

Analysis of the carbon bubble risk in the Dutch pension market

Guido Mathieu Houben - 4421507

Faculty of Technology, Policy & Management, Delft University of Technology,

Jaffalaan 5, 2628BX, Delft, The Netherlands

Email address: G.M.Houben@student.tudelft.nl

Abstract

To avoid uncontrollable climate change, the increase of global temperature should not exceed 2 degrees Celsius. Taking this into account, not all fossil fuel reserves can be exploited, which will affect the oil & gas companies and their assets. This not only poses a risk on companies operating in the fossil fuel sector, but also on the financial system which has close ties with this industry. Among the Dutch institutional investors, pension funds are most exposed to the “carbon bubble” risk. This thesis aims to identify how the Dutch pension market should value this carbon bubble risk. Seventeen interviews were conducted with a pension fund, pension providers, and actors related to the pension market, comprising of 990 out of the 1300 billion euros in assets under management of the Dutch pension market. The average exposure to O&G companies in the pension portfolios is 7.45%, which is high. However, the Dutch pension market does not value a carbon bubble burst probable, mainly due to an expected dominant rise in fossil fuel energy demand. Strategic Asset Allocation tools such as Asset Liability Management studies are not yet applied on O&G industry level. The scenario analysis using data of 11 O&G multinationals found ConocoPhillips, Exxon Mobil and Chevron are most at risk in a Carbon Bubble Burst scenario, assuming an abrupt energy transition. The results of this thesis can be used by other institutional investors to obtain insight into carbon bubble risk valuation. Furthermore, it provides transparency for the Dutch citizens with a pension plan, in how their pension providers value these risks. The scientific relevance of this thesis is the verification of the usage of ALM and SAA methods at O&G sector level on carbon bubble risk with practitioners in the Dutch pension market. Future research can be devoted towards the potential indirect impact of a carbon bubble burst on other sectors in the portfolio, or optimal strategies for pension providers to deflate a potential carbon bubble without facing the risk of missing additional returns.

Keywords: Carbon bubble, Oil and Gas companies, Climate Risk, Dutch Pension Market, Stranded Assets, Strategic Asset Allocation, Asset Liability Management.

1. Introduction

Climate risk is defined as a systemic risk, since it could generate severe instability to our

economic system (Guyatt et al., 2011; Schoenmaker; 2015; ESRB, 2016). Carbon emissions are one of the main contributors to

climate change and carbon risk is, to an increasing extent, incorporated in the risk management of companies (Busch et al., 2006; Bokenkamp et al., 2005). An example of a specific carbon risk, is the burst of a carbon bubble. The carbon bubble refers to the overvaluation of fossil fuel reserves and related assets, taking into account the world complies with Paris' (COP21) goal to limit climate change. Avoiding irrepressible consequences of climate change implies we must control the global temperature rise to 2 degrees Celsius compared to the pre-industrial levels. If we meet this target there is a limit on future carbon dioxide emissions, and on the volume of fossil fuels which can be burned. The emissions associated with the combustion of the current global reserves of coal, oil and gas are multiple times larger than this amount, even if emissions are restored via carbon capture and storage (IPCC, 2013; Heede, 2014; McGlade et al., 2015; Weyzig et al., 2014).

Avoiding a carbon bubble burst implies that a large share of fossil fuel reserves can become stranded assets: they cannot be used if detrimental climate change is to be avoided. Investments in energy are part of the portfolio of many institutional investors. The burst of this bubble could create a carbon shock with heavy implications for our financial system (Generation Foundation, 2013; Caldecott et al., 2015; Halle et al., 2014; Lucas, 2015; McGlade et al., 2015; Sussams et al., 2015; Van der Ploeg, 2016).

1.1 Knowledge gap

Previous research focused on how pension funds can be stimulated to finance more green growth initiatives (Della Croce et al., 2011), or on the risks of stranded assets for multinationals operating in the fossil fuel industry (Van der Ploeg, 2016). Helm (2016), addressed the complexity of governmental

policy in fostering a renewable energy transition and the end of the fossil fuel era. The role of financial sector and climate risk was also discussed by various authors (Bokenkamp, 2005; Weyzig et al., 2014; Ritchie et al., 2015; Dietz et al. 2016). However, none of these studies focused explicitly on Dutch pension funds and providers.

The Dutch Central Bank(2016) found that the pensions funds are more exposed than banks and insurance companies to the risk of a carbon bubble burst, with 5.4% (DNB, 2016). Little is known on how Dutch pension funds and providers specifically value the risk of oil and gas companies in their portfolio. This knowledge gap can lead to an underpricing of these risks, which can lead to losses of these pension funds and providers (Schoemaker et al., 2015; Guyatt et al., 2011; DNB, 2016). Since the pension money of the Dutch citizens is at stake, more knowledge and transparency on how the Dutch pension funds and providers value the risk of these O&G companies in their portfolio is crucial to secure the future payments of the Dutch pensions.

Elaborating on the report of DNB(2016a), this research will focus more on the carbon bubble risk of the O&G companies. Coal companies are excluded, since these companies have a different production process, subject to different risks compared to the O&G multinationals. Furthermore, the investments of pension funds and providers in coal companies are decreasing, so assessing the risks of O&G companies will be more relevant for the future. Although coal is the most polluting fossil fuel, the emissions of the products of the O&G industry account for half of the global CO₂ emissions in scope 1, 2 and 3¹ (IEA, 2015).

¹ Emissions can be divided into three scopes. Scope 1, the emissions which are directly emitted by sources of a company. Scope 2, the indirect emissions related to

the usage of electricity, cooling or heating of a company. Scope 3 includes all indirect emissions not related to the direct activities of the company, but

Based on this information, the main research question of this research is: *"How should the Dutch pension funds and providers value the carbon bubble risks of oil and gas multinationals in their portfolio?"*

The objective of the research is to analyze how the Dutch pension market values the carbon bubble risk of O&G companies and evaluate this, leading to some recommendations for the pension market and regulators. Both quantitative and qualitative methods are used were used, described in the next section. The theory of the carbon bubble, ALM & SAA are discussed in section 3. The result section elaborates on how the O&G companies are currently valued by the Dutch pension market, how COP21 affected this, what the effect could be of a carbon bubble burst in the portfolios of the Dutch pensions and how the risk of a carbon bubble burst is valued. The final section includes the main conclusions and implications of this research, followed by the limitations and suggestions for future research.

2. Methods

Literature research, desk research, scenario analyses and interviews with seventeen relevant experts in this field were used to analyze the carbon bubble risk of O&G companies in the Dutch pension market.

2.1 Literature research

Literature research was conducted by collecting articles via search engines Google Scholar and Scopus. Both empirical and review articles are used combining analysis of quantitative and qualitative nature. Search terms included possible combinations of:

fossil fuels, divestment, oil, gas, energy transition, carbon risk, carbon bubble, institutional investors,

pension funds, oil and gas, strategic assets allocation, asset liability management, stranded assets.

Additional articles were found via the bibliography sections of those search results. Based on the results of those second search phase, new articles were found in the bibliography sections. This process was repeated until no new relevant literature resulted from these search activities. The articles used were predominantly published in journals focusing on energy, finance, climate change or business & economics. The articles used were analyzed using the computer program Mendeley, which helped to structure, highlight and add notes in the literature used.

2.2 Desk research

Desk research was of added value, to include the most recent information on this topic. Regarding the rapid developments in this field, not all relevant information could be obtained via peer reviewed academic sources. The desk research consisted of research for both quantitative and qualitative data, in business reports, annual reports, energy outlooks from different agencies, or reports from data providers focusing on the energy and financial industry. Also information on relevant laws and regulations on national, European and global level was obtained via desk research. Data on actual price levels of commodities was found via renowned websites depicting the different levels at different periods in time.

2.3 Scenario analyses

The scenario analysis was used to explore which O&G companies would be most at risk compared to their competitors. 11 of the largest O&G companies with a combined Market Capitalization of 25% of all companies in the fossil industry, were ranked based on quantitative and qualitative data. This showed Occidental Statoil and Eni are

related to the activities of the company. This is the biggest scope for the O&G industry and the financial

sector. However, the least data is reported in scope 3 among most companies.

most at risk in a *Business as Usual* scenario assuming a gradual energy transition. ConocoPhillips, Exxon Mobil and Chevron are most at risk in a Carbon Bubble Burst scenario, assuming an abrupt energy transition. Pension providers mainly invest in large caps which are included in indices like the MSCI, which contributed to the relevance of this sample.

The method of selecting the worst in class per scenario was chosen to provide a concise overview for investors which companies are most at risk. Divesting from the companies performing worst in class, also delivers a concise investment strategy towards portfolio optimization by incentivizing the others in the portfolio (Anderson, 2015).

2.4 Interviews

Interviews were used to obtain more information from experts in this field, essential in answering the research sub-questions of this thesis. Respondents were approached via LinkedIn, email, telephone, at events related to climate risks for investors, or via other people. To acquire more information on the carbon bubble risk in the Dutch pension market, seven interviews with people with expertise on this subject were interviewed before the interviews with respondents of the pension fund and providers. The information from these preliminary interviews were also used to scope the sub-questions of this research, and test the questions which were asked during the interviews with the Dutch pension providers. Since most of the pension funds were not open for an interview, only one pension fund was interviewed. Instead, nine of the eleven biggest pension providers in the Netherlands were interviewed, comprising 990 billion in assets under management of the total of 1300 in the Dutch pension market (DutchInvestor, 2015). Interviewed respondent had different functions, four types of expertise were distinguished: Responsible investments expertise, Risk expertise, financial expertise, energy

expertise. An overview of the interviewed respondents in the pension market is depicted in appendix II.

3. Theory & Background of the Dutch pension market

Theory on the carbon bubble, Asset Liability Management and Strategic Asset Allocation was relevant for this research. The carbon bubble is a specific form of a climate risk. Carbon bubble risk can be defined as: *‘The financial exposure to fossil fuel companies that would experience impairments from assets stranded by policy, economics or innovation.’* (Ritchie et al. 2015. p.59). Economics can either include market forces of low fossil fuel prices, or the divestments due to socio-political pressures.

Strategic asset allocation is defined as by Guyatt et al. (2011) as: *‘The use of optimization tools by asset owners to determine long-term asset allocation benchmarks to achieve their long-term objectives. The objectives vary depending on the type of asset owner and its obligations to beneficiaries or other stakeholders.’* (Guyatt et al., 2011. p.5) Francis et al. (1987) already discovered strategic pension funding is complex due to the tradeoffs between the different incentives for funding. Since over 90% of the variance in portfolio returns is due to SAA, it is an important aspect (Brinson et al., 1986; Grinblatt et al., 1989; Brinson et al., 1991; Ibbotson et al. 2000). Asset allocation indicates how investors decided to spread their investments among different asset classes and how much they hold in each of these classes. This can include for instance equities, bonds, property and cash. ALM is one of the more effective strategies to construct portfolios which minimize the risk (Vrontos, et al., 2013). Kleynten (2005) p. 531 identifies ALM as: *‘The ALM process is intended to generate risk/return profiles that match the predefined risk attitude. If this match is accomplished, the risk return profile is efficient. Efficiency is thus generated if the resulting risk/return profile coincides with the predefined risk attitude taken by the pension fund.’* (Kleynten, 2005. P. 531).

Both ALM & SAA are used by the Dutch pension market to optimize the risk and return of their investments and meet their future payment obligations. In this research, the Dutch pension market is defined as the pension funds and providers. The Dutch pension participants pay a share of their earned capital to their pension funds, which have the mandate over the pension money. The pension providers allocate the assets on behalf of their clients, the funds. Pension participants cannot choose their pension fund, since these are assigned to them based on their sector or company of employment. Figure 1 depicts the overview of the asset allocation of the Dutch pension market.

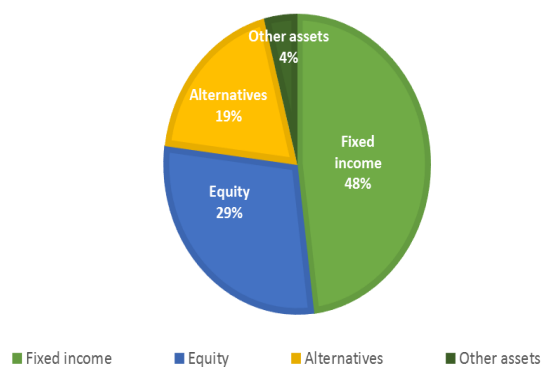


Figure 1: Average asset allocation of 5 biggest Dutch pension funds in 2015 (PWC, 2016)

4. Results

4.1 Valuation of O&G companies

Based on the interviews and desk research, the most important findings are that the pension funds have little knowledge of the valuation of O&G companies, this is done by the pension providers. These providers do not work with lists of indicators to value O&G companies. Many more factors, both normative and financial are taken into account by pension providers. Discounted cash flow is the most important indicator. The other indicators discussed in this section all have influence on the discounted cash flow

models. Oil price is important for O&G companies, since it affects the revenue of the company and changes the breakeven price of different projects. However, companies can exert little influence on it. The O&G production of a company and its proven reserves are important determinants in the cash flow models. O&M costs, F&D costs per barrel of oil are indicators of financial performance and are taken into account during the investment decisions. The RRR is to lesser extent important for pension providers. The normative view of the O&G company deals with the sustainable direction and transparency of the O&G company, and how it is scoring on ESG criteria.

4.2 Translation of COP21 to Dutch pension market

COP21 has not changed the way O&G companies are valued by Dutch pension funds and providers. Mainly because there is no binding legislation in place which affects the O&G companies. Besides creating more awareness, one of the more important implications of the climate agreement is that institutional investors have more leverage to ask the O&G companies for more transparency and progress towards an energy transition. Since the direction of the policy is confirmed, part of the uncertainty is eliminated and it gives pension providers more leverage to favor sustainable investments. Three of the nine pension providers mentioned they not explicitly support COP21, via changing their portfolio management to foster realization of the two Degrees' target.

The absence of climate change data is an important obstacle for pension providers to make low carbon investments decisions. The energy transition law implemented in France can accelerate this process of more data and disclosure on climate impact of the financial sector. Support should be created in the financial sector for such a law. The adaption of IORP II by the European Parliament is another regulatory change which aims to

foster knowledge, data and methods on climate risks in the European pension sector. Among the respondents, it differed whether they were on track regarding ESG integration and data on climate risk assessment. Some were already giving equal attention to climate risks compared to other investment risks. Others lacked confidence in the effectiveness of such additional regulatory means or carbon foot printing as an investment tool.

4.3 Effects for pension funds and providers of a potential carbon bubble burst

From the interviews with the respondents resulted that the average total exposure to O&G companies in the different portfolios is 7.45 %, which is an average of the different portfolios and different clients of the pension providers. This equals 96.85 billion euros for the complete Dutch pension market. The effect of the financial crisis (25%) in 2008 had more impact. However, the carbon bubble burst would have an effect in multiple sectors than only O&G. The response to a carbon bubble burst differed per pension provider. Most would reevaluate to see if the companies would be able to increase in value over the long term, if not the time to divest the O&G companies could range between 24 hours and three months, depending on how the market responds.

The effects of a carbon bubble burst would be substantial according to the Dutch pension market, considering the effect on their portfolio, which will be more than just the exposure of O&G companies. However, the pension market values the probability of a carbon burst unlikely. Section 4.4 elaborates on this.

4.4 Risk valuation of carbon bubble risk of O&G companies in portfolio

Based on the interviews with actors from the Dutch pension market, the carbon bubble risk of O&G multinational is not perceived as a substantial risk in their portfolio. Although the impact on the portfolios can be 15%, the

probability of a carbon bubble burst is considered low. All respondents think the energy transition will happen gradually. The growing global demand for energy is expected to be dominant over the environmental priorities. The benefits of investing in O&G companies outweigh the risks for investors, and the risk of environmental legislation on limiting fossil fuel exploration or a major transition to renewable alternatives, which are required for this risk to materialize, are not considered probable soon. More unconventional fields are explored by O&G companies, and debt levels are increasing. To the pension providers, these developments were to an increasing extent large concerns, but it does not lead to divestment yet. Either because the pension funds are to make that decision, or because the developments are part of the market fluctuations.

MSCI is the main data provider for ESG analyses. The indicators used by the pension providers can be divided into financial data, CO2 emission intensity of the production process, specifications on fossil fuel reserves and governance of the company. Dominant methodologies for carbon risk valuation include carbon foot printing and stress-testing of the portfolio. However, not all providers see the added value of carbon intensity as a sufficient developed tool for portfolio management. ALM and SAA are not yet applied on carbon risk of the O&G industry.

The respondents disagreed whether the carbon bubble risk is currently correct priced in the financial markets. Most responsible investment managers thought the carbon risk is currently underpriced, other respondents believed in the efficiency of markets. Capital flexibility, and climate governance & strategy are considered the most important risk factors for O&G companies in the future.

To deflate a potential carbon bubble, pension funds and providers need to overcome the impasse, where one has the mandate but no knowledge, and the other has the knowledge, but not the mandate. Regulation could eliminate this impasse between pension funds and providers to deflate a potential carbon bubble and accelerate the energy transition. More data availability due to obligatory climate disclosure of investors, like in the French energy transition law, could facilitate this.

5. Conclusions

5.1 Implications of main findings

The exposure of 7.54% in the Dutch pension portfolios is higher compared to the research of the Dutch Central Bank (2016). More research is needed to conclude whether the exposure of the Dutch pension market to O&G companies has increased, or that other reasons are the cause of this deviation. Pension participants can use this research to gain more insight in the valuation methods of the carbon bubble risk and use the results of this thesis to start the dialogue with their own pension funds.

To accurately value the carbon bubble risk of O&G companies in the portfolios of the Dutch pension market and determine how they should value the carbon bubble risk, more data is required on the actual investment positions of the Dutch pension funds and providers, since the carbon bubble risk can differ per company. The results of the scenario analyses indicate that pension funds and providers with positions in those companies are more at risk. These results can be used by other institutional as a first overview to base their investment decisions on and to minimize their investments in the O&G companies most at risk. The scenario analyses can also be used as starting point for further analyses on which indicators are important in assessing the future credit worthiness of O&G companies in different scenarios.

Since the Paris agreement has not changed the way the Dutch pension market value O&G companies, global, European and national regulatory entities can use this result to accelerate implementation of binding legislation of COP21. If this regulation is absent, investors will not change their (risk) valuations of companies which have a negative impact on the environment, like O&G companies. Likewise, the O&G companies have no incentive to change as long as their investors not change their (risk) valuations. This will be an important step in achieving the 2 degrees target.

An important finding of this research, is that there is no consensus in the Dutch pension market on whether the carbon bubble risk is currently correctly priced in the financial markets or not. To prevent a potential carbon bubble burst, additional action is required if people who believe the carbon risk is currently underpriced are right. If markets are indeed efficient and the carbon risk is currently priced correct, the status quo is less alarming, since the markets will eventually solve this. To deflate a potential carbon bubble, the impasse between the pension funds and providers should be eliminated. Several recommendations are made.

5.2 Recommendations:

Public Policy

- I. A Dutch Energy Transition Law should be implemented by the Ministry of Finance, which requires investors to disclose their impact on the environment and requires equal attention to ESG risks compared to other risks. This will increase the data availability on climate risks.
- II. The European Commission should propose a Shadow Carbon Price Directive, which requires carbon-intensive sectors to account for a shadow price on carbon. This info will also be available for investors to reduce the risk

on asymmetric information and stranded assets.

- III. A legally binding form of the long-term goal to reach a carbon-neutral economy should be designed by the Ministry of Finance. The current Energy Agreement (Energieakkoord), does not provide sufficient detail or certainty for investors. More specific transition pathways, on national and sector level, towards a lower-carbon economy along a more detailed timeline are required.

Dutch Pension market

- IV. Pension funds and their boards should inform themselves about the risks associated with carbon and engage with their pension provider on what methodologies can be developed.
- V. Pension providers should start with testing of new methodologies to assess climate risks and present alternative investment views to the funds.
- VI. Both pension funds and pension providers should not wait until data & methodology on climate and carbon risks are fully developed, but start using them since the risks can materialize in portfolios before that time.

Financial Authorities

- VII. The Ministry of Finance, AFM & DNB should set up working groups to create support within the Dutch financial system on the important aspects and regulatory details of this Dutch Energy Transition Law.
- VIII. DNB should prepare internal policy to develop new channels and methods to control the compliance of the new Dutch Energy Transition Law, since this data will be not standardized yet.

- IX. DNB should monitor if pension funds and providers are on track regarding the adaptation of IORP II, and facilitate information sharing sessions with the pension funds and providers. Potential bottlenecks can be deducted from the transcribed interviews of this thesis.
- X. AFM should develop internal policy which focusses on the impasse between Dutch pension funds and pension providers. Point IV, V, and VI to alleviate this impasse should be addressed in surveys and interviews with the boards of Dutch pension funds and providers. The AFM can use these assessments to intervene where needed. The ostrich policy of the boards of the pension funds and providers regarding climate risks can in this way be transformed to a more progressive attitude towards assessing these risks.

5.3 Scientific added value

The scientific relevance of this research is the verification of the usage of ALM and SAA methods at O&G sector level on carbon bubble risk with practitioners in the Dutch pension market. Although ALM and SAA are not applied on O&G sector level to assess carbon bubble risks, these tools should more be used to acquire insights in the ESG risks of the total portfolio, in line with the forthcoming implementation of IORP II in the European pension market. Dutch financial regulatory entities can use the result of this thesis that not all providers are in line with the new directive, to support the Dutch pension funds and providers in preparing their ESG risk management before IORP II comes into force on January 13th, 2019.

5.4 Limitations and future research

One of the limitations of the research is that only one pension fund was interviewed. To do a comprehensive analysis of the Dutch pension market, I aimed for more interviews with the pension funds. Unfortunately, most

of them were not open for an interview. Interviewing more pension funds would have increased the validity of this research. Future research could focus more interviews with pension funds, to acquire more insight in how the impasse between the pension funds and providers can be eliminated and how they see their role in deflating a potential carbon bubble burst and accelerating the energy transition, since they have the mandate over the money of the pension participants.

To make a better assessment on how the Dutch pension market should value the carbon bubble risk, actual investment data on the investment position of the pension providers would be of added value, since this would provide more information on the exact risk level per pension provider. Unfortunately, this information was classified. Disclosure by the pension providers on the details of the discounted cash flow models of O&G companies, or details on stress tests and risk assessments of the carbon bubble would also have contributed to better answering the research question, but this was also classified. Future research could be pointed at investigating how large exactly the role of proven reserves is in those discounted cashflow models, to acquire more insight in O&G company valuation. This can perhaps be done via more outdated, less competition sensitive data from other financial institution which invest in O&G companies.

Due to the time constraints of this research, the scenario analyses have the limitation of using only four or five indicators per scenario, and the focus on only three scenarios. Although it provides a good first overview, this is too simplified to base solid investment decisions upon, since the future of the energy system is highly complex and involves many different characteristics and interdependencies. To get a better picture of which O&G companies are most at risk at a potential carbon bubble burst, future studies could focus on which reserves are more likely

to strand than others under which different circumstances.

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Appendix I

Overview O&G companies from sample most at risk per scenario.

Scenarios:	Business as usual	Carbon bubble Burst
Key factors for O&G companies	- Ability to meet growing fossil fuel demand	-Unburnable carbon -Ability to Adapt
Companies most at risk	Occidental	ConocoPhillips
	Statoil	Exxon Mobil
	ENI	Chevron

Appendix II

Overview interviewed organizations Dutch pension market

Pension Provider	Clients	Assets under Management (billions €)
APG	ABP & BpfBouw	433
PGGM	PFZW	183
Achmea Investment Management	Achmea & others	100
MN	PMT & PME	92
Actiam	Various clients	52
TKPI ²	Various clients	23
Aegon asset management	Various clients	58
NNIP	Various clients	61
Delta Lloyd asset management	Various clients	46
	Total	990
Pension Fund		
One large pension fund		

² TKPI is part of Aegon asset management, hence only TKPI is included in the sum of total assets under management.

Overview preliminary interviews

Organizations	Expertise of organization	Function of respondent
VBDO	Representation of sustainable investors	Senior Project Manager
DNB	Regulating financial entity	Program lead climate risk
Accenture (4 interviews)	Consultancy	Consultant Company Valuation
		Consultant Business Strategy
		Management Consultant Resources
		Manager Risk Management Consulting
Sustainalytics	Provider and analysis of sustainable data	Carbon Team Manager