries, which were attracted by cheap electricity. Aside developing a Norwegian model, there were also early concerns not to develop a “Norwegian disease” and the fourth oil commandment states that pre-existing economic sectors should be preserved.

The commission known as the Tempo-utvalget (1983) recommended oil to be extracted at a low pace to preserve the Norwegian economy from overheating, and to secure future generations a share of this wealth. The theory that backs this second recommendation comes from the Hotelling (1931) rule which seeks to maximize the profit from resource extraction over time. A non-renewable wealth can be fully transmitted to future generations if the value of the reserve remains constant, after correcting for inflation. Hence the pace of depletion should be equal to the expected increase in price equal to the discount rate (US bonds), as the resource becomes more scarce.

In practical terms, the Hotelling (1931) rule is difficult to implement since oil prices have been historically unstable and, once corrected for inflation, it is not certain that they have a growing trend. Thanks to technology, new deposits are regularly discovered, or made economically viable. In other terms, the amount of oil accessible at a certain cost of extraction increases, so despite not being renewable in the long run, oil supply is not finite in the medium run. Short run implies ramping costs and potential price manipulation by creating a mismatch between supply and demand and without knowing the slope of the long-term trend, it can be challenging to react accordingly. Moreover, in case of a permanent downward shock, it could be suggested to buy back oil in order to smooth the shock through generations. However, the current context suggests that we will reach a peak in oil demand, and that a large share of

² The biggest oil companies, such as BP, Chevron, Exxon, Total, Shell, Conoco...

deposits will never be exploited. Buying back oil would then make the country poorer now, without benefitting future generations, and potentially harming them if oil income is used efficiently and the higher prices triggered by reduced supply catalyse the decrease in demand.

Another approach recommended by the Tempo-utvalget (1983) was to save the proceeds from oil extraction into a fund, in order to replace natural capital with financial capital, based on the Hartwick (1977) rule which uses a weak sustainability framework. It would however not make sure to sell the oil at the highest price, nor to avoid that an oversized oil industry suffocates other export-oriented activities.

When focusing on utility evolution, the Hartwick (1977) rule does not allow for smoothing. Only financial income can be spent, and financial capital increases as commodity revenues are saved. In this setting, utility grows progressively, which is a strong mismatch with human impatience. Nevertheless, it can be argued that the economy is benefitting from a supplementary activity triggered by the commodity boom, hence the rule does indirectly reduce the likelihood for Dutch disease. However, short-sighted politicians are more likely to focus on smoothing consumption from the windfall and oversee the stimulus created by an oil rush. Paul Collier (2013) suggests that non-OECD countries with limited reserves have a limited rationale and chance to develop their own commodity industry, hence that extraction profits will be captured by foreign companies, so focusing on utility smoothing is justified. The rate of return from domestic investment can also be higher than in financial markets.

Gjedrem et al. (2017) describe the path towards creating the Government Pension Fund Global (GPFGL). Despite the unlikelihood that Norway suffered from an acute capital shortage, politicians kept fully spending the oil rent. In 1986, oil prices plummeted, and the state was soon back in international markets to borrow money, illustrating the need for at least a buffer fund allowing to compensate for price variations. The Oil Fund was established in 1990, during an economic downturn, hence the first deposit was only made in 1996, more than 26 years after the Ekofisk discovery.

1.2 An overview of the Fund

When the Oil Fund was established, petroleum income was recovering from a sharp drop, therefore moderate. It primarily aimed at balancing market turbulences, and hopefully allow for intergenerational sharing but there were no expectations that the fund would become so large. Therefore, Norges Bank (the Norwegian central bank), which had experience with investing in foreign bonds from managing currency reserves, was handed the responsibility to extending its activities to the Oil Fund.

As prices remained relatively high and oil extraction increased, the Oil Fund's investment horizon was modified, and 40 per cent share of listed equity was introduced in 1997. A specialized body is created to implement this decision in 1998: Norges Bank Investment Management (NBIM). To prevent depletion of this now sizeable financial wealth, a bird-in-hand rule was established in 2001 (*handlingsregelen*), requiring public spending to at most the expected real return of the Oil Fund.

In 2002 the Oil Fund, now exclusively managed by NBIM, is allowed to invest in corporate bonds. Four years later, the Oil Fund has passed the 1 trillion kroner mark and is officially a “pension fund”, and in 2007, the fund was allowed to invest in small capitalization firms while the equity share of the portfolio was increased to 60 per cent. The financial crisis of 2007-2008 severely depressed asset prices before NBIM had significantly increased its exposure to stocks, so the GPFG hugely benefitted from the post-crisis recovery.

In 2010, it was decided to open for unlisted real estate investments. A specific subsidiary of NBIM was set up to manage these assets in which the fund usually takes large shares. The Oil Fund sometimes has a majority control of the properties whereas it is banned from owning more than 10 per cent in a single corporation, usually remaining below the 5 per cent threshold.

Norway now owns the world biggest sovereign wealth fund, approximately worth a trillion dollars. Unexpectedly high financial returns have compensated for not saving in the first decades. Lemaire (2016) illustrated this in a previous research project by plotting the available oil-related income for consumption according to different models and comparing with historical data. Norway seems to be poorer than if it had followed the Hartwick rule, and its wealth accumulation follows a path closer to the “Collier (2013) rule”.

1.3 Challenges for the future

One specific challenge is linked to an ageing population and therefore pensions. The Norwegian system is not fully financed and will require transfers from the general budget. The oil fund might not be sufficient to finance these obligations, which concerns the central bank governor Øystein Olsen (2017), Finansdepartementet (2018b) (Norwegian Ministry of Finance), and independent economists such as Harding and Van der Ploeg (2009).

Olsen (2017) explains that aiming to improve the Oil Fund's return is therefore key to avoid a decrease in welfare, along an increase in total factor productivity and increased labour supply through longer working weeks, later retirement age, higher fertility and/or qualified immigration.

NBIM (2016) echoes concerns that future stock returns may not be as high as historical figures. Total Factor Productivity has only been slowly improving and large emergent economies will not contribute as much to total growth as they used to. Steady high government debt among OECD members can also reveal challenging, and constraint their ability to rebound after a shock. In a context of higher income and wealth inequalities, public fiscal imbalances are even more problematic since parts of the population rely on social spending while others manage to avoid taxation, austerity policies are then painful and less effective.

Higher inequalities also mean higher financial savings, which in the absence of new investment opportunities should be expected to bring the cost of money downwards, hence lower returns. Asset bubbles are a major concern for fund managers. Bubbles can be fuelled by unreasonable expectations, as during the pre-2007 real estate boom during which houses there was no demand for were built, resulting in wasteful resource allocation and eventually large financial losses.

However, negative interest rates have also revived fears about rational asset bubbles in a world where there is more capital supply than investment opportunities. Cochrane (2011) explains that asset prices do not vary because of variations in revenue expectations but because of changes in discount rates, without reaching a definitive conclusion about the reasons backing these changes.

Aoki, Nakajima and Nikolov (2014) show that rational bubbles can occur when there is a shortage for riskless assets. Their work builds on the sovereign debt crisis starting in 2009 during which many states have seen their rating downgraded and the supply for safe bonds has dropped. Demand from risk-averse individuals who want to insure against idiosyncratic risk (precautionary savings) remains high and the competition for the remaining safe bonds leads to higher prices, hence lower returns, and the emergence of useless but quasi-riskless assets. We could think of these assets as commodities, properties or zombie firms: often large and established corporations that survive despite not making profits. With negative real interest rates, these assets only need to lose less value than would a deposit at the central bank.

This precautionary savings framework can describe people saving for their retirement. If the shortage for safe assets remains, the incurred costs are insurance expenses in an imperfect market. However, when safe bonds will again be readily available, useless assets will lose all their value. Demographic evolutions make this threat credible, indeed European dependency ratios are planned to increase,³ hence there will be more retired people and fewer individuals in the working force. *Ceteris paribus*, it would mean more people divesting to finance their retirement and lower savings from active workers. Hence, the shortage for safe assets would disappear.

Caballero, Farhi, and Gourinchas (2017) build further on the global “savings glut” used to explain the imbalances preceding the 2007-2008 financial crisis. They explain the long-lasting low interest rates by a continued pressure from emergent economies, and particularly China who ask for more specifically safe assets. Since their demand increases faster than the developed economies’ GDP, hence the solvability of their government, there is an imbalance pushing interest rates down to a minimum. They argue that this minimum is lower than optimal. Since interest rates are higher than required to clear markets, this would continue to stimulate savings.

One option is to issue more safe assets, but many governments are financially constrained. Moreover, old age benefits will also be a challenge to public finances where pensions systems are not fully funded. It could result in higher deficits, hence lower bond

³Euro http://ec.europa.eu/eurostat/statistics-explained/index.php/Population_structure_and_ageing#Past_and_future_population_ageing_trends_in_the_EU

quality and prices, or austerity, hence lower demand and reduced economic activity. Since Europe is overrepresented in the GPFG equity portfolio and the fund is also heavily exposed to European sovereign debts, the fund has large stakes at risk.

This scenario would be a repetition of the downrating of Southern European countries' debt, increasing the pressure on the remaining safe assets. The easiest way to move away from this downward spiral is to create assets that are acceptable and transparent substitutes. There could then be a progressive shift among pension and sovereign wealthfunds, but also insurers towards these defensive assets, contributing to growth in the target country but also to relieve the safe assets shortage, hence boosting growth in developed countries. Many regulatory changes are required but there is long-term potential.

When it comes to quantitative easing, Caballero, Farhi, and Gourinchas (2017), note that it could be implemented by acquiring risky assets, as did the FED with mortgage loans in the US and the Bank of Japan with equity shares. They suggest that the ECB's indiscriminate purchases, which include AAA bonds from Germany, could be counter-productive. Once again, the overweight of European securities in the GPFG's portfolio seems to increase the risk of underperformance.

Private equity creates value by accompanying promising ventures and optimizing existing firms. In its current form, it is unlikely to be a candidate as safe asset substitute. However, it still creates new assets in a context of general pressure on the existing ones (the classical form of Bernanke's *savings can glut*⁴) and offers exposure to different risk sources. Infrastructure is key to productivity and well-designed projects relieve an area from bottlenecks, fostering a value creation process that benefits both the general economy and the asset owner, which in the GPFG's case is also invested in the global stock market.

This motivates our research question, and we think that both private equity and infrastructure are sound options to be explored when seeking new investment opportunities with more robust returns than public markets, which seems to be affected by bubbles.

⁴ FED <https://www.federalreserve.gov/boarddocs/speeches/2005/200503102/>

2. Methodology

Our master thesis started with the problem stated in introduction: Many observers are concerned that listed assets might be overpriced and predict lower returns in the future, even though there were plenty of opportunities to invest in real assets.

We spent several months exploring the different ramifications of our research question and mapping the different sub-questions. We then tried to acquire a comprehensive and solid understanding of the challenges related to the two main asset classes that we had identified as candidate solutions to our problem.

A major issue linked to unlisted real assets relates to the lack of public and robust numerical data. This will be reminded throughout our thesis as it affects every author, even though some have had access to commercial databases.

Instead of performing a numerical analysis, we could have conducted a series of interviews to gather a large number of perceptions and point of view from academics, civil servants and professional investors. We would then have analysed the obtained data.

However, it would have been both impolite and wasteful to interview professionals without mastering the information we could readily access nor knowing which issues are the most heavily debated. We read therefore more reports and articles and noticed that many surveys of both investors and managers had already been conducted.

It would therefore have been difficult to sensibly contribute to the state of knowledge by conducting an umpteenth round of interviews and comparing our results with previous findings. This strategy could have been attractive in order to give a closer look at a specific aspect, but our research subject is particularly large.

We attempted to interview a responsible from the Ministry of finance, but they could not divulgate much more information than what is already available in the public reports.

The broadness of our subject results from the absence of a simple answer since asset prices inflation and bubbles are still an open question. We had therefore to gather information from various horizon to build a bridge over an apparent lack of solution. It appeared therefore

logic to us that our thesis would be a synthesis which would discuss unlisted assets in the light of the Oil Fund's specificities.

Our work relies intensively on some studies ordered the Ministry of Finance about private equity and infrastructure. They are indeed useful sources because of their comprehensiveness and quality.

Since we try to answer a different question than the one asked by the Ministry of Finance to the reports' authors, our analysis brings another light and new considerations to their discussion. Our discussions will often be separated from the reports' findings by starting a new paragraph.

Our work also tries to capture the future evolution of the private equity and infrastructure markets. Some strategies might be currently inappropriate but become attractive in a not so distant future. Through backward induction, we can identify which choices should be made today.

This ambitious prediction attempt seems to consequently affect the balance of the Norwegian debate about unlisted assets and active management.

If we hope that our thesis will lead to a better understanding of the potential of investing in unlisted assets and the room for improvement in the active management of the fund, we are fully aware that it is not exempt for weaknesses.

Firstly, we have been obliged to set arbitrarily limits to our exploration work, so there may be important aspects that we have overseen.

Secondly, our team is composed of a French and a Norwegian. If this binational composition has helped to hold a critical and understanding stance towards the Norwegian debate, there are probably losses of meaning and small misunderstandings on the linguistic level.

3. Norges Bank Investment Management capabilities

3.1 A factor-driven management

3.1.1 *A successful allocation strategy, with potential for improvements*

Historically, the Ministry of Finance and the Parliament in Norway have indirectly decided on the risk factors the GPFM should be exposed to, by increasing the number of asset classes available in the fund's investible universe. Within stocks, the work of Fama and French (1993) have initiated a cycle of studies concerning company characteristics that could on the aggregate level lead to excess return over the market. The two first factors were capitalization size and book-to-market, but the literature has been exploring other specificities that could open for superior strategies. Cahart (1997) for example introduces the momentum factor.

According to Gjedrem et al. (2017), there was no specific need for assessing manager performance when the fund was only invested in sovereign bonds. However, with the establishment of NBIM and recruitment of equity managers came the question of their compensation, which should include a considerable variable share, to follow the industry's standard. Benchmarking was therefore introduced.

Dahlquist and Ødegaard (2018) explain that the chosen benchmarks, delivered by FTSE Group for equity and Bloomberg Barclays Indices for bonds, are used to measure NBIM's performance but also to state the owner's, that is to say the Ministry of Finance's preferences.

The Fama-French (1993) multifactor model has proven relatively robust, and Dahlquist and Ødegaard (2018) refer to the previous evaluation of the GPFM when justifying the use of this model in improving returns. The allocation strategies division of NBIM is in charge of adapting the benchmark to create a specific investment universe, aimed at improving the Oil Fund's returns. This can be done within and between asset classes, notably by using factor models, but NBIM's possibilities to deviate from the benchmark are limited by the tracking error (1,25 per cent).

The tracking error prevents the GPF's equity managers from artificially increasing their performance by seeking exposure to risk sources that are not measured by return volatility, that is to say factors. However, excluding some investment strategies that do not suit the most common measurement for risk-adjusted returns, the Sharpe ratio, seems inefficient. NBIM should instead use more sophisticated methods for assessing risk and consider more factors than return volatility.

An important issue that Dahlquist and Ødegaard (2018) do not discuss, is the choice of benchmark. Should NBIM follow the industry standard, the most popular one, or should it seek less famous but maybe better performing indexes? In a piece for the *Financial Times*, Nicole Bullock (2018) observes that the S&P600 has outperformed the Russell 2000 over a period spanning from 2009 to today. Considering that the S&P600 is more defensive, with lower stakes in Healthcare (hence biotechnologies) and Financials but a higher share in Industrials, this might be the result of weighting more heavily in the value factor.

Unfortunately, the Russell 2000 is delivered by FTSE Group, hence probably used to benchmark the Oil Fund's investment in small cap stocks. A manager who passively follows the S&P600 but is benchmarked according to the Russell 2000 would therefore be considered as skilled, even though they only delivered a limited input.

More broadly, as noted by Bullock (2018), indices have the potential to distort the market by channelling large amounts of money to their components, on the expense of excluded corporations. Components of the main indices will then be more expensive compared to their peers.

Can this be understood as a liquidity premium for less investable stock? Potentially, but it also illustrates the power of index providers and the opportunities that could arise from deviating from their references. Still, the Oil Fund cannot ignore the developments of the index market and increasing the share of passively managed Exchange-Traded-Funds, as shown by their reaction to MSCI's aim to underweight companies where the "one vote one share" principle is not respected⁵. Even though the Oil Fund would not be bound by MSCI's decision, it is likely to have broad consequences for the valuation of targeted corporations.

⁵ <https://www.ft.com/content/3aabfb22-6a6b-11e8-8cf3-0c230fa67aec>

There is potential for improvements. The strategic benchmark imposed by the Ministry of Finance could be revised to better reflect the investment strategies implemented by NBIM. Critics could argue that the Oil Fund's performance should still be evaluated against the global market. In this case, the tracking error could be made more flexible, and NBIM could release the benchmark they use for investment decisions.

Currently, Dahlquist and Ødegaard (2018) note that the tracking error is larger than for most mutual funds, allowing NBIM not to rebalance too often, hence reducing transaction costs and opening for liquidity-making when the other passive funds must rebalance. This seems to be a smart step taking advantage of the Oil Fund's long-term stance, but giving more freedom to management would open for more opportunities to beat (or underperform) the market.

Dahlquist and Ødegaard (2018) find that the returns' distribution is considerably skewed with excess kurtosis across investment classes, which underscores the importance of using broad passive indices. An investor who would only select individual securities could miss the positive outliers who overperform the market and earn much less than the market return.

This empirical observation has been studied over a longer time period in American markets by Bessembinder (2017), who finds that only a handful of stocks manage to outperform the risk-free return over time. His time series mostly include periods with much higher risk-free interest rates than those of the two last decades, but this does not downplay the major role played by the few positive outliers.

Despite warning that modifications of the Oil Fund's market exposure make an analysis difficult, Dahlquist and Ødegaard (2018) also find that more than half of the GPF's excess returns are linked to market exposure. Their results show that the equity managers had liquidity-consuming strategies and positively exposed the Oil Fund to momentum. This might be linked to an overweight in small aggressive but profitable companies.

Through a flexible but fixed asset class allocation, the Oil Fund has a counter-cyclical attitude. When stocks soar, their share of the Oil Fund's portfolio reaches a ceiling, obliging the equity managers to reinvest dividends in bonds and limiting the damage caused by an equity bubble. Conversely, during market turmoil such as the 2007-2008 financial crisis, the

equity share of the Oil Fund's portfolio drops since stocks are more volatile than bonds, and the Oil Fund buys stocks at a potentially discounted price.

On the other hand, stocks have a higher expected return than bonds. A fixed allocation rule therefore implies that even during "healthy" or "normal" periods, NBIM must rebalance the portfolio, resulting in trading expenses and lower long-term return compared to a scenario where the equity share increases freely according to market returns. The attractiveness of this rebalancing strategy depends on the expected severity of market collapses.

A "buy the dips" strategy could otherwise be undertaken by reducing the allocation to sovereign bonds when the market has crashed, and then rebalancing ex-post, compared to today's situation where rebalancing happens ex-ante: sell equity and buy bonds before the crash, then sell bonds and buy equity. Such an ex-post strategy would require estimating the discount rate for which equity is neither "cheap" nor "expensive" compared to bonds, which could prove challenging.

A liability approach may explain that this ex-post strategy is more difficult. Indeed, it would lead to a smaller bond portfolio before the crisis compared to the current strategy. Then, the Oil Fund would sell bonds to buy equity while a systematic crisis is likely to also hurt Norway. Hence, the government would increase its withdrawals from the Oil Fund to implement budgetary contra-cyclical policies. It would make sense to sell bonds since their value is less impacted by the crisis, but the bond portfolio would become much depleted.

In the event the financial recovery did not happen before some years, the fund would face liquidity challenges. A solution would be to temporarily borrow money on international markets, which would be a rupture with the current practice. Indeed, as mentioned by Finansdepartementet (2018b), the Norwegian State only borrows for the needs of its financial operations, such as increasing the capital of the public banks or repaying the existing bonds.

Norway's debt would likely remain investment grade, even in this pessimistic setting, so borrowing could be an expensive but doable option. If Norway became unable to borrow because the capital market had become fully frozen, it would mean there is no buyer for sovereign bonds in the market. Hence, their market value is close to zero and the current strategy does not protect from such an "apocalyptic" scenario. In fact, dividend-paying stocks, even if these companies had to reduce their dividend payments because of the crisis, might be a more reliable cashflow than low-yield bonds.

The GPFG has consequently a buy-and-hold attitude, and an ex-ante rebalancing strategy allowing it to prudently “buy the dips”. A detailed cost-benefit analysis of this prudent approach would be interesting for further research.

3.1.2 Unlisted investments challenge the current risk management framework

The GPFG’s real estate portfolio is managed by Norges Bank Real Estate Management (NBREM). According to Dahlquist and Ødegaard (2018), the performance of this portfolio was previously assessed by using the IPD Global Property Index, corrected not to consider the Norwegian market. But the Oil Fund’s real estate investments are not sufficiently diversified, being concentrated in a handful of markets: United States, United Kingdom and France. From 2017 it was decided to only evaluate real estate against a general benchmark made of 67,5 per cent of equity and 32,5 per cent of fixed income.

Such a benchmark is unsatisfying since it measures the performance of very different assets. Nieuwerburgh et al. (2015) suggest that using a benchmark representing the stocks and bonds portfolio is appropriate as it allows to price real estate according to the opportunity cost of divesting from bonds and stocks. Such benchmarking can support the expansion of the Oil Fund’s investment universe to real estate by illustrating that it can indeed increase returns, but it does not give a good measure for relative manager performance.

Still, Nieuwerburgh et al. (2015) argue that the Opportunity Cost Model can relatively well account for risk of an unlisted assets by using factors representing known risk sources for bonds and stocks, such as duration. In comparison to the current lack of benchmark, and because of incomplete data sets, this proposal seems to be an interesting option.

It is also interesting to wonder why NBREM has until now chosen to invest in the major financial capitals: London, Paris, New York, Singapore and Tokyo, instead of focusing on growth areas. Indeed, the potential for property prices increases in city where most inhabitants struggle to access property or even pay their rent, is limited. The Oil Fund could have focused on less mature markets such as Germany, Poland and the Baltics, or even emerging countries.

One explanation can be that the chosen cities represent the biggest share of the market, and that NBREM’s investment universe should reflect in the best possible manner global

investment opportunities. However, this is not very convincing since focusing on assets everyone else is buying is unlikely to yield specific premia. Another explanation is that only the major financial hubs have deep and large enough property markets to justify the fixed costs linked to opening a NBREM subsidiary.

Dahlquist and Ødegaard (2018) note that unlisted real estate is illiquid, hence it is difficult to price with certainty the current portfolio, and the first years of ownership will be negatively affected by large transaction costs. Therefore, academics have suggested assessing the returns by using a five-year moving average, but this requires long time series and proves difficult since NBREM has only five years of available data.

Dahlquist and Ødegaard (2018) used the IPD, assessing returns country by country, hence using small samples and a little robust methodology. While the Oil Fund could have outperformed in the United Kingdom where it started its acquisitions and underperformed in the United States where it only entered the market recently, the results are not much conclusive.

It would therefore be challenging or inadequate to re-introduce a specific real estate benchmark in the fund management, and real estate will continue to be included in the aggregate returns of the GPF, contributing to the fund's tracking error. Dahlquist and Ødegaard (2018) report that NBREM evaluates the real estate portfolio separately to better assess the contribution from different asset classes to the tracking error. They find a tracking error of 7,2 per cent, compared to the 2 per cent limit for the Oil Fund overall (and 1,25 per cent limit for equity).

Since real estate only accounts for a limited share of the GPF, this is not yet a major issue, but increasing the share of unlisted investments would make the tracking error challenge much bigger. As the real estate portfolio extends and diversifies, the error might be reduced, but it is also likely that a different risk and performance management model should be considered.

3.2 Contrasted results in asset selection

3.2.1 *Negative contribution from bonds*

When assessing bonds performance by comparing it to the in-house benchmark, Dahlquist and Ødegaard (2018) note that the excess return for the whole period is 0,15 per cent, against 0,49 per cent for equity, and that the excess return for the period starting in 2010 has been negative.

Dahlquist and Ødegaard (2018) evaluate bonds according to an artificial world risk-free rate as well as duration and default risk factors. However, it is not possible to trade these factors, and bonds are mostly traded over the counter, making it more difficult to automatically rebalance an index. So, it is possible that the managers have generated small but positive excess returns, once correcting for the incompressible transaction costs.

Still, both this weak performance and the potential declining trend in average inflation and interest rates explain why the share of equity has been increased while the real estate allocation further reduces the proportion of bonds in the Oil Fund.

3.2.2 *Weak positive contribution from stock picking*

The fund is not allowed to take ownership stakes that exceed 10 per cent of a corporation's market capitalization, which puts constraints on the upwards scalability of a stock-picking strategy. Since the Oil Fund has a global investing universe, it would also be difficult to review every suitable stock without an extremely large managing team.

Stock selection displays as mentioned net excess returns of 0,49 per cent over the reference index. According to Dahlquist and Ødegaard (2018), the information rate for the equity portfolio is high, and higher in 2013-2017 than the previous period. However, the Oil Fund has a third strategy, in addition to allocation and selection it lends securities to traders who want to short them, which helps to keep transaction costs as low as possible by potentially delaying rebalancing and seeks to buy assets at the lowest price possible, potentially in primary markets or outside the main exchanges.

Once accounting for this Asset Management strategy and breaking down information rates between internal and external selection, the information ratio (excess return divided by deviation from the index) of internal stock selection is 0,10 against 1,43 for external managers.

NBIM's managers are according to this measure outperformed, but Dahlquist and Ødegaard (2018) point out that attributing returns to the different strategies is a difficult exercise.

Dahlquist and Ødegaard (2018), also find that Asset Management has an information ratio of 2,57. It can be inferred that NBIM's stock pickers are performing but that the value they deliver barely exceeds their wages, so the GPFG does not seem to have a competitive advantage for stock selection, but profits from its size and long-term focus through its Asset Management strategy.

Dahlquist and Ødegaard (2018) suggest that the structure of stock selection may not be optimal. Indeed, each manager is assigned a certain budget and asked to manage their portfolio within a certain universe. This technique opens for optimal allocations at the sub-portfolio level, but not when aggregating all the sub-portfolios. Indeed, optimizing the risk-adjusted return of the aggregate portfolio would require to consider the covariances between the different sub-portfolios.

There could also be an incentive factor since stock-picking is not as collegial as defining the main indexes and choosing risk factors. Therefore, it is possible that managers are prudent and prefer not to outperform the benchmark rather than risking losses that would be detrimental to their career. On one hand, it is an issue since the GPFG might miss supplementary returns, but when considering the fund's public exposure it could be better to have overly prudent managers than needing to explain to the Parliament and media why the managers decided to deviate from the benchmark and were unlucky for once, despite yielding better returns on average.

3.2.3 Good at selecting external managers

Once the risk factor exposure has been determined through defining indexes, managers can only create value by outperforming the index. Luck may help achieving better returns in the short run, but the longer term requires to generate added value through management, hence to find outstanding managers since market returns already reflect the ability of the median or at least average manager. On the other hand, highly talented analysts and stock-pickers will require a higher compensation for their skills. Indeed, a no arbitrage argumentation suggests that, if an efficient market can be outperformed, it either requires a rare set of skills - to find the right manager or to directly pick stocks - or the costs of an outperforming strategy equals the potential benefit from beating the market.

The Oil Fund is frequently quoted as a model for managing commodity windfalls. NBIM has succeeded in extending this good reputation into asset management thanks to its high ethical standards, good financial results and a sustained effort to improve their performance. As a result, there is much prestige linked to being selected as an external manager for the GPF, while the fund's size turns it into a potentially major customer.

Taking advantage of this desirability, the fund can access the most skilled managers and influence them by asking for lower fees and requiring that they abide by Norges Bank's ethical standards. These theoretical advantages are identifiable in the Oil Fund's performance as Dahlquist and Ødegaard (2018) estimate that external mandates contributed for half of the net active excess returns (stock-picking) in 2016 while external management fees are only of 0,5 per cent, which can be compared to the 1,5-2 per cent range offered to private Nordic investors, with sometimes higher figures abroad.

3.2.4 Contrasted results for the real estate portfolio.

Real estate investments require a precise local knowledge of the market, and proximity to the other market players in order to access the best deals and partners. NBREM (2017) mentions that 76 per cent of the portfolio's investment are made in cooperation with other investors. Norges Bank Real Estate Management has consequently opened six dedicated offices and hired 139 employees, representing a quarter of the whole management team, even though real estate only amounts to 2,5 per cent of the fund's capitalization.

Until 2015, the relative management costs for direct property as a percentage of Assets Under Management (AUM) have been declining but have stabilized between 0,20 and 0,30 per cent since. As the dataset stops in 2016, it could only be a temporary pause, justified by the opening of an office in Japan without any investment being made yet. These management fees are comparable to stocks (0,20 per cent).

To an extent, these expenses are comparable since Dahlquist and Ødegaard (2018) focus on costs within NBREM, excluding expenses incurred for administrating assets within the specialised subsidiaries, as operational expenses in a technology company are not added to the management expenses of NBIM.

Still, when studying the cumulative returns for the three asset classes: bonds, real estate and equity, starting in 2011 when NBREM was founded, Dahlquist and Ødegaard (2018) finds

that properties have only outperformed bonds since late 2014 and remain less profitable than equity, being an intermediary class between the two others in terms of risk and return profiles. In terms of management expense efficiency, the expense-return ratio is unfavourable to real estate compared with stocks, and Gjedrem et al. (2017) indicate that NBREM's cost structure is similar to its counterparts and sometimes higher, criticizing the entity for not taking advantage of potential economies of scale or competitive advantages of the Oil Fund.

This critique is not much surprising, in the light of the chosen investment universe and general approach of the Oil Fund's management who focuses on repeating best practices from the industry. Imitation cannot be expected to yield better results than the original.

3.3 Limitations emerging from the size of the Fund

3.3.1 *Volatility timing*

Volatility is derived from the return's standard deviation and is the most widely used measure of risk. It determines options' prices, and until the market correction of February 2018 it was an increasingly attractive object for passive and automated strategies.

Volatility timing describes a strategy modifying a portfolio's exposure depending on the market's volatility. Moreira and Muir (*forth.*) present for example a strategy in which the portfolio reduces its exposure to stocks as soon as volatility increases and conversely overweight's equities when volatility is decreasing after a financial crisis. The strategy might not be optimal since it is difficult to identify significant volatility increases, and it fails to address the possibility that another crisis follows quickly a short recovery from the first one.

It is not either implementable by the GPF. Indeed, where even a large hedge fund could short the market, the Oil Fund represented 1,4 per cent of the global stock market by the end of 2017, and 2,4 per cent of the European market⁶. Initiating a sale of the GPF's stocks would create liquidity challenges and depress market prices so the fund would either not manage to sell a significant share of its portfolio or trigger a market correction.

⁶ E24, <https://e24.no/boers-og-finans/oljefondet/aldri-har-oljefondet-eid-mer/24271843>

The current counter-cyclical buy-the-dip strategy is therefore the most suitable for a fund of this size. It might result in acquiring assets that will lose even more value and maybe never recover, but this risk can be reduced through diversification and potentially thanks to talented stock selection. The Oil Fund is also allowed to invest in corporate bonds, allowing it to seize debt restructuring opportunities in a distressed firm.

More generally, Langensjö et al. (2012) point out that funds with specialized teams have less opportunity to switch strategy.

If NBIM hires experts within one field, as it did with real estate, the potential restructuring costs in case the strategy proves insufficiently attractive should not be underestimated. In other words, while it is a comparative advantage to have the critical size enabling dedicated teams, it also implies a loss in flexibility.

3.3.2 *Declining active share as the Fund grows*

When considering the Oil Fund's *Active Share*, a measure introduced by Cremers and Petajisto (2009), Dahlquist and Ødegaard (2018) observe that the Oil Fund is an index fund, with a decline in weight deviation from the reference index. However, when using the degree of overlap with the reference index by comparing weights stock by stock, the Oil Fund has a stable active share situated between 15 per cent and 20 per cent.

The Oil Fund has been growing in absolute terms, but also as a share of the global stock market thanks to excess returns and large incoming streams from oil revenue. Hiring more internal specialists could create personal management issues and threaten the lean structure that permits extremely low management costs, estimated at 0,03 per cent for risk exposure and 0,20 per cent for internal asset selection by Dahlquist and Ødegaard (2018). This limits the scalability of stock selection and trigger a decrease in the active share of the Oil Fund.

It has been partly compensated by increasing the external mandates portfolio, but there is probably a very limited number of managers who are able to consistently beat the market. And as the GPF's investments represent a steadily increasing share of the global capitalization, its returns should be expected to be steadily more strongly correlated with the market average.

Identifying new risk factors, hence risk premia, will therefore be increasingly important and further justify assessing closely the introduction of new asset classes or markets to the Oil Fund's investment universe.

3.4 A politically anchored state fund

3.4.1 *The negative impact of epistemic proceduralism on efficiency*

The expression "A politically anchored state fund" is taken from the official report of Finanskomiteen (2017), and contrasts with the repeated message that the Oil Fund is first and foremost a financial owner who focuses on returns. Ethical considerations should not be detrimental to profit-seeking. This balance is also a goal mentioned by the Swedish AP-fonderna in their reports and by Langensjö et al. (2012).

Clark and Monk (2010) aims to demonstrate why the GPFG has sacrificed returns on the altar of ethics. They use the concept of *epistemic proceduralism* defining a situation where legitimacy derives from the quality of procedures rather than an assessment of the results. The Oil Fund excludes companies operating within some sectors or breaching international conventions on a principle basis, instead of running a cost-benefit analysis of excluding these companies. Clark and Monk (2010) note that there is no accounting of the costs and potential profits of abiding by the ethical rules.

It would require simulating the Oil Fund's portfolio in the absence of the ethical standards and compare them to the one effectively achieved, which is doable for the passively managed part, but more difficult for the active share. Running a comparison of the moral costs and benefits would also be difficult. One would have to assess the consequences of blacklisting for the affected companies and measure it against alternative use of the supplementary return, which could be delayed far in the future.

Clark and Monk (2010) note that contrary to many other pension funds, the GPFG is owned by the Ministry of Finance and supervised by the Parliament. The paper consequently argues that the Oil Fund "project[s] Norwegian belief around the world", becoming an indirect instrument of Norway's soft power. This use is expected by Norwegians and politicians, hence politically justified, and while the Oil Fund's management places ethics over efficiency, this compromise might also be required for the GPFG to exist.

Gjedrem et al. (2017) does not contest that the Oil Fund is potentially too vulnerable for political meddling and suggests moving it out of the central bank and transforming NBIM into an independent state corporation. The presence of Erna Solberg at the One Planet Summit, informally described as the Finance for Climate Summit, in Paris in December 2017 blurred a little more the lines, even though the Prime Minister recalled that the Oil Fund only pushes for best practices and is not a tool of climate activism.

However, Gjedrem et al. (2017) also argues in favour of the ethical standards. Considering the size and breadth of the Oil Fund's portfolio, the externalities from its unethical investments would affect negatively the returns of the GPF's stakes in other activities. It would be convincing if companies excluded from the scope of the Oil Fund were to disappear or change their attitude. For corporation who breach international conventions, there is indeed hope that the *name and shame* effect of excluding them from the Oil Fund's investment universe works.

Nevertheless, numerous stocks are excluded on the basis of their weaponry production, such as Airbus, Textron or Boeing. It seems unlikely that national champions⁷ will suddenly stop producing the nuclear warheads required by their home state's army. While the decision might be right in principle, it has the major drawback of preventing the Oil Fund from investing in the biggest defence companies, therefore reducing its diversification and profit potential.

The recent pressure in media and the Parliament where some parties asked for the Oil Fund to divest from gambling companies⁸, despite their attractive returns, illustrate another occurrence of the necessary arbitration between democracy and portfolio efficiency. Moreover, it also weakens the long-term competitive advantage of the GPF. If NBIM decides to invest in a project or company that later proves to be politically explosive, it might be forced to quickly sell the fund's share, potentially at a large discount.

Clark and Monk (2010) note that the Ethics Council of the Oil Fund can be asked by the Ministry of Finance, hence the political power, to observe a specific case, and that the

⁷ Large corporations aiming not only to make profits but also to advance national interests. Results from economic nationalism and dirigisme.

⁸ <https://www.nrk.no/norge/ap-vil-kaste-spillselskaper-ut-av-oljefondet-1.13926846>

Council prefers to instruct large companies with recognized names. This strengthens the idea that the Ethics Council pursue a soft power objective rather than to adopt a cost-benefit analysis on the Oil Fund's portfolio returns. On a positive note, they focus on cases where they feel confident in their ability to demonstrate the existence of ethical violations. A careful screening process by NBIM before deciding to buy a large stake in a project or company will therefore highly reduce the risk of being forced to divest an important but newly blacklisted investment.

3.4.2 Environmental mandates

The Oil Fund's mandate requires to seek long-sighted investment opportunities in corporations and technologies which opens for more environmental friendly economic activity, particularly through the development of new environmental technologies. Finansdepartementet (2018a) reports that by the end of 2017, 68 billion kroner were invested in 206 different sustainable stocks and 7 billion kroner were invested in green bonds. While in 2017, the return from the sustainable stocks was 21,7 per cent against 19,4 per cent for the whole equity portfolio, the annualized returns for the whole period (2010-2017) are of 6,2 per cent against 10,6 per cent for the whole portfolio.

Finansdepartementet (2018a) also informs that environmental investments have had higher volatility than the rest of the Oil Fund's portfolio, so overweighting this class has so far not been an optimal decision in financial terms. Still, NBIM presents on its website these environmental mandates as a part of its risk management, more specifically as a management of the climate change risk.

The notion of climate risk has been analysed by the Bloomberg (2017) report. The task-force points that there will be a steadily higher political and regulatory pressure towards climate neutrality, resource preservation and energy efficiency, accelerating the development of new technologies that will disrupt the economic system, hence market conditions. It also includes reputational risk, especially for consumer-oriented corporations. Another form of risk is being exposed to the negative consequences of climate change itself.

The group led by Michael Bloomberg (2017), founder and owner of the eponymous market data and information company has elaborated recommendations for better reporting of this climate risk. In principle, it is not much different from asking Kodak to report on the progress of digital photography and how the company intends to tackle this trend. However, a

common source of risk is affecting the whole economy in the climate change case, and while it does not require much effort to understand that the coal industry is negatively affected, the consequences for other sectors are more difficult to assess, hence this report.

Conversely, Bloomberg (2017) identifies opportunities within resource efficiency, preferring clean energy sources, greater climate-friendliness emphasis in the product and services offer, accessing new asset types that contribute to sustainable growth, and adapt resilience strategies against the negative effects of climate change.

Based on this notion of climate risk, divesting from carbon intensive activities can be seen as a risk-reduction measure. Hence, while the decision to divest from coal was a strong political demand, it intervened as the industry had already initiated its decline.

Divesting from oil can be justified both with the notion of climate risk and when reasoning in diversification terms. The Oil Fund is only one part of Norway's wealth. The State is by far the biggest, and majority shareholder in Statoil, and it owns shares of oil fields through the fully-owned Petoro, in addition to the value of future cash streams from the petroleum tax and mainland activity in the hydrocarbon sector. At the aggregate level, Norway is more exposed to oil and gas than this industry's share in the world economy would imply.

However, while the Bloomberg (2017) report encourages to explore new markets and to focus on energy efficiency, it does not advocate predict that currently moderately profitable entities operating within environment technology will suddenly become cash-machines. The environment mandates are a bet that companies specialized within environmental technologies will succeed in harvesting the opportunities of the climate neutral economy.

Oil majors, and Statoil, explore the potential of renewables and redirect their development efforts towards renewables, strong of their large engineering teams and financial solidity. Therefore, some oil companies could preserve their dominance, in spite of the technological disruption. A piece by Agrawal, Grans and Goldfarb (2016) reminds that disruptions do not come from high-end sophisticated technology, but from it becoming cheap enough to be used at a large-scale in the economy.

To conclude on this part, the environmental mandates might be legitimate procedurally and politically, their efficiency remains to be proved, especially in the light of past returns. Here, the exclusion of coal and oil companies can be sound both politically and in terms of

financial efficiency, this is the negative part of the mandate. However, the positive part: overweighting corporations of the “green economy” seems to be in breach of the principle that ethics should not supersede profitability in NBIM’s investment decisions.

3.5 Summary of the performance review

The current management of the Oil Fund has succeeded in delivering excess returns through risk factor weighting and asset management. While the selection of external managers has been a success, internal security selection does not result in sizeable outperformance. The limited abilities of the Oil Fund’s own managers could also apply to the recently established real estate subsidiary.

Considering that the Oil Fund’s staff is able to identify skills when hiring external managers, there could be limitations within their own mandate that explain their lack of performance. The chosen approach for implementing an ethical investment standard reveals a stronger focus on principle and intents than on efficiency, which seems to be a consequence of influence from the political sphere.

This influence could explain that managers prefer to only slightly outperform the market with a high level of certainty, rather than taking riskier bets which would result in higher risk-adjusted returns but also open for underperformance, hence political backlash.

Aware of these constraints on the Oil Fund’s management, but also noting that there have been reform proposals, notably last year from the Central Bank Committee, we will assess the suitability of private equity and infrastructure investments for the GPFG.

4. Private Equity

Creating a synthesis of research on private equity, we make an analysis on what the GPFG may expect from private equity (PE) asset class in terms of general characteristics. As the private equity market is as implied, private, data quality and availability are scarce. The best quality data is found from private equity funds, which we discuss in more detail in chapter 5. Much of the discussions in this chapter is therefore based on evidence from these funds.

4.1 The private equity investment process

Cendrowski, Martin, Petro and Wadecki (2012) define private equity as equity capital invested in companies that are not publicly traded on any exchange. Unless specified otherwise, we will not include holding companies for real estate, infrastructure or natural resources under this label.

The number of unlisted companies around the globe is large, and equity investments in all these companies are either not accessible or not attractive for large institutional investors such as the GPFG. Some businesses are arguably too small with a too limited growth potential for being considered by institutional investors. Many large family-owned and fully state-owned corporations are unlikely to be offered for sale and will remain out of our focus. Døskeland and Strömberg (2018) define the private equity market as the investment universe available to institutional investors.

Investing in private equity consists in acquiring stakes in unlisted companies, with often a finite investment horizon. Over the holding period, named the private equity investment process, the PE investor seeks to add value through active engagement. Kaplan and Strömberg (2008) summarises common profit improving activities in three forms of engineering; Governance engineering, financial engineering and operational engineering. The time horizon for an investment in private equity typically spans from three to seven years, depending on the time necessary to implement the various value-creating strategies.

Once satisfied with the improvements made in the company, investor will divest. World Economic Forum (2015b) note that the privileged exit strategies are Initial Public Offerings (IPOs), which is a listing of the corporation on a stock exchange, and selling to a strategic buyer. This second exit type has been common in the tech industry where giants like

Google or Facebook acquire potential competitors or seek to exploit the opportunities brought by new technologies. In some cases, investors will sell their shares to another private equity investor. Because of the focus on exiting and intensive value improvement, returns to the PE investor is mainly in the form of capital gains.

4.2 Market segments

The private equity market is divided in different sub-classes in respect to characteristics of the target companies, and the report by Døskeland and Strömberg (2018) to the Ministry of Finance makes no exception.

4.2.1 Buyouts

PE buyout firms (or leveraged buyouts) represents the largest segment. McKinsey & Company (2018) reports that it accounts for slightly under 60 per cent of the overall PE market measured on total asset under management (AUM).

Leveraged Buyouts (LBO) describe companies that are acquired through highly leveraged transactions. capital and debt. World Economic Forum, (2015b) reports that debt

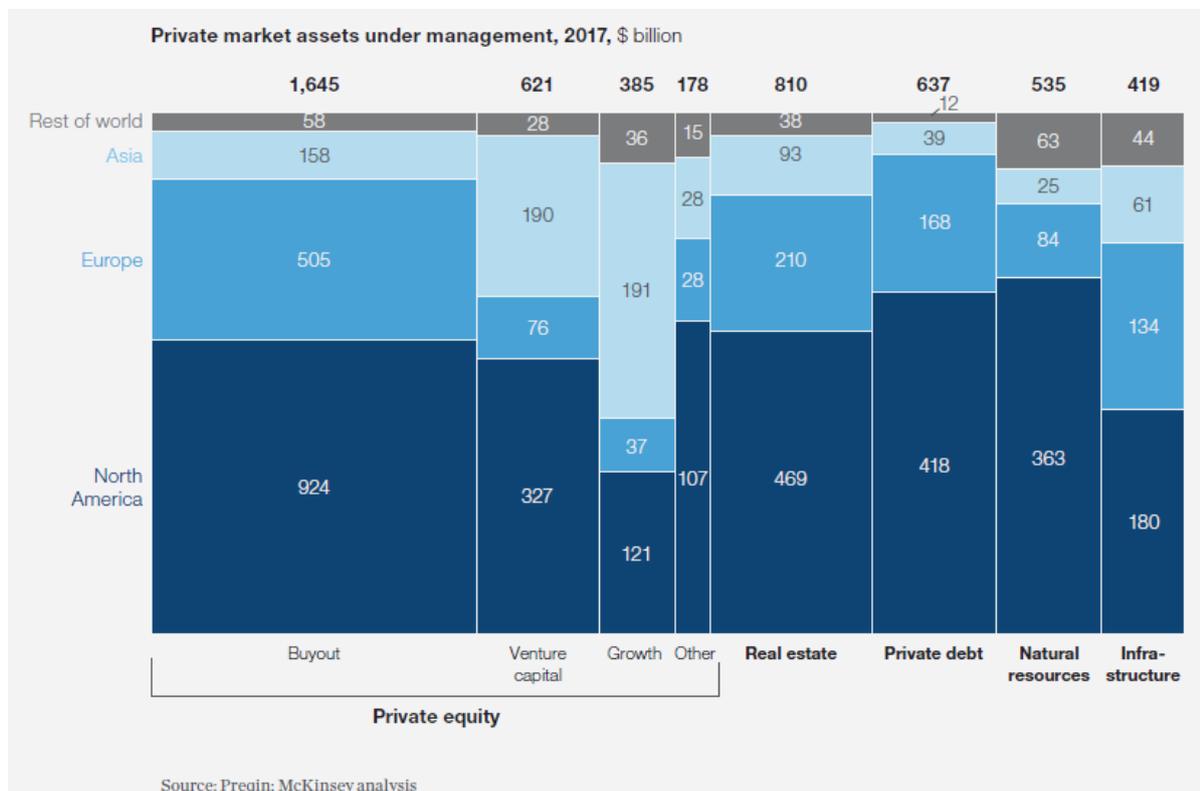


Figure 1: Repartition per class of assets under private management, USD billion (Total: 5,2 trillions)

typically accounts for 50-70 per cent of the total purchasing price. In many jurisdictions debt liability can be transferred from the buyer to the acquired company, so only the latter goes bankrupt if the buyout is unsuccessful. A number of buyout investments have defaulted due to excessive leverage levels, such as the toys retailer Toys R Us, triggering losses not only for equity holders but also owners of the high-yield bonds used to finance the transaction.⁹

Døskeland and Strömberg (2018) note that buyout investors tend to acquire controlling stakes in mature, established companies with a strong record of earnings, and in which they see a potential for additional growth. They indeed seek to implement “good-to-great” and “small-to-large” investment strategies to improve profitability and the size of the target company.

PwC (2018) note that in 2018 European private equity firms seek first and foremost (82 per cent of the respondents) to achieve consolidation by merging smaller companies and creating market leaders. This is not contradictory with a “small-to-large” strategy but implies a heavy reliance on inorganic growth.

PwC (2018) also indicates that implementing a “Good-to-great” strategy used to be the major motivation of European private equity managers and is still nearly as important as consolidation. The remaining differences between Døskeland and Strömberg (2018) and PwC (2018) may be explained by variations in the size and sector repartition of the portfolio companies.

Leverage buyout is often associated to vulture funds extracting as much profit as they can from their target and hindering long-term growth through under-investment. According to Boucly, Sraer and Thesmar (2011) the evidence backing this reputation comes from studies of the American and British private equity market during the 80s and 90s. This period was characterized by painful restructuring processes across developed countries. This also brings reputational risk for the investor, which is not ideal for the GPFG.

When focusing on economies with higher credit constraints and less efficient financial markets, such as France, Boucly, Sraer and Thesmar (2011) show that LBO can not only increase profits but also create growth. Yet, they also observe that while companies acquired

⁹ <https://www.ft.com/content/17dfa7fe-eaf7-11e7-8713-513b1d7ca85a>

from a private owner benefitted from the LBO, companies acquired from the public market displayed no specific improvement.

By targeting mature firms that are either already publicly listed or could have been listed, leverage buyout opens for a relatively transparent management. The size of the market and long track record of numerous actors in the industry should allow NBIM to screen the best managers from a financial and ethical perspective. Since the acquisition targets are relatively large, comparable to middle and small capitalisations in which the GPFM already invests, direct investments are also a possibility.

4.2.2 Venture capital

The second largest segment is venture capital, accounting for approximately 21 per cent of total AUM as shown in figure 1 by McKinsey & Company (2018). Døskeland and Strömberg (2018) points that in contrast to LBO, venture capital firms tend to target early stage, unprofitable companies that have no or very short earning records. These firms are usually innovative businesses that the investor believe to have significant potential for rapid development and growth. Capital is invested through a fund raising to provide the target with the necessary resources for its growth.

According to World Economic Forum (2015b), venture capital investors tend to be even more actively involved in the portfolio companies and specialized in terms of sectors and company life stages, compared to the buyout investor. Different life stage specializations include start-ups, seeds and early-stage companies or later-stage and expansion phase companies.

Venture capital is also considered riskier. Frank, et al. (1996) define the “Valley of Death” for new technologies, when they are stable and ready to be used but have not yet reached the commercialization stage. A lack of funding towards implementation and scalability results in high failure rates. There are also challenges linked to screening candidate targets and assess whether a technology is viable and has a commercial potential.

Quoting World Economic Forum (2015b): “Given the high failure rate of start-up companies, the [venture capital] business model is predicated on the hope that a few investments will deliver exceptionally high returns (>10x invested capital) in order to offset for the many other investments where some or all of the equity invested are lost”.

When it comes to reputational aspects, the risk level displayed by venture capital could be compared to informed gambling. If the GPFG's investments were to underperform in this asset class, sharp criticism from the political sphere could follow. On the other hand, by providing capital to promising early stage companies with a strong potential for improving welfare, venture capital investments could enhance the Oil Fund's reputation as a responsible investor.

The extremely high idiosyncratic risk calls for extensive diversification efforts, hence large portfolios. However, venture capital also requires skilled and specialized managers, and most funds are specialized in a small set of industries. Buchner, Mohamed and Schwienbacher (2017) observe however that diversified funds led by experienced managers succeed in harvesting diversification benefits.

At first, the GPFG sounds like an ideal candidate for this type of investment, but its market value approaches the trillion dollars, whereas the total AUM for venture capital is only of 621 billion dollars according the Preqin database, quoted by McKinsey & Company (2018). World Economic Forum (2015b) note that the investments of venture capital firms are commonly in the 1 million dollars to 10 million dollars range.

McKinsey & Company (2017a) reports that the median venture capital fund is on average (over time) \$49 million. In contrast, the median buyout fund was an additional \$300 million. Døskeland and Strömberg (2018) argues, "For an investor with a multi-billion PE mandate, investing in small funds does not make much sense. A small fund might take as much due diligence effort as a large fund, but even if incredibly successful, it has a negligible effect on total portfolio performance".

Information technology represents 17,8 per cent of the MSCI World Investable Market index, including large, middle and small capitalisations in developed economies.¹⁰ The same index for emerging countries displays a share of 27,1 per cent.¹¹ NBIM, (2018b) indicates that the technology sector delivered the highest return for the Oil Fund in 2017, even though it only accounted for 11,2 per cent of the fund's equity portfolio.

¹⁰ <https://www.msci.com/documents/10199/cc93af9f-9373-4f3b-87bb-1c523ca7431e>

¹¹ <https://www.msci.com/documents/10199/97e25eb7-9bd0-4204-bea9-077095acf1d3>

Since the GPFG is heavily underweighted in the technology sector, which can partially be explained by its overweight against Europe, there could be some diversification advantages in accessing venture capital, which according to World Economic Forum (2015b) is dominated by information and biotechnologies.

Powell (2018) argues that the current valuations of information technology companies are not the result of a bubble, since the Price per Earnings ratio of the FAAMG (Facebook, Amazon, Apple, Microsoft and Google) is lower than half of the same ratio for key components of the 90s tech bubble, such as Microsoft, Cisco Systems, Intel, Oracle and Lucent. Powell (2018) also shows that once correcting for Europe's undersized technology sectors, the American corporations do no longer display higher margin than their European counterparts.

If there is no bubble in the American tech market, the first reaction could be to adapt the GPFG's reference benchmark so it better reflects the sector repartition of the world market. However, it could also be attractive to access start-up companies with a high growth potential, not least for diversification purposes.

4.2.3 Growth equity

While the venture capital industry has improved, Wilson, Wright and Kacer (2018) observe that there is a second equity gap, or a second "Valley of Death" when firms are almost ready for a public listing but still could profit from further support and funds in order to achieve their growth potential. They refer to Sadler (2016) who quotes Michelle Deakers saying that such listings look "great initially but they will become a company in the land of the walking dead".

McKinsey & Company (2017a) define the growth segment of private equity as intermediate between buyout and venture capital. It targets relatively large but growing businesses in need of more funding. This category seems to be an attempt to match the needs of the second equity gap, but is much smaller than both venture capital and buyout, with only 13 per cent of the AUM in private equity.

When bringing closer the observation by Boucly, Sraer and Thesmar (2011) that numerous non-listed companies in continental Europe face credit constraints, and that these

firms benefit highly from buyout investors, and the estimation by Wilson, Wright and Kacer (2018) that the second equity gap represents annually and in Britain alone between 12 and 32 billion pounds, there seems to be an insufficiently explored market for the GPFG.

Unfortunately, the growth market has been mostly overlooked by McKinsey & Company (2017a) and Døskeland and Strömberg (2018) in their reports on PE for the GPFG delivered to the Ministry of Finance, with most of the focus being on venture capital and buyout. Døskeland and Strömberg (2018) still note that growth equity segment is both growing and focused in China. They suggest that it could result in companies remaining private for a longer time. Therefore, investing in growth equity could yield sensible diversification benefits.

Since governments and chambers of commerce are aware of the existence of a capital shortage, there are numerous associations for the promotion of investment. Though they have mostly been targeted at foreign corporations, there could provide advices and information about firms that would be the best candidates for a growth investment. As the interaction with these agencies is likely to be repeated, they would be interested in sourcing quality deals to avoid being blacklisted. The GPFG could therefore aim to invest directly in growth private equity.

4.2.4 Implications for the GPFG

The buyout segment seems to suit well the existing public equity management by NBIM. It concerns companies with similar characteristics to the listed market, and allows for investing sizeable amounts, either through funds or directly. If the LBO industry has had a mediocre reputation, it should improve as more recent research proves that some segments increase both profits and economic activity.

Venture capital is smaller in scale, much riskier and requires highly-skilled managers to succeed. Investing in venture capital funds could potentially be attractive, but such investments are likely to remain marginal in the GPFG's portfolio.

Last but potentially the most promising, growth equity describes an intermediate subclass, with lower reputational and technological risk. The size of the required investments, though probably lower than for buyout targets, remains sizeable and this segment is likely to grow in the coming years since it only represented 37 billion dollars in 2017 (Figure 1), while

the estimation of the needs in the United Kingdom ranges up to 32 billion pounds, or 43 billion dollars.

4.3 Size and growth of the private equity market

4.3.1 *Private equity market size*

Because of data availability, the further analysis mainly focuses on buyout and venture capital.

Since private equity are not publicly priced on an open market, there are valuation challenges when estimating the market size of the asset class. One solution is to sum up committed and uncommitted capital, controlled for trivial segments, resulting in the total AUM of the PE market. However, the true market value is probably not equal to the amount of the initial investments. Assuming that the market value of private equity is equal to deployed capital is a strong assumption ignoring non-realized returns.

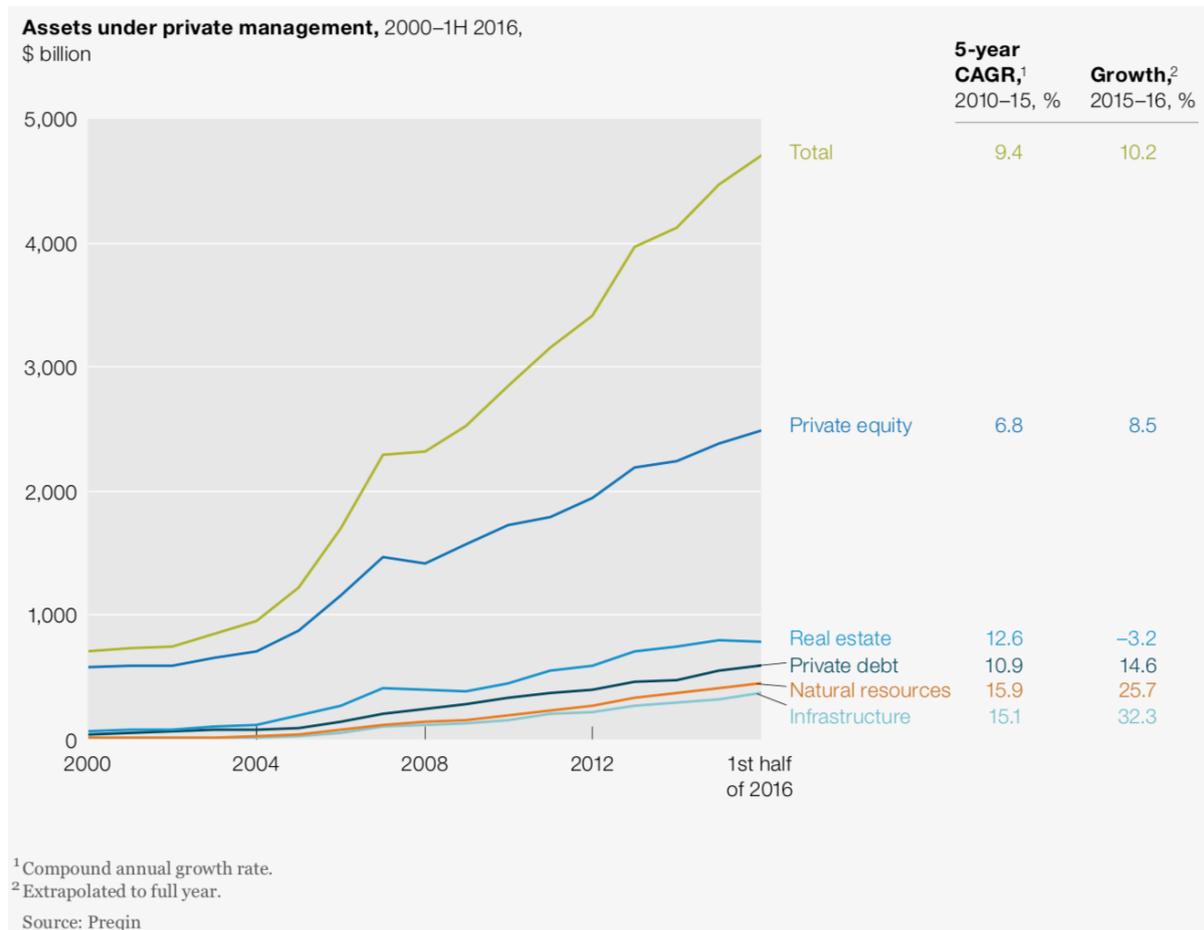
Døskeland and Strömberg (2018) report estimates of total AUM provided by Preqin, which is measured from net asset value (NAV) reported by PE funds. However, this only includes buyout and venture capital funds, and excludes direct investments and co-investments.¹² The estimate by Preqin may therefore be interpreted as a lower bound of the market value of PE. Excluding dry powder, which represents committed capital awaiting to be invested, AUM in buyout and venture capital funds totals 1.63 trillion dollars as of June 2017. If dry powder is included, AUM totals 2.48 trillion dollars. According to Døskeland and Strömberg (2018), the total asset under management in the PE market represent 5 per cent of the global public equity market.

4.3.2 *Private equity market growth*

Noteworthy is the size of dry powder in the market, indicating that the market is floating with excess capital awaiting to be invested. According to McKinsey & Company (2018), the

¹² Direct investments and co-investments are concept we discuss in chapter 5

private equity industry has a record amount of capital, and dry powder has grown on average 10 per cent the last 6 years.



*Figure 2: Evolution of AUM in private markets, separated by asset class.
Source: McKinsey & Company (2017b)*

However, the growth in total AUM has been tremendous the last decades. Mainly driven by the buyout segment, private equity averaged 14 per cent annual growth in the period 2005–2010 and 7 per cent annually in the period 2010–2015 and 8,5 per cent in 2016, according to McKinsey & Company (2017b). Figure 2 shows the evolution of assets under private management, illustrating the sharp increase for private equity.

Dry powder as a share of AUM is therefore stable, but this evolution still reflects a pressure from investors looking for higher returns and wanting to invest in private equity. Both the World Economic Forum (2015a) and to McKinsey & Company (2018) suggest that pension funds are faced with unfunded liabilities, and consequently are intensively looking for higher yields.

Døskeland and Strömberg (2018) are concerned that the PE market is in a booming period and currently overvalued, argue that the GPFG should postpone any private equity investment.

However, bubbles and overvaluation are difficult to identify, so staying outside the market when facing uncertainty involves high opportunity costs.

Private equity is probably not sufficiently mispriced compared to the public market to justify any arbitrage attempt. Therefore, while Døskeland and Strömberg's (2018) remark should result in extra care when investing, the strategy of NBREM (2017) to invest progressively rather than engaging in market timing has a better risk-return profile than postponing.

4.4 Performance

4.4.1 *Historical performance hard to estimate*

Again, the illiquidity and lack of transparency in the PE market makes it difficult to get good estimates of performance. Common performance measures on financial assets requires regular market valuation. According to Norges Bank (2018), the best quality data is that of PE funds. But as the market is private, PE fund managers has no obligation to make their performance public, and often do not.

Harris, Jenkinson and Kaplan (2015) indicates that LPs may get data on request but are often not allowed to share these data with third parties. Furthermore, many performance measurements have relied on net asset value reported by PE funds themselves. As PE funds has the incentives to make themselves look good to attract capital, how much we can rely on these estimates of performance is questionable.

Later research has instead looked at cash flows from PE funds to their investors to avoid the caveat of self-reported net asset value. These cash flows are often net of fees and profit sharing with the PE manager. Performance measures on cash flow data is therefore on a net return basis, and the actual return is higher. BVCA (2015) reports common techniques used to estimate returns on these cash flows, including Internal Rate of Return (IRR) and

Public Market Equivalents (PME). We will evaluate evidence of such estimates in this subsection.

Internal rate of return estimates

Using cash flow data (net of fees and profit sharing) from 1800 buyout and venture capital funds reported by about 300 investors to the Burgiss database, Harris, Jenkinson, & Kaplan (2015) estimates average IRR and PME. Figure 3 reports their average IRR estimates separately for North American buyout and venture capital funds.

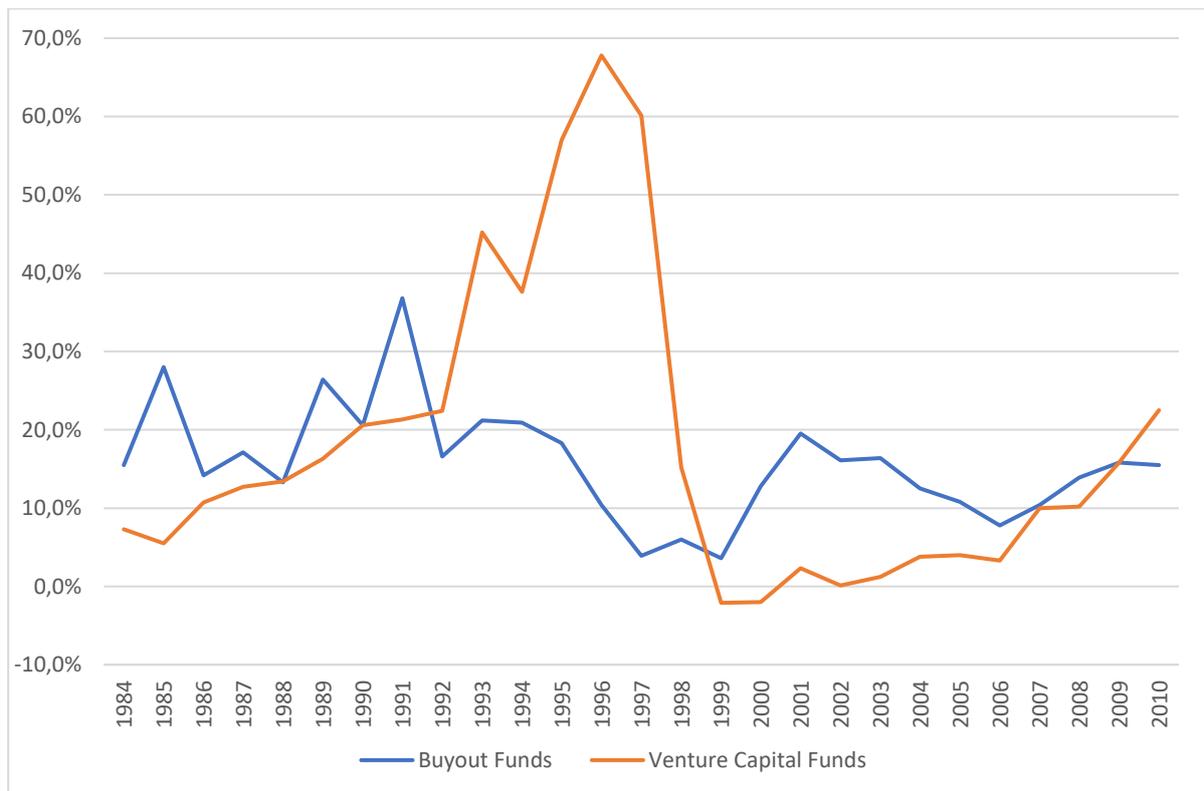


Figure 3: Annualized average internal rate of return (AIRR) for North American buyout and venture capital funds. Source Harris, Jenkinson, & Kaplan (2015)

Harris, Jenkinson, & Kaplan (2015) have compared the performance of the funds present in the Burgiss database to the ones present in the Preqin and Cambridge Associates databases and do not find significant discrepancies, suggesting that the figures they used are unbiased.

However, the use of average internal rates of return (AIRR) results in smoothing of crisis. While Harris, Jenkinson and Kaplan (2015) note that the extreme returns of venture capital in the late 1990s are linked to the dotcom bubbles, the figures show a negative mean

AIRR for 1999, even though the Nasdaq Composite increased the most in 1999 and peaked in January 2000¹³.

As a result, the persistent positive AIRR over the estimation horizon is artificial, and while the graph shows that both segments delivered mean AIRR higher or equal to 10 per cent, this is more likely to result from data smoothing than from remarkable hedging abilities of private equity funds.

Harris, Jenkinson and Kaplan (2015) also note that accounting standards did not require private equity firms to quarterly value their assets at fair value before the 2007-2008 financial crisis, so the data from which they computed the mean AIRR could also be underestimating volatility.

Over the studied period, the mean AIRR is 15.7 per cent for buyouts and 17.9 per cent for venture capital. These figures are inflated by the exceptional returns of the dotcom boom, and if we look at the mean AIRR for the period starting in 2003, when the S&P500¹⁴, Russell 2000¹⁵ and Nasdaq started recovering, buyout funds deliver a mean AIRR of 13 per cent whereas venture capital funds now only exhibit a mean AIRR of 9 per cent.

McKinsey & Company (2017a) reports figures for the global private equity market and finds slightly different results, claiming that buyouts and venture capitals has managed to deliver equal figures of an IRR approximately 15 per cent annually in the period 2001 to 2012.

World Economic Forum (2015b) also reports global private equity performance, where buyout returns in the period 2003 to 2012 have been close to 12 per cent annually, and global venture capital funds have struggled following the dotcom bubble with close to zero return until the aftermath of the financial crisis of 2008, when returns recovered and have been since in the 15 to 30 per cent range.

¹³ <https://markets.ft.com/data/indices/tearsheet/summary?s=COMP:NAS>

¹⁴ <https://finance.yahoo.com/quote/per cent5EGSPC?p=per cent5EGSPC>

¹⁵ <https://finance.yahoo.com/quote/per cent5ERUT?p=^RUT>

This last figure is sourced from the National Venture Capital Association and because of the large discrepancy with the results from McKinsey & Company (2017a) and Harris, Jenkinson and Kaplan (2015), we can infer that the database of the National Venture Capital Association is either biased or incomplete.

Otherwise, since the McKinsey & Company (2017a) uses figures from Cambridge Associates and Thomson One whereas Harris, Jenkinson and Kaplan (2015) use the Burgiss database, it is not surprising that their results display some variation, especially for venture capital funds which McKinsey & Company (2017a) assess as even less transparent than buyout funds.

Public market equivalent estimates

When assessing private equity, investors might be interested in comparing it to public equity. Alessandro (2016) points out that public market performance is in general evaluated by looking at time-weighted returns, which consist in estimating the return over the holding period of a single investment.

Since IRR is sensitive to the timing and size of capital flows between the PE funds and the investors, it is less suitable to estimate public market performance. Therefore, AIRR estimates are not directly comparable to simple return estimates of a pre-defined benchmark.

A solution can be to use a Public Market Equivalent (PME) estimate, which is a relative performance measure. The PME is constructed by first making an investment in a pre-defined public market benchmark that mimics the cash flows from the PE fund investment. The IRR of the public market investment is then estimated, and directly comparable to the IRR estimated on PE fund cash flows, giving the PME.

The PME estimate is then for simplicity normalised to one, so that a value of one represent the case when the IRR of the public market investment and PE investment is the same. PME estimates below one then indicates PE underperformance and vice-versa. The normalization makes the measure easy to interpret; for instance, a PME estimate equal to 1.1 indicates that the PE investment had outperformed its benchmark by 10 per cent at the end of the investment horizon.

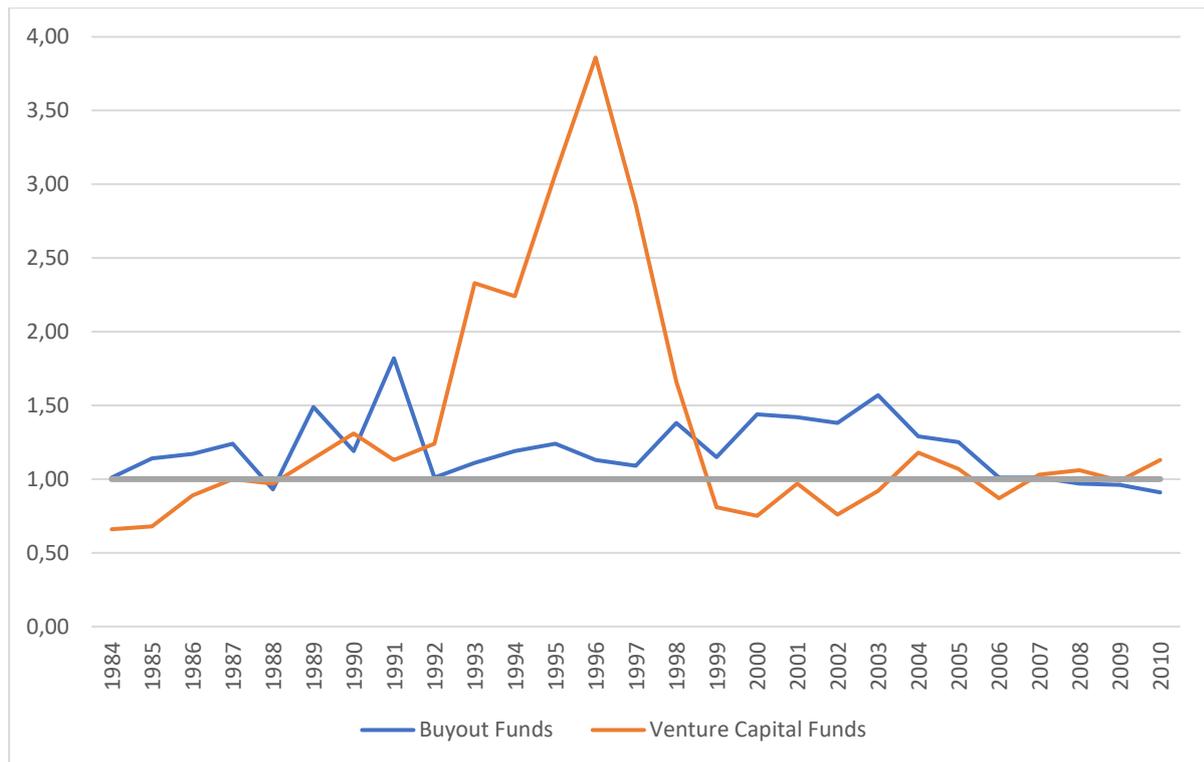


Figure 4: Average public market equivalent (PME) ratios of 1800 North American buyout and venture capital funds. Estimates are made on cash flow data reported by 300 PE fund investors, net of fees and profit sharing with fund managers. $PME > 1$ indicates PE outperformance relative to public markets. $PME < 1$ indicates PE underperformance relative to public markets. Benchmark is the S&P500 index. Source: Harris, Jenkinson, & Kaplan (2015).

Harris, Jenkinson and Kaplan (2015) uses the S&P500 index as benchmark to estimate historical average PME ratios among the 1800 North American buyout and venture capital funds. Figure 4 reports their results.

Harris, Jenkinson and Kaplan (2015) observe that buyouts tend to outperform. The average of the average PME for buyouts are 1.20, suggesting that buyouts over time gives the investor an additional 20 per cent compared to an equivalent public market investment.

Interestingly, not only the top and mean buyout funds outperform the S&P500, but the median fund does too, so the performance of buyout funds is not exclusively the result of positive outliers. However, venture capital does not have the same persistency of outperformance as buyouts, with extensive periods of under- and outperformance.

The average of the average PME for venture capital is higher at 1.35, but like the mean AIRR previously computed it can be imputed to the dotcom boom. Excluding the 1990s from

the estimation gives an average of 0.95, thus venture capital has in general (in normal periods) underperformed relative to public markets.

In average, Harris, Jenkinson and Kaplan (2015) find annual excess returns ranging from 3 to 4 per cent for buyout funds and from 0.5 to 3 per cent for venture capital funds.

Whether the S&P500 index is the correct benchmark to use is questionable since the targets for private equity are likely to be heavily exposed to the size risk factor. Harris, Jenkinson and Kaplan (2015) conduct robustness checks with the small-cap Russell 2000 and the small-cap Russell 2000 value, and find that the average vintage year PME for buyout is lower for these two indices than for the S&P500 but remains statistically significant above 1.

Still for buyouts, Harris, Jenkinson and Kaplan (2015) finds similar results in the European market. However, European venture capitals has struggled to keep up with public equity. Buyouts seems to be a more homogeneous on the international level.

Wrapping up

Data unreliability and discrepancy among databases impose to be careful about making any definitive conclusion. However, as the results from Harris, Jenkinson and Kaplan (2015) and McKinsey & Company (2017a) seems to converge, while World Economic Forum (2015b) has also similar performance figures for buyout funds, we should have a relatively accurate outlook of private equity performance.

Both McKinsey & Company (2017a) and Harris, Jenkinson and Kaplan (2015) are wary of the large gap in performance between the top and bottom quartile, stressing the importance of fund selection, especially for venture capital. There could still be selection bias in the dataset, but since Harris, Jenkinson and Kaplan (2015) observe that the performance of the Burgiss database is similar to the performance of the Preqin database which is largely based on reports by public pension funds, the sample should reflect the investment universe available to institutional actors.

Venture capital, especially outside the United States might not be outperforming the market average, but there is strong evidence that buyout funds do, so they should be considered as candidates to the GPFG's investment universe. We could not look in details the performance

of growth funds, but as an intermediary class between venture capital and buyout, they should also display attractive returns.

4.4.2 Private equity performance is skill-dependent

Active management of a stock portfolio implies to select securities, sometimes bid in IPO, vote and potentially submit a question during a general meeting and decide when to sell. Private equity portfolios are even more actively managed because of a stronger focus on creating value in the acquisition targets during the investment period. Assets are also more difficult to source and identify since they are not publicly listed and, reaching a deal with a strategic buyer or managing an IPO is arguably more demanding than executing a trade.

The skills of the general partner or manager are therefore particularly important. Sensoy, Wang and Weisbach (2014) argue however that as the private equity industry has matured, picking a good general partner has become more difficult. Their main result is that some investors could invest in limited access private equity funds without being particularly skilled at fund picking. These access-restricted funds seem to have been superior, but the maturation of the industry has produced more homogeneous general partners, and lower restrictions. As a result, investors need now a special ability in selecting managers, and Sensoy, Wang and Weisbach (2014) do not find evidence that a specific type of investor has this skill.

NBIM's ability to choose performing external managers could possibly be developed further to select good private equity managers, but as mentioned, private equity requires different talents compared to stocks trading. Alternatives to fund investment will be discussed more in details in Chapter 5.

4.4.3 Private equity sentiment

A consecrated expression figuring on any financial prospectus reminds that past returns are no guarantee of the future. Still, the previously studied performance assessment suggest that private equity should keep overperforming the market.

Most institutional and professional investors share this view. The Prequin (2018) investor outlook indicates that 75 per cent of investors expect that private equity will outperform.

However, half of the investors also point at a more intense competition to source attractive investment opportunities, which could explain why only 37 per cent of investors intend to increase their exposure to private equity the next 12 months, but the figure increases to 96 per cent for the longer term.

Most recently, McKinsey & Company (2018) finds that 90 per cent of a pool of PE investors believe that private equity overall will outperform public markets in the years to come.

A PwC (2018) report indicates that over half of the European private equity managers expected that the market conditions will improve, with Benelux-based managers being the most optimistic. Over half of them also expect to slightly increase their investments.

The three studies indicate an optimistic outlook for private equity, with concerns that it might be temporarily overheating, which is in line with the overvaluation fears expressed by Døskeland and Strömberg (2018).

4.5 Does private equity offer diversification benefits?

The GPFG currently has a well-diversified portfolio built up by a broad exposure to public equity, fixed income securities and unlisted real estate. Markowitz (1952) enlightened the importance of correlation between the assets in a portfolio for the total risk born by the investor. If private equity had a correlation with public markets significantly lower than one, it would help to improve the risk profile of the Oil Fund's investment universe.

Norges Bank (2018) argues that private equity will expand the GPFG's investment universe (which is true) and for that reason enhance diversification. Døskeland and Strömberg (2018) argue for the same and point out that private equity might contain exposure to systematic risk not presented in public markets, which enables the GPFG to expose itself to additional risk factors that are otherwise unavailable.

Welch and Stubben (2018) shows that historical evidence of large diversification benefits from private equity are mostly an illusion relying on accounting rules. Before 2006 in Europe and 2008 in the US, private equity funds valued their assets at the acquisition price

according to the cost-based accounting method. This method was the industry standard due to difficulties in assessing the true market value of the assets.

However, fair value accounting based on market valuations, has since replaced the cost-based method. Welch & Stubben (2018) use the European regulatory change in 2006 to observe an impact on correlation between public and private equity returns. Through a difference-in-difference approach, they document that the market beta of the European funds that switched to fair value accounting converged towards one (0.26 to 0.90), significantly reducing diversification benefits.

Welch and Stubben (2018) also indicate that private equity firms raised roughly 50 per cent less capital after a change in the European rules. This seems to be a strong indication that investors seek diversification when investing in private equity. Since the American PE managers had not yet implemented the rules, it is likely that their funds appeared suddenly more attractive than their European counterparts, explaining why the latter suddenly struggled to raise capital.

European firms are a better candidate for such a study since the accounting standards were changed in the middle of financial and economic turmoil in the US. However, there is still only one year of data to analyse the consequences of the switch to fair valuation, which weakens the result.

More importantly, buyout funds represent 78 per cent of the European private equity market according to McKinsey & Company (2018), while they only make up 62 per cent of the American market. These differences in structure, and potential differences in economic sectors, might justify that European private equity investments display a high correlation with the market since the experiment is not randomized.

Finally, there is a benchmark issue. Welch and Stubben (2018) compare the returns of private equity against the returns of the MSCI World Index. As previously mentioned, the technology sector represents 15-20 per cent of the global public capitalization. However, technology only represents 4,6 per cent of the STOXX Europe 600 index¹⁶. The high level of correlation between European private equity and the MSCI World Index likely results from a

¹⁶ <https://www.stoxx.com/document/Bookmarks/CurrentFactsheets/SXXGR.pdf>

similar sector repartition, but a longer time period could have identified that European private equity provides a much larger exposure to the European economy.

Welch and Stubben's (2018) contribution shows that historical data is flawed but does not exclude that introducing private equity to a portfolio brings diversification benefits at all. Their work should rather lead us to look closer at the fundamentals instead of focusing on unreliable time series.

Døskeland and Strömberg (2018) point to the strong growth of the private AUM compared to public market capitalization. There has simultaneously been a sharp drop in the number of listed companies since the dotcom bubble. While this decrease has been strongest in the United States with a fall by almost 50 per cent, Norges Bank, (2018) notes that a decreasing trend is also observed in Europe and has expanded to the rest of the world after 2011.

As a result, private equity might become steadily more important for diversification, as an increasing number of companies are unlisted through LBOs and high growth firms increasingly attempt to remain private by raising funds in the relatively recent growth segment of private equity.

Furthermore, the artificial smoothing resulting from lagging valuations could contribute to a more stable valuation of the GPFG's total portfolio. This would help mitigate the headline risk associated with short term "noise" in public markets, which can become a challenge for NBIM during financial downturns. Finansdepartementet (2018a) underlines the importance of broad political support of the fund. And in our interview with the Ministry of Finance, they agreed that the stable valuation of unlisted investments could in practice be beneficial in the short run.

4.6 Is private equity suitable for the GPFG?

The GPFG's political character imposes carefulness about reputational risk and to enforce strict ethical guidelines promoting transparency and responsibility. Public-to-private leverage buyout might therefore be inappropriate, while the venture capital industry does not have strong transparency records.

Since it is dubious that venture capital generates excess returns and the small size of the investment opportunities in this segment would not allow the GPFG to benefit from economies of scale, the current market situation does not suggest that NBIM should mobilize resources to integrate venture capital in its portfolio.

However, the private-to-private buyout and growth segments generate value for the investment targets, and consequently seem to outperform the market. Corporations are steadily delaying their public listing, especially in Asia, where growth private equity is already much developed thanks to market players like Softbank and its Vision Fund¹⁷.

As a result, the diversification benefits from entering the growth and buyout segments will probably increase. Target companies in the growth segment sell shares to raise funds whereas buyout implies to acquire shares from the existing owners, but the two sub-classes are otherwise much similar. NBIM would therefore only need to establish one manager pool to address both segments.

McKinsey & Company (2017a) affirms that private equity as a stand-alone asset class has in general offered two appealing attributes: attractive returns and diversification benefits. We overall agree, despite the discussed weaknesses. The buyout and growth segments seem to be the more promising while venture capital could be considered but will likely remain a niche.

¹⁷ <https://softbank-ia.com/vision-fund>

5. Private equity as a management method

In the previous chapter, we discussed what the GPFG may expect from private equity as an asset class. In this chapter, we turn to the implementation phase of unlisted investments, and discusses issues that would arise for the GPFG if private equity was added to its investment universe.

Infrastructure is also a class for unlisted investments, and while its optimal management model is probably different from the optimal model for private equity, we will review different alternatives and challenges that have a sensible degree of commonality for the two classes.

5.1 Liquidity and implications for the long-term investor

5.1.1 *Some theoretical background*

The well-diversified investor is exposed to systematic risk, as all the idiosyncratic or asset-specific risk is diversified away. Greater exposure to systematic risk reduces the risk averse investor's willingness to pay for an asset, and all else equal, such an asset will trade at a discount reflecting the compensation that the investor require.

Risk-averse rational investors are supposed to both dominate financial markets and require a compensation for assuming risk. The first models such as CAPM were based on a uniform systemic risk, the market, to which the assets related in different ways through their beta. However, the explanative power of this model was limited and Fama and French (1993) introduced new risk factors: Company size and book-to-market value.

We will be looking at the existence of another factor, related to liquidity. Døskeland and Strömberg (2018) distinguish two components of the liquidity premium: Liquidity level and liquidity risk. The former describes a lack of depth on the financial market while the second refers to variations in liquidity over time and their correlation to the market.

Liquidity level premium

An early work on liquidity level is undertaken by Amihud and Mendelson (1986) who observed that assets displaying a large bid-ask spread are traded at a discount, hence yield

higher expected returns. This is exploited by some investors who harvest a liquidity premium by holding illiquid assets for a long enough period so the excess return net of trading cost is positive.

The liquidity level of an asset refers to how easy it is to sell a significant quantity of that asset in the market without moving the price. Foucault, Pagano and Röell (2013) explain how dealers have developed strategies to make profits while providing liquidity levels, and how it affect asset prices. There is consequently a liquidity level cost, which in modern financial markets can be turned into a premium either by behaving as a dealer or using “black pools”, where large investors exchange bulk amounts of shares outside the main market.

When Dahlquist and Ødegaard (2018) conclude that the Oil Fund is consuming liquidity since it exhibits a negative short-term reversal exposure, it is requiring dealers to provide a higher level of liquidity for the available securities. This is not surprising considering the size of the fund, hence the amount of its trades.

However, when investing in unlisted assets, the liquidity level might be much less relevant since it is comparable to only trading in black pools. So, when it comes to liquidity, the GPFG might be better suited for unlisted assets than listed stocks, since it would not have to pay for liquidity when acquiring unlisted assets. A forced sale would however be much costlier than on a public market.

Liquidity risk premium

Longstaff (1995) uses the concept of marketability and focuses on the potential inability to quickly sell an asset. His model reflects then that the lack of marketability results in a cost for the investor, and especially that securities that are temporary untradeable (after an IPO for example), are sold at a discount.

Acharya and Pedersen (2005) use the concept of liquidity risk to describe the risk that the liquidity level will deteriorate during market turmoil. It is mainly measured as the covariance of a security's liquidity and return with the market average. The higher the risk, the higher discount will be required in order to sell the asset during market turmoil.

Their work builds further on Lubos & Stambaugh (2003) who found that securities with a larger “liquidity beta” deliver excess returns, which they partly attribute to a “flight-to-

quality”, and that the liquidity beta explains partly the same risk source as the small size beta from the Fama-French model.

One of the main findings of Acharya and Pedersen (2005) is that investors are willing to pay a premium for securities that remain liquid during market turmoil. They also find that stocks that are illiquid in the sense of Amihud and Mendelson (1986), that is have a large bid-ask spread, have a higher liquidity risk. Acharya and Pedersen (2005) find that liquidity risk explains 1,1 per cent of the returns.

For a long-term investor such as the GPF, there should therefore be a premium to harvest, even on listed markets. Since unlisted assets are highly illiquid in the Amihud and Mendelson (1986) sense, we expect that they carry a large liquidity risk, hence premium.

5.1.2 Liquidity and unlisted assets

Liquidity risk

Private equity and unlisted infrastructure are relatively illiquid asset classes since it is harder to quickly sell one’s stake of these assets compared to an equivalent public market investment. The seller of an unlisted asset has to initiate a process to search for potential buyers. Duffie, Gârleanu and Pedersen, (2005) explain that the rarity of buyers in the private equity market, and their long-term investment horizon result in a much lower turnover than for listed stocks, hence creating illiquidity.

Døskeland and Strömberg (2018) report that the poor data quality of private equity makes scarce the empirical evidence on liquidity level premiums in the PE market. Much of the considerations are consequently extensions of the liquidity theory for listed equity.

Still, there is empirical evidence of liquidity risk premia in private equity. Using a four factor model, Franzoni, Nowak and Phalippou (2012) find the liquidity risk premium of PE to be close to 3 per cent annually.

Døskeland and Strömberg (2018) argues that historically, investors have been rewarded for being exposed to the illiquidity of private equity since their study on the Preqin database shows that all segments have outperformed the market, with the best returns achieved by leveraged buyout funds. They do however mention that their database is incomplete.

Finansdepartementet (2018a) argues consequently that there is not enough evidence that private equity investors have been compensated for liquidity risk.

Green (2015) observes that there is a correlation between illiquidity and returns, suggesting that the risk is rewarded but acknowledges that the literature is much less conclusive, and that the premium for holding an unlisted asset could be lower than 1 per cent.

Van Nieuwerburgh, Stanton and de Bever (2015) review academic studies about the existence of an illiquidity premium for real estate and infrastructure and find that in both cases, listed assets outperform the unlisted. They nevertheless note that listed and unlisted assets are often much different and that unlisted assets display both higher returns and risk, which explains why non-adjusted unlisted infrastructure outperforms listed infrastructure.

The Ministry of Finance (Finansdepartementet (2018a)) seems therefore to be right to doubt of the existence of an illiquidity premium for unlisted assets, but the lack of such a premium should not hide that unlisted assets provide exposure to different risk sources and risk adjusted returns profiles, hence opening for diversification advantages.

Funding liquidity risk

Døskeland and Strömberg (2018) explain that investing in unlisted assets funds requires to commit capital to the fund. This capital will be progressively called by the fund manager as they find attractive investments. The investors must therefore keep highly liquid resources available to respond to the calls, or they would breach their contract with the manager, which can result in a complete loss of the already invested capital. This requirement to keep free slack resources to comply with the calls, and the consequences if failing to do so is called funding liquidity risk.

Funding liquidity risk imposes to keep cash and assimilates on balance until the fund manager has found a suitable investment, leading to a cost of opportunity since the capital is not invested in riskier but less rewarding assets.

Robinson and Sensoy (2016) find that investing in several PE funds of different vintages, so called vintage diversification, is a suitable strategy to handle funding liquidity risk. Vintage diversification exploits the irregular cash flows of PE funds over the holding period, which typically are negative in early stages as capital calls are made, and positive in later stages during realization of investments. By investing in a range of PE funds of different

vintages, the investor can use positive cash flows from later stage funds to meet the capital calls from earlier stage funds.

The GPFG is increasing its exposure to equity by divesting from investment grade, hence highly liquid, bonds. It would probably not be much hurt by funding liquidity risk if it began soon to invest in private equity funds and could then use vintage diversification.

More generally, Norges Bank (2018) explain that they would fund a PE acquisition through an immediate sale of securities in the country of the investment and rebalance the portfolio. The size of the envisaged investments compared to the GPFG's valuation reduces highly the challenges linked to funding liquidity risk.

5.1.3 *Liability-implied liquidity constraints*

Broeders, Jansen and Werker (2017) observe that an increase in the liability duration of Dutch defined benefit pension funds increases their ability to invest in illiquid assets, up until 17 years.

Langensjö et al. (2012) points that most institutional investors have a long-term focus and represent a large share of the invested capital. The lack of illiquidity aversion of these funds reduces the importance of illiquidity as a risk, and therefore weakens the case for a liquidity premium.

However, the GPFG has not only a long investment horizon, but it also has limited liabilities. The mandate under which the NBIM (2018b) operates allows for withdrawals to be made in accordance with the *handlingsregelen*, but this budgetary rule caps the Norwegian State's structural deficit, hence the withdrawals to 3 per cent of the fund size. This figure corresponds to a conservative estimate of the real long-term return of the fund.

In other terms, despite being named Government Pension Fund Global, the Oil Fund is rather a wealth fund than a pension fund and, since it is only supposed to pay out its real returns, has an unlimited investment horizon. This is strengthened by the GPFG's official mission "to safeguard and build financial wealth for future generations in Norway".

As a result, the Oil Fund has a larger capacity to take on liquidity risk than most other funds, which could result in lower liquidity cost if not harvesting illiquidity premia. In fact, Rauh (2017) observes that numerous pension funds in the United States are underfunded

compared to their liabilities and need therefore much liquidity to meet their short-term obligations.

Consequences of the liability gap faced by pension funds.

Our overview of the debate on unlisted assets for the GPFG suggests that the debate has often overlooked a key aspect mentioned by McKinsey & Company (2018): Increased liability gap among large pension funds around the globe.

The liability gap refers to the difference between a fund's assets, measured in market value, and its short-term liabilities, such as pension payments. The problem that pension funds has faced the last decade is that their liabilities have grown faster than the value of their assets. The gap increased substantially during the financial crisis of 2007/2008 as asset prices dropped, and has since then increased by 0.9 per cent annually despite the strong growth in public equities in recent years.

This apparent incoherence is linked by Monga (2013) to a drop in discount rates, which are in the United States based on the yields of AA and AAA bonds. On a more general basis, the drop in interest rates has at first increased the value of the pension funds' bonds holdings, but also results in lower returns in the longer term.

The FED (2018) reports in its latest statistics a liability gap of 1.8 trillion dollars. However, the study undertaken by Rauh (2017) criticises the accounting standards used to land on these estimates, and finds, based on market valuation techniques, that the actual liability gap is closer to 3.8 trillion dollars, or twice the official amount.

This increasing liability gap put pension funds on pressure for liquidity and should in theory increase illiquidity premia for other investors such as the GPFG. Its ability to tolerate illiquidity would therefore become more valuable in the future since American (and likely other) pension funds will need more liquidity when their returns will not cover their liabilities.

The OECD (2015) suggests that the liquidity gap has in fact created a yield-seeking behaviour among pension funds around the globe. Paradoxically, the funding gap increasing their liquidity needs has led these funds to increase their allocation towards illiquid assets, such as real estate, mortgages, hedge funds, PE and private infrastructure. Indeed, they are driven by expectations that higher returns from these assets will compensate for their illiquidity.

The average pension fund allocates now about 15 per cent of its AUM towards private markets according to Rauh (2017). Pension funds have to a large extent contributed to the considerable growth in PE markets the last years and are among the largest investors in unlisted assets. McKinsey & Company (2017a) notes that it results in an intensive competition in sourcing the best deals for potential newcomers.

However, in the longer run, liquidity-constrained pension funds might need to sell some of their unlisted assets, especially for infrastructure, and there may arise opportunities for the GPF to buy assets at a much-discounted price. Indeed, if there is no liquidity premium to harvest in the long run, we saw with Acharya and Pedersen (2005) that there is potential during market turmoil to buy illiquid assets at even more depressed prices, compared to the market average.

5.2 Investment-Relationship models

Investors invest in the private equity market through different models defining the relationship between the owners and the managers of the assets.

A common practice is to use a limited partnership model, where the investor, in our case the GPF, acts as Limited Partner (LP), and the PE manager acts as General Partner (GP). Infrastructure being a younger and less demanding asset class, there has been conducted a limited amount of specific research, so we will later use the discussion below to assess the best fitting investment model for this class as well as private equity.

5.2.1 *Traditional fund model*

The majority of investments made in the PE market are done by private equity funds. According to the World Economic Forum (2015a) PE funds are limited partnerships with a finite lifetime, typically 10-15 years. A PE manager, the GP, sets up the PE fund and is responsible for managing the investments and operating the assets over the life of the fund.

McKinsey & Company (2017a) explain that LPs own shares of stock in the PE fund, either directly or indirectly via fund-of-funds. In the indirect case, an external fund-of-fund manager is hired to build a portfolio of PE funds by selecting private equity managers.

Unsophisticated investors could find the fund-of-fund option attractive, but it results in higher costs and NBIM should be able to select PE funds internally. Small investors can also be attracted by funds-of-funds since they do not have enough capital to directly spread their investment across several funds. Of course, the GPFG does not face this type of challenge.

The downside of selection risk (selection skills)

By using the traditional fund model, the GPFG does not need to obtain the specialized skills required to handle the PE investment process, such as the three forms of engineering. The responsibility of operating the assets is assigned to external PE managers. However, for a successful PE programme, the GPFG should manage to identify and select PE managers that are likely to deliver top performance in the future, and to monitor them along the way.

PE fund performance was discussed in more detail in chapter 4. Harris, Jenkinson, Kaplan, and Stucke (2014), find that the earlier observed persistency in performance among top quartile buyout funds has vanished post 2000, making it harder for LPs to select top performing fund managers on the basis of past performance. Hence more resources and due diligence skills are required in the selection process.

Harris, Jenkinson and Kaplan (2015) also note that buyout funds display more homogeneous returns, choosing the “wrong” GP is therefore less problematic than before. Braun, Jenkinson and Stoff (2017) study buyout funds performance at the deal-level and also observe a declining persistency of outperformance.

McKinsey & Company (2017a) refer to Preqin when stating that outperformance seems to persist among buyout funds. However, a paper by Korteweg and Sorensen (2015) argue that this outperformance exists in the data but is noisy and that LP would struggle to exploit it. Braun, Jenkinson and Stoff (2017) explain that they used data at the deal-level to obtain the cleanest data possible, hence reduce noise-related caveats.

Braun, Jenkinson and Stoff (2017) suggest that their result is linked to an increased competition among fund managers which helps to consolidate the market.

It is likely that the specialized knowledge necessary to handle the PE investment process is more readily accessible than before, as research on private equity has developed and is more extensive than earlier.

Among venture capital funds, persistency seems to resist. Harris, Jenkinson, Kaplan, and Stucke (2014) finds that top quartile venture capital funds tend to repeat outperformance, making it easier for LPs to identify the talented venture capital managers from their track records.

Harris, Jenkinson, and Kaplan (2015) find a significant performance gap between top and bottom quartile venture capital funds. Considering that performance persistency has been negatively associated with homogeneity for buyout funds, this is not surprising. Venture capital managers seems to be more diverse, with some very good GPs delivering consistent high returns, and some more likely to repeatedly fail at creating value for their investors.

If the GPFG's investment universe is enlarged to venture capital and NBIM decides to invest through externally managed fund, screening and due diligence will be even more important than for buyout funds, but potentially easier.

Fund investing is a high-cost strategy

For the Oil Fund, the delegation of responsibility to specialized PE managers may be beneficial as this makes it easier to diversify, for example in respect to sector and geographies, without the need to build extensive in-house PE teams. Because of the outsourcing of operation of assets, investing through funds also limits the complexity of private equity investments, hence the overall costs.

However, delegating the operation of assets to external managers is far from a low-cost method to access unlisted equity investments. Norges Bank (2018) estimates that there will only be a limited need for hiring new employees since NBIM already has experience in picking external managers but is mainly concerned about the level of the fees required by external managers.

Indeed, Døskeland and Strömberg (2018) report that management and performance fees annually charged by PE fund managers to the average limited partner may be as high as 6-7 per cent of invested capital. Infrastructure funds are however much cheaper according to Inderst (2010) who indicates that management fees are approximately of 1,75%, plus a performance incentive.

McKinsey & Company (2017a) has an only slightly lower estimate, with total annual expense reaching 5.7 per cent of invested capital. This approximately covers 2.7 per cent in

fixed management fees, 1.9 per cent in performance related fees, 0.9 per cent in partnership expenses charged by the GP to investment targets. The remaining 0,3-0,2 per cent correspond to the internal expenses linked to due diligence and monitoring of PE fund managers.

Phalippou, Rauch and Ueber (2018) note that there is a variable part in manager compensation. Buyout GPs who achieve an AIRR higher than 8 per cent are typically entitled to retain 20 per cent of the total profits over and above the hurdle rate, which correlates with figures from McKinsey & Company (2017a). Fees for venture capital might be higher as it requires more skilled managers. Døskeland and Strömberg (2018) also note that private equity managers retain much of the value they create.

Since most of the value generated by private equity investments arises from active management, such levels of profit sharing can be understood, even though Phalippou, Rauch and Ueber (2018) note that LPs have since the 2007-2008 financial crisis been much more suspicious of management fees.

Finansdepartementet (2018a) insists on the importance of the Oil Fund's low-cost approach to asset management and reminds that the overall expense roughly equals 0,06 per cent of the Oil Fund's AUM. Dahlquist and Ødegaard (2018) had also noted that the fees in the Oil Fund for external stock management are of 0,5 per cent while internal real estate management exhibits costs lying between 0,2 and 0,3 per cent of asset under management.

Norges Bank (2018) consequently explains that the projected fees to be paid to external private equity managers would deviate from the established standards and potentially require to raise the upper limit on external fees, which is decided by the Ministry of Finance through the investment mandate.

Thus, the traditional fund model does not seem to fit the Oil Fund's current low-cost approach to asset management. Both Norges Bank (2018) and Døskeland and Strömberg (2018) suggest that the size of the GPF and its reputation in the market may help to reduce the total bill charged by PE managers, even though the magnitude of this reduction is uncertain. They also suggest to consider co-investments to reduce the burden of management fees.

Agency problems and lack of transparency

A large part of the literature dedicated to private equity, including Phalippou, Rauch and Ueber (2018), discusses agency problems. Indeed, there is a double principal-agent situation, first between the target corporation management team and the PE fund's GP, and then between the GP and the LPs.

However, the results of the Prequin (2018) survey suggests that LPs are not particularly concerned about agency problems. In five yearly interviews with 550 institutional LPs, Prequin (2018) finds that about 70 per cent believe that their interests are properly aligned with the interests of their PE fund managers.

Still, Prequin (2018) also note that 25 per cent of investors frequently refuse opportunities because of the proposed terms and conditions, the figure jumping to 90 per cent when including those who disclosed declining offers "occasionally". 81 per cent of investors within infrastructure are satisfied, but again 25 per cent frequently refuse offers.

This seems to indicate that investors are satisfied with their current agreements because they have screening skills allowing them ex-ante to identify potentially biased contracts. Both McKinsey & Company (2017a) and Døskeland & Strömberg (2018) note that building long-terms partnerships between LPs and GPs opens for reducing the agency problem through repeated interactions. Phalippou, Rauch and Ueber (2018) support this understanding and add that fund managers have limited incentives to deceive their investors since they need to raise a new fund every 2 to 3 years.

Harris, Jenkinson and Kaplan (2015) note that private equity funds are reluctant to allow their investors to share information with the public. However, Finansdepartementet (2018a) clearly states that adequate transparency is a prerequisite when investing with these funds. The Minister of Finance even declared to the Financial Times that "The greatest challenge [with private equity] is openness, information we can share with the public".¹⁸

The Ministry of Finance argues that transparency requirements may reduce the scope of suitable PE funds for the GPF, but PwC (2018) reports that 60 per cent of European private

¹⁸ <https://www.ft.com/content/2092083c-3cb5-11e8-b7e0-52972418fec4>

equity firms face pressure for improving their disclosures, as institutional investors and particularly pension funds become more prominent.

Norges Bank (2018) suggest that the GPFPG would succeed in negotiating contracts with GPs that will grant access to all relevant information and allow the Oil Fund to share this information with the public. Consequently, Norges Banks (2018) does not see transparency issues as a major concern, and refers to the GPFPG's comparative advantages in negotiation of contracts, such as size and reputation.

Norges Bank (2018) also argues that PE funds are the investment model with the most extensive performance track, which should be helpful in gathering political and public support for such investments.

5.2.2 Co-investments

In some cases, limited partners in private equity funds are allowed by the general partner to take an additional direct stake in some companies of the PE fund's portfolio. This investment method is called co-investing and, because of the prominent role played by an external GP, has many similarities with investing through PE funds, even though it allows LPs to harvest some benefits of direct ownership.

Requires additional internal capabilities

Indeed, the PE fund manager still handles the operation of assets, but the LP needs to assess the investments opportunities suggested by the GP. Hence, the GPFPG would need additional internal due diligence capabilities to screen manager proposals and also handle unforeseen events such as an increase in capital or early divesting.

McKinsey & Company (2017a) notes that GPs may have incentives to offer co-investing on its least attractive deals, as they prefer to harvest performance fees on the most attractive ones. Even though this behaviour is inconsistent with the trust-building strategy mentioned for PE fund investments, the possibility that GPs tend to offer co-investment on least performing assets stresses the importance of due diligence.

As the current mandate of the GPFPG allows the fund to invest in unlisted companies where the board has the intention to execute an IPO, so called pre-IPO investments, Norges Bank (2018) argues that the GPFPG already holds some of the required internal capabilities.

The GPFG may also find that experience with co-investing will be rewarding in the long run, for instance if the fund intended to make direct investments in the future, an investment model we discuss later.

Co-investing is cost reducing

A main advantage of this model is that co-invested capital is often free of performance and management fees, which as discussed are significantly high on capital invested in PE funds. Investors have then only to bear partnership expenses, estimated at 0,9 per cent by McKinsey & Company (2017a). On co-investments, a market survey by Preqin (2015) reveals that half of the GPs charge no performance and management fees, and around one third offers reduced management and performance fees.

By co-investing, the Oil Fund reduces the average fee paid to PE fund managers, measured as a per cent of total deployed capital, and is therefore an effective way of reducing the overall cost of the PE programme. The more co-invested capital, the greater the benefits.

Døskeland and Strömberg, (2018) find that co-investments successfully extract benefits if an additional 25 per cent is co-invested on top of fund investments. For buyout and growth funds, 25 per cent of a company can represent large sum that only few institutional investors are likely to invest, giving the GPFG a comparative advantage.

World Economic Forum (2015a) emphasizes the additional cost accumulated by developing strong in-house PE teams to handle co-investing, notably because the compensation level of private equity managers is higher than for stocks managers. Co-investing is therefore only suitable for large investors but is also more sensitive for public entities such as pension funds and the GPFG, since the wages paid to internal managers could trigger criticism.

A Preqin survey quoted by World Economic Forum (2014) finds that half of the LPs asked, think that co-investments are much more performant than fund investments alone, with an additional 33 per cent considering that it is slightly better. However, this survey only reflects perceptions and it is likely that at least some of the respondents do not co-invest in private equity.

Co-investing offers flexibility

In a PE programme where the GPFG holds a portfolio of PE funds operating in different sectors and geographies, the co-investment model may embody additional benefits. World Economic Forum (2015a) describes co-investing as an option that allows the LP to make direct investments in specific deals. This option effectively provides the holder with the opportunity to fine tune its portfolio diversification by injecting additional capital in selected unlisted companies.

Norges Bank (2018) finds that the unlisted market is more exposed to consumer goods, health services and technology and underweighted in the financial sector. While specialization might suggest that private equity funds have a relatively narrow focus, we have previously discussed their ability to benefit from diversification, hence improve their risk-adjusted returns and attractiveness. As a result, PE funds are likely to provide exposure to a composite source of risk. NBIM could then find it attractive to modify this exposure through co-investments in some portfolio companies.

An increasing significance of the manager-investor relationship

As pension funds are seeking higher yields, they pressure GP to provide them higher net returns, through more cost-effective solutions. In a synthesis of private market surveys World Economic Forum (2015a) finds that co-investing is increasingly popular among the larger LPs, mainly because of its cost reducing qualities.

This increase might happen at the expense of the PE fund managers who earn lower fees, but World Economic Forum (2014) indicates that a third of GPs are willing to increase their co-investment offers, with only a tiny fraction planning a reduction. General partners seems to be motivated by enhancing the loyalty of their LPs and facilitating fundraisings, but also in some cases by the potential to raise extra capitals for specific deals, which might save some investments from a “Valley of Death” and allow PE funds to target larger companies.

However, McKinsey & Company (2017a) observes that around the globe, GPs are reluctant to supply LPs with co-investment opportunities, creating an imbalance between supply and demand for co-investing. They argue that access to such deals are only granted in exchange of a strong, long-term partnership.

McKinsey & Company (2017a) identifies success criteria for LPs desiring to co-invest. They name long-term commitment not to withdraw capital, the ability to quickly supply

additional funds when the GP spots a new investment opportunity, credibility, good decision-making processes and general sophistication.

Both Døskeland and Strömberg (2018) and Norges Bank (2018) consider that the GPFG fulfils these criteria, and our review of both NBIM capabilities and the Fund's exposure to funding liquidity risk supports this conclusion.

However, it seems like co-investing is an approach that can only be phased in over time, in the meantime, the Oil Fund likely have to bear the high costs of PE fund investing.

PE fund and co-investing. Suitable for the GPFG?

In an overall assessment, Døskeland and Strömberg, (2018), Norges Bank (2018) and Finansdepartementet (2018a) argue that if private equity is made target, building a portfolio of PE funds is how the GPFG should access the asset class in the early stage of the programme. They highlight that PE fund investing is the least complex approach, and does not require sizable structural changes in the GPFG's current asset management.

Døskeland and Strömberg, (2018) and Norges Bank (2018) suggest that this will allow to develop the required skills to engage in co-investment over time and lower the burden of external management fees.

While building internal competence could happen relatively quickly, the reluctance of GPs to provide co-investment opportunities, might impose additional delays, until a sufficiently strong relationship has been established. Nevertheless, co-investing is interesting because of the potential reduction of management expenses.

5.2.3 Direct investments

The most sophisticated PE investors develop internal capabilities to handle the PE investment process themselves and make direct investments into unlisted companies. Direct investment comes in different forms, some investors choose to invest alone, others prefer to enter partnerships with peers or to create a joint-venture with a private equity fund provider.

Demanding, but the GPFG keeps the upside

Direct investments cut out the middleman (GP), and the investors avoid performance and management fees to external fund managers altogether while transferring agency problems towards their internal teams.

However, direct investing is much more demanding. For the GPFG to be able to handle direct investments, the fund need to develop in-house PE teams. The in-house teams need skills in due diligence, asset-selection and valuation, to be able to perform the transaction, handle the operation of the portfolio assets to create value over the investment horizon and finally handle the exit strategy. In addition, World Economic Forum (2014) indicates that direct investors handle legal and compliance issues, risk management, performance measurements and reporting.

As argued earlier, the PE investment process is a complex craft that requires specialization, and the GPFG must therefore devote time and resources to build up professional in-house PE teams.

However, in the long run, direct investing is still generally accepted as cost effective relative to PE fund investments or co-investments, especially for investors that with large amounts of investable capital. McKinsey & Company (2017a), finds that larger investors are able to conduct direct investments at a cost of 0.5 per cent of their PE portfolio net asset value.

However, these figures are uncertain. The sample size is limited to 15 respondents, and the figures do not consider transaction costs. The study does not mention either the performance enjoyed by the surveyed investors.

World Economic Forum (2014) observes that the cost of direct investment programmes varies substantially between investors, and reports that few institutions claim that their direct investment programme is particularly cost advantageous compared to other alternatives like PE fund and co-investing. The net benefit is highly uncertain.

However, Døskeland and Strömberg (2018) highlights distinguishing features with the GPFG that would be rewarding in a direct investment programme: In addition to cost efficiency due to economies of scale, the size of the Oil Fund will make it a prestigious programme that may attract highly talented employees. They also point at the GPFG's success in building a real estate investment team, and that the fund should be able to draw on this experience.

This last assumption is unfortunately weakened by our discussion on NBREM's performance in chapter 3. More generally, the active management of the GPFG has underperformed external managers. Since external private equity managers charge particularly

high fees, cheaper but less performing internal managers could deliver higher net returns, but this is highly uncertain.

Asset-level control, but hard to diversify

By investing directly in unlisted companies, the GPFG retains full control of the assets in its portfolio. According to Norges Bank, (2018), holding PE fund stakes would not give the GPFG voting rights in the portfolio assets since all control on the asset-level is delegated to the PE fund manager. This is a source of agency problems since the GP might not follow the instructions of the GPFG. Retaining control over the assets through direct investment also offers the most transparent approach to PE investments.

McKinsey & Company (2016) notes however that partnerships and joint-ventures restrict the transparency benefits. Indeed, the different parties must negotiate frontally which information they intend to release, and with which delay. Still, the increasing importance of institutional investors in the unlisted markets suggests that the GPFG should be able to find like-minded partners.

Compared to fund investment and co-investment, it may be more difficult to achieve diversification by investing directly. World Economic Forum (2015a) indicates that much of the success of private equity relies on specific knowledge, often with a focus on the local market. The GPFG would therefore need to establish multiple private equity teams across geographies which would make it difficult to mutualize sector-level knowledge.

NBIM (2015) note that investing directly in renewable electricity production would only be attractive for a portfolio of at least 50-100 billion dollars, which corresponds to between 5 and 10 per cent of the GPFG's AUM. Døskeland and Strömberg, (2018) recommend that the allocation to private equity represents 5 per cent of the Fund's AUM, but Norges Bank (2018) suggests to cap the private equity allocation to 4 per cent of the GPFG's AUM, which might then be insufficient for engaging in direct investments.

Failing to diversify sufficiently would therefore result in high idiosyncratic risk. This might not be a major challenge for the GPFG as a whole since private equity would likely remain a minor asset class, but could result in high variation in the returns of the private equity sub-portfolio and trigger public criticism.

Partnerships and joint-ventures could be more suitable as they open for asset pooling and benefitting from the partners' local knowledge of their home markets. When investing in infrastructure, McKinsey & Company (2016) indicates that such cooperation is essential, even for large and highly-sophisticated investors if they intend to invest in developing countries or infrastructure projects (by opposition to existing assets).

Partnerships and joint-ventures might also be easier to build in the infrastructure market due to the abundance of public and multinational development banks whose mission is to support private investment by providing technical assistance but also funding, as noted by Inderst and Stewart (2014).

Not proving successful by multi-asset investors, some examples

The direct investment model has indeed proven to be difficult to implement and operate over time for institutional investors. Consider the case of the sixth Swedish AP-fund, which established a direct investment programme in venture capitals. The fund suffers weak historic returns which can be blamed on the complexity of asset level operations according to Langensjö et al. (2012).

The sixth AP-fund found it hard to build the necessary internal capabilities to manage direct investing. As a result, the Langensjö et al. (2012) underline the potential net benefit of external PE managers. Despite the management and performance fees, they recommend that multi-asset institutional investors rather focus on PE funds and co-investments.

However, the sixth AP-fund only manages 3,5 billion dollars¹⁹, and is therefore a relatively small investor. So even with intensive support from academics and external advisors, it seems difficult to acquire comprehensive competence within managing a complex asset class. In comparison, the Norwegian state-owned company Argentum²⁰ is also specialized in investing in Nordic private equity and disposes of even less capital with only 1,6 billion dollars but has decided to invest in PE funds.

While some infrastructure assets in developed markets might be suitable for direct investments as they require little supervision of their operations, which makes it easier to build

¹⁹ <http://www.apfond6.se/sv/Start/>

²⁰ <https://argentum.no/nb/>

in-house competence, most assets are so complex that they should be accessed through partnerships and joint-ventures, if not funds and co-investment.

World Economic Forum (2014) also observe that even the largest and most sophisticated investors who reports investing directly in private equity keep requesting assistance from external advisors and managers. Moreover, McKinsey & Company (2017a), Døskeland and Strömberg, (2018) and Norges Bank (2018) note that these investors are only investing a share of their portfolio directly, and that they keep investing in and with PE funds.

The GPFG's size could allow to build extensive in-house teams, but this would require an overhaul of its current structure and philosophy as indicated by Ambachtseer (2015). He indeed indicates that a large increase of active management within the GPFG could result in clashes between the existing stability advocates and the incoming managers who would support return-maximization.

A solution suggested by Gjedrem et al. (2017) could be to move the GPFG outside of the central bank, into a special law state corporation. Another option could be to let NBIM manage the fund as a subsidiary of the central bank but to create an external structure dedicated to active management. This option was chosen by PensionDanmark when they established Copenhagen Infrastructure Partners²¹.

Externalizing the active management of unlisted assets could also facilitate the creation of joint-ventures but would create coordination challenges with NBIM. Indeed, Dahlquist & Ødegaard (2018) already consider unfortunate that the GPFG management is divided within sub-portfolios with little control for their covariaences and the problem would only grow bigger with an externalized structure.

Direct investing seems to work for real estate but would not for private equity

After the introduction of real estate in the GPFG's mandate in 2011, the fund has managed to build up a cost effective internal investment team to handle its unlisted real estate investments. A central question is if the GPFG could repeat this success in a PE programme.

²¹ <http://cipartners.dk/about/>

The answer lies in the nature of the asset classes in consideration. We have already reviewed the complexity of undertaking private equity investments. Managing a portfolio of unlisted real estate is comparatively easier.

Currently, NBREM invest alone or with a handful of partners in real estate, and actively manage the assets. Among other tasks, the real estate investment teams actively develop and implement business plans for their properties, ensures stable cash flows by managing leasing agreements, identify redevelopment potentials and arrange for development work to be executed as reported by NBREM (2017).

Since operating the assets does not differ much from one location to another, it is easier for NBREM to diversify its portfolio. However, as we observed in chapter 3, the GPFG's real estate portfolio is highly concentrated in London, Paris and New York, which is a debatable choice. Five years after the introduction of real estate into the Oil Fund's investment universe, they have not yet achieved a satisfying level of diversification. This issue would arguably become even worse with private equity.

We also observed challenges with assessing the performance of the real estate portfolio. Large properties might be difficult to value, especially in illiquid markets, but the real estate portfolio still pays out dividends from rent income, so it is possible to assess its value. In the private equity case, many investments might be much more difficult to price, as illustrated by the debate about using fair-value or cost-based valuations.

Since it may be impossible to know the accurate value of the assets before they are mature enough for an exit, this may be a hinder for the Oil Fund to do direct investment in private equity. Indeed, Finansdepartementet (2018a) points out the importance of being able to communicate the GPFG's performance to the public.

This challenge is present for private equity independently of the investment form. External managers will still need to release a valuation of their portfolio, and though it may be biased to improve their fund's attractiveness, it should still reflect the price at which an investor could expect to sell its shares. Because of illiquidity, this valuation is weak, but could seem more reliable than an internal measure computed by NBIM. Infrastructure investments as we will see further in chapter 6 are however relatively easier to price, especially for mature assets whose value can be assessed by discounting their expected cash flows and is reputed less volatile.

5.2.4 Separately managed accounts

Large pension funds in North America have been using Separately Managed Accounts (SMAs) to invest in overseas listed equity markets. According to Gallo, Lockwood, & Bhargava (2010), this model consists of delegating the management of a portfolio to an external manager while retaining ownership of the assets. SMAs have been increasingly popular since 1986 and have delivered attractive net returns.

As Peterson, Iachini and Lam (2011) observe that SMAs performance increase with the portfolio's active share but decreases with portfolio size, SMAs should be a good match for managing private equity.

World Economic Forum (2015a) describes a variation of SMAs that is used to access unlisted assets. SMAs has been largely ignored by Døskeland & Strömberg (2018), McKinsey & Company (2017a) and Finansdepartementet (2018a) in their discussion on adding new asset classes to the GPFPG.

The structure of separately managed accounts

SMAs is in the family of direct investing models but benefits from some attractive features of the traditional fund model.

According to the World Economic Forum (2014), the investor supplies an account with capital and redacts an investment mandate specifying general principles and regulations for a chosen GP, who is a professional private equity manager assigned to operate the assets. Finding investment opportunities is also delegated to the GP, but the investor may interfere in asset selection. A main distinction from PE fund investments is that the in SMAs, the GPFPG directly owns the portfolio assets and retain full property of the account.

Securing the GPFPG's interests

Finansdepartementet (2018a) communicates its concerns about reputational risks that could result from investing in private equity. As we already have discussed, there is indeed historical evidence, also reported by Døskeland and Strömberg (2018) that some buyout funds, have behaved unethically.

The structure of SMAs gives the GPFPG the flexibility to construct the investment mandate that would best secure its interests and mitigate non-financial risks by clearly stating

its sustainability goals to the external manager. If the GP was to breach its contract, the GPFG could fire and replace them without divesting any assets, as otherwise required for both fund investments and co-investments. SMAs are therefore much more efficient for disciplining management.

Finansdepartementet (2018a) is specifically worried about asset-level reputational risk. Even if the private equity fund's management was respecting the guidelines negotiated by NBIM before investing, the Ethical Council or the Parliament could later extend the scope of the exclusion list for investments. This would narrow the GPFG's investment universe but more importantly might obligate it to early divest from some assets.

If the GPFG has co-invested or invested through a PE fund, it would probably have to sell its shares in the fund and might be forced to accept a large discount. However, if the GPFG directly owns the assets, it only needs to instruct the manager to sell one specific asset, reducing the magnitude of the potential losses.

In terms of transparency, SMAs share many characteristics with the other direct investment models previously discussed. Therefore, they do not raise additional transparency concerns: The GPFG would have direct access to information on its assets and could independently choose what to release to the public.

Investing in the long run

As previously discussed, PE firms, hence managers, is typically specialized according to sectors, geography and company life stages. Through specialization, manager increases their skill level. They also raise funds at a higher pace and exit their investment faster according to Gejadze, Giot and Schwienbacher (2017).

Hence, if the investor acquires a promising early stage company and intends to keep it in its portfolio, they will need managers with different specializations as their investment is maturing. Since SMAs provide flexibility in replacing GPs over the lifetime of the assets, the GPFG could develop companies over several life stages instead of being obliged to exit its investments following a decision of the private equity fund manager.

Such a solution would reduce transaction costs and open for holding assets over several decades, which would also be suitable for new infrastructure projects. The GPFG could invest

in early stages with the help of a specialized manager and later transfer the asset to a more mature sub-portfolio.

Internal capabilities

Managing SMAs as a limited partner is much like handling regular investments in PE funds. However, as an asset owner the GPFG will need some additional skills. It would not only need to identify talented external managers, but also assign the right type of skills to its different projects.

World Economic Forum (2015a) note that investors should acquire internal competences in understanding the risk exposure of their assets in order to benefit from the real time information provided by the SMAs model. It is likely that these capabilities are already largely present within NBIM, so there would be no need for a large team expansion.

The SMA also brings advantageous in terms of diversification. The GPFG can give more precise instructions to the manager concerning its risk profile needs and expectations. The resulting portfolio would therefore be tailored to NBIM's preferences, for example in terms of sector and geographies.

Not a low-cost strategy

The discussion so far implies that SMAs are more LP friendly than PE fund investing. Still, investors must pay management and performance fees to the GPs managing their accounts. World Economic Forum (2015a) note that the Teachers Retirement System of Texas is a pioneer, and has established two accounts with two major private equity firms: KKR and Apollo, who otherwise offer investors to invest in their funds. There therefore little reason to believe that these private equity firms can afford to charge SMAs customers much lower fees than their other investors.

SMAs are relatively new, and accordingly there is little evidence to be found on the expected costs of an SMA investment programme. World Economic Forum (2015a) suggests however that SMAs are more cost efficient than regular PE fund investing. Since the GP can easily be replaced, there is an additional competition among GPs which increases the LPs' bargaining power.

The GPFG, with its distinguishing features like size and reputation, may be in an even better position to negotiate lower fees. Indeed, World Economic Forum (2014) claims that

institutional investors who are ready to invest large amounts on the account, is in a particularly good position to negotiate low fees. Yet, this impact is not quantified, making it difficult to come to a definitive conclusion.

5.3 The shift in balance of power favours large investors

World Economic Forum (2015a) talks about a shift in the balance of power between GPs and LPs in the alternative investment industry.²² After decades of investing in alternative assets, most commonly via indirect investment models, institutional investors have gained confidence and experience with the different asset classes.

The increased sophistication among institutional investors is also driven by a search for yield. As lower cost strategies seem to improve net returns, investors are seeking more direct ownership models than externally managed funds. World Economic Forum (2015a) argues that it has put private equity managers under pressure and results in more LP friendly contract terms.

This observation should be nuanced by the observation from both McKinsey & Company (2018) and Døskeland and Strömberg, (2018) that the private equity market is flooded with capital. Since dry powder is reaching new heights, performing general partners should not be in need to raise more funds in the near future. Consequently, the pressure described by World Economic Forum (2015a) might be temporarily lower. Yet, PwC (2018) notes that the increasing importance of institutional investors among private equity firms' customers has a progressive impact on the industry's practices, especially in terms of disclosures.

In the infrastructure market, Willis Towers Watsons (2017) observe a discrepancy between the increasing levels of dry powder resulting in slightly less favorable deals for investors, and the continued infrastructure investment gap. They note that some of the biggest institutional investors are seeking to establish joint-ventures and invest directly.

²² Alternative investment here includes not only infrastructure, private equity and real estate but also hedge funds.

Both private equity investing and parts of the infrastructure market require advanced specific skills. External management seems therefore to be the best way for the GPFG to enter unlisted markets. However, many of the drawbacks resulting from traditional fund investing can be avoided by using SMAs. Because of the large size, long-term focus and ethical requirements of the GPFG, we think that SMA would be a better match.

SMAs could also provide NBIM with valuable experience, so it could later manage internally some of the assets. Establishing partnerships and joint ventures could also be a promising path in order to exchange local knowledge at a lower cost and diversify geographically.

The Norwegian debate has been focused on common practices among large institutional investors, but if SMAs are relatively new for unlisted investments, they have a long track record for international stocks investments and seems to be the more attractive option in the near term.

Feil! Fant ikke referanseilden.

6. Infrastructure

6.1 A broad asset class

6.1.1 *General considerations*

According to the OECD, infrastructure is the system of public works in a country, state or region, including roads, utility lines and public buildings. Major Information Technology companies operating cabled TV, internet and phone networks, multinationals within electricity generation, water and sewage treatment are often listed on stock exchanges, hence already a part of the GPFG's investment universe.

In fact, utilities and telecoms made 5,2 per cent of the Oil Fund's equity portfolio in the end of the first quarter of 2018, according to NBIM (2018). Infrastructure operators can alternatively be listed under industrials if they are also active in construction, or financials.

The literature reports tremendous needs in capital for the infrastructure sector, even though McKinsey & Company (2018) indicates that only 419 billion dollars are currently under private management. NBIM (2015) indicates that there is an annual underinvestment of a trillion dollars for renewable energy production alone and NBIM (2015b) estimates that developing market also need a supplementary trillion dollars in investments.

McKinsey & Company (2016) is more conservative and only identifies a yearly deficit of 100 billion dollars while Collier (2014) describe Africa's need as "trivial" compared to global financial markets, even though the continent suffers the most from capital deprivation. If it is difficult to assess the number of investments that are foregone because of a lack of funding, the capital needs are clearly large enough for enabling the GPFG to build a sizeable portfolio.

6.1.2 *Valuation challenges*

Inderst (2010) offers a relatively early oversight over infrastructure as an asset class. Starting in the second part of the 1990s with specialized Canadian and Australian pension funds, infrastructure saw capital inflows when the stock market was booming and seen as

expensively priced. Troughs however were associated with sharp drops in infrastructure investment, considerably slowing down the growth of the asset class. For Inderst (2010), infrastructure is not only an alternative asset class in the sense of not traditional, but also because its attractiveness is at least partly linked to the lack of attractive investment opportunities in other markets.

Inderst's (2010) view matches our approach: seeking different investment opportunities when there are few "buy" cases in public equity and bonds markets. Nevertheless, the procyclical nature of the infrastructure investment universe relative to financial cycles, indicates that the risk of buying overpriced assets remains, especially on the second-hand market. A potential asset bubble would spread across investment classes. Cochrane's (2011) observation that asset price variations are explained by changes in discount rates rather than in expected cashflows implies that infrastructure's supposedly stable cashflows do not solve our bubble challenge. Infrastructure might at best bring exposure to more stable sources of risk, hence yield more stable risk premia.

The lack of liquidity and the complexity of unlisted assets also means that it is more difficult for arbitrageurs to realize quick profits, hence reducing their activity. Mispricing could then potentially reach even higher levels than for listed assets, underlining the importance of the investors' (or the manager acting on their behalf) skills in valuation.

Benchmarking

Inderst (2010) identifies numerous benchmarking methods for infrastructure investments, noting that setting an absolute rate of return is the most popular option, compared to other proposals such as listed infrastructure indexes or inflation/LIBOR indexation. Inderst (2010) does however not explain how the target is set but discusses further historical performance from infrastructure investments.

Bachner et al. (2012) discuss infrastructure benchmarking and note that, within their limited sample, it is popular to use an index with inflation as basis, and to either add a fixed margin or a measurement for risk premium. They further assess different benchmarking options, according to adapted Bailey (1992) criteria, and note that no option is ideal. Some benchmarks are not investable, hence no real alternatives to active management, and most do not reflect properly the specificities of the infrastructure investment universe.

The question of benchmarking is crucial in several manners. First, managers need a guidance when deciding whether or not to invest in a project, in order to know how low the expected rate of return can be. Secondly, the managers' performance need to be assessed to determine their compensation, without benchmarking it would be almost impossible to implement the right incentive sets. Finally, the transparency requirement, which is strong for the GPF, implies to release information about risk-adjusted returns and relative performance, hence benchmarking is important.

The Oil Fund was expected to deliver a real return of 4 per cent, but this expectation has been revised to 3 per cent, with a consequent adaptation of the *handlingsregelen*, mentioned by Finansdepartementet (2018b). It would therefore be tempting to require infrastructure investments to have a real return of 4 per cent. However, not all investments will be successful, so a real return of 4 per cent should be targeted as an average. As a result, the required real return for undertaking an investment should be higher. At the same time, solutions implying to benchmark with a mix of equity and bond indexes, as the current choice by NBIM to benchmark real estate, are only satisfactory if their returns are sufficiently correlated to infrastructure returns.

Historical performance

As mentioned, Inderst (2010) reports historic performance. He notes that unlisted infrastructure funds have a J-shaped returns curve, as it is otherwise common for private equity. There is a lag between fully funding the investment vehicle, investing in projects, and when these projects start generating cash flows. When observing returns for the 2005-2007 period, Inderst (2010) notes a sharp drop in the median IRR from 9 per cent for the previous vintages to 5 per cent for the 2005-2007 period. He attributes it to the J-shaped curve, since many funds were starting new projects in this period. The financial cycle was indeed reaching a peak, and infrastructure investment seems to be procyclical.

Another explanation Inderst (2010) suggests is that this boom in infrastructure fund raising before the financial crisis resulted in a shortage of projects, or investments that have later been downgraded. This last reason immediately echoes our concerns about the procyclical character of infrastructure investment. Thierie and De Moor (2016) also suggest that the abnormally high returns in the early days of infrastructure privatization may explain historically higher returns in the 1990s. As privatization processes have slowed down and

governments are probably now better at pricing their assets, returns have decreased and are likely to remain at the current levels.

Bahçeci and Leh (2017) also note that pension funds have excess liquidity and that large deals are being valued with “high multiples”, in other terms expensive. Moreover, they note that discount rates for infrastructure have been going down together with bond yields. They estimate that the discount rate for safe infrastructure assets was still over 10 per cent in 2016 but expect that the contagion will reduce the equity premium for infrastructure.

Bahçeci and Leh’s (2017) remark that “valuation multiples should continue to benefit from new entrants to the market” is worrying as it describes an increased competition among investors, hence bullish tendencies fuelled by asset shortage. Since Bahçeci and Leh (2017) focus on established infrastructure with determined or contracted income, there may be more potential to harvest by investing in less mature or riskier projects. Indeed, it is unsurprising that fixed-income assets, quasi-bonds are affected by the same discount rate developments as the debt market.

Inderst’s (2010) observations are based on the Preqin database, which mostly covers OECD countries with a significant focus on Europe. From the Cambridge Associates and Thomson One databases, McKinsey & Company (2017a) suggest that unlisted private equity has had IRR of around 7 per cent. Not only do the data sources vary, but also the reference periods, which make any comparison difficult.

Newell et al. (2011) analyse historical performance of the Australian unlisted infrastructure investment industry, noting that many large providers had troubles revealed by

Asset class	Q3:1995–Q2:2002			Q3:2002–Q2:2009		
	Average annual return	Annual risk	Sharpe ratio*	Average annual return	Annual risk	Sharpe ratio*
Unlisted infrastructure	15.05%	6.87%	1.37 (2)	13.09%	5.69%	1.30 (1)
Listed infrastructure	28.76%	26.59%	0.87 (3)	5.85%	21.72%	0.01 (6)
Global listed infrastructure	3.74%	16.00%	−0.12 (7)	14.68%	18.87%	0.48 (3)
Direct property	10.12%	0.51%	8.83 (1)	11.00%	4.24%	1.26 (2)
A-REITs	12.76%	8.72%	0.82 (4)	−2.51%	22.95%	−0.36 (7)
Stocks	10.69%	12.14%	0.42 (6)	7.56%	15.58%	0.12 (5)
Bonds	7.86%	4.83%	0.46 (5)	6.22%	4.49%	0.12 (4)

*Risk-adjusted rank given in brackets.

the global financial crisis with excessive gearing, inflated asset values and poor corporate governance, including lack of transparency and conflicts of interest. They name Macquarie and Babcock & Brown among the affected managers but exclude them from their analysis.

Newell et al. (2011) results show that infrastructure has historically displayed among the best Sharpe ratios, and has outperformed Direct Property (real estate) during the 2002-2009 and 2007-2009 periods. The two asset classes have a relatively low correlation of 0,52 and 0,68 for the two periods respectively, indicating diversification benefits. During the financial crisis (the 2007-2009) period Newell et al. (2011) find that unlisted infrastructure performed best, followed by bonds and real estate, while the other asset classes suffered losses.

Their study does not include private equity, and as they point out, there are serious caveats in comparing volatility of listed and unlisted assets. Newell et al. (2011) also acknowledge that there is a need for comparisons with other geographic areas. They do not mention survivor bias, which should be obvious when selecting only 5 funds on the basis of their size and the availability of data dating back to 1990. These funds are investing directly, so potential incentive misalignments are overlooked. The picture we get from their analysis, is therefore closer to an ideal towards which NBIM could eventually converge, than an indication of what their first decade in the market would yield.

The review conducted by Thierie and De Moor (2016) shows that listed infrastructure has been particularly resilient under the financial crisis. A main caveat with their work is that they use listed infrastructure as a proxy for unlisted, but since listed infrastructure is usually found to be more volatile, their results seems robust. Moreover, historical data for unlisted infrastructure is only available for Australian investments, so we can only work with second best databases.

2008-2015	Global equities	Global bonds	UScore private real estate	Private equity	Hedge funds	Global listed infrastructure	Global core private infrastructure
Global equities	1.0						
Global bonds	-0.2	1.0					
UScore private real estate	0.2	-0.2	1.0				
Private equity	0.9	-0.3	0.4	1.0			
Hedge funds	0.9	-0.3	0.1	0.9	1.0		
Global listed infrastructure	0.9	0.0	0.2	0.9	0.8	1.0	
Global core private infrastructure	-0.1	-0.2	0.5	0.1	0.0	0.0	1.0

Source: Bloomberg, MSCI World Index for global equities, Barclays Global Aggregate Bond Index for global fixed income, NFI-CDCE for U.S. core private real estate; Burgiss for private equity, HFR for hedge funds, S&P Global Infrastructure Index for global listed infrastructure, and MSCI Global Quarterly Infrastructure Asset Index for global core private infrastructure.² Data are quarterly from Q2-2008 through Q4-2015 (the full available range for the MSCI Infrastructure Index), and are denominated in local currency. Data as of December 2016.

Figure 6: Correlation of some asset classes with listed and unlisted infrastructure (2008-2015)

Returns do not only depend on the asset type, but also on the maturity of the project, and leverage. The following section is linked to project finance. Indeed, few listed companies only focus on operating assets according to NBIM (2015). This translates into a low, if any correlation between the valuation of listed infrastructure companies and unlisted core infrastructure assets (see figure 6).

However, if there are good reasons to argue, as NBIM (2015) does, that unlisted infrastructure should only be partly correlated with listed infrastructure, we should be wary of any form of “diversification illusion” resulting from accounting norms as pointed out by Welch and Stubben (2018) for private equity.

6.2 Specific risk exposure

6.2.1 An asset class in the public focus

Infrastructure provides significant positive externalities by increasing the local’s welfare and many assets are highly visible, sometimes symbolic for local communities according to McKinsey & Company (2016). New projects tend to deeply disrupt the locals’ lives and require their consent. This kind of sensitivity is much higher for infrastructure than for real estate and often increased by the investors’ reliance on subsidies or regulated revenues.

On the other hand, many other asset classes are exposed for public pressure, not least in the technological and financial sectors. A well-functioning banking system and digital

platforms are often considered as socially critical infrastructures and when DNB's Norwegian systems were affected by repeated outages in 2017, their services began to be labelled as of public importance.²³ A large difference with unlisted infrastructure is the existence of sector-wide advocacy organizations who are in charge of dealing with authorities.

McKinsey & Company (2016) define political and regulatory risk as the potential that the authorities will change the rules under which an investment was undertaken in a manner that affect its profitability. Regulators are tasked with enforcing market efficiency and are most likely to intervene if they consider that the current market structure, hence monopoly agreements, or price regulations are too favourable to the infrastructure provider, and harming consumers.

Reputational risk is to be considered both abroad and in Norway: it relates to the public opinion impact of the investments undertaken by the GPF. Locally, McKinsey & Company (2016) uses the concept of *social licence to operate*, to describe the legitimacy of an infrastructure project. Operating a wind turbine park can be at first perceived as legitimate but lose its social license if it is proven that the plant has negative health consequences or that authorizations have been obtained through trade in influence.

Finally, political risk results from intervention by the governing bodies, potentially in response to public pressure. While regulators may affect the rentability of a project and social unrest disturb operations, politicians can decide a forced nationalization, cancel agreements or decided of a shutdown, which results in a total loss for the investor. The McKinsey & Company (2016) report notes that regulatory and political risk can be mitigated, notably through contracting in countries with stable institutions.

While institutions might be stable, they can also be incompetent. Takano (2017) discusses a case in Lima, where a Public-Private-Partnership was awarded without competitive bidding since no one else was interested in the project. The authorities did not manage to evaluate the bid correctly, and its income was consequently hugely underestimated. Indeed, the project was consequently sold to Vinci for more than twice its original valuation, being then priced by discounting future cash flows.

²³ https://www.nrk.no/norge/ikt-norge-om-dnbs-nettrobberl_-_kan-vaere-samfunnskritisk-1.13429418

If in this particular case there does not seem to be any adverse reaction from authorities, the rent is perceived as unjustified by the population. There could therefore be a risk for Vinci (who bought the project from a Brazilian construction company) that the contract will be forcibly revised.

Mitigation

The McKinsey & Company (2016) for the Ministry of Finance identified five levels for assessing risk. First should one acquire knowledge about the local conditions of operation at the micro level and check if the project's implementation include neighbouring municipalities, regions or even countries. Then, can one gather information about the regulating authorities and determine their level of reliability as well as their expectations for the project. The next step is to understand the local societies and securing a *social license to operate*.

Then the operational unit, the asset itself should be under scrutiny, notably when it comes to its technology: infrastructure is illiquid and has typically a long lifespan so future developments in the coming decades should be tentatively forecast. As an example, the social license to operate coal plants evolves as climate change becomes a steadily more important topic.

Finally, and definitely not least, the partners associated with the project should be assessed. These partners can be co-investors, advisors, lawyers, contractors or managers. Both their skills and their reputation are crucial to the success of an investment. By association, a fund could be compromised if their partner was elsewhere involved in controversial businesses.

6.2.2 Greenfield-Brownfield

Ehlers (2014) divide infrastructure investment in three stages: Planning, construction and operational. A different division can be used, for example by Inderst (2010), between greenfield assets which cover planning, construction and the first years of operation, and brownfield which describes a mature asset with relatively stable cash flows. Brownfield investments would therefore be closer to the activity of buyout funds while greenfield would be more similar to venture capital activity.

Brownfield assets

Inderst and Stewart (2014) distinguish brownfield investments from secondary stage investments. Brownfield investments require significant amounts of capital in order to renovate or expand the assets and provide slightly higher returns than secondary stage investments. This second category is the most similar to acquiring a long-term bond paying out coupon and does not require any specific intervention.

McKinsey & Company (2016) recommend that large funds with no specific expertise limit their investments to brownfield assets. They are indeed easier than greenfield assets to price since their cashflows can be forecast with a high level of certainty according to historical performance. Some assets are also bound by a power-purchase agreement, an availability lease contract, or a rate of return regulation, which further reduces the uncertainty concerning their future income.

Bahçeci and Leh (2017) who also analyse core infrastructure, that is to say brownfield assets, advise to invest in open-ended unlisted funds, which seems to be the industry standard according to Inderst (2013). This recommendation can however be targeted by smaller-scale investors. Moreover, the Bahçeci and Leh (2017) article is published by JPMorgan, so they may have an incentive to advocate fund investments.

Some brownfield assets can be acquired from their developer, some are traded on the secondary market among investors, and finally some are sold by governments during a privatization process. Siemiatycki (2015) observes that assets originating from a privatization may be less attractive to several pension funds who manage the savings of unionized workers. Such acquisitions could also represent some risk for the GPF's reputation.

As previously pointed out, many funds are entering the asset class, which may result in inflated prices or lack of attractive deals on the secondary market, and lead developers to increase their price expectations. So, greenfield projects might be more attractive to a large fund as the GPF.

Greenfield assets

Greenfield assets are immature assets that are not yet delivering stable income streams. They are typically exposed to planning, contract or regulation negotiating and construction risk. The demand risk is also higher as market studies are conducted but effective demand can

be lower than projected. Technological risk is also considerable: projects involving innovations often face cost overruns because of the lack of experience in construction.

Ehlers (2014) notes that the construction stage is highly risky and exhibits high failure rates, not least because of a funding shortage. This description echoes the “Valleys of Death” discussed for private equity. As for the construction phase, few private investors are willing to provide capital. Along construction consortiums, there are some institutional players mainly from Australia and Canada according to Ehlers (2014). McKinsey & Company (2016) describe these investors as highly sophisticated specialists.

OECD (2018) registers an increased interest for greenfield investments among institutional investors, even though almost half of the respondents are still not considering the option. IRENA and CPI (2018) observe that institutional investors still fund less than 1 per cent of the over 200 billion dollars annually invested by the private sector in renewable energy projects. Most of the funding is still carried by project developers, as indicated above by Ehlers (2014).

Both Ehlers (2014) and Collier (2014) underline the importance of “pipelines” to support projects from their planning until they are ready for raising private funds, notably among institutional investors. In the absence of facilitators, there will remain a discrepancy between investable assets and the demand from large investors, even though the infrastructure gap remains huge.

6.2.3 Highly leveraged investments

The projects are typically funded with large amounts of debt and Wagner, Bertol and Murphy (2014) suggest that leverage ratios span from 60 to 85 per cent. As a result, both NBIM (2015b) and NBIM (2015) explore the possibility to invest in infrastructure debt, interestingly, most of the other independent reports do not carefully consider this option.

Some projects will be undertaken by public authorities, especially in the field of mitigation of climate change consequences, and result in emission of sovereign and municipal bonds. According to NBIM (2015), these bonds should be labelled as green, but there is little evidence they will have any distinctive feature in financial terms, compared to the other government and municipal bonds.

EY (2015) estimates that there is a favourable class mismatch in investment grade infrastructure bonds rating. Their risk spans from A to BBB, but their returns correspond to bonds rated BBB- to A-. In this case, the underlying would be a brownfield asset. Infrastructure loans do not match rating agencies criterion, and are difficult to price relatively to similar assets, so the authors suggest there should be a liquidity premium for this category.

These loans could be subscribed through partnerships with a bank called Mandated Lead Arranger, that manage the bond and sells participation to its customers. The Fund could also purchase bonds from a Special Purpose Vehicle that securitizes loans from bank pools or invest in a debt fund according to NBIM (2015).

NBIM (2015) points that debt has been historically favoured by pension funds and insurers in the OECD, and consequently choses to assess this type of claim for the GPF. Non-listed bonds could be relatively liquid if the issue is large. Indeed, most of the corporate bond market is over-the-counter, and project bonds could relatively easily be integrated in this framework.

The reason back this preference might however be linked to liabilities. Inderst (2010) notes that the cashflow structure of infrastructure, with limited potential upside can make debt a superior governance mechanism to private equity.

The benefits of using the bankruptcy threat to discipline managers, without its traditional drawbacks, such as missing out positive net present value investment opportunities may explain that infrastructure projects are highly leveraged, together with diversification strategies. Pension funds prefer to hold more liquid sovereign or large corporation bonds, together with the risky share of an infrastructure project, letting banks provide funding for the safer part through their syndicates.

McKinsey & Company (2016) argues that there are governance advantages from being the sole equity owner, not least when it comes to reporting, transparency and best practices. Leveraging should therefore be more attractive to the GPF than shared ownership.

NBIM (2015) note that it is however difficult to find investment grade infrastructure bonds, while the fund's mandate only allows a small share of speculative bonds, for bonds that were previously rated as investment grade but have been downrated. This mechanism makes

advantage of the long-term investment horizon of the fund and avoid experiencing losses by holding these downrated bonds until maturity.

The problem with high leverage is that it requires to invest in economies with deep capital markets. But markets that do not experience capital scarcity are typically markets with lower returns. Diversification could suggest that the GPFG invests in less leveraged projects in developing countries. The capital scarcity of a market is a risk factor that it cannot otherwise access by investing on global stock exchanges.

A report by Varadarajan, et al. (2017) explores the potential for reducing the cost of capital in renewable energy investment by decomposing the cash flows into several classes, to create the best possible matches for different types of investors. There would first be a project phase, funded by project finance and developers, then they would sell the project with some guarantees to a vehicle, the Clean Energy Investment Trust. This trust would in return sell tail risk to investors with lower risk-aversion or the ability to use these cash flows as a hedge for their other operations.

By bundling a large number of projects together, this would lead to vehicles in the billion-dollar class, large enough to be listed on stock exchanges, and likely to be rated investment grade since most of the potential volatility has been sold, at a highly discounted price since the value of tail returns and the “security margin” would represent approximately 2 per cent of the value of the trust.

There are governance challenges with this model as the main vehicle owns and operate the assets but without any incentive for them to overperform. Their managerial role is limited as the model builds on long-term contracts for both income and operational expenses, which makes the main cashflows safer. However, some of the tail risk could be mitigated, but it would require an effort for a management who represent the interest of unaffected investors.

Still, the analysis by Varadarajan, et al. (2017) illustrates well why leveraging is attractive for infrastructure projects, in order to provide each type of investors with cashflows matching its preferences. The GPFG being a mixed fund, the distinction might seem less relevant, even though the existence of a potential for reducing costs by adapting the claims’ structure suggest that there are inefficiencies that the Oil Fund could profit from.

Project Bond Initiative

The European Union, observing how strategic infrastructure is for stimulating the bloc's economy, and willing to achieve the Commission's investment plan has launched two measures to improve the attractiveness of infrastructure debt.

To improve credit quality of infrastructure bonds (not bank debt), subordinated debt is made available by the European Investment Bank (2012). It is a liquidity facility that aims to prevent the projects from entering bankruptcy if it was running out of cash and can be compared to the "security margin" in the Varadarajan, et al. (2017) model.

Solvency

After the 2007-2008 financial crisis, the Bank for International Settlements has led progressive efforts to increase the stability of the financial system, notably through Basel regulations for banks, which have been adapted for insurers into the Solvency directives in the European Union.

Caballero, Farhi and Gourinchas (2017) argues that by imposing higher core capital requirements, which are to be fulfilled with investment grade assets, these regulations might have increased bank's likelihood to survive to a new crisis but also reduced their ability to lend and boost growth.

Considering that infrastructure debt is relatively safe but that projects are often so small that hiring a bond rating agency would be prohibitive, the European Insurance and Occupational Pension Authority (EIOPA) (2015) has advised the Commission to grant some flexibility to insurers who would like to invest in infrastructure debt. Its quality can be assessed internally, according to guidelines provided by the directive, with notably a focus on the experience of the project's management.

Since insurers analyse potential investments not only in terms of risk-adjusted returns, but also with regard to the risk-budget introduced by the Solvency directive, classifying infrastructure as investment grade and even for some projects as quasi-safe, the class becomes more attractive.

Consequently, and according to the European Commission aims, more insurers will be willing to buy infrastructure debt, allowing for more projects to be funded at a lower price. A major caveat however, is that this flexibility only applies to projects situated in the OECD and

that an infrastructure project's debt cannot receive a better rating than the sovereign rating of the country hosting the project.

The large availability of debt (within the OECD) ensures that there will be no funding shortage, even for large projects. While this is the expected outcome for European authorities, it might not be desirable for an investor seeking to harvest premia. Indeed, the incentives result in higher competition for projects, hence also lower equity returns.

Therefore, the recommendation from Van Nieuwerburgh, Stanton and de Bever (2015) to let NBIM explore opportunities in emerging markets seems even sounder, especially when there is a contagious asset price inflation on the stock markets.

The GPFG is unaffected by the regulatory preferential treatment granted to OECD infrastructure debt and is seeking higher yields than the ones offered by investment grade bonds. Consequently, it should rather seek to take equity stakes when investing in OECD infrastructure.

Inderst (2010) also observe that in the Preqin database, infrastructure funds are overwhelmingly favoring equity. He further notes that investment debt has been mostly overlooked and AMP Capital (2014) indicates that debt is mostly held by banks in the form of syndicated loans. OECD (2018) also mentions that institutional investors prefer to invest in equity, even in emerging markets.

6.3 Class by class

6.3.1 *Social Assets*

Social assets include mostly special purpose real estate with the associated equipment and potentially including a maintenance contract, both in terms of reparations but also by supplying a janitor or concierge services. According to AMP Capital (2014), they are provided on an availability basis to local authorities. The contracts take the form of public-private partnerships or private finance initiatives and have been used by budget-constrained governments to renovate or build new facilities without further increase of their debt.

Once the asset is built, there is a monopsony. In most cases, local authorities are the only possible customers, therefore the construction is conditioned upon agreeing on leasing terms: the investors earn money through putting an asset at disposing, as for real estate and can do little to influence the revenue streams, except for keeping costs low. Typically, such contracts are inflation-protected and relatively safe.

Indeed, once it is known that the contract has been signed, it is difficult for a government to decide to buy services from another provider since it would reveal to a competing investor that the counterpart is not reliable. So, the monopsony is in fact a bilateral monopoly. Moreover, such Public-Private-Partnerships might be entered by financially constrained authorities but cover either immediately vital (healthcare) or services crucial to economic growth (education). Even in the event of budgetary austerity, there would still be a strong demand for the asset and willingness to pay.

Social infrastructure is consequently placed among the safest investments, but also the one with the smallest returns, with a strong cap on upside potential. (EY, 2015) indicates that the equity of these projects is often debt-alike.

The United Kingdom has been leading in structuring the sector and examples of assets can be schools or hospitals. However, this strategy has been criticized and the British public auditor has pointed out that many projects are considerably more expensive than if they had been funded by the public sector.²⁴ The reputation risk is also quoted by Finanskomiteen (2017) when it justifies its refusal to open for infrastructure investment. The level of political risk is also increased when “tariffs are set by foreign authorities”.

Indeed, when a private investor can sue a state or ask for international litigation, often in accordance to international trade and investment agreements, it is more delicate for a public state fund to sue another state. In this context, especially with regards to the low returns from social assets, this segment should not be an area of focus for the GPFPG.

²⁴ <https://www.ft.com/content/db1b5c66-fba7-11e7-9b32-d7d59aace167>

6.3.2 *Regulated utilities*

AMP Capital (2014) also distinguishes regulated businesses as a special asset class. These businesses are mostly utilities: electric grids or water and sewage companies. They are natural monopolies faced limited demand variation. The pricing power of their operators has led government to impose caps on profit and to operate according a rate of return rule: investors should be remunerated for immobilizing capital, at an indexed rate.

Their profitability profile is nevertheless more flexible than social infrastructure. The operative part of a utility business is larger than simply renting out and subcontracting maintenance. Smart grid investments for example can improve network management. Demand is also more variable. Depending on the weather, households might feel more or less compelled to water their garden. In developing countries, demand for electricity grid connection and the amount of energy consumed will be strongly influenced by economic growth while sewage services, which carry huge externalities and can prove difficult to bill will depend more on the host state's finances.

Regulated utilities are less sensitive than social assets, not least because some of them are operated on a commercial basis (electric and gas grid). Still, the market in developed countries is mostly made of existing assets and network operators can often finance upgrades on their balance sheet. Developing countries have therefore a better potential, but electric grids are threatened by the rise of distributed renewable energy production. Moreover, institutions are often of lesser quality than in the OECD, hence creating a large regulatory risk. Considering the low-return profile of regulated utilities, they are probably little suitable for the GPFG.

6.3.3 *Toll Roads*

AMP Capital (2014) places apart transportation networks: roads and railways. These infrastructures are imperfect monopolies and we can illustrate it by imagining that the Fløyfjell tunnel is privatized. At first, it seems that there are few alternatives for motorists from the North of Bergen who want to reach the South without being stuck in traffic jams in the centre. Building another tunnel would be very expensive and it can therefore be argued that the new owners have a pricing power.

However, if the toll becomes too important relative to the motorists' purchase power, they may consider enduring congestion since the cost of waiting becomes lower than driving through the tunnel. If Bergen city council decides to extend the light rail network further to the north, or lower the price of bus tickets, some users will similarly modify their attitude and not use the tunnel anymore. So, transportation networks are exposed for both economic development and improvements of alternative solutions: they are demand-based assets.

In practice, it has been observed that many works that were financed with private capital have a relatively mature profile with a relatively inelastic demand. Siemiatycki (2015) conducted an analysis of the Canadian pension funds attitude towards transportation assets. Except for Eurotunnel linking London to the mainland, they could not think of any railway project financed by raising equity among private investors. This project entered bankruptcy and most of its debt was converted into equity in 2007, but a single case is not sufficient to assess the viability of a whole transportation mode.

Siemiatycki (2015) also indicates that investors do not favour either urban transit because of its reliance on public subsidies which could be incompatible with capital gains in the public opinion. They also prefer the least possible interactions with bureaucracy, which increase management expenses, and invest in North America, Europe and Chile, in other terms advanced economies. Chile seems to have specifically good institutions for Public Private Partnership, explaining its inclusion among more developed countries. Indeed, the pension funds require monopoly agreements, insuring that no competitive project will shift the demand away their asset before it is amortized.

Glaeser and Ponzetto (2018) describe three ages in American transportation investment. First there was enthusiasm and mega-projects as citizens ignored the long-term taxes and toll consequences of immediately enjoying new infrastructure. Then came more protests and the "Not In My BackYard" movement, leading to a stall in new projects. Finally, infrastructure investment has increased but projects have become much more expensive since they must be considerate of local populations.

The projects must not only have globally positive welfare consequences but also offset local harm, increasing their private cost and the public's utility. In this context, few projects may be financially viable for private investors, hence most transportation assets in developed countries are likely to be brownfield opportunities. Ehlers (2014) observe that the riskiest or

in attractive greenfield projects tend to be funded by construction firms on their balance sheets, sometimes with public support.

Roads and railways in the OECD are therefore not much suitable for the GPFPG since the market is too restricted and the sector is much exposed to regulatory risk.

6.3.4 Ports

Both are crucial to economic development and have risen in importance with globalization. Seaports are only quoted in the Canadian study, implying that they either might not be as attractive, or rarely available to investors.

International trade is widely seen as a growth driver, inducing a correlation with the business cycle for seaports. International air traffic on the other hand has a global income elasticity of approximately 1,5 according to Gallet and Doucouliagos (2014), international air traffic having a higher elasticity than domestic. Most of the previous analysis that this article reviews suggest figures higher than 1. It means that airport traffic evolves pro-cyclically, hence that airports are among the most exposed assets to the business cycle, which is generally synchronised with financial markets.

Each port has a catchment area and there can be a certain level of competition among them. In a Norwegian context, Moss airport used to compete with Gardermoen for low-cost traffic for the Oslo area. On the Northwest shores of the Mediterranean Sea, the harbours of Genoa, Marseille and Barcelona are competing for serving Latin Europe.

Network effects can also create competition among ports that are more geographically distant. We observe for example a competition among Oslo, Stockholm and Copenhagen airport to become the main hub for Scandinavia. Airports are commercially more challenging than an electricity grid.

NBIM (2015b) notes that in developing countries, toll roads are preferred to airports by investors. The supplementary complexity resulting from operating in a less mature market could deter funds from choosing more sophisticated assets.

Some airport companies are directly listed on stock exchanges, like the German Fraport, the Spanish AENA, the French ADP or Malaysian Airports. These companies frequently own a portfolio of participation on top of a majority stake in some major platforms, which provides

diversification, but they can also have other activities in travel retail or engineering. Conversely, some airports are owned by construction groups, such as Heathrow airport owned by the listed Spanish company Ferrovial. Finally, some might be seen as strategic assets by their governments. This includes for example the Norwegian Avinor which uses profits from its major platforms to support loss-making smaller airports. A private investor would arguably aim to close these regional platforms, so a privatization of Avinor would either necessitate complex operation contracts and scare potential buyers or require an overhaul of the support scheme for remote airports.

In other terms, some airports are already accessible to investors as listed investments, often bundled with other activities, and others fully belong to public owners. Public listing could be unattractive for governments who want to keep a strong influence. Indeed, the recent rise in ADP shares has been attributed by commentators to the French state's project of selling its majority stake, implying that government control made the company trade at a discount.²⁵

Yet, as the Eurotunnel case was not sufficient to relegate railways to the annals of history, the ADP case could be little representative. The French government also has a large ownership stake in Air France group, which is one of the main customers of ADP, adding to the potential conflict of interest, and its record in exercising its ownership could be more biased towards non-financial stakeholders than the tracks of other governments.

Taylor and Benderson (2017) explain that harbours are especially exposed for corruption because of the multiple inspections, customs and requirement for permits. These risks are twice as high in emerging countries than in the OECD. The Finanskomiteen (2018) member from the Centre Party is already vocal against corruption risk in acquisition and procurement, arguing for only investing in developed markets, if investing at all in infrastructure.

The existence of a large corruption risk in port operation, makes these assets unsuited for the GPF. Mitigation measures could potentially be implemented, but since few deals concerning harbours are reported, the market seems to be small. The creation of a specific maritime anti-corruption taskforce might therefore not be economical. NBIM could instead

²⁵ Financial Times <https://www.ft.com/content/7587c9dc-2200-11e8-add1-0e8958b189ea>

hire external advisors to prevent corruption and improve the host country's fiscal revenues. As a result, regulatory risk and political pressure would be reduced, if politicians were not privately benefitting from maritime corruption.

This latter condition is unlikely to be fulfilled in every country and mobilizing large organizational resources in order to access a tiny and risky niche is not a good strategy for a large "politically anchored fund".

6.3.5 Telecommunications

Telecommunications used to be natural monopolies, until a wave of market liberalization in advanced economies in the late 1990s, slightly before electricity markets were progressively deregulated. The sector is consequently more mature, and likely to have been more consolidated. Even in developing countries, NBIM (2015b) notes that the opportunity window is closing.

Many papers we reviewed did not mention telecoms or barely mentioned them. The industry has been severely affected by technological change, with wireless technologies being under constant development, and requiring to regularly update the installations.

Regulators have also worked towards removing entry barriers, and challengers such as ice.net in Norway or Free in France have entered the market by leasing capacity from established players before building their own network. In this context, the "easy to manage" and "low operational cost" features of infrastructure are no longer present, since there is a strong competition.

There might still be some potential with long distance optic cables, which interconnect continental or domestic networks and require large investments. An example could be Aqua Comms, which operate underwater cables and seems not to have any industrial owner. However, its founding company Aqua Ventures International FZE is presented as a family business specialized in alternative investments²⁶, registered in Fujairah free trade zone, and

²⁶ <https://www.zoominfo.com/p/Jacob-Logothetis/-2098615764>

appears in the Paradise papers²⁷. Another investor is the private equity Cartesian Capital Group²⁸, specialized in private equity and active ownership. This illustrates a case of a niche markets requiring sophisticated owners who value discretion. International telecommunication cables are also politically sensible because the governments controlling their landing points are interested in listening to the traffic they carry.

These observations being made, telecommunications do not seem particularly suitable for pension funds as infrastructure investments. Since numerous carriers are listed companies, seeking exposure to this market should probably be done through traditional stocks as the GPFG already does.

6.3.6 Power Generation

Wangensteen (2012) explains how the power generation sector has been profoundly disrupted by the emergence of climate change on the international agenda and massive breakthroughs in renewables technology.

The market is characterized by a mix of long-term power purchase agreement programmes which remove price uncertainty for both supplier and customer, these often being large industrial electricity consumers, and market prices that are set to balance the network. Power generators will in this case determine their marginal cost of production, and either inform a central authority (US), or bid accordingly on the market (EU). Because of ramping costs, some plants are likely to operate continuously, this is especially the case of nuclear plants. Renewables have typically extremely low marginal costs and have so long been subsidized, so they produce independently of market prices, which can become negative. The network operator may then decide to disconnect them to avoid an overload on the grid.

Thermic plants face variable capital costs, Operation and Maintenance expenses and high fuel costs. In a market with extremely inelastic demand, they participate along hydropower to the determination of electricity prices in the short term. Normally, they should bid so to recover both their marginal cost, and their capital costs. They are however constrained

²⁷ <https://offshoreleaks.icij.org/nodes/80030509>

²⁸ <https://globenewswire.com/news-release/2016/05/05/837037/10162426/en/AQUA-COMMS-SIGNS-INVESTMENT-AGREEMENT-WITH-CARTESIAN-CAPITAL-GROUP-FOR-UP-TO-75-MILLION-IN-EQUITY-CAPITAL.html>

in doing so. Gas plants have low capital costs but the highest fuel cost, so they are used as back-up reserve and can afford to produce only rarely. Coal plants in return have both high capital costs and high fuel costs (especially when including carbon pricing), so they should ideally be producing continuously, at a relatively elevated price. Finally, hydro powerplants face fuel constraints and high capital costs mitigated by an extremely long lifetime, hence amortization period. They determine a “price of water”, based on the cost of opportunity of using water now, rather than later when electricity will be worthier, and bid on the market accordingly.

Blakers, Lu and Stocks (2017) analyze the introduction of steadily more renewables in Australia, which have made coal plants unprofitable since they could not operate often enough. Not only does it make unlikely that more will be built to replace the ageing ones, but owners often choose to close their plants when presented with large upgrade or maintenance expenses.

Blakers, Lu and Stocks (2017) predict that future investments will be in renewables, especially since wind and sun are widely available in Australia, and they explore the potential for relieving capacity constraint with Pumped Hydro Energy Storage, explaining that the current technology is sufficient to achieve this goal at market prices.

A major measure when comparing energy generation processes is the Levelized Cost of Energy (LCOE). It allows for comparison of both capital, operational and fuel expenses over the lifetime of the plant, hence comparing different technologies with different cost profile. This measure is notably used in pricing Power-Purchase-Agreements to determine the profitability of an investment and assess the potential need for subsidies. It can also be used to compare different projects.

The Lazard (2017) analysis assess LCOE with a focus on the North-American market, but reflects a more general evolution of the competitive and technological picture. For utility-scale Solar Photovoltaic panels in the 43-53\$ per MWh range, when Coal is priced in the 60-143\$ per MWh range, before subsidies. When comparing capital costs alone, Coal emerges at 3000-8400\$ per kw of installed capacity, when Solar Photovoltaic panels cost 3500€ per kw of installed capacity, once accounting for storage requirements. Gas emergency generators cost less than 1300\$ per kw, depending on their efficiency.

The cost of installed capacity does not reflect sufficiently the intermittency of renewables. However, the comparative advantage of solar and wind power against fossil

generation technology explain that the focus has been shifted away from coal plants, and merely assess the cost of gas turbines against batteries and water storage solutions.

Another important takeaway from this review is the very large span of production prices, which reflect real market conditions. In other terms, careful project selection is decisive for the investors.

Both NBIM (2015) and Saha et al. (2018) note that renewable electricity production is increasingly favored by institutional investors when they seek to invest in infrastructure, being often the first or second largest market. OECD (2018) observes that investments in renewable energies account for 50% of the global infrastructure investments in the period 2010-2016, with 1,3 trillion dollars, confirming the attractiveness of the segment.

NBIM (2015) points out challenges linked to technology improvements. An experience curve effect has quickly brought production costs down, which in a competitive market implies lower revenue. There is here no first-mover advantage, in the contrary pioneers must be compensated with subsidized agreements, whose value depends on the counterpart's reliability. McKinsey & Company (2016) notes that subsidized agreements increase risks but also costs since they imply more effort to maintain a good dialogue with the authorities. Most investors prefer therefore projects that are viable at market prices.

The threat of past agreements being revised in the light of more recent market conditions, is not only hypothetical or contained to developing countries with unstable institutions. France for example is considering cancelling or renegotiating its offshore wind power tender²⁹.

²⁹ <https://www.reuters.com/article/us-france-windpower-offshore/france-wants-to-renegotiate-offshore-wind-projects-les-echos-idUSKCN1GL2NZ>

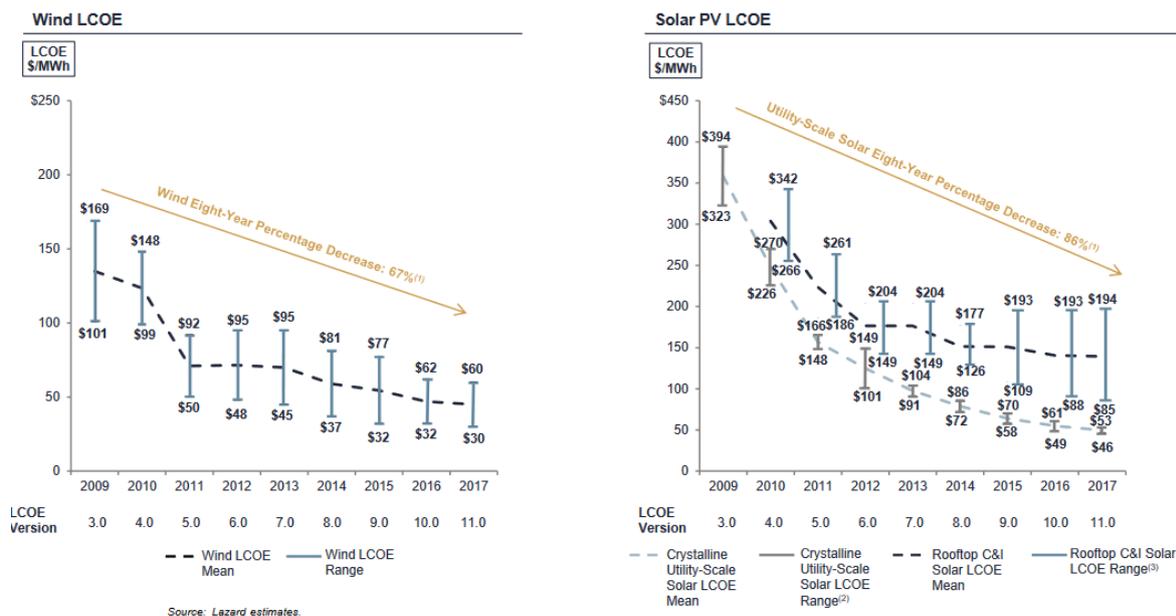


Figure 7: Lazard estimates for renewables Levelized Cost of Energy

Reuters note that France has much unexploited wind potential off its shores, but this can illustrate the “no free lunch” argument: there are good reasons for this potential to remain undeveloped.

On another note, the Lazard (2017) study exposes extreme discrepancy in photovoltaic solar costs, the cheapest residential rooftop panels having a LCOE of 187\$, while Commercial and Industrial buildings can hope of costs as low as 85\$, which remains much higher than the 43-53\$ range for utility-scale plants. When the report presents estimates for the cost of capital, which are in the 1100-1400\$ range for utility-scale solar without storage, it specifies that the projects with the lowest LCOE are those with the highest capital expenses.

Economies of scale largely emerge from dividing the grid connection expenses and this is even more striking for offshore wind projects. These projects also imply higher operation and maintenance expenses, since the turbines are not readily available, and part of this excess cost comes from transporting maintenance teams to the wind park. NBIM (2015)

This combination of economies of scale for both renewable technologies and comparative advantage to the most capital-intensive projects within solar projects suggest that the Oil Fund could use its size as a comparative advantage in the electricity generation market. NBIM (2015) considers taking direct ownership in deals within and over the 100 M\$ range.

Table 1 presented in (AMP Capital, 2014).

Table 1 gives an indication of return profiles for each asset class. However, both Inderst (2010) and Bahçeci & Leh (2017) state clearly that returns tend to decline. The former attributes it to the disappearance of a first-mover advantage, the second to a general move in discount rates.

6.4 A blue horizon in emerging economies?

6.4.1 *High returns justified by high risks*

General challenges

In emerging economies, sources of risk become much more severe. The investor often lacks knowledge of the local conditions in terms of market structure but also climate. McKinsey & Company (2016) links this lack of knowledge to deceiving performance compared to the expectation leading to an investment decision.

McKinsey & Company (2016) also note that social institutions are typically weaker and the threat of political meddling, including expropriation can be considerable. Financial risks are also much higher as a result of capital scarcity and economic vulnerability. These characteristics make infrastructure investment unattractive to many investors but also result in high risk premia. An actor who would have the skills required for mitigating this risk increase could therefore consider emerging countries as attractive.

Often the projects will exceed both the competence and funding capacity of local banks and NBIM (2015b) observes that most emerging economies do not have functioning markets for long duration bonds. Since infrastructure is typically leveraged, the project sponsors need to borrow from international banks in foreign currency which creates a currency risk according to Collier (2014). Indeed, liabilities are expressed in dollars or euros while the income used to repay the loan will be in local currency.

Jena, Meattle and Shrimali (2018) note that even in India, swaps are often excessively expensive and only available for short periods of time. But within a diversified portfolio, the GPFG might be able to hedge currency risks arising from investing in large economies.

Focus on Africa

Sy (2017) explains that African pension funds are still rare and can neither acquire equity nor significant debt stakes in infrastructure projects since many countries have pay-as-you-go systems, without reserve funds. South American pension funds are however already active, for example in Brazil as noted by Willis Towers Watsons (2017).

The Swedish pension system is fully funded and Langensjö et al. (2012) describe its rebalancing system. If demographic developments or a drop in the reserve funds value weakens the financial position of the retirement system, the nascent liability gap will be automatically closed by reducing pension amounts. Langensjö et al. (2012) also explains that it creates risk aversion among the funds' managers since they do their best to avoid triggering an automatic rebalancing of the pensions, which would create political scrutiny.

Sy (2017) considers that there is an opportunity window to reform pension systems in Africa because of the demographic forecast. A young and increasing population reduces the impact of the double-burden triggered by the transition from a pay-as-you-go to a fully funded system. If the Swedish model is chosen, African pension funds might favour stable investments such as bonds and infrastructure. In the first case, they would help financing the required leverage, in the second they would be potential partners. However, Sy (2017) note that the few already existing funds prefer to invest in equity.

Local governments are aware that their economies are heavily suffering from an underinvestment in infrastructure and that growth would be boosted by more investment as shown by Calderón, Cantú and Chuhan-Pole (2018). Collier (2014) note that they regularly hold speeches and sign declarations of intention, but little happens, because too few projects are ready to be invested and governments fail to address the political risk by denying its existence. Calderón, Cantú and Chuhan-Pole (2018) also points that current infrastructure investment is inefficient, which might further discourage investors.

International Bank for Reconstruction and Development (2018) assess the ability of a large panel of countries to provide private investors with suitable public-private partnerships. They observe that both the OECD and Latin America have attractive frameworks while Sub-Saharan Africa and East Asia must improve. This inability of Sub-Saharan authorities to prepare attractive projects for investors might partly explain the severity of the funding gap.

Collier (2014) describes the market for infrastructure in Africa as too small compared to the required skills. McKinsey & Company (2016) partly shares this view by noting that the fragmentation of infrastructure markets in emerging economies often makes specialisation uneconomical. Both Collier (2014) and McKinsey & Company (2016) note that even neighboring countries do not have common standards, making interconnection efforts difficult and requiring to adapt technological solutions to each region.

McKinsey & Company (2016) also points at the importance of the reputational risk. Very few local partners are familiar with environmental, social and corporate governance standards, nor with the principles for responsible investment. Corruption might also be widespread, as noted by Finanskomiteen (2018)

Indian success

A more positive example could be India which seems to have created favourable market conditions. Jena, Meattle and Shrimali (2018) consider that the market is moving towards an expansionary phase with high to medium returns and much lower risk.

Some actors such as Softbank is already very active in the area, with deals in excess of 10 billion dollars.³⁰ However, this attractiveness means once again competition, as shown in the EY (2018) attractiveness report, in which India falls from the second to the fourth place. There are limits to how much infrastructure at once the market can absorb. And this also means that a large fund like the GPFG should be able to switch markets: have a strong in-house team on the sector level but cooperate with local experts.

6.4.2 Multilateral attempts to structure a market

International organisations assistance

NBIM (2015b) suggests that Export-Credit agencies could provide cheap insurance for infrastructure investment abroad. Indeed, the Danish or German agencies could be tempted to support a large wind power project, since the turbines' production would generate much domestic economic activity.

³⁰ <https://uk.reuters.com/article/uk-softbank-group-india-idUKKBN1JA3CG>

Collier (2014) also mentions, as many others the existence of the Multilateral Investment Guarantee Agency (MIGA), which belongs to the World Bank Group and provide insurance for political risk. Collier (2014) notes that despite recent capital increases, it has still limited potential for insuring deals, but that the agency is filling an important role. Mapila, Lauridsen and Chastenay (2017) propose an alternative in which investments are partly insured by the Swedish international development cooperation agency.

McKinsey & Company (2016) indicates that the most important function of multilateral institutions is not much to provide funding or insurance but their contacts with local authorities and their technical knowledge. As a result, MIGA has very low default rate and can provide insurance against a premium of approximately 1 per cent according to Collier (2014).

The Private Infrastructure Development Group (PIDG) is another innovative multi-donor organisation aimed at facilitating investment in developing countries. Their GuarantCo³¹ programme provides credit guarantees in order to increase the projects' debt attractiveness among international investors.

Political entrepreneurship

Collier (2014) stresses a need for experts with the ability to structure projects and for political entrepreneurship. International engineering and consulting companies have the skills to prepare the projects technically, but one cannot succeed without intermediaries able to gather political support.

McKinsey & Company (2016) also mentions such a need but focuses more on the importance of involving local communities, through employment and co-decision. They also recommend to create a team dedicated to public relations.

Political entrepreneurship can unfortunately be linked to corruption (Datz, 2013). The proximity between the president Lula and trade unions enabled him in 2003-2004 to convince them to let public pension funds invest in projects with "a social vision that [the government] cannot demand obviously from a private bank". Political scandals started in 2005 and even though the projects should increase public welfare and generate attractive returns, the more

³¹ <http://www.guarantco.com/>

recent revelations about widespread corruption within the construction sector added to the already puzzling priorities of politically-controlled funds may threaten profitability.

When in association with local pension funds or hiring local political entrepreneurs, the GPFG should therefore be wary of their intentions and have the project reviewed by an independent external auditor.

External help can be supplied by other PIDG companies such as the PIDG technical assistance facility. In order to fund the planning phase of new projects, one can also ask DevCo for support.³² Finally, PIDG also own two early investment subsidiaries, InvestCo Asia and InvestCo Africa aimed at providing capital to start the projects before they can be sold as greenfield assets to financial owners.

Collier (2014) mentions a private group named BlackIvy, but note that the potential for funding private administrative services is low because of scrutiny from international donors. Multilateral initiatives are probably the best suited since institutions like the World Bank have precise local knowledge and large networks, but also solid integrity records.

Frontier markets and especially Africa are challenging, but the intensity of the multilateral efforts to improve market conditions is likely to generate attractive opportunities in the coming decade. Economies facing large capital shortages and exhibiting low-quality institutions are deeply inefficient. As a result one can expect very high rates of returns, Lin and Wang (2013) suggesting that they can in some cases exceed 100% even though part of them will be captured by third parties.

6.4.3 Ad-hoc solutions.

When facing currency risk or high short-term volatility in returns, Jena, Meattle, and Shrimali (2018) suggest to increase the required buffer or to sell tail risk. This proposal is similar to the one made by Varadarajan, et al. (2017) in order to reduce capital cost in more mature markets. Because of the extremely high original risk for infrastructure investments in frontier markets, the mitigated risk, and returns should remain sufficiently high to be attractive for equity investors.

³² <http://www.pidg.org/what-we-do/companies>

Collier (2014) sees the structuration of attractive investment opportunities as the main challenge. If multilateral agencies succeed in sourcing attracting deals, he suggests to bundle projects from frontier markets with much safer OECD investment in order to synthesize assets with an attractive risk-return profile for most institutional investors. The size of the GPFG allow it to diversify large idiosyncratic risks, even for relatively large investments such as infrastructure. By being an early player in frontier market, it could potentially realize substantial profits and contribute to economic growth in the target markets.

Resource-for-infrastructure deals described by Landry (2018) have been for some time part of the Chinese toolbox to access much-needed resources in Africa and open new markets to their construction companies. Their success have been mitigated as noted by Landry (2018) and Collier (2014) estimates that the offers made by Chinese companies are difficult to evaluate since they is no alternative.

A radical proposal comes from Lin and Wang (2013), based on new structural economics, which Lin (2012) describe as a third wave of development economics, based on neoclassical concepts and focussing on endowments.

Lin and Wang (2013) propose indeed to create a “global structural transformation fund” that would eclipse the Marshall plan. As mentioned above, they identify tremendous potential returns, that may however not be retained by the investors. Lin and Wang (2013) state that local businesses are among the largest beneficiaries and look at the Chinese experience of special economic zones.

Lin and Wang’s (2013) suggestion is to develop free-trade clusters where a fund provides infrastructure in exchange of land area. This model also reminds of the land grants provided by the American Congress to the companies investing in railways at the end of the 19th century.³³

The free-trade cluster would become particularly attractive since they would be equipped with the required infrastructure to open factories and export goods, and Lin and Wang (2013) also suggest that they should be granted a duty-free status. The presence of a

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<https://www.loc.gov/teachers/classroommaterials/presentationsandactivities/presentations/timeline/riseind/railroad/grants.html>

harbour or railways and of electricity and water supply would after some time also boost the development of the neighbouring areas, creating a win-win situation.

This proposal however requires tremendous amounts and intensive coordination. Moreover, it raises sovereignty issues. Indeed, these free-trade clusters could be perceived as colonial concessions because of the already impressive Chinese presence in Africa.

Still, Lin and Wang's (2013) idea to bundle infrastructure investment with industrial projects is promising. We could imagine that the GPFG funds the development of an area according to the global structural transformation fund model, and that OECD firms decide to locate in the same area production units aimed at international markets.

The colocation decision would ensure the GPFG that there will demand for the services it provides. Moreover, the exporting firms would have operating expenses in local currency but perceive their revenue in euro or dollar, creating an attractive match to enter a currency swap agreement.

We will therefore conclude that frontier markets might soon be attractive thanks to multilateral efforts, and that new, market-based approaches to development economics could foster innovative but slightly complex solutions to improve risk adjusted returns.

7. An impeached potential

A review of NBIM's management performance indicates that they succeed in choosing appropriate risk exposures and external managers but that their internal asset selection only yields mediocre results. A closer look at the weight of political influence on management suggests that the GPFG would achieve higher returns if it focused more on efficiently performing financially and ethically, instead of relying on proceduralism.

Active management seems also to be politically sensitive in Norway and could require a transformation of the structure of the Oil Fund's management to mitigate the impact of political meddling, public opinion volatility and potential culture clashes within the central bank.

If such a revolution was initiated, the GPFG could become a major investor in the private equity and infrastructure markets, allocating over 10 per cent of its asset to alternative investment classes.

Our analysis suggests that the private equity portfolio would mainly include companies in the buyout and growth segments. The latter segment is promising as it addresses capital shortages in developed markets and provide exposure to companies that might never be listed since a large number of firms under private equity management are sold to strategic buyers, notably in the technology sector.

We identified that renewable energy is the most interesting segment within infrastructure, and observe that the market is maturing, hence risks decreasing. As the Paris climate goals require to replace polluting powerplants and emerging countries already face a large funding gap, there will be numerous investment opportunities.

Thanks to partnerships, the management of the GPFG could access local knowledge in most locations, and therefore invest in both developed and emerging economies, providing high diversification benefits. We also considered frontier markets for infrastructure and think that they will in a decade provide attractive opportunities to sophisticated investors.

We began our research by observing a market failure resulting in high if not excessive valuations on the listed markets despite large funding gaps for profitable investments. We

were convinced that the GPFG could contribute to mitigate these failures while increasing its risk-adjusted return. However, achieving such an outcome implies to implement innovative strategies, since the replication of the financial industry's standard can only contribute to a status quo and average returns.

Per Strömberg who co-authored a main report on private equity for the Ministry of finance declared to the Financial Times in the aftermath of a recent decision not to open for private equity investments: "I am sympathetic to the complexity of changing policy but it is likely to come at a considerable cost in lower returns in the future".³⁴

Because of the mitigated results from real estate investment, we are wary of recommending an increase of the internally and actively managed share of the GPFG. Renewable infrastructure will be assessed by the Ministry of finance, and such investments could be undertaken as part of the environmental mandates, but their portfolio is already exceeding the authorized limit.³⁵ As a result, there is only room for small investments which will probably be made through infrastructure funds. Yet, the relative simplicity of infrastructure made the class a good candidate for quickly building the internal competence required for direct ownership.

The most realistic scenario for including private equity in the fund's investment universe would be through Separately Managed Accounts for the buyout and growth segment. This solution has not been extensively discussed yet, and we can hope that it will gain momentum as an increasing number of institutional investors adopt it.

Overall, the GPFG is a political success and sets the world standard in commodity rent management but it is not particularly sophisticated in financial terms even though its performance is slightly superior to a pure index fund.

As Norway will experience more constraint public budgets and there is much uncertainty about the future trend of returns on listed markets, we recommend increasing the active share of the fund. Since internal asset selection has yielded contrasted results, NBIM

³⁴ <https://www.ft.com/content/2092083c-3cb5-11e8-b7e0-52972418fec4>

³⁵ <https://www.stortinget.no/nn/Saker-og-publikasjoner/publikasjoner/Referat/Stortinget/2017-2018/refs-201718-06-11?all=true>

should focus instead on value-adding ownership, which might also be less politically controversial.

8. References

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