

ALL SWANS ARE BLACK IN THE DARK

HOW THE SHORT-TERM FOCUS OF FINANCIAL ANALYSIS
DOES NOT SHED LIGHT ON LONG TERM RISKS



TRAGEDY OF THE HORIZON

EXPLORING AND ADDRESSING THE SHORT-TERM FOCUS OF CAPITAL MARKET ACTORS TO SECURE A MORE SUSTAINABLE ALLOCATION OF CAPITAL FOR THE LONG-TERM

A 2° INVESTING INITIATIVE & GENERATION FOUNDATION PROJECT:

ABOUT THE PROJECT: The 2° Investing Initiative & The Generation Foundation have formed a multi-year partnership to explore and address the 'Tragedy of the Horizon', describing the potential suboptimal allocation of capital for the long-term due to the limited ability of the finance sector to capture long-term risks within short-term risk-assessment frameworks. The project aims to assess artificial and natural factors that compress the horizons of market players, such that long-term risks—'travelling' from physical assets through to asset owners and managers—get mispriced. Such a mispricing of long-term risks creates a 'void' between the assets and liabilities of long-term asset owners and can eventually amount to an asset-liability mismatch.

Stages of the 3-year project include:



1. Informing the debate by quantifying time horizons across the investment chain, for example, with respect to the liabilities of asset owners, mandates of asset managers, maturity of credit, equity portfolio turnover, time periods analysed by analysts when performing discounted cash flow calculations, time horizons of risk models, backward-looking/forward-looking time horizons of data, and the lifetime of industrial assets, etc.).



2. Identifying the unintended consequences of risk management practices resulting from short-term frameworks, including barriers to the transmission of long-term risk signals and the implications for efficient and productive capital allocation;



3. Developing responses in partnership with the two key stakeholder groups, financial policymakers and long-term asset owners, to overcome the tragedy of the horizon, for example, by addressing reporting, risk management practices, products and tools, as well as policy frameworks.

ABOUT THE AUTHORS: The project is developed by the 2° Investing Initiative research team, engaging with other research organisations and key stakeholders, including investment consultants, equity researchers, rating agencies, regulators, etc. The authors of this report are Mona Naqvi, Brendan Burke, Svenja Hector, Tricia Jamison, and Stan Dupré (2° Investing Initiative). The report benefited from inputs from Daniela Saltzman (Generation Foundation).

Published February 2017

We are interested in your views on this report and welcome collaboration. For more information, please visit:

www.tragedyofthehorizon.com

Main contact:

Mona Naqvi | 2° Investing Initiative | New York
mona@2degrees-investing.org

New York (USA): 205 E 42nd Street, 10017 NY, USA
London (UK): 40 Bermondsey Street, SE1 3UD, London UK
Paris (France): 97 rue LaFayette, 75010 Paris, France
Berlin (Germany): Am Kupfergraben 6a, 10117 Berlin Germany

ABOUT THE AUTHORS



2° Investing Initiative (2°ii) is a not-for-profit think tank working to align the financial sector with the 2°C climate goal and long-term investing needs. With offices in Paris, London, Berlin and New York, the Initiative engages a global network of over 40 partners and members, including financial institutions, investment researchers, asset managers, policymakers, research institutions, academics and NGOs. Our work primarily focuses on three pillars of finance - metrics and tools, investment processes, and financial regulation; the Tragedy of the Horizon project informs all three.



The Generation Foundation was established alongside Generation Investment Management in order to strengthen the case for Sustainable Capitalism. Our strategy in pursuit of this vision is to mobilize asset owners, asset managers, companies and other key participants in financial markets in support of the business case for Sustainable Capitalism and to persuade them to allocate capital accordingly. All of the activities of the Foundation, a not-for-profit entity, are funded by a distribution of Generation IM's annual profitability.

INDUSTRY ENGAGEMENT: This report benefits immensely from intense engagement with the financial industry. As an essential part of our research, we conducted workshops and seminars as well as interviews and a survey for equity research analysts. The conclusions of this report do not necessarily reflect the views expressed by the organizations consulted via workshops and interviews. However, we offered them the possibility to integrate their feedback in the final report in the form of anonymized quotes.

Concluded industry engagement workshops, conferences, and seminars (in 2016):

18th August, 2016: Workshop on Time Horizons in Equity Research, New York City

23rd August, 2016: Workshop on Time Horizons in Credit Analysis, S&P, London

24th August, 2016: Workshop on Time Horizons in Equity Research, London (co-hosted with The Generation Foundation)

31st August, 2016: Workshop on Time Horizons in Equity Research and Credit Analysis, Paris (co-hosted with Moody's)

1st-3rd September, 2016: 2°ii Seminar on 2D Stress Testing & The Paris Agreement, Corsica

15th September, 2016: Conference on Time Horizons in Financial Analysis, Paris

9th September, 2016: Workshop on Time Horizons in Credit Analysis, Moody's, New York City

21st September, 2016: Conference on Time Horizons in Financial Analysis, New York City

Participants included analysts from the following organizations:

Barclays Equity Research, Bank of England, Blackrock, Carbon Tracker Initiative, Citi Research, Comgest, Edmond de Rothschild Group, Etho Capital, Exane BNP Paribas, French Society of Financial Analysts, Generation IM, Grizzly Reponsible Investment, JP Morgan Chase, Jupiter Asset Management, Kepler Cheuvreux, Moody's Investor Service, Métropole Gestion, Morgan Stanley, MN, MSCI, Natixis Global Asset Management, Oddo Meriten Asset Management, The Pensions Trust, S&P Global Ratings, Sustainable Insight Capital Management, Sycomore Asset Management, UBS Wealth Management America.

Disclaimer: All text, artwork, photographs, layouts and other content and associated intellectual property rights, including copyright, and are owned by The Generation Foundation or used with permission. The content is provided to you for general, non-commercial purposes only. Although we endeavour to ensure that the content is accurate and up to date, The Generation Foundation accepts no responsibility for loss or damages arising from reliance on information contained in this document. Unless otherwise stated, all content is licensed to you under the Creative Commons Attribution-Non-Commercial 3.0 Unported licence (<http://creativecommons.org/licenses/by-nc/3.0/>). This means that you are free to share the content by copying, distributing, and transmitting it, and you may produce derivative works from the content, but you may not make commercial use of it and you must always attribute it to The Generation Foundation. You must always make reference to the Creative Commons Attribution-Non-commercial 3.0 Unported licence with your use of the Content and retain any other copyright or proprietary notices or other licensing information specified by The Generation Foundation.

Cover Image: Jeff Ruane, "heavy fog in the foothills at night," 2009

TABLE OF CONTENTS

EXECUTIVE SUMMARY	5	PART III: HOW FINANCIAL ANALYSTS EQUIP INVESTORS WITH LOW BEAMS	37
PART I: WHITE SWANS MAY LOOK BLACK IN THE DARK	7	3.1 Equity and Credit Analysts in the Investment Allocation Chain	38
1.1 Analysts in the Investment Chain	8	3.2 Financial Models are the Predominant Tool in Equity Analysis	39
1.2 The Role of Equity Research	8	3.3 Equity Research is Blind After 5 Years	40
1.3 Equity Analysts Swing Between Accuracy and Inaccuracy	9	3.4 How Short-termism Is Embedded in Valuation Models	41
1.4 The Role of Credit Rating Agencies	10	3.5 Analysts' Explicit Cash Flow Forecasts Focus Only on the Next 5 Years	44
1.5 Ratings are Generally Accurate and Stable	10	3.6 Risk Sections Are Not Long-term	44
1.6 Optimal Accuracy and Stability Depend on an Investor's Time Horizon	11	3.7 Credit Risk Assessments Largely Focus on the Next 3-5 years	45
1.7 Analysts and Long-term Risk Assessment	11	3.8 Emerging Risks and Trends Beyond 5 Years Are Unlikely to Impose Ratings Action Today	46
1.8 Not All Risks are Incorporated in Financial Models	12	3.9 No Evidence of a Clear Framework to Distinguish a 'Kodak' from a 'GE'	48
1.9 White Swans that Appear Black in the Dark Often Get Missed by Financial Analysts	13	Feedback from Industry Engagement Workshops: How Analysts Equip Investors with Low Beams	50
1.10 White Swans in the Dark Are Common and Actionable	14	PART IV: THE DRIVERS BEHIND THE LOW BEAMS	51
1.11 Our Taxonomy of White Swans in the Dark	15	4.1 Analysts Face Multiple Obstacles to a Long-Term View	52
1.12 White Swans in the Dark May Have Long Time Horizons	16	4.2 Company Disclosures Focus on the Short-term	53
1.13 Examples of Megatrends That May Be Mispriced	17	4.3 ESG Factors Overlap With Long-term Risk	53
1.14 Case Studies: How Long-term Risks Affected Capital Markets in the Past	18	4.4 Developing New Valuation Methods	55
1.15 Future Risks: how Long-term Risks could Affect Capital Markets	24	4.5 Assessing Adaptive Capacity	56
Feedback from Industry Engagement Workshops: White Swans in the Dark	28	4.6 Research Budgets Place Limits On Long-term Risk Assessment	57
PART II: THE RATIONALE FOR LONG-TERM ANALYSIS: EXPOSING THE WINDOW OF MATERIALITY	29	4.7 A Lack of Demand for Long-term Analysis Drives Short-termism in the Analysis	58
2.1 Many Asset Owners Have Long Investment Horizons	30	Feedback from Industry Engagement Workshops: The Drivers Behind The Low Beams	59
2.2 Company Value Is Mostly Based on Long-Term Cash Flows	31	PART V: CONCLUSIONS AND DIRECTIONS FOR FURTHER RESEARCH	61
2.3 Companies Are Exposed To Long-term Risks	33	5.1 Consequences	62
2.4 Company Value Relies on Long-term Intangible Assets	34	5.2 Directions for Future Research	63
2.5 The Bond Market Is Exposed to Long-term Risks	35	5.3 Mapping Potential Solutions	64
		5.4 Conclusions	66
		ENDNOTES	67
		GENERAL INDUSTRY FEEDBACK	69

EXECUTIVE SUMMARY

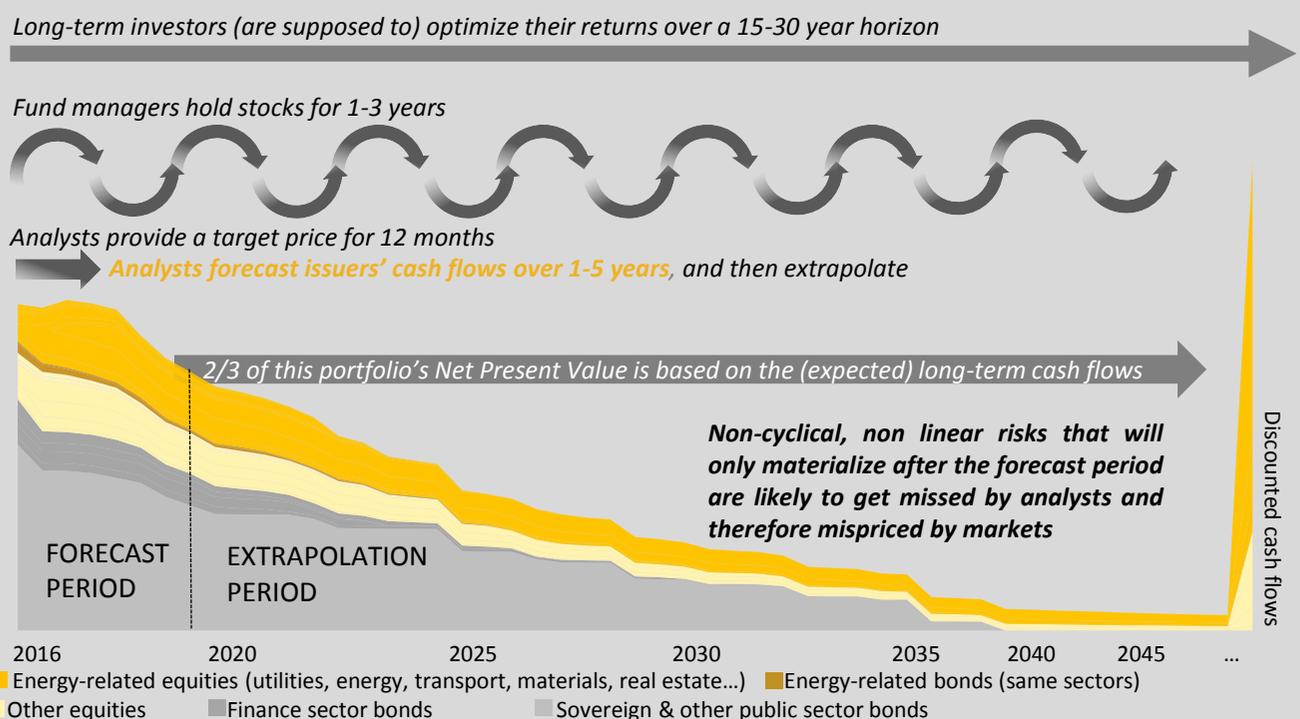
Academic literature calls ‘Black swans’ financial risks that are unpredictable. Our research suggests that certain non-cyclical, non-linear, long-term risks are actually predictable ‘white swans’. They are left in the dark by the ‘low beams’ of financial analysis that focus on the next 1-5 years.

1. Financial analysis is ‘calibrated’ on a specific time horizon. Financial analysts provide a target price (equities) or rate the risk of default (bonds). Given the variability of these metrics over time, analysts need to adjust their recommendations over a specific timeframe if they want to maximize accuracy. Equity research analysts usually provide a 1 year target. Credit rating analysts, on average, change 1/3 of their investment grade ratings over a 3 year period. Our analysis suggests that analysts currently calibrate their analysis on a 1 to 3 year time horizon: they value the risks that are likely to impact the cash flows of the issuers within this timeframe.

2. Non-linear, non-cyclical, long-term risks likely to get missed. Risks that are unpredictable are categorized as ‘black swans’ in academic literature. Past examples such as the subprime crisis or the more recent VW emissions fraud suggest that some of these ‘black swans’ might actually be predictable but missed by financial analysts due to their long-term, non-linear, non-cyclical profile. In other words these swans are ‘white’ but ‘left in the dark’ due to the short term focus of financial analysis. Current examples of such risks that are likely to get mispriced include energy transition risks and the disruptive impact of artificial intelligence and automation for services and transportation.

3. Material impact on long-term investors’ returns. Investors with long-term liabilities, such as pension funds and insurers, are supposed to optimize their return on a 15-30 year horizon. The net present value of their portfolio is usually based on the ‘expected’ long-term cash flows generated by the issuers of stocks and bonds. Indeed, in many sectors, the value of companies is based on long-term assets such as power plants, oil reserves and infrastructure. Based on our analysis, we estimate that about 80% of the net present value of a long-term investor’s portfolio is based on cash flows expected after 5 years.

Figure 1: Time horizons in long-term investors’ portfolio management



Source: 2ⁱⁱ 2017, representative institutional investor portfolio, 40% equity, 60% fixed-income

4. Analysts' models are based on cash flow forecasts for the next 3-5 years. In this report, the core part of the research focuses on the models used by sell-side equity research analysts and credit rating agencies. Our analysis suggests that in both cases, analysts rely on past financial data and forecasts for the next 3 to 5 years. In rare cases for sectors with very stable cash flow profiles this forecast period can extend up to 7-11 years. After this period, the expected future cash flows of issuers are extrapolated. Therefore analysts only price the risks that impacted issuers in the past or are likely to impact them during the forecast period.

5. Long-term financial analysis faces methodological obstacles but also a lack of demand from investors. When interviewed on the drivers behind the short-term focus, analysts highlight the methodological obstacles, attributing the lack of forward-looking data reported by issuers, and justifying the focus on short term by the ability of most companies to adapt to any risk in the long-term (through innovation, divestment and acquisitions, etc.). However, a closer look also reveals that the demand for financial analysis is heavily driven by short-term traders, and that even long-term investors actually trade their assets with relatively short horizons. A sister study developed in partnership with Mercer shows that long-term equity managers hold assets for 1.7 years on average. During the interviews, most analysts agreed that this lack of demand alone can explain the lack of long-term analysis.

6. Developing 'alternative' long-term analysis? We conclude that the methodological obstacles can be better addressed. In sectors with long term assets like power, avenues include the use of physical asset level data to better assess the locked-in effects, the extension of the forecast period, and a more forward looking approach in the calculation of the risk premium. The climate-related risks are currently the main focus of attention: the Financial Stability Board established a task force to explore options, and the EC finances a research project (led by 2°ii) to develop an open source methodological framework. However, moving forward, the lack of demand from investors will remain a key obstacle. To address it, the report identifies both voluntary measures (e.g. long-term alternative ratings and valuation commissioned by a pool of investors or regulators), and public-policy actions (e.g. mandatory long-term risk analysis and disclosure). Both dimensions are currently discussed or/and experimented for climate-related risks.

RESEARCH APPROACH

The research is based on a mix of quantitative and qualitative analysis. Most figures are based on third party research, both academic and non-academic as well as market data from Bloomberg, S&P, Thompson Reuters, etc.. Our own quantitative analysis focuses on the breakdown of equity NPV by time period, and the length of the forecast periods based on Morningstar DCF models and Bloomberg fixed-income data. We also quote the results of a study on equity portfolio turnover, based on Mercer proprietary data and Morningstar funds data. The qualitative analysis is based on a review of sell-side research papers, Credit Rating Agencies' methodologies, as well as engagement with practitioners (see below, page 6 and p 70).

FEEDBACK FROM PRACTITIONERS

Based on a discussion paper, our team engaged with sell-side and buy-side equity research analysts as well as credit analysts via a survey, interviews, and workshops. The large majority of feedback confirmed our findings. The three main caveats are:

- Some equity analysts blamed us for giving too much credit to DCF models, since in most cases analysts just use DCF to justify a price set based on peers' estimates and market price.
- A strong minority of analysts also questions our optimism regarding the ability to overcome methodological obstacles and uncertainty in general.
- Finally, one CRA explained that it seeks to incorporate all risks into ratings, whether long-term or short term, with the most forward-looking view that visibility based on the availability of data into these risks permits. We however did not find enough evidence supporting this view to modify our conclusions.



PART I

WHITE SWANS MAY LOOK BLACK IN THE DARK

SECTION SPOTLIGHT

- Equity analysts are very accurate when markets are calm but they tend to miss their price targets by more than 50% in volatile markets.
- Credit ratings have historically been very good signals of default; however, ratings must trade-off accuracy and stability, and the trade-off point chosen by credit analysts may not adequately transmit risk signals most relevant to different types of investors.
- Credit and equity analysts may be missing long-term, non-linear risks.
- Long-term risks, in particular those with non-linear and non-cyclical risk profiles, are likely to get missed by financial analysis due to the short-term focus of current risk and valuation models.
- In light of these long-term future risks, long-term investors are potentially exposed to mispriced, financially material threats.
- The subprime crisis was a case in point. Disruptive trends such as the transition to a low carbon economy currently raise the attention of financial regulators and intermediaries themselves.

1.1 ANALYSTS IN THE INVESTMENT CHAIN

Analysts play a key role in assessing financial risks and opportunities for investors. By undertaking fundamental risk and valuation analysis of companies and individual securities, analysts provide recommendations and offer value judgments that help investors determine how to allocate their capital. Their specific function relies on their business model: analysts can provide services to companies, investors, or act independently as third-party providers. This paper addresses four key types of analysts and their role within the investment chain (see Fig. 2 for more information):

- **Sell-Side Equity Research Analysts:** Sell-side equity research analysts undertake independent research to value companies and estimate the 'fair value' of listed equities, ultimately prescribing a 'buy, sell or hold' recommendation.
- **Buy-Side Equity Research Analysts:** Buy-side equity research analysts undertake the same type of research but directly on behalf of fund managers.
- **Credit Rating Analysts:** Credit rating analysts assess the creditworthiness of debt issuers and make judgments about their ability to repay any outstanding debt obligations.
- **Environmental, Social, & Governance Research Analysts:** 'ESG' analysts cover both the risks and opportunities associated with environmental, social and governance factors, which may be either short- or long-term.

These analysts offer a range of services but their principal role is to make judgments about the value or creditworthiness of investment securities, which necessarily comprises fundamental risk-assessment. Because analysts offer a range of products and services, their key performance indicators may vary. However, analysts are doing their job if their judgments give investors an accurate sense of the risks and opportunities posed by the real economy. Precisely how the work of analysts facilitates this flow of information will vary between debt and equity markets. This paper seeks to determine whether analysts provide the investment community with enough information about the future prospects of the companies or securities they cover.

1.2 THE ROLE OF EQUITY RESEARCH

The role of equity analysts is to accurately forecast stock prices by assessing the fundamental value of companies. Equity analysts offer recommendations on stock investment decisions. Both buy-side and sell-side analysts produce earnings estimates and provide investment recommendations to investors. These recommendations can change frequently based on new information so should be accurate in the near-term.

Our focus on the sell-side. The nondisclosure of recommendations by the buy-side makes sell-side recommendations much more accessible and comparable over time and thus is the focus of our research. Our survey of analysts revealed, however, that the valuation models used by both the buy- and sell-side do not differ. To that extent, our analysis of the valuation models applies to both groups, though the business-model constraints vary.

Fig. 2: Primary Investment Allocation Analyst Types and Roles

Source: Authors 2017

Type	Role	Product	Users	Fee Structure
Sell-side	Value companies and estimate 'target price' of equities vs. market value	Research reports with buy/sell/hold recommendations	Equity investors	Revenues based on transactions
Buy-side	Same as above but directly on behalf of asset managers	In-house trade recommendations	In-house fund managers	No fee since internal
Credit rating	Assess ability of debt issuers to repay debt obligations	Credit ratings	Debt investors	Paid by issuers (up to 21% of deal volume)
ESG	Cover risks and opportunities associated with ESG factors	ESG ratings	Investors w/ ESG interest	Sell for fixed rate or as a % of basis points of fund

1.3 EQUITY ANALYSTS SWING BETWEEN ACCURACY AND INACCURACY

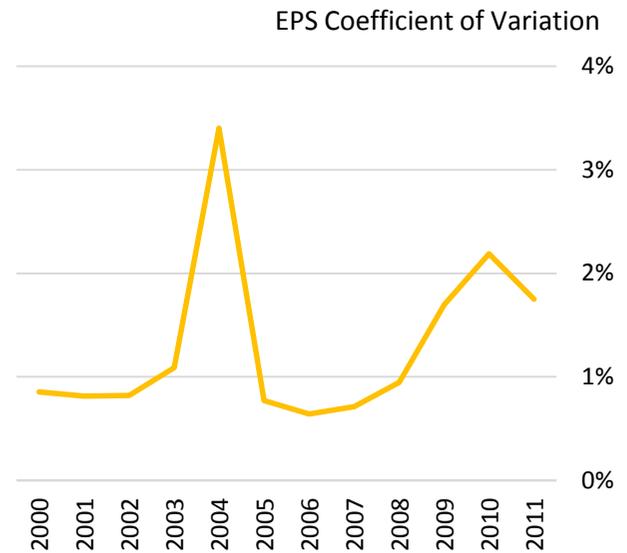
Equity analysts miss their targets by 10% two-thirds of the time, and by more than 20% one-third of the time. With regular revisions of estimates based on new information, analysts privilege accuracy over stability but often miss their targets. A survey of approximately 170,000 sell-side price targets from 1999 to 2012 suggests that they are typically within 20% of the actual price after 12 months (see Fig. 4).¹ Aggregate price targets fell within 20% of the actual price in 9 out of the 14 years in the sample. In the other five years, however, analyst targets missed the mark by more than 20%. Figure 4 reveals an inverse relationship with accuracy and the S&P 500 – when the market plunges, analysts miss high, and when the market booms, analysts miss low. This suggests that some events are not anticipated by analyst models.

Sell-side analysts are subject to peer pressure.

Across the sell-side industry, analysts offer earnings-per-share (EPS) forecasts 6-12 months ahead. These approximate the 'rational' share price based on estimates of company fundamentals. Analysts often offer estimates that are very close to each other, exhibiting a herding effect around the industry average. Research has shown that analysts seek to approximate the industry mean because of the risk of being an incorrect outlier.² Anecdotally, in one workshop an analyst told us the starting point for his forecast model is the target prices of other analysts. Since 1999, the standard deviation of estimates only exceeded USD \$0.20 once in 2009, a low figure considering the average EPS of an S&P 500 stock has been \$14.33 over that same timeframe (see Fig. 3). This suggests that 68% of analysts are usually within 1% of the industry average.

Fig. 3: Ratio of Analyst EPS Estimate Standard Deviation to S&P 500 Earnings Per Share

Analyst price targets exhibit a herding effect

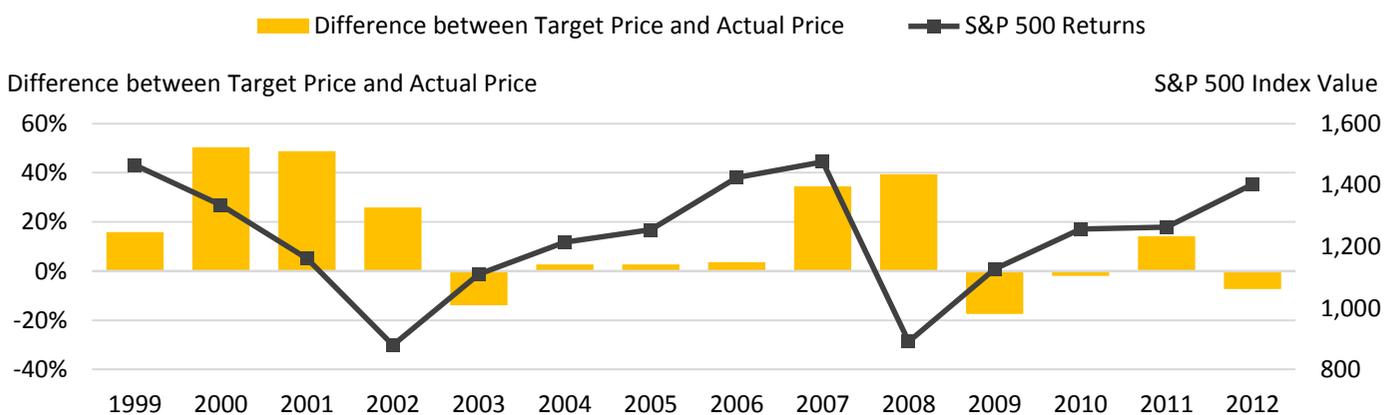


Source: Authors from Papakroni 2012 and Ycharts 2016

The frequent inaccuracy of targets implies the market may routinely be getting misleading and unstable signals. Since analysts tend to herd around periodically inaccurate estimates, investors sometimes have poor guidance on the near-term prospects of companies. Though analysts revise their estimates every 6 to 12 months, investors cannot rely on them to be accurate. Analysts are, on average, 16% off from actual prices over 1 year and likely farther off over longer timeframes. This means that analysts routinely do not anticipate major risks to their target prices and yet offer them anyways. Thus, not only do analysts fail to give a stable view of a company's value in the long-term, they also fall short of providing accurate recommendations regularly. Providing more stable long-term views with less frequency might serve to reduce this problem.

Fig. 4: Difference between Sell-side Price Targets and Actual Prices 12 Months Later

Analyst price targets are often highly optimistic



Source: Authors from Dechow & You 2015 and Quandl 2016

1.4 THE ROLE OF CREDIT RATING AGENCIES

Credit analysts judge the creditworthiness of issuers – their ability to repay their debts. Credit ratings are a measurement of the *relative credit risk* of issuers or products within the debt capital universe, rather than an assessment of the *probability* of default.³ Beyond ratings, ratings agencies also disseminate information about companies and securities but ratings are their main output. As such, investors rely on rating agencies to assess the relative downside risks to their capital. Banks and certain institutional investors supplement these ratings with in-house credit risk analysis.

1.5 RATINGS ARE GENERALLY ACCURATE AND STABLE

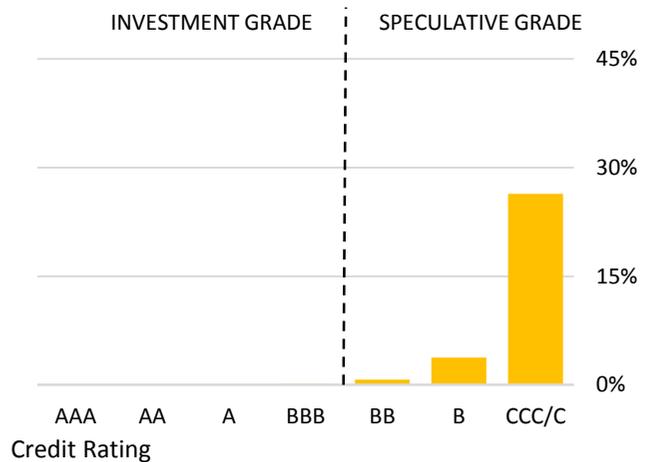
Ratings are evaluated by their ability to signal default. The accuracy of credit ratings is traditionally determined by how well they signal defaults. A ratings system with high *absolute* accuracy has low rates of default in the top categories (e.g. investment grade) and high default rates in the lowest categories (e.g. below investment grade). The rating agencies also define *relative* accuracy as the ability of a ratings system to distinguish defaulters from non-defaulters.⁴ Perfect relative accuracy implies a perfect ranking of issuers by credit risk; only those in the lowest categories default.

Historically, credit ratings have been accurate. There is a strong inverse relationship between default rates as defined by the agencies and credit ratings (see Figs. 5 and 6).⁵ For S&P, the default rate is calculated as the probability of default. Moody's default rate is the expected credit loss, a function of both the probability of default and the expected loss if default occurs. For both S&P and Moody's, triple-A corporates essentially never default, and default rates increase as down the scale. Measures of relative accuracy demonstrate that most defaults occur among the lowest-rated categories.⁶

Ratings are generally stable. Over 1981-2015, S&P kept 70% of ratings across all categories unchanged each year; 85% of the time, investment grade issuers maintained their rating 1 year later (see Fig. 7, next page). Alternatively, Moody's volatility metric measures the gross number of rating notches that credits have, on average, moved each year—roughly 1/3 for investment grade and 1/2 for speculative grade issuers (see Fig. 8, next page). Interpreted as a turnover rate, this implies that investment grade issuers on average move one notch every 3 years while speculative grade issuers move one notch every 1.8 years.⁸

Fig. 5: S&P Weighted Average One-Year Global Default Rate, 1981-2015

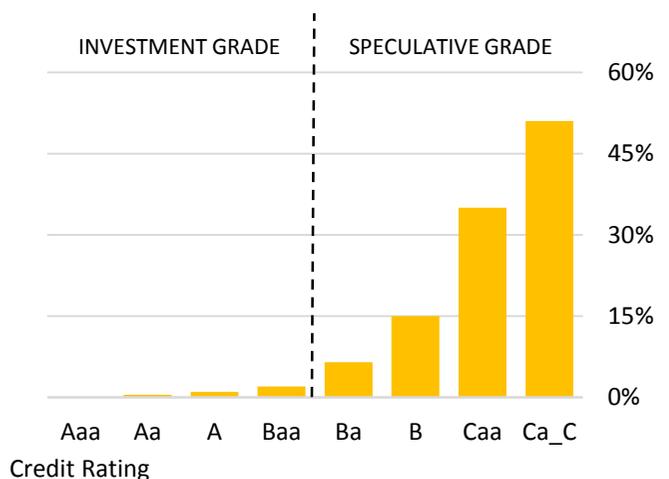
Investment Grade corporate bonds rarely default



Source: S&P Global Ratings 2015

Fig. 6: Moody's Historical Average Three-Year Corporate Default Rates

Investment Grade corporate bonds rarely default



Source: Moody's Comprehensive History of the Performance of Moody's Corporate Credit Ratings 2015

Stability matters. From a debt investor's perspective, the stability of ratings is important. Most do not hold bonds to maturity, and so their returns depend upon selling bonds in the secondary market. Credit rating changes signal a change in relative riskiness. Credit spreads, yields, and therefore bond prices will adjust to compensate investors for assuming this new level of risk. Even within investment grade ratings, this credit spread can be substantial. Further, rating changes can have financial ramifications beyond bond prices. Asset managers may be required to sell bonds that go below investment grade; regulators often set capital requirements based on the riskiness of an institution's assets.⁷ Both of these ultimately impose costs on investors.

1.6 OPTIMAL ACCURACY AND STABILITY DEPEND ON AN INVESTOR'S TIME HORIZON

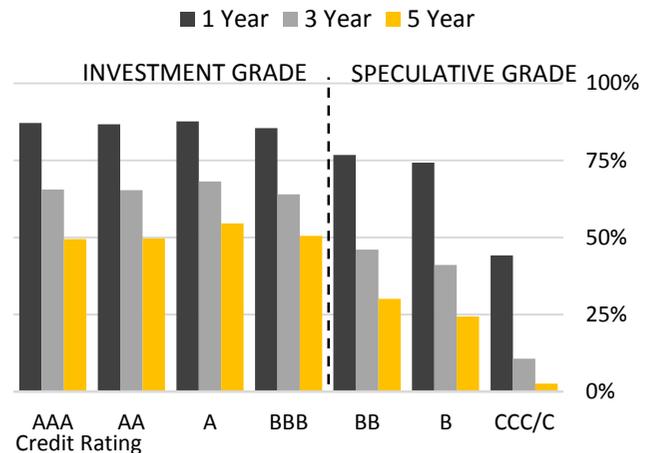
There is a trade-off between accuracy and stability. Prioritizing accuracy over a short timeframe requires frequent changes and implies less stability. Both Moody's and S&P change their ratings to reflect new information. For S&P, 1/3 of investment grade ratings change after 3 years and 1/2 change after 5 years. Unsurprisingly, speculative grade ratings change even more frequently. At the other extreme, if a rating agency were to prioritize stability over the maturity of a long-term bond (e.g. 30 years), it would be at the expense of ongoing integration of new information and would therefore reduce accuracy. Rating agency publications have identified this tension, noting that "it may be possible to increase ratings accuracy while reducing, perhaps substantially, ratings stability" and also "For some purposes it may even be worthwhile to trade away some accuracy for greater stability".⁹ Our understanding is that the optimal trade-off between accuracy and stability will at the end of the day depend on the horizon of the investor. Since credit rating agencies only provide a single 'long-term rating' per issuer, we assume they select an implicit time horizon to calibrate the trade-off. During the review phase involving executives from credit rating agencies, some of them agreed with this framing while others challenged it (see page 46).

1.7 ANALYSTS AND LONG-TERM RISK ASSESSMENT

This study seeks to understand the extent to which analyst and investor time horizons are aligned. While the relevant 'window of materiality' inevitably varies by investor, it's worth examining whether the typical timeframes of analysis and the exposure of investors diverge. A natural follow-up question is whether misaligned horizons make certain types of risk likely to get missed? Failure to capture these risks in analyst models could imply a mispricing of assets, potentially amounting to a suboptimal allocation of capital for investors, and society more broadly, in the long-term.

Fig. 7: S&P Percent of Credit Ratings that Stay the Same over 1, 3, and 5 Years, 1981-2015

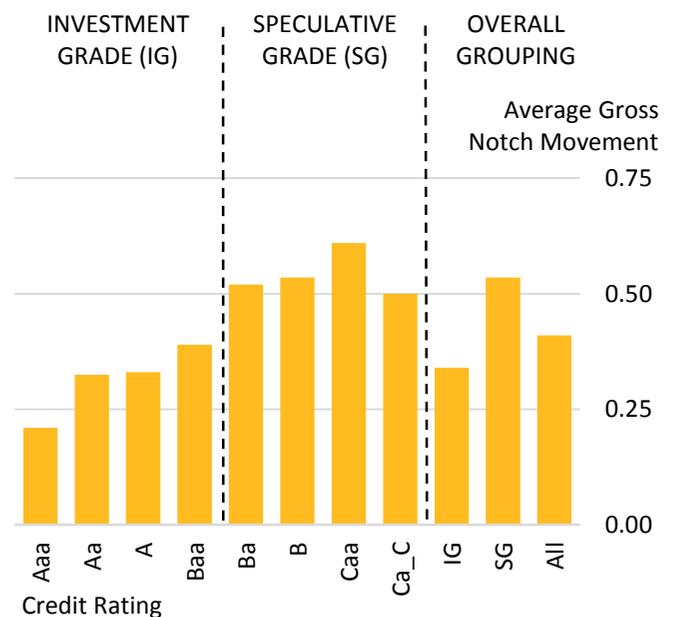
Over 5 years most S&P ratings are likely to change



Source: S&P Annual Global Corporate Default Study and Rating Transitions 2015

Fig. 8: Moody's Historical One-Year Corporate Rating Volatility

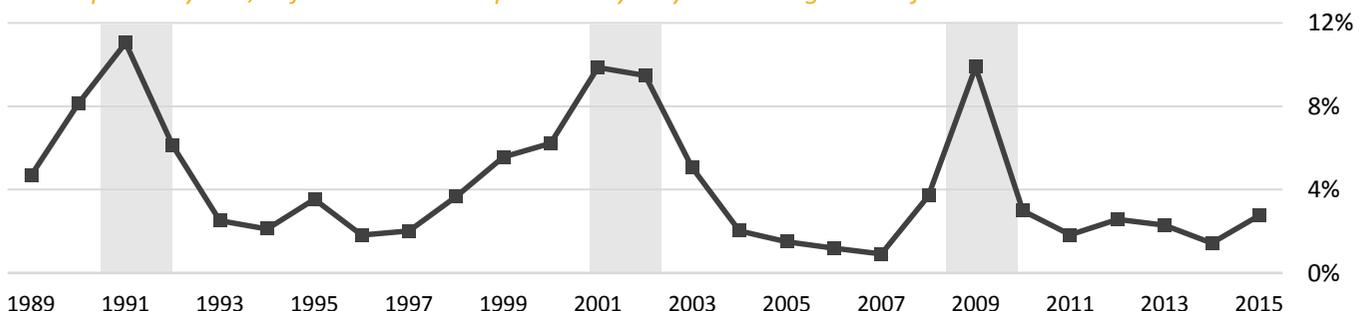
Moody's credit ratings are stable



Source: Moody's Comprehensive History of the Performance of Moody's Corporate Credit Ratings 2015

Fig. 9: S&P 1-year Default Rate, 1989-2015

Over the past 30 years, default rates have spiked every 10 years during times of crisis



Source: S&P Annual Global Corporate Default Study and Rating Transitions 2015

1.8 NOT ALL RISKS ARE INCORPORATED IN FINANCIAL MODELS

Some, but not all, events contributing to financial market losses may be predicted and thus managed before the fact. While some events that induce financial market losses are too idiosyncratic to reasonably predict, there are cases where a longer time horizon or more in-depth analysis by financial analysts would better equip investors to manage potential disruptions. Taleb categorized unpredictable events that fall in the ‘unknown unknown’ realm of certainty as ‘black swans.’¹⁰ Building on Taleb’s notion of a black swan event, gray and white swans have since been conceptualized to specify events that, contrary to their black swan relatives, are predictable and thus manageable to an extent (see Fig. 10).¹¹

Black Swan events are nearly impossible to predict and incorporate into financial models. Taleb defines Black Swans as low probability events with potentially astronomical impacts. Commonly cited examples include the rise of the internet or the 9/11 terrorist attacks. Black Swans are generally unprecedented risk or combinations of events, typically defying expectations based on empirical evidence. Black Swan events are therefore too uncertain to reasonably incorporate into financial models, to the extent that losses (or gains) to investors are largely inevitable when such an event occurs.

Gray and White Swan events may be incorporated into financial models, albeit at some cost. Like their black counterparts, gray and white swan events are also financially material to investors when they occur. Yet, they are typically much more likely, such that prior experience makes it easier to predict them and include in risk-assessment models. White Swan events are clearly visible to financial analysts and can be assessed at fairly reasonable cost. Gray Swans are also predictable but have a higher level of uncertainty than White Swans. Spotting Gray Swans thus requires additional time and resources. As a result, their exclusion from financial modeling is often justified on cost-benefit grounds. Any failure to predict and plan for White Swans on the road ahead, therefore, often links back to a defect in the analysis rather than the cost of analysis or characteristics of the event itself.

The visibility of White Swans on the road ahead depends on the strength of the analyst’s headlights. Forward-looking financial research is like driving at night. A driver can only see as far as their headlights shine. For an analyst, the analytical method is like a car’s headlights. The farther ahead the analytical method looks, the more visibility analysts have of potential risks ahead. Black Swans can appear on the road ahead with no warning so the brightness of the headlights does not increase their visibility (see Fig. 10). But White Swans can be seen in advance with sufficiently bright headlights.

Fig. 10: Taxonomy of Swan Events

Some kinds of long-term risks are probable and predictable

Source: Authors based on Taleb 2007 & Sikich 2010

Swan Event	Characteristics	Implication for Analysts
BLACK SWANS	<ul style="list-style-type: none"> Impossible to predict Very low probability Unlikely to get captured by risk and valuation models Addressing risk is not actionable 	CAN’T SEE THEM; NO RATIONALE FOR TRYING
GRAY SWANS	<ul style="list-style-type: none"> Predictable to an extent Can determine a probability and integrate into models Cost-benefit may not be justified 	CAN SEE THEM WITH HIGH EFFORT
WHITE SWANS	<ul style="list-style-type: none"> Highly predictable Can determine a probability Failure to integrate into models traces back to a defect in the analysis 	HARD TO MISS

1.9 WHITE SWANS THAT APPEAR BLACK IN THE DARK OFTEN GET MISSED BY FINANCIAL ANALYSTS

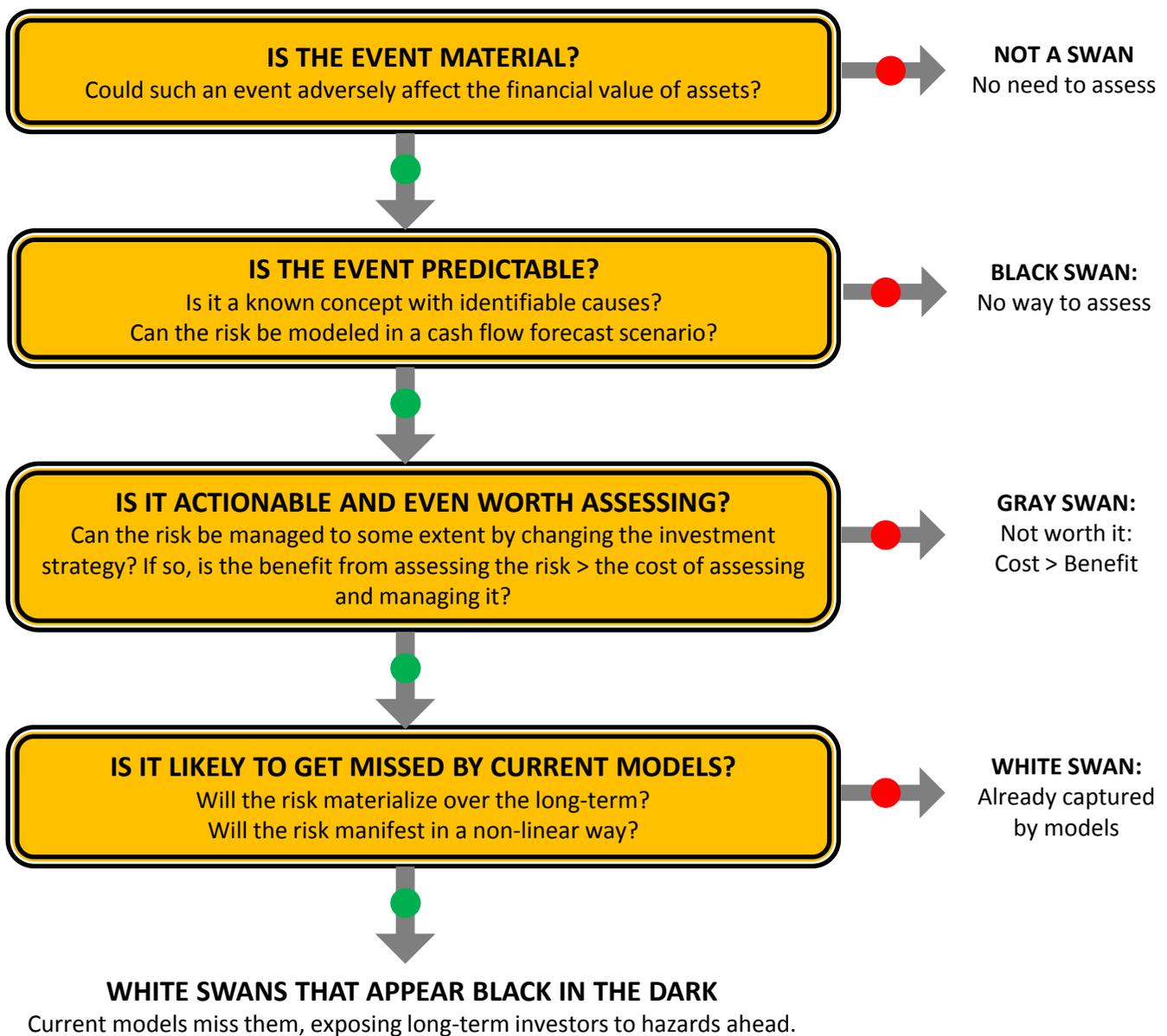
White swans might appear black if financial analysis leaves them in the dark. Our research shows that risk and valuation models typically have a 3-5 year forecast horizon, after which short-term trends are extrapolated (see Part III). Risks and trends with material impacts beyond 5 years are thus unlikely to be captured by financial analysts. When such long-term, often non-linear risks are missed and contribute to market losses, analysts tend to attribute this to black or gray swan event characteristics, with triggers that were either too unpredictable or costly to assess. Upon closer inspection, however, some of these risks were in fact predictable and the accompanying losses thus preventable to an extent.¹² As such, short-term time horizons in financial analysis mean that any white swan events materializing in a long-term, non-linear way

often get treated as though they were black swans and thus typically get excluded from financial models on cost-benefit grounds.

The ‘low beams’ of financial analysis expose long-term investors to a particular set of hazards ahead. White swan events that appear black in the dark are characterized by a distinctive set of criteria (See Fig. 11): (i) They might adversely affect the financial value of assets (‘material’); (ii) Analysts build on existing knowledge to form expectations about their likelihood (‘predictable’); (iii) The benefits to managing them justify the costs of assessment (‘actionable and worth assessing’), and; (iv) They materialize in a long-term (>5 year) or non-linear fashion. When these criteria are met, extrapolating short-term trends in financial risk and valuation models is unlikely to capture the impact of white swan risks, thus leaving investors exposed to hazards (and potentially missed opportunities) ahead.

Fig. 11: White Swan in the Dark Decision Tree

Four key criteria differentiate White Swans from Black and Gray Swans

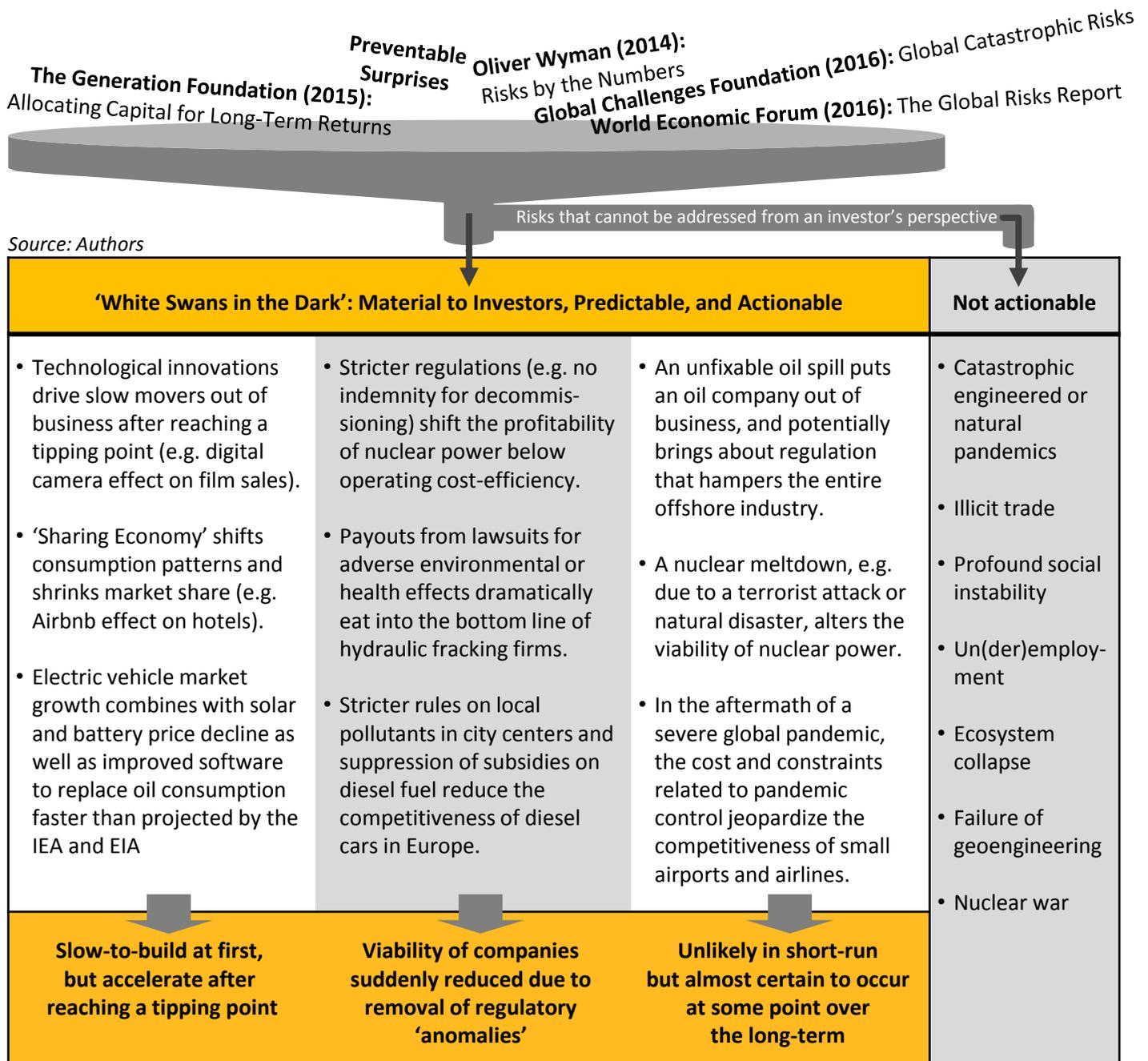


1.10 WHITE SWANS IN THE DARK ARE COMMON AND ACTIONABLE

Many long-term risks on today’s horizon are predictable, material to investors, and can be addressed ahead of time. Several major risks identified in the global risk literature can be considered immaterial to investors (not a swan), unpredictable from an analyst’s point of view (black swan), or too costly to assess (gray swan). Yet, many major risks fall into our category of ‘White Swans that Appear Black in the Dark.’ Importantly, this type of event risk is actionable from an investor’s point of view. That is, investors can manage their risk exposure by adjusting their investment strategy or influencing the investee’s risk management before the risk materializes.

Catastrophe risks are typically not actionable for investors. When catastrophic events occur, like nuclear war for example, assets across all industries and geographies may be impaired, implying that previous portfolio reallocations wouldn’t help. For such risks, a lack of agency greatly reduces the benefit from in-depth risk assessment. Risks with more specific impacts to a particular industry or sector, e.g. the risk of oil spills in the Oil and Gas industry, or risks and opportunities from specific technological trends and innovations, can be managed through targeted investments and divestments. An investor who wants to decrease exposure to the risk of an offshore drilling accident, for example, can redirect investments to oil companies with lesser risk profiles or exercise shareholder rights to foster tougher safety standards.

Fig. 12: Classifying Major Risks on the Horizon
 Long-term risks can be grouped into three categories



1.11 OUR TAXONOMY OF WHITE SWANS IN THE DARK

White swan events that appear black in the dark due to short-term focus of financial analysis are characterized by either slow-building, de-anchoring, or point-in-time risks. ‘White swan in the dark’ types of risks typically exhibit one of three risk profiles that make them unlikely to get captured within the 3-5 year window of risk and valuation models. These profiles provide the basis for our taxonomy of long-term, non-linear ‘dark swan’ risks (see Fig. 13).

Failure to incorporate long-term or non-linear risks into financial models decreases the ability of investors to efficiently manage their portfolios and might ultimately harm society. A short-term focus by equity research and credit rating analysis may prevent the

transmission of risk signals to current and potential asset owners. Thus, over the long-term, investors may suffer unexpected losses, potentially failing to meet their long-term liabilities. Further, since failure to account for long-term risks and opportunities implies a mispricing of assets today, capital will be allocated sub-optimally. This in turn can lead to underinvestment in projects that benefit society in the long-term or may induce the formation of bubbles, which, as they burst, often impose tremendous costs on society.

How do we define materiality? For the purpose of this study, we define materiality as: an impact of at least 20% of stock price and one notch on credit rating (see example on page 19) with a probability of more than 80% to happen at some point. This view was established through workshops with equity research analysts.

Fig. 13: Our Taxonomy: Classifying White Swans in the Dark by their Risk Profiles

White Swans in the Dark exhibit common patterns of risk vs. time

Source: Authors 2017

Type of Risk	Definition	Risk Profile
Slow-Building	<ul style="list-style-type: none"> Risks are slow to build at first but gain momentum over time so the expected impact of an event risk grows at a greater-than-linear rate over time. Linear cash flow projections neglect the non-linear trajectory of the risk. 	
De-Anchoring	<ul style="list-style-type: none"> Status quo relies on artificial or regulatory safeguards or barrier(s) to competition. If barriers are removed, the risk to the future cash flows of incumbents spikes dramatically. Linear cash-flow projections assume an artificial ‘risk anchor’, and thus do not account for the potential that it could be removed. 	
Point-in-Time	<ul style="list-style-type: none"> Probability of a high-impact event occurring in the short-term is low, but almost certain to materialize at some unforeseen point-in-time over the long-term. Linear cash flow projections do not take such high-impact events with low immediate probability into account. 	

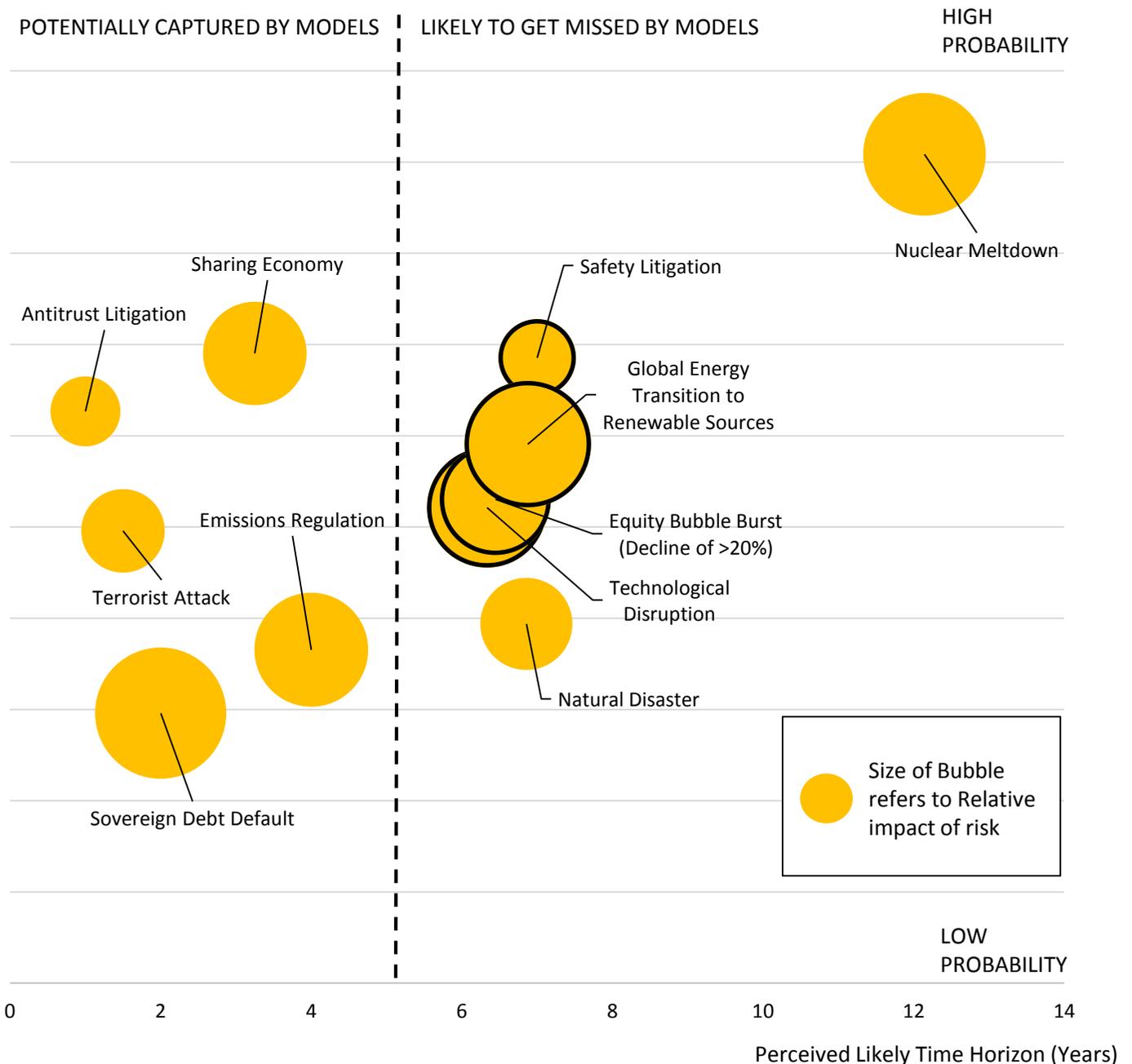
1.12 WHITE SWANS IN THE DARK MAY HAVE LONG TIME HORIZONS

Many probable and impactful ‘swan in the dark’ event risks are only likely to occur in the long-term. Some risks pertain to events that are certain to happen at some point in the future, like a natural disaster. However, a disaster that is material to investors might only occur once every 100 years. To map the relationship between time horizon and risk profiles, we asked equity research analysts on both the buy-side and sell-side to profile long-term risks we found in our literature. We asked how probable and impactful the risks might be and over what time horizons they perceived these risks were likely to materialize.

These risks are visible to analysts and believed likely to occur within the next decade despite not necessarily being included in current models. Equity analysts see Technological Disruption, which undermines legacy business models over time (slow-building), the Global Energy Transition to Renewable Sources, involving changes in policies removing the market anchors of established companies (de-anchoring) and Nuclear Meltdown (point-in-time) as highly probable and impactful risks that are only likely to occur more than 6 years in the future. Given the constrained horizon of current risk and valuation models, these results support the view that there are material risks visible to analysts on the horizon that are not captured by most valuation models.

Fig. 14: The Long-term Time Horizon of White Swans

Analysts view the energy transition and technological disruption as risks to investors over a long time horizon



Source: Authors from 29i Equity Research Analyst Survey 2016

1.13 EXAMPLES OF MEGATRENDS THAT MAY BE MISPRICED

Energy Transition (ET). There is a growing body of evidence that the transition to a low-carbon economy may give rise to risk that could impact financial markets. Such risk, alternatively known as carbon risk, carbon asset risk, and now more commonly transition risk, is on the agenda of the Financial Stability Board and the G20.¹³ Reporting on transition risk is now mandatory for institutional investors in France, and many other investors are examining it on their own within the broader context of climate-related financial risks. This suggests that regulators assume some form of mispricing of ET risks. These risks may fundamentally alter carbon-intensive sectors.

The scale of change in the Energy Transition may alter many sectors. Many governments have adopted decarbonization policies including emissions standards and carbon taxes (Energy Transition Risk and Opportunity consortium). These policies often align with Nationally Determined Contributions to emissions reduction as agreed under the Paris Agreement. In addition to policy changes, consumer preference for decarbonization could lead to reduced demand for fossil fuel-based products and reputational costs to fossil fuel users (see Fig. 15). Litigation may also be targeted at high emitters. Most importantly, costs of low-carbon technologies could plummet. These unconventional risks will develop non-linearly over the long-term and may not be adequately captured by financial models.

Fig. 15: Energy Transition Megatrend Factors and their Cash Flow Impacts

Megatrend Factor	Cash Flow Impact
Market	Commodity Price/Costs
	Technology Costs
Policy	Regulatory Costs
	Regulatory Constraints
Output	Production Volumes
	Fuel/Technology Volumes
Unconventional	Legal Costs
	Reputational Costs
Other macro trends	GDP/Inflation
	Other disruptive shocks

Source: Authors

Artificial Intelligence (AI). The rise of artificial intelligence-based technologies could disrupt numerous sectors and aggregate demand. If computers with the ability to process information and make decisions like humans are implemented throughout the economy, they could have far-reaching effects on employment and existing business model (see Fig. 16). This transition could cause a decline in labor force participation rates.¹⁴ Entire business models based on human resources could be eliminated without adaptation to AI.

AI will generally increase economic output and aggregate GDP.¹⁵ But specific sectors could be disrupted by the substitution of a human workforce with machines. Specific sectors impacted could be human resources services, trucking, brokerage services, and consumer discretionary, due to these sectors' reliance on human labor and high aggregate demand. Without active risk management, investors could be susceptible to losses.

AI will grow over time as new technology is developed and implemented. The Analysis Group predicts that the market will reach maturity by 2024 based on continued support from venture capital.¹⁶ This means that without a 10 year time horizon the likely effects of AI may not be priced today. Particular technologies like autonomous cars may not exceed existing models until 2040.¹⁷ Given the efficiency of proposed AI technologies, some replacement is inevitable, but analysts need to look at R&D plans and switching costs to ascertain when it might occur.

Fig. 16: Artificial Intelligence Megatrend Factors and their Cash Flow Impacts

Megatrend Factor	Cash Flow Impact
Market	Technology prices
	Labor Market Participation
Policy	Universal Basic Income
Intellectual Property	High Research and Development Costs
	Obsolescence of Existing Technologies
Unconventional	Ethical backlash
Other macro trends	GDP/Inflation
	Aggregate Demand

Source: Authors

1.14 CASE STUDIES: HOW LONG-TERM RISKS AFFECTED CAPITAL MARKETS IN THE PAST

Many past financial losses borne by investors resulted from long-term risks that could have been predicted and thus managed. Nonetheless, these risks were often only reflected in equity research and credit ratings once the risks had already materialized. We examine the cases of Volkswagen, Peabody Energy, and the Subprime Mortgage Crisis to showcase how de-anchoring, slow-building, and point-in-time risks resulted in capital market losses in the past. In particular, we examine the extent to which these risks were preceded by either strong or weak signals that could have been incorporated into financial analysts' models. Incorporating such signals might have lessened the harm to investors following steep equity de-valuations or unexpected adjustments of credit ratings only after the events occurred.

SUMMARY: CASE STUDIES

De-Anchoring Risk: Volkswagen's diesel car business was anchored by the lax enforcement of emissions regulations, exposing them to the risk of more effective enforcement. Analysts could have learned about emissions fraud in advance but likely ignored the warning signs.

Slow-building Risk: Peabody Energy faced a slow-building challenge from declining natural gas prices. Analysts failed to recognize the severity of the trend.

Point-in-Time Risk: The Subprime Mortgage Crisis began once house prices stopped rising. Credit analysts failed to recognize the reversal of housing price growth and did not downgrade mortgage-backed securities in time.

Case Study 1: Volkswagen
De-Anchoring Risk: Exposure of Vehicle Emissions Fraud

Summary: Since 2006, Volkswagen (VW) was aware its diesel engines could not meet U.S. emission standards in real-world driving conditions.¹⁸ From 2010-2015, VW sold 11 million diesel vehicles worldwide with "defeat device" software that activated emissions controls only in laboratory test conditions in order to meet requirements. During this time, the anchor of lax regulatory enforcement allowed VW to avoid the costly redesign of their diesel engines that would be necessary to comply with regulations. On September 18, 2015 the U.S. EPA announced that VW had admitted emissions fraud.¹⁹ In the 10 days that followed the announcement of the fraud, VW shares lost 34% of their value; 10 months later, they were still 20% below pre-scandal value.

There were signals of VW's emissions fraud that may have been ignored by analysts.

<p>Automakers had attempted to manipulate lab emissions results before:</p> <ul style="list-style-type: none"> • Ford, 1972: \$7 million fine for manipulating test cars • Chrysler, 1974: Recalled over 800,000 cars with defeat devices • General Motors, 1995: Recalled almost 500,000 Cadillacs with defeat devices²⁰ <p>Vehicle emission standards were tightening since 2007:</p> <ul style="list-style-type: none"> • EU 2009: announcement of mandatory CO2 emissions standards for 2015 • US 2011-2014: Announcement of tougher fuel efficiency standards²¹ <p>Evidence of emissions fraud was growing. After 2013, research by multiple NGOs documented the gap between laboratory and real-world emissions (see Fig. 17). After the fraud was exposed, VW stated that defeat device usage was an open secret in the industry and that regulators were aware of it.²²</p>	<p style="text-align: center;">Fig. 17: Mounting Evidence of Emissions Gap Begins to Dislodge the Anchor of Law Enforcement</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr style="background-color: #FFD700;"> <th style="text-align: center;">Date</th> <th style="text-align: center;">NGO/ Organization</th> <th style="text-align: center;">Key Message/Action</th> </tr> </thead> <tbody> <tr style="background-color: #D3D3D3;"> <td style="text-align: center;">May 2013</td> <td>International Council on Clean Transport</td> <td>Average gap between lab and real-world emissions growing: <10% in 2001, 25% in 2011.²³</td> </tr> <tr style="background-color: #FFD700;"> <td style="text-align: center;">May 2014</td> <td>US EPA; California Air Resources Board</td> <td>Begin investigation of Volkswagen diesel emissions.</td> </tr> <tr style="background-color: #D3D3D3;"> <td style="text-align: center;">Sept. 2014</td> <td>International Council on Clean Transport</td> <td>Average emissions gap in 2013: 31%. New VW Passat model is a major offender.²⁴</td> </tr> <tr style="background-color: #FFD700;"> <td style="text-align: center;">July 2015</td> <td>European Federation for Transport & Environment</td> <td>Diesel vehicles consistently emit much more NOx than regulations permit.²⁵</td> </tr> </tbody> </table>	Date	NGO/ Organization	Key Message/Action	May 2013	International Council on Clean Transport	Average gap between lab and real-world emissions growing: <10% in 2001, 25% in 2011. ²³	May 2014	US EPA; California Air Resources Board	Begin investigation of Volkswagen diesel emissions.	Sept. 2014	International Council on Clean Transport	Average emissions gap in 2013: 31%. New VW Passat model is a major offender. ²⁴	July 2015	European Federation for Transport & Environment	Diesel vehicles consistently emit much more NOx than regulations permit. ²⁵
Date	NGO/ Organization	Key Message/Action														
May 2013	International Council on Clean Transport	Average gap between lab and real-world emissions growing: <10% in 2001, 25% in 2011. ²³														
May 2014	US EPA; California Air Resources Board	Begin investigation of Volkswagen diesel emissions.														
Sept. 2014	International Council on Clean Transport	Average emissions gap in 2013: 31%. New VW Passat model is a major offender. ²⁴														
July 2015	European Federation for Transport & Environment	Diesel vehicles consistently emit much more NOx than regulations permit. ²⁵														

VW's high risk exposure and the consequent drop in share prices suggest it *might* have been worth it to incorporate the risk of tougher enforcement into risk and valuation models.

VW's business was highly exposed to the risk of tougher emission standards and their enforcement: During 2010-2015, 11 million cars were sold in multiple jurisdictions that set standards for vehicle emissions. The total financial penalties that could be assessed by multiple regulatory entities for fraud was significant. Further, the announcement of fraud would likely cause significant reputational damage. However, the exact timing of a violation could not be predicted.

Share prices dropped substantially and did not recover after exposure of VW's emission fraud: In the 10 days that followed the announcement of the fraud, VW lost 43% of its value before bottoming out. One year later, it was still 27% below pre-scandal value (see Fig. 18).

Fig. 18: Volkswagen Share Price Drop

Volkswagen's stock lost nearly half its value due to emissions fraud



Source: Inquiry Financial/Quandl

The sharp reaction in target prices and credit ratings after the announcement of VW's emission fraud *could* indicate that financial analysts had not considered the event to be probable or impactful enough to adjust recommendations or ratings in advance.

Equity research analysts did not see the risk growing. Morningstar's equity research report from late 2014, one year before the announcement, cited short-term risks like "stiff competition," "increasing global excess capacity," consumer switching, and the auto business cycle. No mention was made of the potential costs of emissions violations. Thus, price targets dropped dramatically once these costs were known (see Fig. 19).

Fig. 19: Average Volkswagen Price Targets, 2014-2016

Equity Research Analysts did not lower their Volkswagen price targets until after the announcement of fraud



Source: Inquiry Financial/Quandl

Fig. 20: Volkswagen Credit Rating Changes

Credit analysts Upgraded Volkswagen's Credit Rating just months before the fraud announcement

January 2015

S&P rates VW as stable, citing its ability to meet "stringent environmental standards"

March 2015

Moody's upgrades VW, citing its ability to meet "stringent regulatory requirements"

October 2015

S&P downgrades VW, citing "tarnished reputation" and financial penalties

November 2015

Moody's downgrades VW, citing the cost of regulation

Case Study 2: Peabody

Slow-Building Risk: Fuel Substitution In U.S. Electricity Generation

Summary: In 2011, Peabody Energy was the largest private coal producer in the world, with 82% of its sales by volume to U.S. electricity generators.²⁶ After steady improvements in drilling technology, U.S. shale gas production boomed after 2005, making natural gas an increasingly economical fuel for electricity production.²⁷ Meanwhile, U.S. environmental regulations continued to dampen the relative competitiveness of coal.²⁸ After years of weak coal demand globally, Peabody filed for bankruptcy in April 2016. Loss of equity value was immense: the market cap of Peabody dropped to US\$38m in 2016, down from US\$18bn in 2011. Peabody's stock price fell from US\$72 in 2011 to US\$2 in 2016.

The slow-moving decrease in the competitiveness of coal relative to gas was predictable.

Steady decline in the market share of coal relative to gas:

After steady improvements in drilling technology, shale gas production began a sharp and steady increase since 2005, rising 40% by 2015.²⁹ By 2009, natural gas was price-competitive with certain types of coal. During 2012, gas was price competitive with all but the lowest-cost U.S. coal, thus altering the market share of fuel sources in U.S. electricity generation.

Tightening environmental regulation:

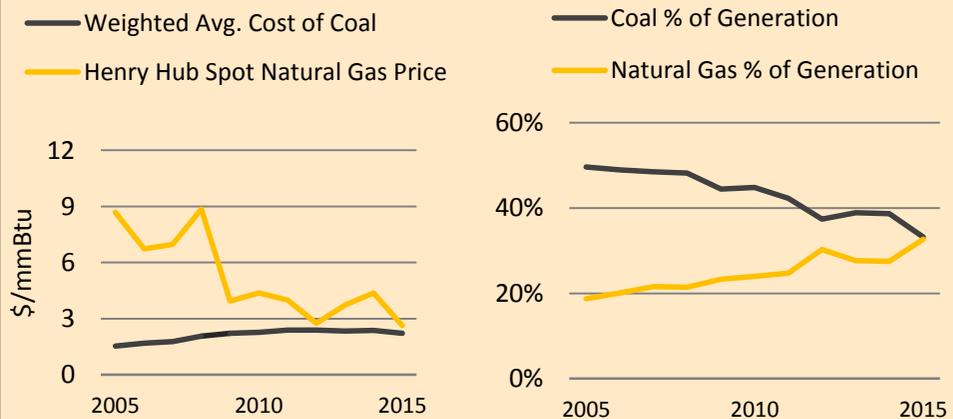
After 2004, the U.S. Environmental Protection Agency (EPA) proposed and in some cases finalized regulations such as the Clean Power Plan (2014) that would increase the operating costs and capital expenditures of many existing coal plants in order to comply. Further, the EPA's New Source Performance Standards (proposed 2011) would essentially make new coal plants uneconomical given existing technology. Though aspects of these rules were successfully challenged in court, the trend towards more stringent regulation increased the risk around coal relative to that around cleaner fuels such as natural gas.³⁰

Evolving drilling techniques spurred cost reductions in natural gas.³¹

- Hydraulic Fracturing: Injecting fluid at a high pressure into shale to ease extraction of gas, largely developed since 1980 by Mitchell Energy.
- Horizontal drilling: A technique of turning wells horizontally underground pioneered by Elf Aquitaine in 1980.
- 3-D Seismic Imaging: Improved imaging of shale formations in 2000s improved discovery and lowered costs, enabling commercialization.

Fig. 21: Slow-building Risk to the Coal Industry

The price of natural gas converged with coal while the share of coal in US electricity generation decreased



Source: EIA 2015

US Regulations Impacting Coal-Fired Power Plants

National Air Quality Ambient Standards, Cross-State Air Pollution Rule, Cooling Water Intake Structures Rule, and Coal Combustion Residuals Rule: From 2004 these regulations specified higher standards for the air emissions, cooling water, and by-products of coal-fired power plants, adding additional compliance costs to a significant portion of US coal generators.³²

Mercury and Air Toxics Standards (MATS): Finalized in 2011, MATS required coal-fired power plants to install Maximum Allowable Control Technology to limit specified pollutants by 2015. Carbon Tracker estimated that 40% of US coal plants needed to upgrade controls in order to be compliant.

Carbon New Source Performance Standards (NSPS). Proposed maximum CO2 emissions levels for new power plants such that new coal plants would effectively require some form of carbon capture and storage.

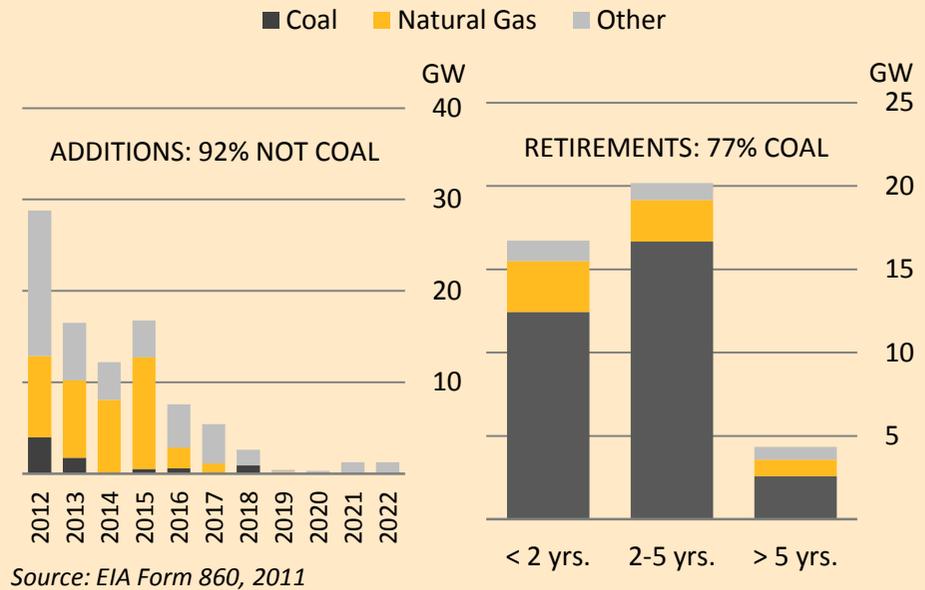
Trends in generation capacity implied a smaller role for coal in the U.S. electricity grid of the future. As of EIA 2011 data, 92% of proposed generation capacity in the US used a fuel other than coal (see Fig. 22), while 77% of the capacity planned for retirement was coal-fired (see Fig. 23). Further, the US coal fleet was aging. As of EIA 2011 data, the average age of a currently operating coal generator was 33 years, while historically the average retirement age of a coal generator was 38.

Fig 22: Proposed Coal Additions

Few coal additions were planned in 2011

Fig 23: Planned Coal Retirements

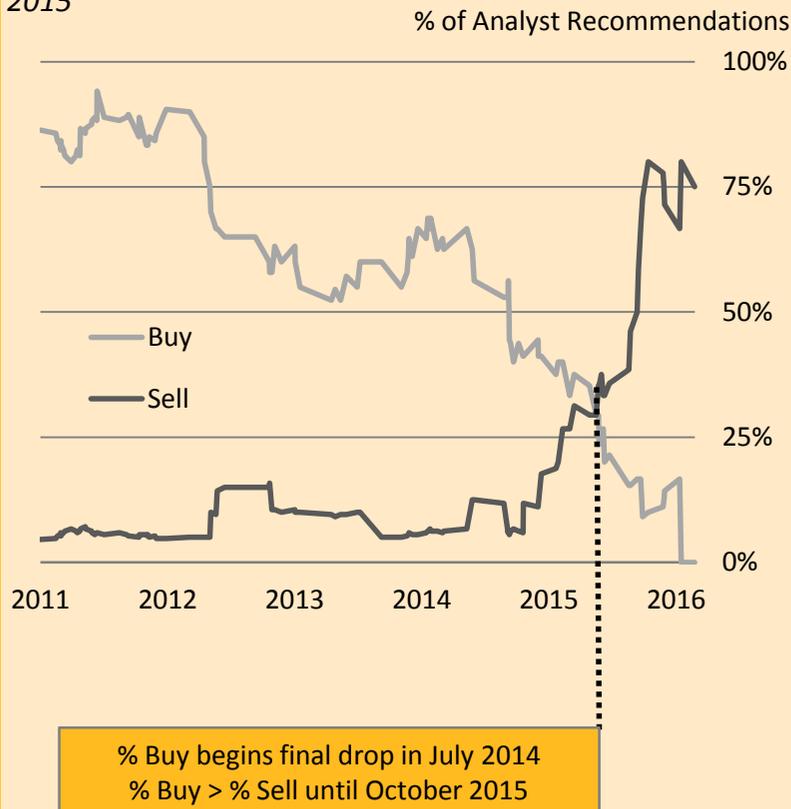
Many coal retirements were planned in 2011



Equity analysts discounted Peabody's vulnerability to the long-term decline of US coal, and relied on optimistic expectations instead. Credit analysts were much more skeptical and ultimately accurate.

Fig. 24: Equity Analyst Percent Buy/Sell Recommendations

Most equity analysts believed Peabody would recover until 2015



Source: Zacks/Quandl

Equity research believed that Peabody could outlast the slump in U.S. coal demand and that sales would essentially return to business-as-usual:

- Analysts regarded Peabody as the dominant US coal player and felt their low-cost, low-sulfur coal could survive alongside abundant natural gas.
- Analysts felt that Peabody could adapt to declining U.S. thermal coal demand by exporting U.S. coal.
- Analysts felt that Peabody's Australian coal (14% of sales by volume in 2013) would provide revenue to outlast the U.S. slump.

EIA data on fuel demand and generator fuel usage was available on a yearly and in some cases monthly basis. However, equity research reports from 2011-2014 focused much more on weather, inventories, and guidance while rarely mentioning coal retirements and natural gas additions. This suggests that analysts could have integrated the risk of a coal collapse before 2014 but did not (see Fig. 24).

Credit Rating Agencies were very cautious on Peabody's prospects.³³ Neither S&P nor Moody's rated Peabody as investment grade during 2011-2014. Moody's had a non-investment grade rating on Peabody beginning in May 1998 when it began coverage on the company. Beginning in 2013, S&P steadily downgraded Peabody's corporate credit rating. This suggests that credit analysts interpreted the signals of weakness in the coal sector.

Case Study 3: Subprime Mortgage Crisis

Point-In-Time Risk: Subprime Bubble Burst

Summary: The subprime mortgage crisis is partly attributed to fraud and conflicts of interest. However, it was also fundamentally rooted in a point-in-time risk: The ‘sudden’ realization that subprime adjustable-rate mortgages cannot be repaid in the long-term. When the development of origination and securitization techniques for subprime mortgages accelerated in 2003, along with the residential housing bubble, the risk of the bubble bursting started to build up. Over the short-term, a collapse of this bubble might have seemed very unlikely. Yet, if longer time horizons had been employed, a housing bubble burst could have been seen as inevitable.

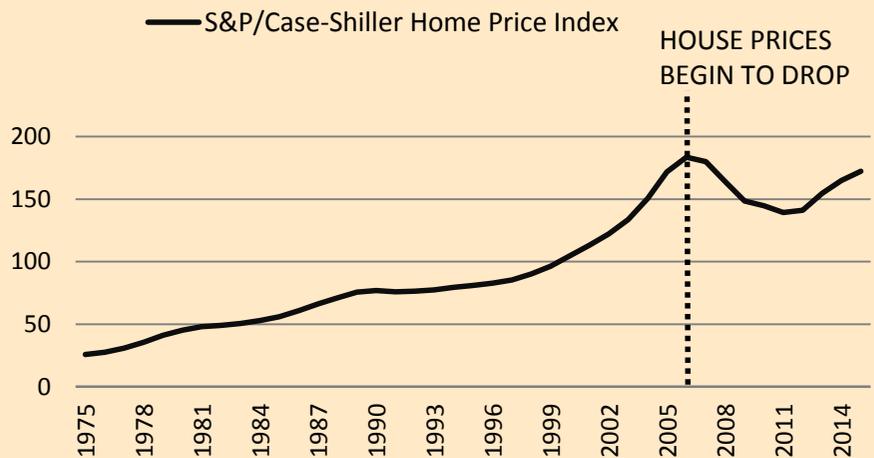
The risk of a housing bubble burst was predictable and subprime mortgage markets were extremely exposed to it, thus suggesting that considering this risk would have been “worth it.”

The burst of the subprime mortgage bubble was inevitable. ‘Subprime’ mortgages targeted low-income - and at times even unemployed - individuals. Since these borrowers often lacked the ability to meet mortgage payments, repayment of subprime loans was largely based on the resale of properties. If a borrower sold the home for more than the purchase price then they could repay the mortgage. With adjustable mortgage rates often exceeding the growth of home prices, the risk of default was high. These mortgages were ticking time bombs, ready to explode when housing market prices eventually declined. This eventually occurred in 2007 (see Fig. 25).

The value-at-risk from a bubble burst was immense. Between 2001 and 2006, the share of subprime mortgages jumped from 7.6% to 23.5% of the total U.S. mortgage market (see Fig. 26). Securitized and re-packaged with other assets, 70-80% of these loans were rated AAA until the beginning of the crisis, creating a pool of \$3.2 trillion of high-risk assets labeled as investment grade.³⁴

Fig. 25: US Home Prices Declined Beginning in 2007

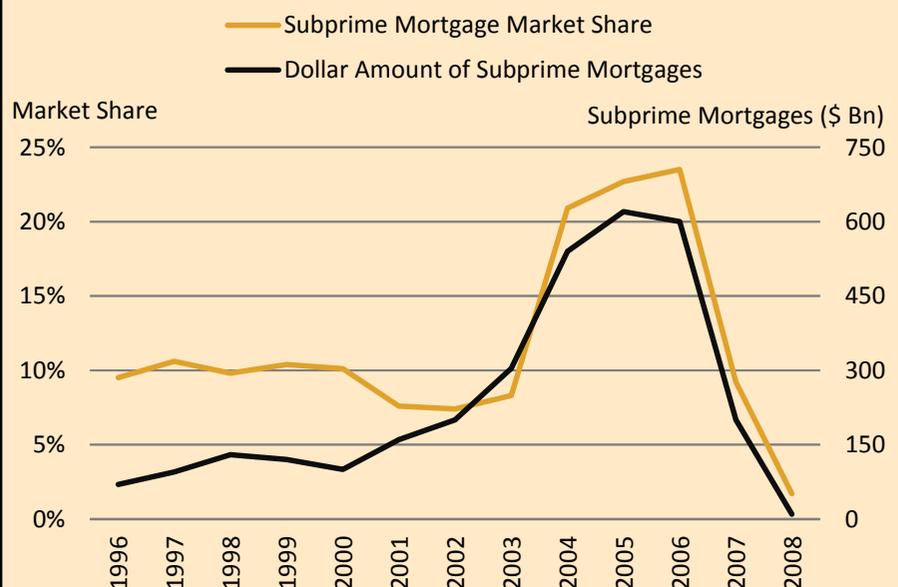
The fall in house prices was a point-in-time risk



Source: S&P/Case Shiller Home Price Index

Fig. 26: Market Share and Dollar Amount of Subprime Loans

The fall in house prices burst a nearly trillion dollar bubble



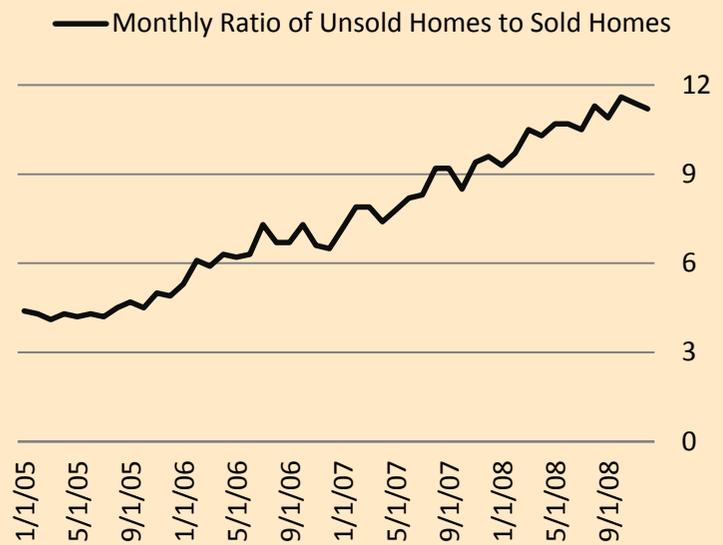
Source: Federal Reserve Bank of St. Louis

The collapse in housing prices could have been predicted...

Housing price collapses occur because of supply and demand. If the housing market is oversupplied, then prices are likely to collapse. Typically, housing builders respond to increased vacancy rates by building fewer homes. However, in the lead up to the subprime mortgage crisis, homebuilders continued to add inventory. This trend, combined with the median house price 67% above its historical average created the initial conditions for a bubble.³⁵ As a result, the number of months required to sell unsold inventory steadily increased (see Fig. 27). Given that the average U.S. monthly supply of unsold homes is 6 months, once the monthly rate crossed 7 in July of 2006, analysts should have been alerted to an oversupplied market. The trend continued as new homes were added until housing prices collapsed in 2007. Early warning signs for a collapse in house prices existed prior to 2007 and the point-in time risk thus could have been factored into analyst models.

Fig. 27: Monthly Supply of Houses, 2005-2008

There was a weak signal of a point-in-time risk before the crisis



Source: Federal Reserve Bank of St. Louis, 2008

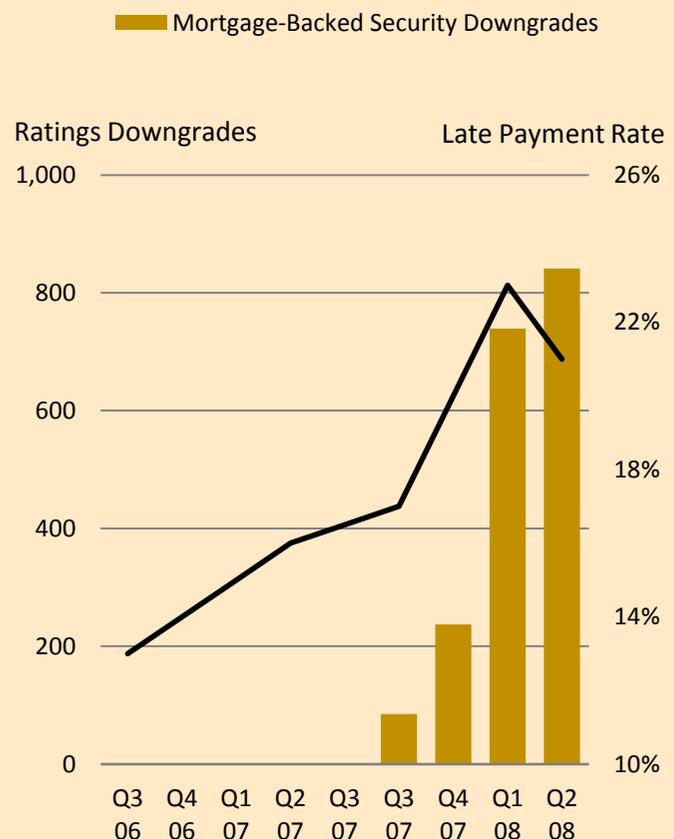
... but was missed by credit rating analysts due to the non-linear risk profile.

The combination of late payments from low-income borrowers and falling house prices made defaults on subprime mortgage-backed securities inevitable though credit rating analysts did not downgrade any of these securities until the crisis was inevitable. The mortgage delinquency rate, which refers to the fraction of mortgages with at least three months of outstanding payments, increased linearly from the end of 2006 (see Fig 28). This correlates directly with the increased market share of subprime mortgage issuances. When housing prices collapsed in 2007, delinquency rates skyrocketed, since borrowers could no longer sell their homes or refinance to cover delinquent payments.

Nonetheless, credit rating agencies were slow to enact downgrades of mortgage-backed securities (MBS). No downgrades of MBS were made by credit rating agencies until late 2007 and not at scale until Q1 2008 (see Fig. 28). An explanation for this was a lack of data on MBS performance. Rating agencies did not have enough data on 2006 MBS vintages to make downgrades until the second quarter of 2007.³⁶ Greater emphasis on forward-looking analysis might have led to earlier downgrades on these securities and smaller losses for investors in 2008.

Fig 28: Credit Rating Agency Mortgage-Backed Security Downgrades & Subprime Mortgage Default Rates

Rating agencies did not downgrade securities until it was too late



Source: Chuanshu Ji, 2008

1.15 FUTURE RISKS: HOW LONG-TERM RISKS COULD AFFECT CAPITAL MARKETS

New ‘White Swan in the Dark’ risks will emerge going forward. Over the next pages, we explore three potential White Swans (see right) that may not be adequately addressed by short-term financial valuation and risk assessment models. First, we examine whether these risks satisfy our criteria of ‘predictability’, ‘justified cost-benefit’, and ‘long-term or non-linear risk profile’ (see Fig. 29). Second, we conduct hypothetical thought experiments to illustrate how these risks could potentially get missed by financial models that rely on linear extrapolation of cash flows.

SUMMARY: EXAMPLES OF FUTURE RISKS

Slow-building Risk: Autonomous car fleets could disrupt legacy automobile manufacturers.

De-Anchoring Risk: The elimination of insurance pools could de-anchor nuclear power operators.

Point-in-Time Risk: An offshore oil rig accident could set an oil major’s profits on a downward spiral.

Fig. 29: Three Long-term Risks that Fall into the Category of White Swans that Appear Black in the Dark

There are numerous White Swans that may fall outside the range of analysts’ headlights

Source: Authors

	Autonomous Cars	Nuclear Insurance	Offshore Oil Drilling Accident
Event Predictable?	YES: Cars with self-driving features are already on the road today. Experts suggest that 10 million cars with full self-driving abilities could be on roads by 2020. ³⁷	YES: Nuclear insurance legislation is renewed regularly. A future legislative body may require nuclear operators to buy accident insurance rather than receiving insurance through regulated insurance pools.	YES: The rise in crude oil prices from 2000 made increasingly complex drilling conditions profitable, and accidents more likely. After BP’s Deepwater Horizon disaster, well control risks are widely understood within the industry.
Risk Worth Incorporating?	YES: The prevalence of autonomous cars is highly probable, potential disruptive effects on the auto industry are large: Estimates suggest a US\$ 87bn market for driverless cars by 2030, with 29% of market volume for software, thus threatening conservative auto makers. ³⁸	YES: The cost of accident insurance would be immense (particularly in view of Fukushima), and would thereby significantly undermine the viability of power producers with large amounts of nuclear production.	YES: An incapacitated rig could cause substantial losses in an oil firm’s drilling revenue, cleanup costs, legal liabilities, and damages to reputation: As of 2015, BP faced costs of US\$ 53.8bn. After Deepwater Horizon, the probability of well control accidents have been well-known within the industry and not too costly to determine.
Long-term and Non-linear?	YES: Fully autonomous cars are a long way from commercial reality. ³⁹ The need for advanced technology, and questions around infrastructure, regulation, and acceptance, slow the prevalence of autonomous cars over the next 10 years, and will likely push a fully autonomous fleet beyond 2040. ⁴⁰	YES: Increasing opposition to nuclear plants could deter governments from passing costs of nuclear insurance onto taxpayers. Further, since regulation such as the US Price Anderson Act is not up for renewal until 2025, the risk may not manifest for 10+ years.	YES: A lack of large accidents over a period of time is likely to erode the emphasis on standards and monitoring, as well as the ability to respond to breakdowns. Multiple low probability and manageable events can combine to produce a sudden high impact event.
Swan risk	Slow-Building Risk: Slow rates of substitution due the long lifetime of cars suggests incremental rather than sudden change. ⁴¹ A tipping point could be reached as fully autonomous cars are widely adopted, and as households reduce their fleet. Eventually, car ownership may be diminished by 43%. ⁴²	De-Anchoring Risk: In the US, operators have a maximum of \$350 million in accident coverage. ⁴³ Fukushima cleanup cost \$50 billion. If operators needed to cover that amount, premiums could increase by a factor of 1,000. This could make nuclear power business models unviable.	Point-in-Time Risk: Future cash flows are at risk from a rig accident that at any one moment has a low probability of occurring, but across the industry as a whole is extremely likely in the long-run.

Future Risk 1: Prevalence of Autonomous Cars

Slow-Building Risk to Car Manufacturers and Long-Term Investors

Summary: Given the current rise of self-driving vehicles, early adoption and development of shared autonomous driving systems will likely be a key determinant of auto companies' long-term success. Companies that lag behind such technological advances are prone to lose market share and may even get displaced from the market entirely. This could be the case as new competitors develop superior products (i.e. Google), or as households abandon car ownership due to car sharing technology. Assuming that 50% of cars are shared by 2040, Barclays Research estimates a 40% decrease in car sales over the next 25 years.⁴⁴ Auto manufacturers currently make up 1.74% of MSCI (MSCI World Index as of Feb 28, 2016).

The evolution of autonomous vehicles along with the sharing economy will likely induce a significant reorganization of the automobile industry, potentially disrupting automobile manufacturers

Short-term scenario: The long development cycle of autonomous driving technology, regulation, and slow adoption inhibits the market penetration of shared mobility solutions. Car-sharing on a broad scale is limited due to slow-moving changes in consumer preferences.

Medium-to-long-term scenario: Market penetration first accelerates and then causes a significant drop in sales as more cars are shared. Manufacturers that do not keep up with the pace of the technology are likely to get left behind.



Present: Self-Driving Technology has Minor Market Penetration
RISK NEGLIGIBLE

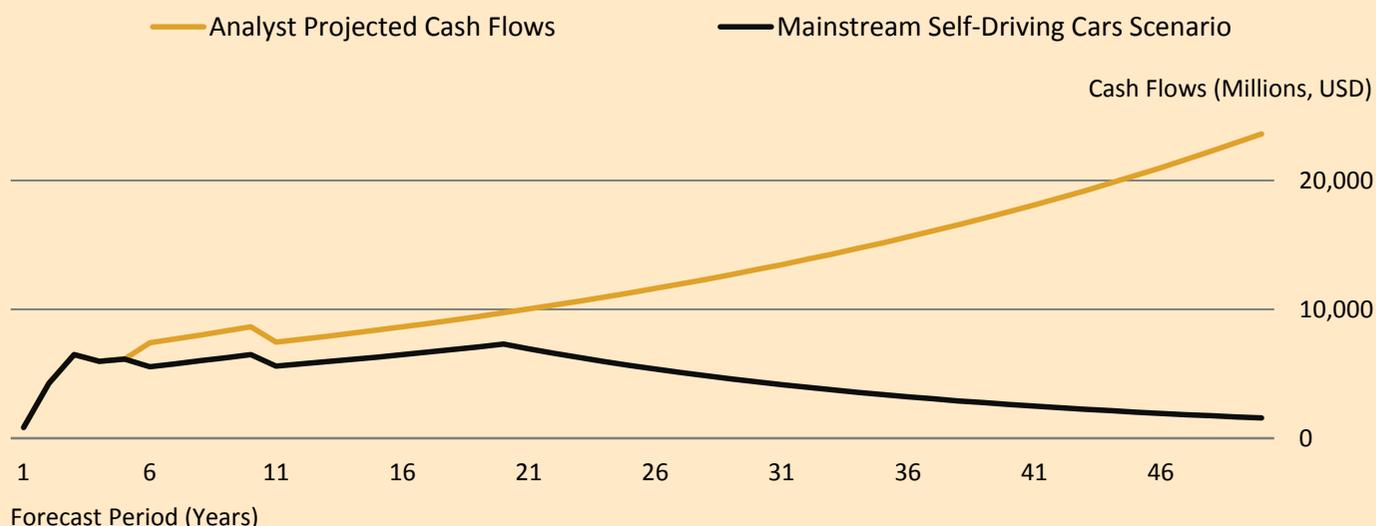


Long-Term: Autonomous Cars Induce Significant Industry Reorganization
RISK BUILDS SLOWLY

Hypothetical implications for financial analysis: Analysts' current cash-flow projections slowly start diverging from the reality of a non-innovative car manufacturer's actual cash flows. The divergence becomes more drastic as more vehicles are shared, implying that non-innovative manufacturers are displaced from the market.

Fig. 30: Hypothetical Effect of a Transition to Autonomous Cars on a Non-Innovative Car Manufacturer

Autonomous cars could slowly erode the new car sales of a non-innovative car manufacturer



Source: Authors, illustrative example (dummy data)

Future Risk 2: Nuclear Operators Must Buy Insurance Coverage De-Anchoring Risk to Nuclear Power Operators and Long-Term Investors

Summary: Nuclear operators are presently protected from accident insurance: regulated insurance pools and maximum liability coverage put an artificial cap on nuclear operators' costs. Future legislation could, however, require nuclear operators to buy costly accident insurance in the private market. A non-renewal of the U.S. Price Anderson Act in 2025, for example, would have detrimental effects on nuclear power generators' cost structure: Insurance premiums could increase by a factor of 1000, thus de-anchoring operators from the cost environment in which their business is grounded.⁴⁵ While the risk of such a severe change in legislation is small in the short-term, increasing opposition to nuclear power could deter governments from passing nuclear insurance onto taxpayers over the longer term. Producers with nuclear operations comprise over 1% of the market capitalization of the S&P 500 and have a weight of about 0.9% in MSCI World.⁴⁶

A non-renewal of nuclear legislation (e.g. Price Anderson Act) would oblige nuclear operators to buy accident insurance, potentially imposing major and permanent drops in some power producer's cash flows.

Short-term scenario: Protection from accident insurance, such as the U.S. Price Anderson act, puts an artificial cap on nuclear operators' costs.

Medium- to long-term scenario: A non-renewal of the Price Anderson Act in 2025 increases insurance premiums by a factor of 1000.



Present
Artificial Cap on Nuclear Operators' Insurance Costs
RISK ANCHOR

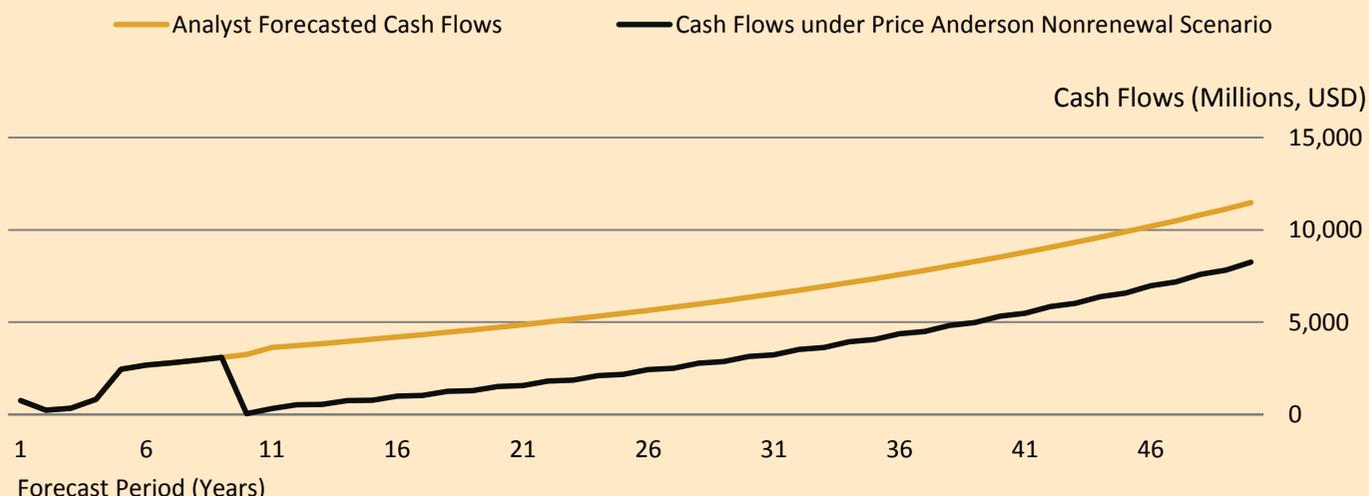


Long-Term
Nuclear Operators Obligated to Buy Costly Accident Insurance
ANCHOR REMOVED

Hypothetical Implications for financial analysis: Analysts' current cash flow projections may neglect the possibility of decreased cash flows if the cap on nuclear operators' insurance premiums is removed. For a nuclear operator with 5-10 operational plants, if the plants remain operational, nuclear insurance premiums could reduce free cash flows by nearly 50% each year (see fig. 31).

Fig. 31: Hypothetical Effect of Removal of Insurance Maximum on Cash Flows for a Nuclear Operator

Non-renewal of Price Anderson Act could massively increase operating costs for nuclear operator



Source: Authors, illustrative example (dummy data)

Future Risk 3: Offshore Oil Rig Accident Point-in-Time Risk to an Oil Major and Investors

Summary: The rise in crude oil prices from 2000 made increasingly unconventional extraction methods profitable and accidents much more likely. While the occurrence of an offshore oil rig accident has a small probability attached to it over the short-term, such an accident becomes more likely when longer time horizons are considered. An oil rig accident leading to an incapacitated rig could impose a downward spiral on an oil major's cash flows, thus leading to deteriorations beyond those faced by BP in the aftermath of the Deepwater Horizon disaster (BP's Deepwater Horizon cost \$53.8bn in 2015 including \$1.1bn damages p.a. for 18 years and \$35.1bn for expenses such as actual cleanup). Companies with offshore rig exposure comprise over 3% of S&P 500 market capitalization.

An oil major who faces a severe oil rig accident would forego immense amounts of revenues and face high clean up costs.

Short-term scenario: Stricter controls and safety standards after BP's Deepwater Horizon disaster support a low probability for a major oil rig accident.

Medium- to long-term scenario: An oil rig accident worse than Deepwater Horizon occurs and takes more than 3 months to cap.



Present

Low Probability for Major Oil Rig Accident
NO EVENT



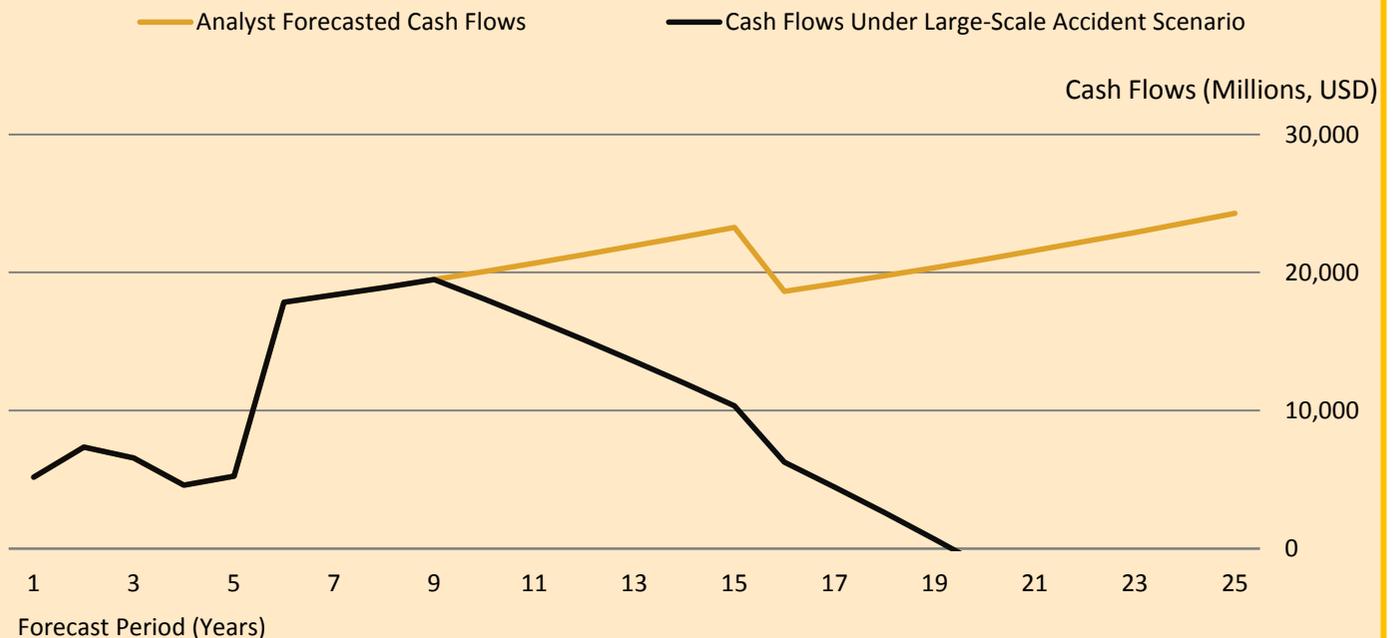
Long-Term

Major Oil Rig Accident Occurs
EVENT HAPPENS

Hypothetical Implications for cash flow analysis: Accumulated losses in revenues, astronomical clean up costs, and reputational damage could lead to an increasing gap between the oil company's realized cash flows and the projections of analysts who assume there will be no major rig accident. In a worst case scenario, a major spill could reduce oil major free cash flows to zero.

Fig 32: Hypothetical Effect of an Oil Rig Accident on Cash Flows for an Oil Major

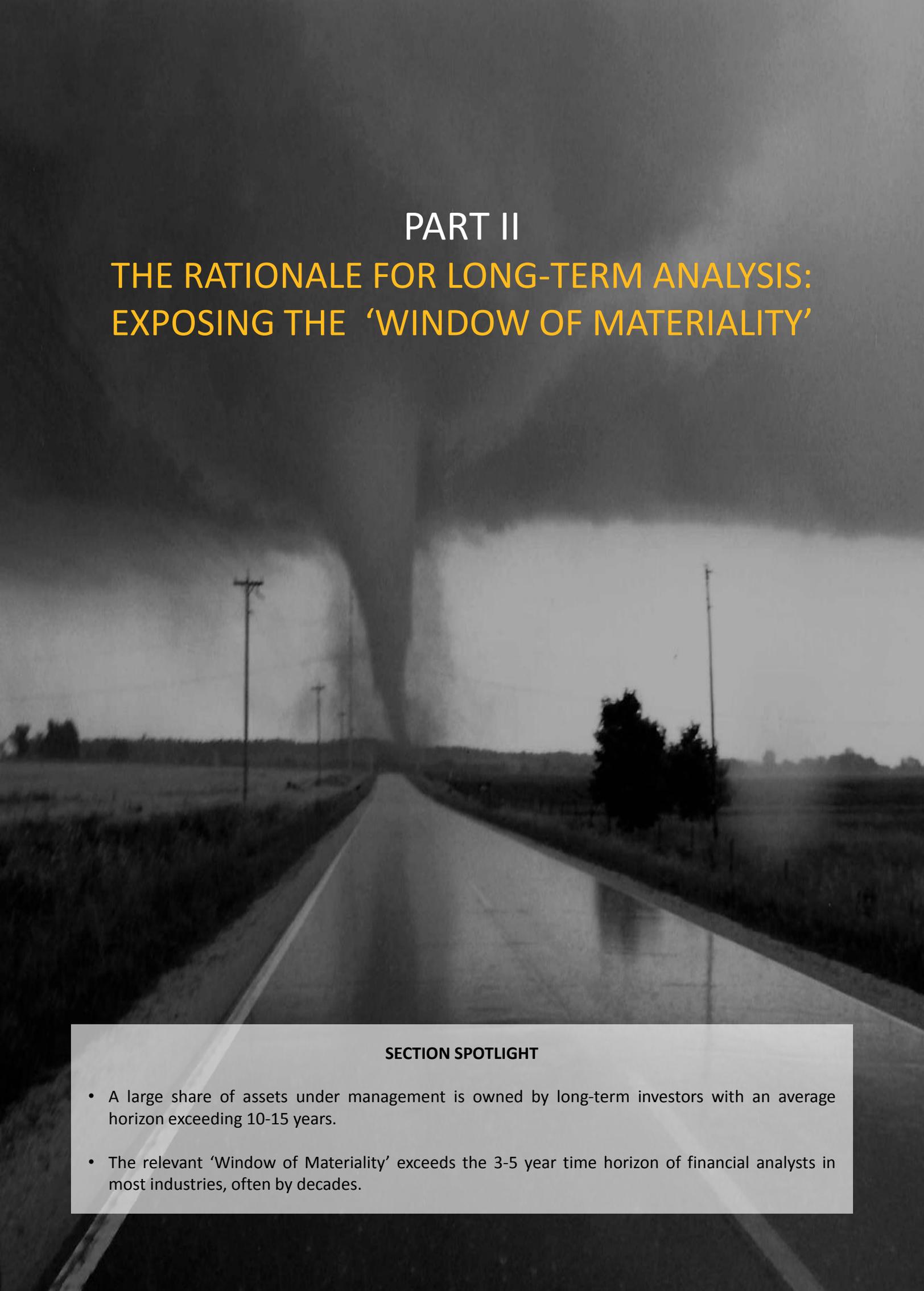
A major accident could cripple the cash flows of an oil major in perpetuity given high litigation



Source: Authors, illustrative example (dummy data)

FEEDBACK FROM INDUSTRY ENGAGEMENT WORKSHOPS: WHITE SWANS IN THE DARK

Section	Feedback Summary	Supporting Quotes
WHITE SWANS IN THE DARK	While analysts and research department managers acknowledged the relevance of non-linear long-term risks to long-term asset owners, they pointed to uncertainty about the future as a constraint to long-term risk assessment. This confirmed our view that long-term risks are not currently analyzed in equity and credit research.	<p><i>“These risks should be considered but their uncertainty makes them difficult to consider.” - ESG Analyst</i></p> <p><i>“Spending time assessing very long-term risks might be difficult to justify to clients if the risks are not very likely to materialize.” - Senior sell-side equity research analyst</i></p>
TAXONOMY OF LONG-TERM RISKS	Analysts pointed out that the risk profiles in our taxonomy typically overlap. For example, slow-building risks could evolve into de-anchoring risks over time, and many if not all risks have a point-in-time aspect to them once they crystallize. While our taxonomy of long-term risks was seen as a helpful broad categorization, analysts pointed out that risks in practice are spotted on a case-by-case basis rather than through a holistic framework.	<i>“This taxonomy is too academic. Tell me what the risk is and when it will happen.” - Former Head of Equities Research at a Bulge Bracket Institution</i>
RISK EXAMPLES	Equity analysts offered many examples of long-term risks that may be missed by financial analysts due to short-term time horizons. Examples included the evolution of energy storage, cybercrime, groundwater depletion, renewable energy, declining Chinese demand, and US Clean Water Act enforcement.	<i>“Energy Storage could be a game changer for the utilities industry” - Former Head of Equities Research at a Bulge Bracket Institution</i>
FUTURE EXAMPLES	There was consensus that capital markets may not be adequately pricing the risk of nuclear policy change into security prices for nuclear operators. Yet, there was some disagreement as to whether oil spills will pose major risks to cash flows in the future, and whether autonomous cars will supplant current models. Some analysts disagreed with the example of autonomous cars due to the uncertainties that surround the trajectory of technological innovation over the long-term.	<p><i>“Nuclear power policy risk is already priced into German utility share prices given the recent phase-out of nuclear power. Yet, such risks might not be factored into the valuation of utilities in other countries.” - ESG analyst</i></p> <p><i>“Large scale oil spills may already be captured by ESG analysis; the importance of such a risk depends on location and the quality of companies’ risk management” - Buy-side analyst</i></p> <p><i>“There are a million possible scenarios in the future. It’s impossible to pick just one.” - Senior Credit Analyst</i></p>
PAST EXAMPLES	The past events considered in our case studies (VW emissions fraud, Peabody’s decline, subprime mortgage crisis) were potentially missed by financial analysts though they could have been anticipated with more foresight. Equity analysts agreed with our Volkswagen example because the rules and fines were already on the books but were not enforced yet. They disagreed partly with the Peabody example because Peabody was trying to diversify as a company, but acknowledged that Peabody’s downturn was predictable to an extent.	<p><i>“The rules for Volkswagen were in place, they just weren’t enforced.” - Managing Director of ESG Research</i></p> <p><i>“Peabody’s downturn was preceded by clear signals in the U.S., e.g. the rise of hydraulic fracturing and clear signals indicating that coal-fired power was under pressure even before the Clean Air Act.” - SRI advisor</i></p> <p><i>“Housing prices empirically had always gone up so it was reasonable to assume that they would keep going up.” - Asset Manager</i></p>



PART II

THE RATIONALE FOR LONG-TERM ANALYSIS: EXPOSING THE 'WINDOW OF MATERIALITY'

SECTION SPOTLIGHT

- A large share of assets under management is owned by long-term investors with an average horizon exceeding 10-15 years.
- The relevant 'Window of Materiality' exceeds the 3-5 year time horizon of financial analysts in most industries, often by decades.

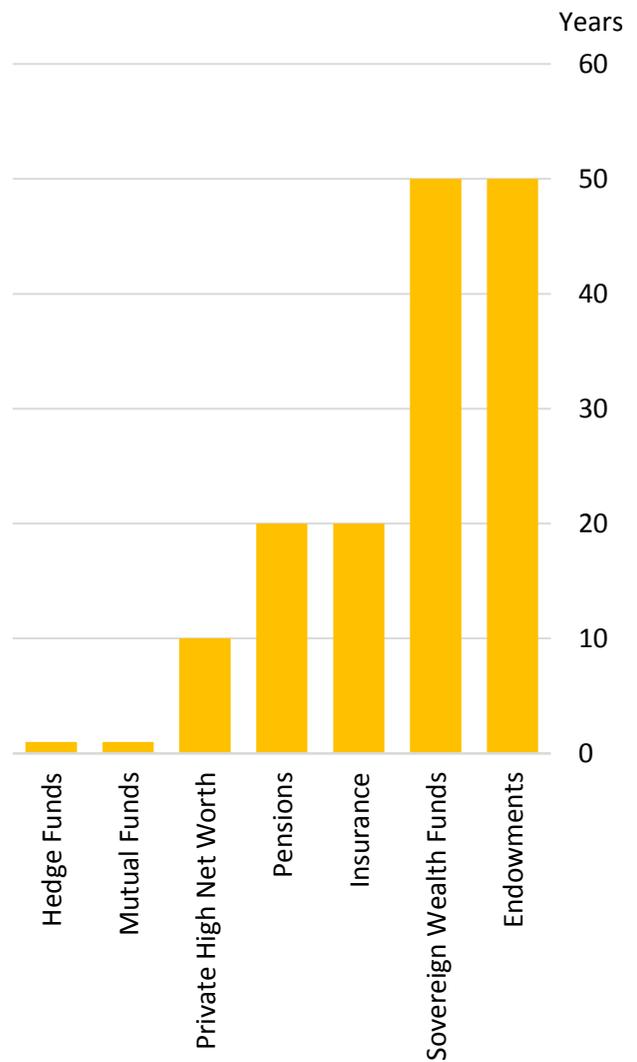
2.1 MANY ASSET OWNERS HAVE LONG INVESTMENT HORIZONS

Analysts should research the long-term because many major asset owners have long time horizons. The length of investor time horizons is demonstrated by the time horizon of common investment vehicles. Typically, sovereign wealth funds and endowments are liable to their beneficiaries over 50 year time horizons while pension funds and insurance funds commit to 20 year horizons (see Fig. 33). These long horizons are driven by the long-term liabilities of the funds. Endowments, sovereign wealth funds, pension funds, and insurance companies seek to maximize long-term return because of their long-term responsibilities to their investors. Similarly, high net worth asset owners generally invest for their retirements or long-term wealth management. While hedge funds and mutual funds have comparatively smaller time horizons, they do not comprise a large portion of equity market ownership.

Indeed, funds with long-term liabilities own nearly half of equity markets. 48% of the U.S. domestic equity market is owned by Investors with liabilities of over 10 Years (see Fig. 34). International investors, including sovereign wealth funds, and other investor classes, including endowments, also own significant portions of the equity market. Hedge funds and mutual funds, investor classes with short time horizons, only own 25% of the equity market. Thus, among the fund types, more investment comes from long-term investors than short-term investors. This implies that there is demand for long-term investment research.

Fig. 33: Average Liability Lengths of Leading Asset Owners

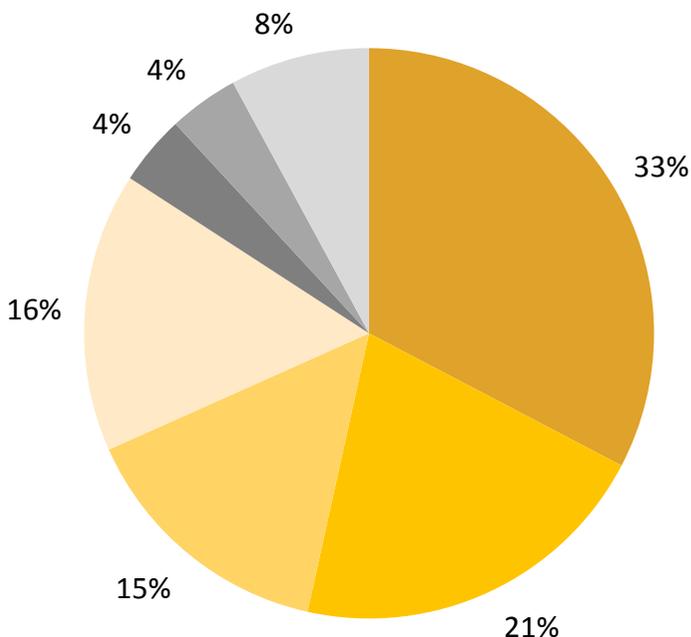
Asset Owners Have Long Liabilities



Source: MFS 2016

Fig. 34: Ownership Share of U.S. Domestic Equity Market, 2015

A Majority of Asset Owners Have Long-term Investment Horizons



Source: Authors based on Goldman Sachs and Federal Reserve Board Data

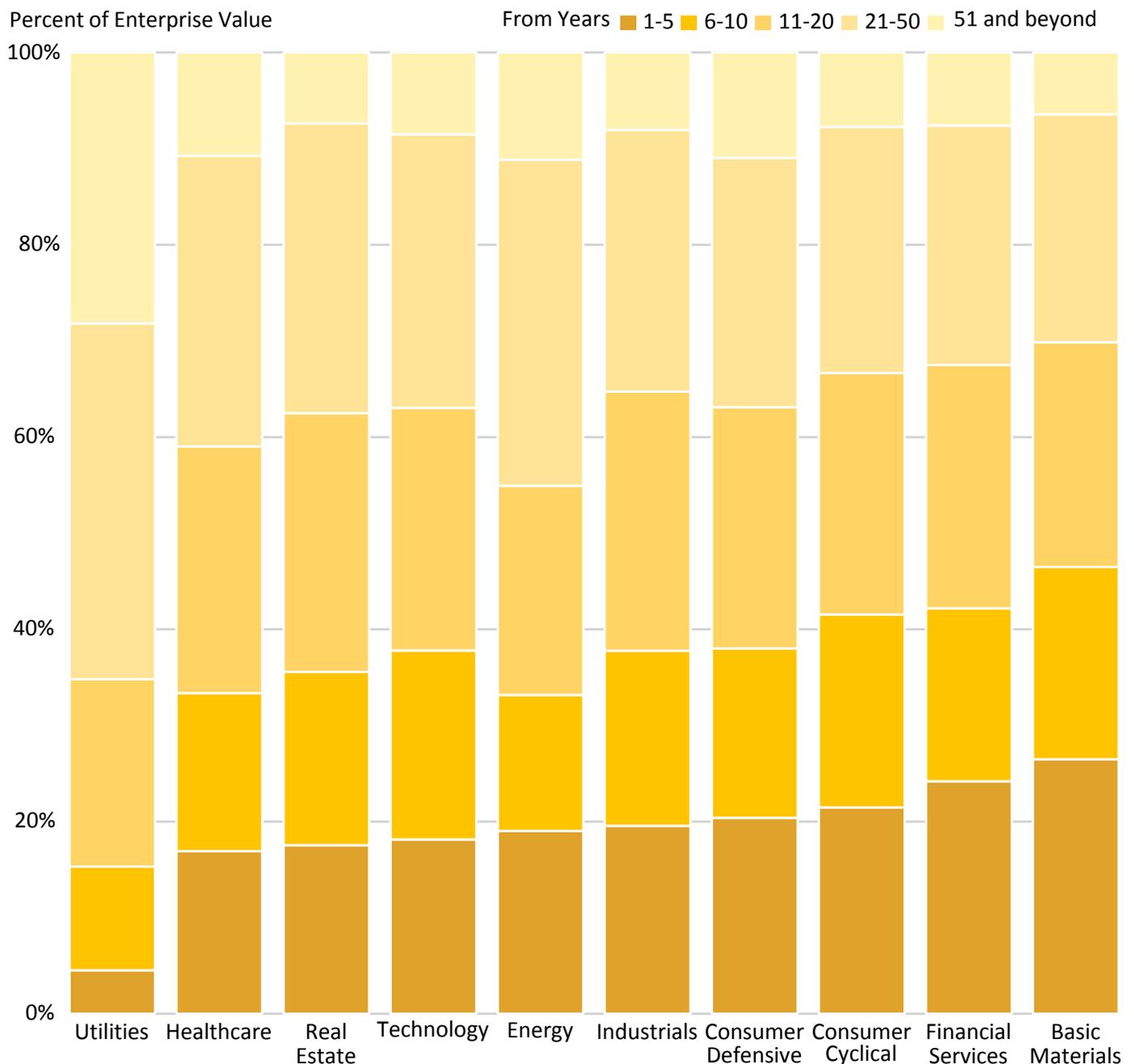
Asset Owner Type	Typical Liability Lengths (yrs)
Households	10
Mutual Funds	1
Pension Funds	20
International Investors	Mixed
Hedge Funds	0.5
ETFs	1
Other	Mixed

2.2 COMPANY VALUE IS MOSTLY BASED ON LONG-TERM CASH FLOWS

In equity valuation, over 82% of company value comes from cash flows more than 5 years in the future. Figure 35 shows Morningstar net present value calculations by time period. Each of the S&P 500 sectors represented in this figure derives at least 32% of its fair value estimate from cash flows beyond 20 years in the future. Although analysts use discount rates to reduce the net present value of future cash flows, the present value of future cash flows is still high. As a consequence, long-term risks should be accounted for when valuing shares.

The companies that are most exposed to long-term risks derive a major part of their value from the long-term. Both real estate and utilities derive less than 13% of their net present value from the next 5 years. This relates to the low risk of investments in these sectors and the corresponding low discount rate for future cash flows. But just as the physical assets of utilities and real estate last for long time periods, they are exposed to long-term risks. Over 65% of the net present value of Utilities stocks derived from cash flows occurring more than 20 years in the future. This means that long-term risks to the utility sector, if accounted for, could strongly affect the net present value of its constituent companies. The values of many industries are skewed toward the long-term, as shown on the next page.

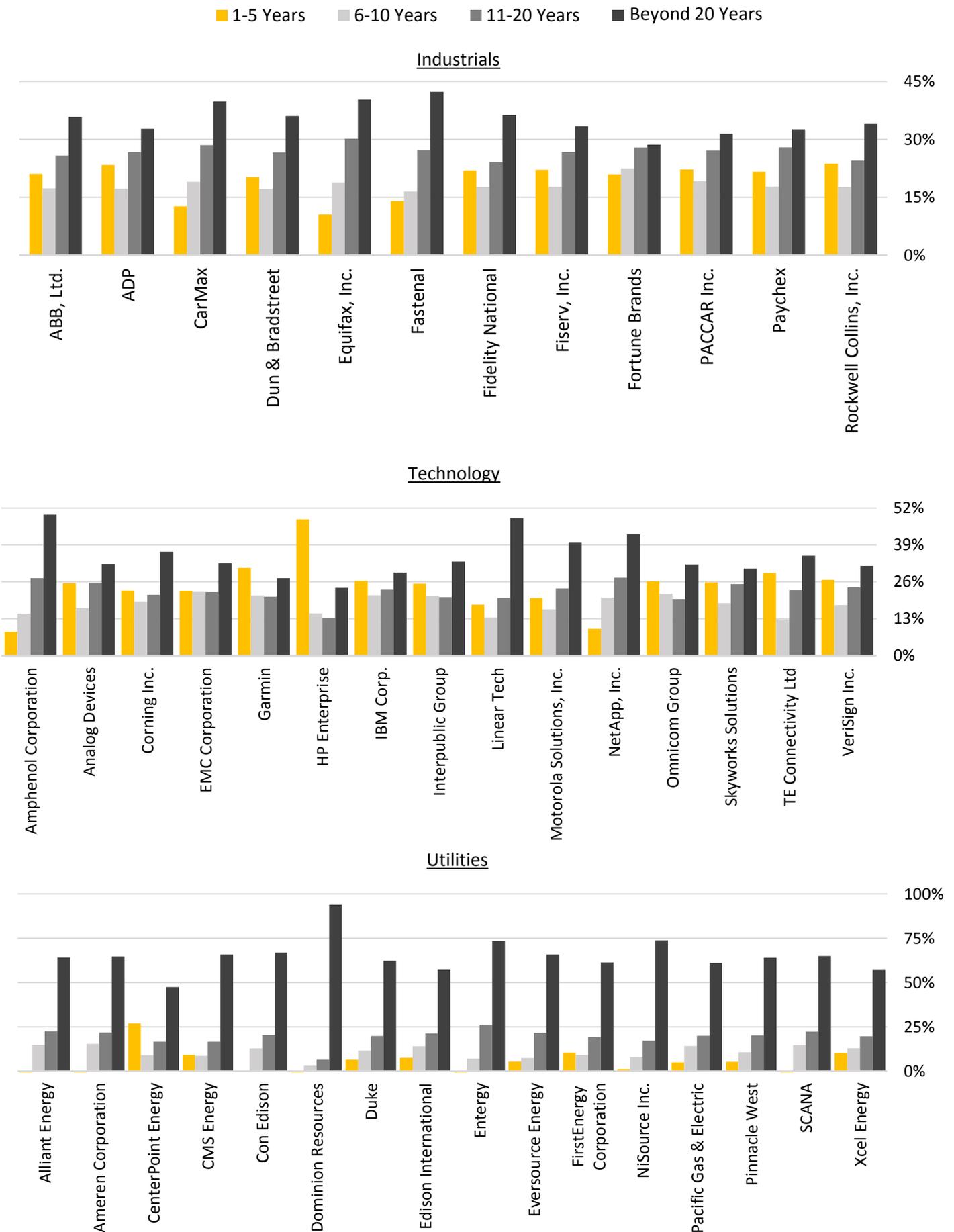
Fig. 35: Stock Value By Future Time Period of DCF Models for Sample of S&P 500 Stocks
Stock Value is Based Mostly on Cash Flows that Are Exposed to Long-term Risks



Source: Authors, from Morningstar DCF Models 2016 (n=107)

Fig. 36: Company Net Present Value by Forecast Time Period

Industrials and Utilities stocks are more exposed to Long-term risks than Technology Stocks: Cash flows from beyond 20 years generate the largest percentage of net present value in capital intensive sectors



Source: Authors from Morningstar DCF Models 2016

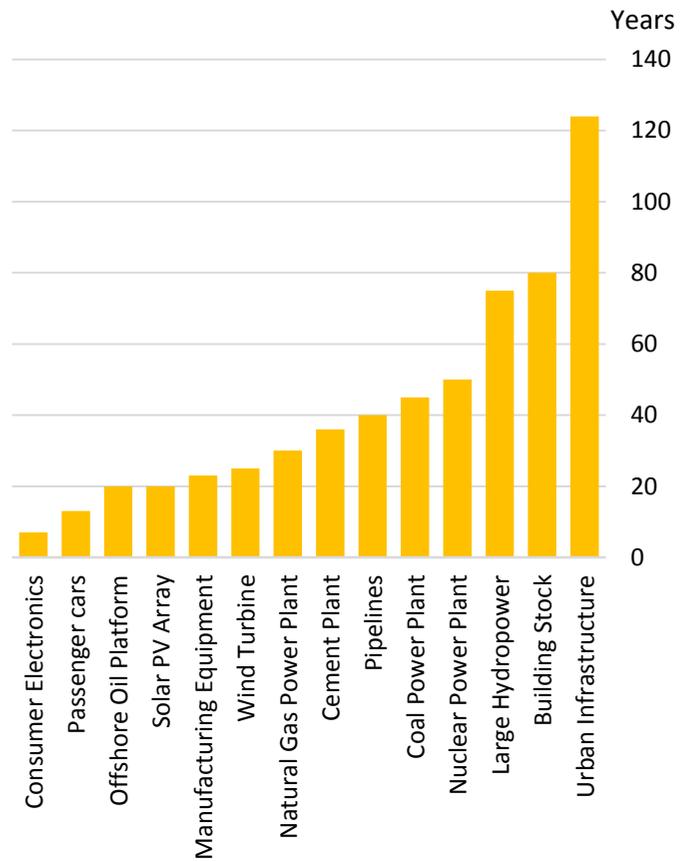
2.3 COMPANIES ARE EXPOSED TO LONG-TERM RISKS

Many companies derive their cash flows from physical assets with lifespans as long as 120 years. Assets such as buildings and infrastructure are built by companies to generate cash flows for 80 or more years. Even if the assets are sold during their useful life, their resale value is based on the long-term. In the power sector, generation assets are typically designed to last for 30 years or more (see Fig. 37). Buildings and urban infrastructure, developed in sectors such as Real Estate and Industrials, can last as long as 120 years. The cash flows from these projects can be affected by long-term risks.

In capital intensive sectors of the S&P 500, assets are amortized over a minimum of 6 years (see Fig. 38). Depreciation recovery period refers to the useful life of assets and encompasses all physical assets used in a sector. When companies build assets to conduct physical asset-intensive business, such as transportation, natural resource extraction, or power generation, they invest in assets with long, useful lives. This means that capital raised from asset owners is used to fund long-term projects. As a result, asset owners should be able to realize value from and understand the risks of the assets they are investing in. Long-term investors should understand the risks to physical assets.

Fig. 37: Average Lifespan of Physical Assets

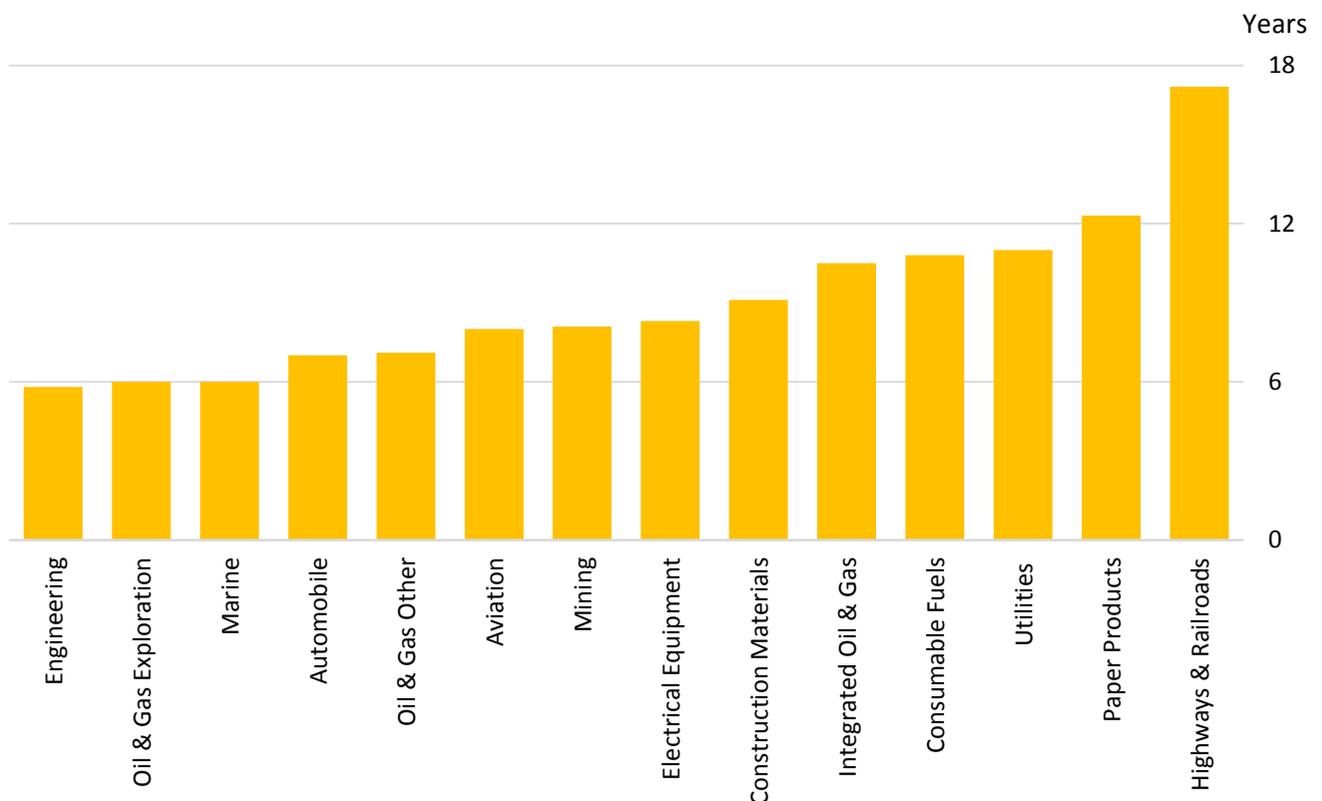
Real asset lifespan can last 100+ years



Source: Authors based on IEA Data 2012

Fig. 38: Median Depreciation Recovery Period

Median depreciation recovery period can last up to 18 years



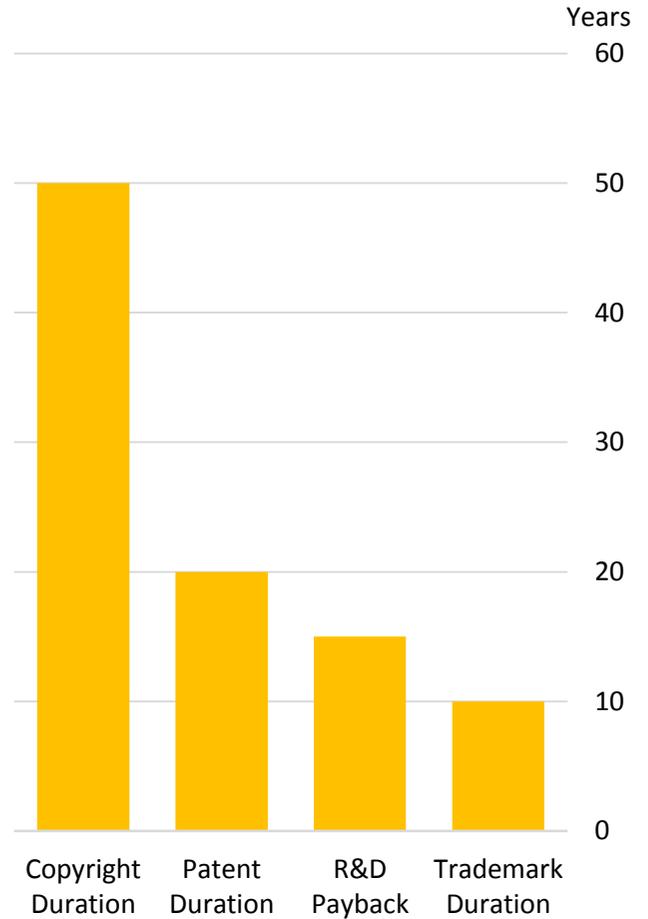
Source: Authors based on Bloomberg Data 2015

2.4 COMPANY VALUE RELIES ON LONG-TERM INTANGIBLE ASSETS

About 84% of the S&P 500's value derives from intangible assets. Intangible assets refer to non-physical assets like brand names, patents, regulatory licenses, goodwill, corporate strategy, intellectual capital, and reputation. Studies have shown that the majority of intangible asset value derives from patents, which are not clearly accounted for on balance sheets.⁴⁷ Based on Ocean Tomo's valuation of patents in S&P 500 companies, the share of intangible assets has increased from 17% in 1975 to 84% in 2015 (see Fig. 40). This implies that the value of companies is increasingly derived from non-physical assets.

Intangible assets are largely long-term investments. Patents have 20-year terms and trademarks are renewable every 10 years (see Fig. 39). Copyrights, further, last 50 years. Furthermore, intellectual capital incurs long-run paybacks. Research and development projects have, on average, 15-year payback periods. Not all intangible assets are long-term, though. Goodwill is a common intangible asset derived from excess acquisition prices that is essentially just paper money and can be written off in any given year. Aside from that, investment in intangible assets exposes asset owners to long-term risks. Over the lifespan of these assets, long-term risks can lead to impairments or write-downs of these assets. As, the value of these assets today does not necessarily mean they will carry the same value tomorrow.

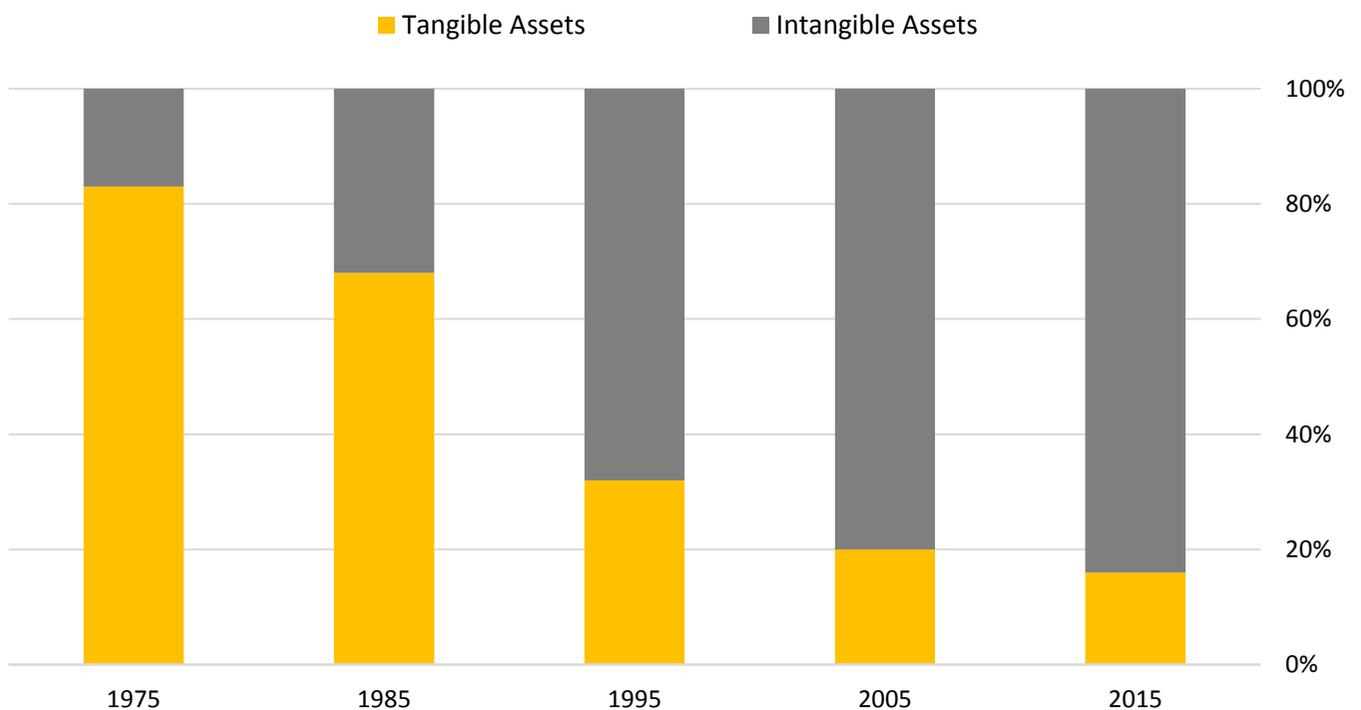
Fig. 39: Typical Lifespan of Intangible Assets
Intangible Assets are long-lived



Source: Authors based on Dabbah 1999 and Wiley 2001

Fig. 40: Breakdown of S&P 500 Company Valuation by Asset Type

The value of S&P 500 stocks is increasingly based on intangible assets



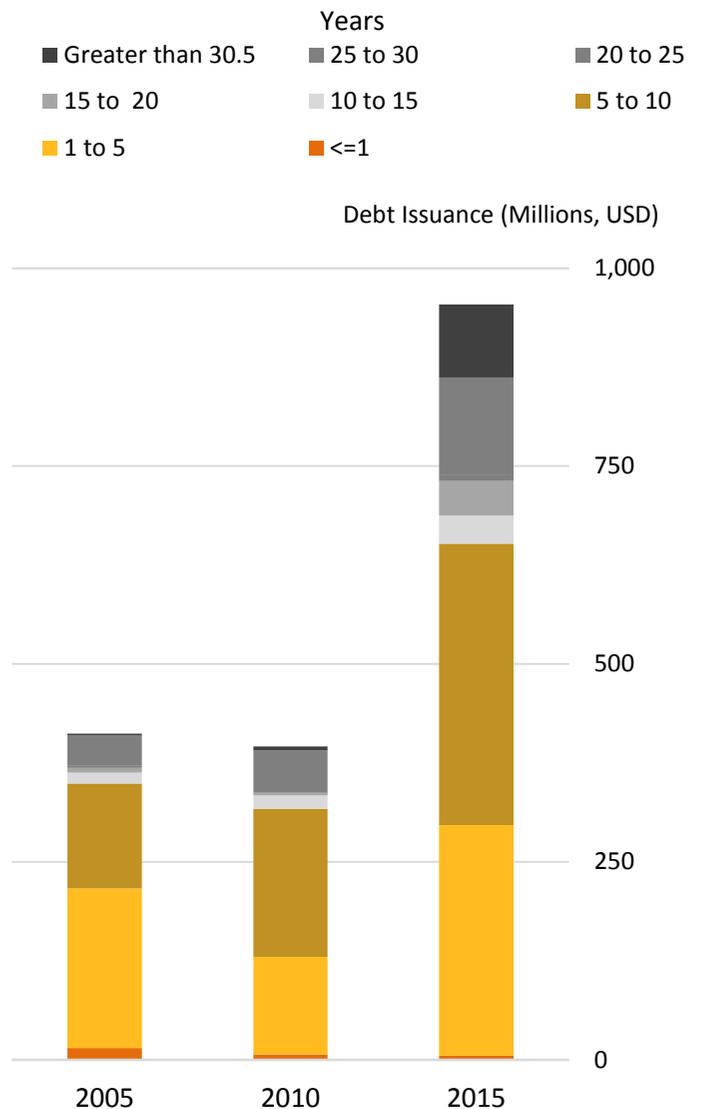
Source: Ocean Tomo 2015

2.5 THE BOND MARKET IS EXPOSED TO LONG-TERM RISKS

The net present value of corporate bonds is focused on the long-term. Given the low yields of corporate debt, especially in the current low interest rate environment, the net present value of corporate debt is mostly based on payments beyond 5 years. In 2015, debt issuers in all S&P 500 sectors except Materials had average maturities of 10 years or more. When accounting for current bond yields, this means that the majority of the present value of the bond payments of the average bond comes from years 5 to 15 in most sectors (see Fig. 41). Consumer Staples and Financial Services have over 30% of their present value from 11 to 15 years in the future. Further, since principal is not paid until maturity, they are exposed to loss of principal and the risk of the debt being refinanced to a lower yield. The longer the average maturity, the longer into the future analysts must look to assess the risk of default in each sector.

Most of the S&P 500 corporate bonds issued in 2015 will not reach maturity until at least 5 years from now (see Fig. 42). Hence, credit analysts should focus on at least the period covering the outstanding maturity of debt. Because of this long window of materiality, the ability of issuers to repay their debt depends, in part, on the issuer's ability to respond to long-term risks. The presence of long-term debt on the market in 2015 is due in part to the low-interest rate environment. But even in 2005 and 2010, half of corporate debt issuances carried maturities of 5 years or more. This means that even in high-yield environments, there is a market for long-term debt. This demand meets companies' needs to issue long-term debt.

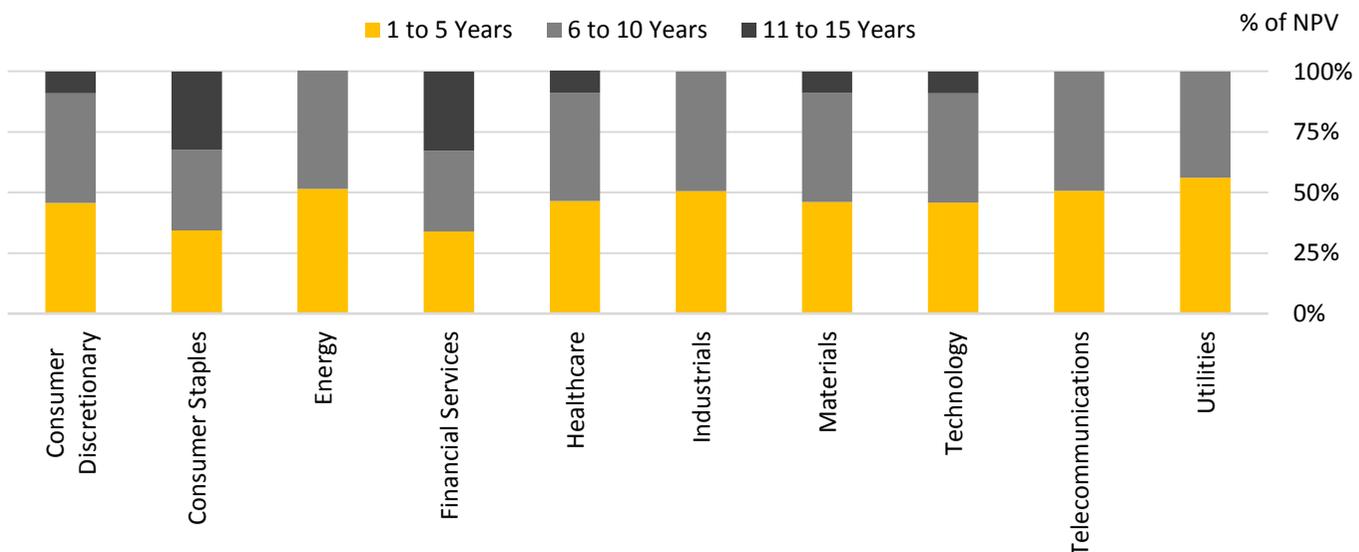
Fig. 41: Breakdown of S&P 500 Debt Maturities
Most corporate bonds have maturities of 5 or more years



Source: Authors from Bloomberg 2016

Fig. 42: Net Present Value of Bond Payments for Sector Average Bond by Time Period

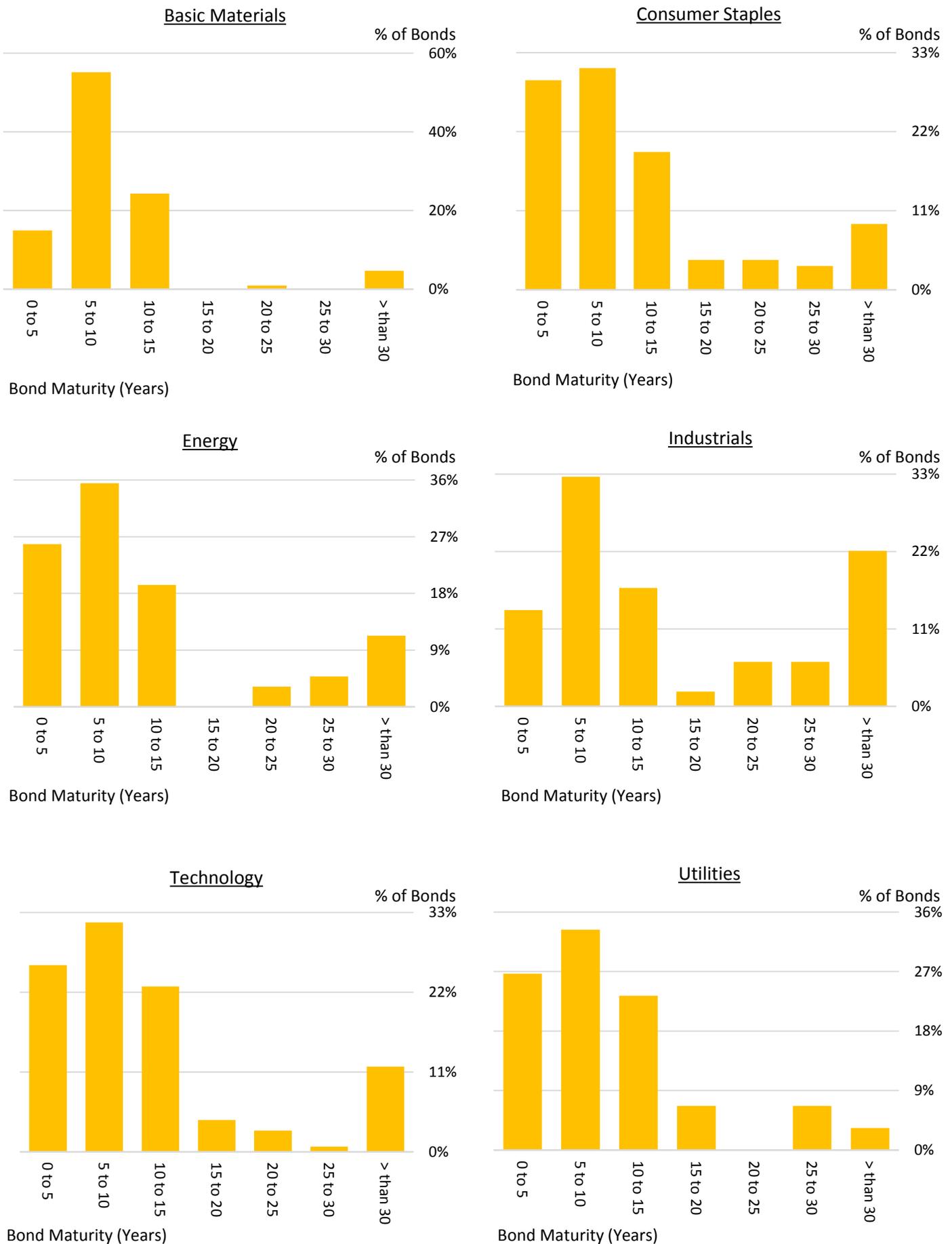
Bond NPV is primarily based on long-term cash flows



Source: Authors from Bloomberg 2015 and Thomson Eikon 2016

Fig. 43: S&P 500 Sector Average Bond Maturity By Time Period

Maturities for Consumer Staples and Industrials sectors often extend beyond 10 years



Source: Authors from Bloomberg Data 2015

PART III

HOW FINANCIAL ANALYSTS EQUIP INVESTORS WITH LOW BEAMS

SECTION SPOTLIGHT

- Valuation models used in equity research typically have a time horizon of no more than 3-5 years and recommendations focus on the next 12 months.
- Although credit risk assessments can extend beyond 5 years, rating action today is unlikely to follow from risks likely to materialize beyond 3-5 years.
- Financial analysis often relies on companies' capacity to adapt over the long-term, yet a comprehensive framework to assess adaptive capacity is missing.

3.1 EQUITY AND CREDIT ANALYSTS IN THE INVESTMENT ALLOCATION CHAIN

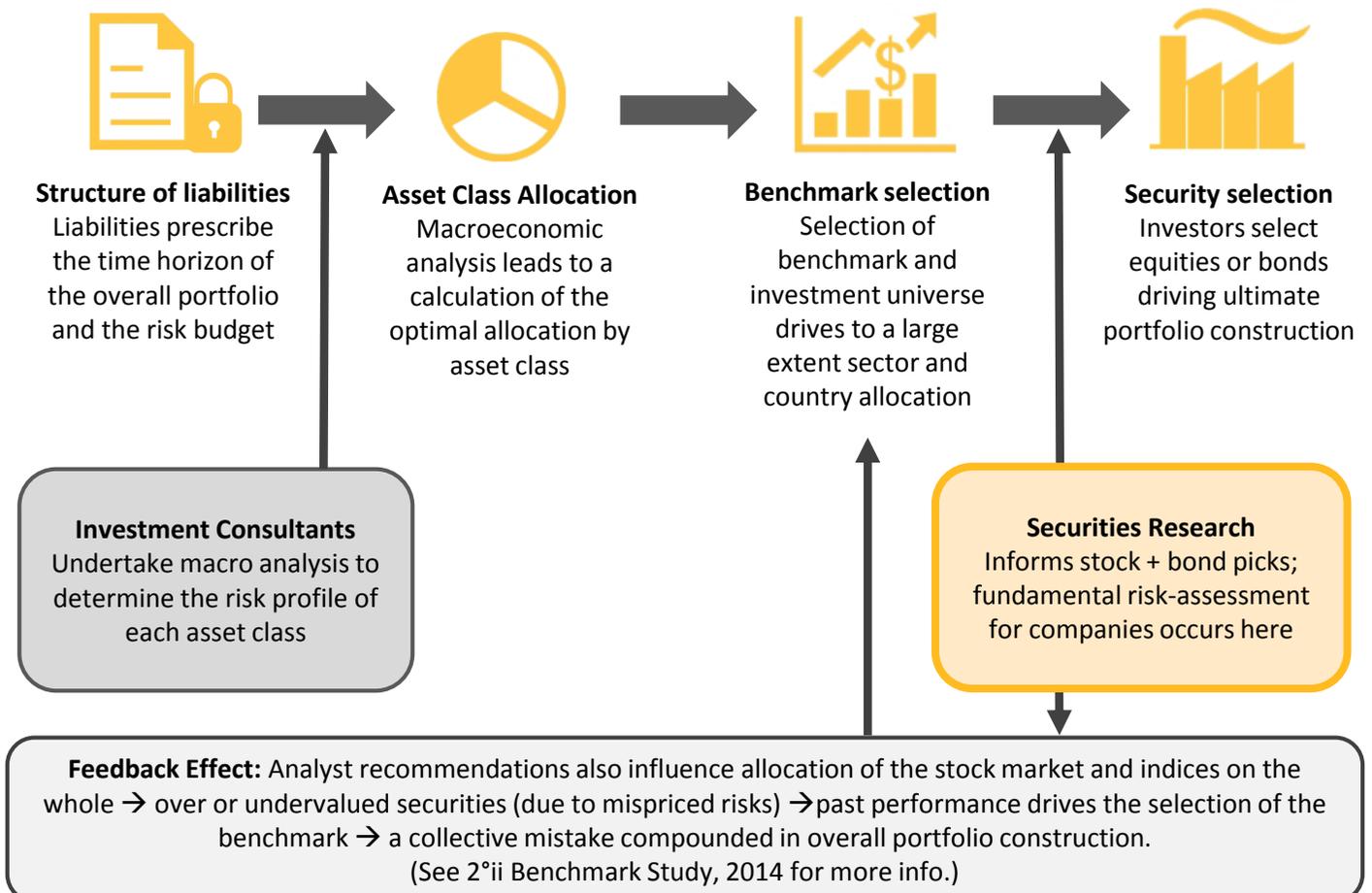
Asset owners rely on a chain of intermediaries to make investment decisions. Capital allocation involves a chain of players from asset owners to asset managers to investee companies:

- The first step in this chain is the asset owner that decides on strategic asset allocation based on the structure of its liabilities and regulatory constraints. This process is informed by investment consultants performing forward-looking macro-economic analysis of interest rates, global growth, etc. The asset allocation strategy is generally reviewed every 5 to 7 years.
- Then, equity and bond portfolios are managed day to day by dedicated internal teams or external fund managers. This process involves the definition of mandates, including performance indicators and maximum level of risk. These indicators are usually defined in relation to a benchmark (stock or bond index). Performance review usually takes place on an ongoing basis (e.g. weekly). Performance targets and related bonuses rarely exceed 5 years.

- Finally, fund managers buy, hold or sell securities on a daily basis based on the recommendation of internal (buy-side) and external (sell-side) analysts. The in-depth analysis of company-specific risks takes place at this stage.

Equity and credit analysts play a key role in the hunt for swans. Equity research departments and credit rating agencies examine the potential performance of securities, disseminate information about companies and securities, and make buy/sell/hold recommendations for stocks (equity analysts) or assess the potential risk associated with fixed income products (credit analysts). In addition to the information that financial analysts deliver to investors, their recommendations and assessments also have a second-order, “feedback” effect: The selection of securities (based on analysts’ recommendations and assessments) shapes the benchmark and changes the allocation of index funds (see Fig. 44). The recommendations and assessments of equity and credit analysts thereby fundamentally impact the flow of capital in financial markets. Thus, analysts play a key role in capital markets’ overall assessment of, and alignment with, all types of risk.

Fig. 44: The Role of Analysts in the Investment Allocation Chain



Source: Authors

3.2 FINANCIAL MODELS ARE THE PREDOMINANT TOOL IN EQUITY ANALYSIS

The role of equity research analysts is to intermediate between company management and capital markets.

Through the analysis of company earnings and management quality, equity research analysts communicate and translate nuanced business information further down the investment chain and thus facilitate concrete investment decisions. While the role of analysts is not to exactly predict the future, analysts must communicate earnings forecasts and investment recommendations. These core outputs of equity research analysts are typically based on:

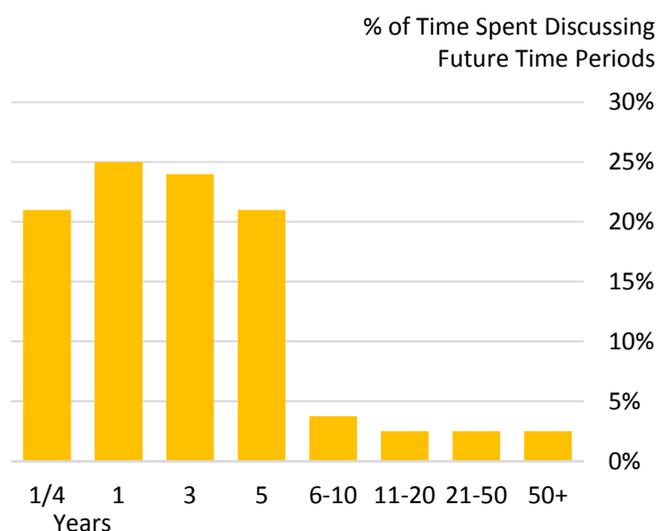
- The ability of a company’s management team to operate effectively and adapt to change
- The strength of a company’s past earnings
- The prospects of an investment to deliver returns going forward

Thus, the key role of analysts is to evaluate future performance. Yet in doing so, their time horizons are constrained.

Analysts do not treat all future time periods equally. As a matter of fact, their time horizons are artificially constrained due to the availability of information, limited client demand for sophisticated long-term analysis, conflicts of interest, and the lack of technical tools needed to forecast future performance (see part IV for an in depth discussion of these obstacles). Ideally, analysts could receive all the answers they need on future performance from company management. In practice, however, analysts spend over 90% of their conversations with corporate management teams discussing short-term prospects (see Fig. 45). This in part relates to the lack of insight

Fig. 45: Breakdown of Analyst Conversations with Management by Time Period

Analysts discuss the next 5 years nearly exclusively



Source: 2° ii Equity Research Analyst Survey 2016, n=6

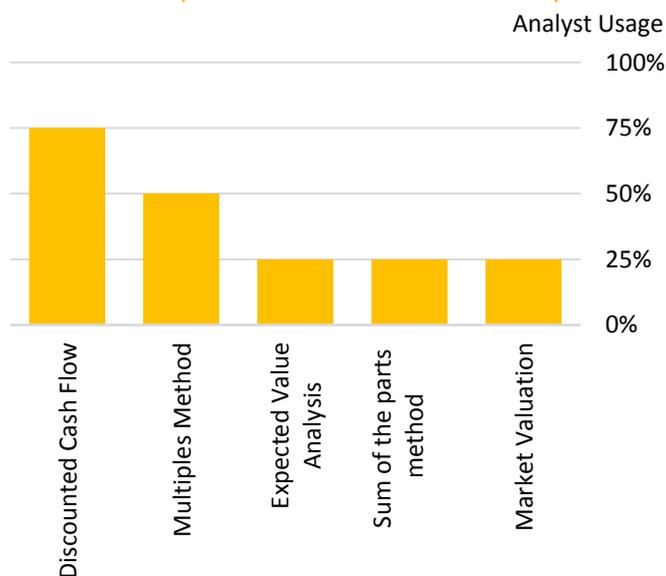
from company management. The 10% of time spent discussing periods beyond 5 years shows there is interest in the long-term outlook of the company. But the information coming out of these conversations does not meet analysts’ data needs. To complement short-term information from management with longer term projections, analysts conduct quantitative extrapolations of short-term results and compare company prospects using common indicators. These core tasks of financial analysis are primarily accomplished through quantitative valuation models.

Valuation models are only part of the equity research function but are the primary means for reflecting a company’s long-term prospects.

Financial modeling is only one of a suite of tools that analysts have available to them when evaluating a company and its business environment. Qualitative risk disclosure and management quality evaluations are others. However, nearly all analysts build financial models to assess companies’ prospects. This is because valuation models allow for a direct comparison between companies and enable the translation of earnings forecasts into investment recommendations. In fact, 96% of respondents to our analyst survey used some form of valuation model, although the primary type of model varied between users. Discounted Cash Flow (DCF) and Multiples Methods are the most commonly employed models by survey respondents, with 75% of the sample relying mainly on Discounted Cash Flow models (Figure 46). Each of these models uses different equations to translate analyst earnings forecasts and company financial statements into market values that can be compared between companies. Each of these models also carries embedded time horizons of analysis, as detailed on the next page.

Fig. 46: The Most Common Valuation Methods in Equity Research

DCF and Multiples are the most common analyst models



Source: 2° ii Equity Research Analyst Survey 2016, n=10

3.3 EQUITY RESEARCH IS BLIND AFTER 5 YEARS

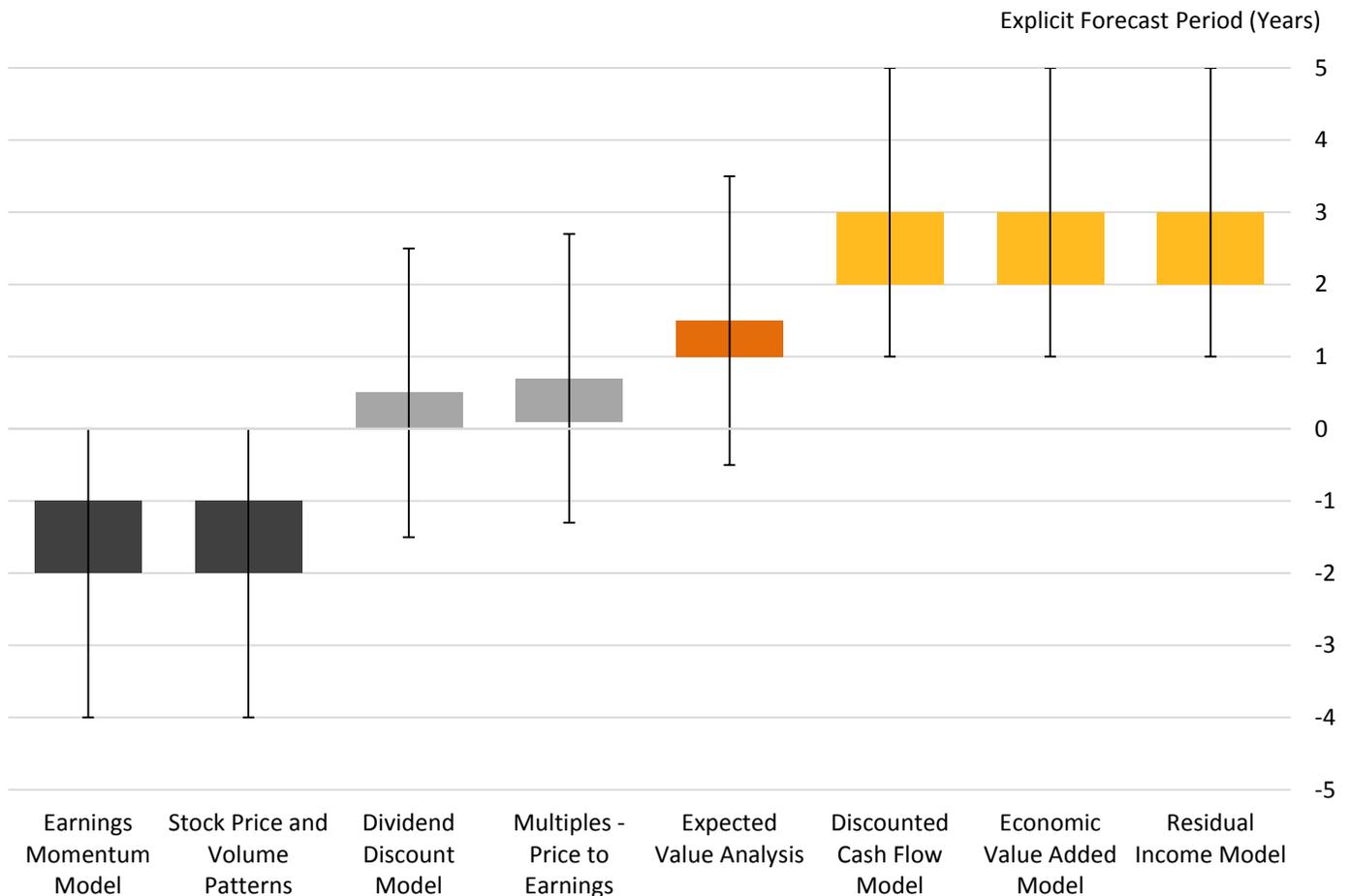
The most common valuation models used by equity research analysts are inherently short-term. The two dominant valuation models in equity research are Multiples and Cash Flow models (see Fig. 46 on previous page). These models only make explicit cash flow forecasts for up to 1 to 5 years on average (see Fig. 47). We assessed the time horizons embedded in each model, showing that equity research is rarely based on forecasts of 5 years or more. There are two principal methods of equity valuation:

Absolute Valuation methods have -1 to 5 year time horizons. Absolute value methods analyze the intrinsic value of companies through forward-looking models of near-term estimates. In this group, Cash Flow, Residual Income, and Economic Value models rely on build outs of earnings estimates over 1-5 years, with most estimates made 2-3 years in the future. Hence, intrinsic value calculations exclude long-term risks.

Comparable Valuation methods have a -4 to 3 year time horizons. Comparable valuation methods look at recent performance and, at most, one year earnings estimates to determine the relative value of securities. The most common method of comparable valuation is a multiples approach based on a common metric like Price to Earnings. Price to Earnings models rely on either trailing indicators or one year forward earnings estimates to compare companies based on price. The Price to Earnings ratio is thought of as a proxy for time horizon because it gives the enterprise value divided by a year of earnings. However, by relying on, typically, current earnings or one year forecasts, this ratio implicitly assumes linear earnings growth and does not impute long-term risks. Comparable models are inherently short-term and often are a rough but expedient way to value companies. Earnings momentum and stock price/volume models look at recent performance, up to 4 years in the past, to determine trends related to specific securities.

Fig. 47: Time Horizons of Common Equity Valuation Models

Equity Valuation models rely on short-term explicit cash flow forecasts, rarely extending more than 5 years ahead



Sources: Authors 2017, from 2⁹i Equity Research Analyst Survey 2016, Damodaran 2010 and CFA Institute, 2016

Note: Figure was compiled based on a review of authoritative sources on valuation methodologies and survey of practicing analysts. Specific mentions of years in academic material and survey responses were used to generate the box for each method and the whiskers reflect realistic interpretations of each method. Negative Forecast Period means the method looks backward to past results and positive Forecast Period refers to forward-looking estimates.

3.4 HOW SHORT-TERMISM IS EMBEDDED IN VALUATION MODELS

Comparables methods do not anticipate non-cyclical long-term risks. By only assessing the trailing or leading 12 months, Price to Earnings methods may be distorted by economic cycles. According to the U.S. National Bureau of Economic Research, the average business cycle lasts for 69 months, or nearly 6 years. By only focusing on the short-term, comparable methods may value a company based on cyclical factors, ignoring the inverse trends that might emerge when another cycle begins. Beyond this cyclicity, comparables methods typically do not evaluate long-term risks. Since companies are compared to similar companies in their sectors, comparable approaches assume that all things are equal between companies except their prices, and that in the long-run the market should treat like stocks alike.⁴⁸ This conceals, however, that companies face differentiated risks based on their business models and products.

Even when analysts evaluate the intrinsic value of companies, they build out explicit cash flow forecasts for usually no more than 5 years. Absolute value calculations are forward-looking but are limited by analysts' forecasts of future earnings. Analysts forecast cash flows by making exact financial statement replicas for a defined forward-looking period. This process creates a set of specific expectations for company performance including line item budgets and costs. A study of sell-side equity analyst models revealed financial statement forecast periods of 5 years or less.⁴⁹ Our study revealed that some outliers forecast as many as 11 years depending on the sector but the typical DCF model only goes out to 5 years at most (see

page 45). This forecast period constitutes Stage 1 in DCF models (see Fig. 48). This means that beyond 5 years, analysts cannot assess specific risks that affect financial statements.

To address this, analysts rely on perpetual extrapolation of their cash flow estimates. Typically, in cash flow models, the three key variables are the explicit cash flow forecast, perpetuity growth rate, and discount rate. The last cash flow forecast, usually made 3 to 5 years out, in conjunction with the growth rate and discount rate form the basis of the stock's terminal value. Based on these variables, cash flows are extrapolated to grow in perpetuity (see Fig. 48). This perpetuity growth rate is based on aggregate economic growth and applies across industries. This means that the growth rate is rarely company- or sector-specific. While the perpetuity growth rate may not be accurate, its effect is mitigated by the effect of the discount rate.

To extend their forecast period, analysts use a discount rate based on past results. In DCF models, the discount rate is usually based on the cost of equity or weighted-average-cost-of-capital. In both cases, the rates are generally based on historic equity returns.⁵⁰ The cost of equity refers to the premium that equity investors require over the risk-free rate. This is based on historical averages and relates to the level of risk in the economy at the time. This rate does not capture non-cyclical forward-looking risks and is typically not company-specific. Thus, the long-term value of companies is based on generalized metrics (see Figure 49, next page). Many of the forecasted cash flows attributed to a specific business are eliminated from valuation through broadly applicable discount rates.

Fig. 48: Cash Flows Before and After Discounting in Typical DCF Models

Equity NPV Relies on Perpetual Growth Extrapolation

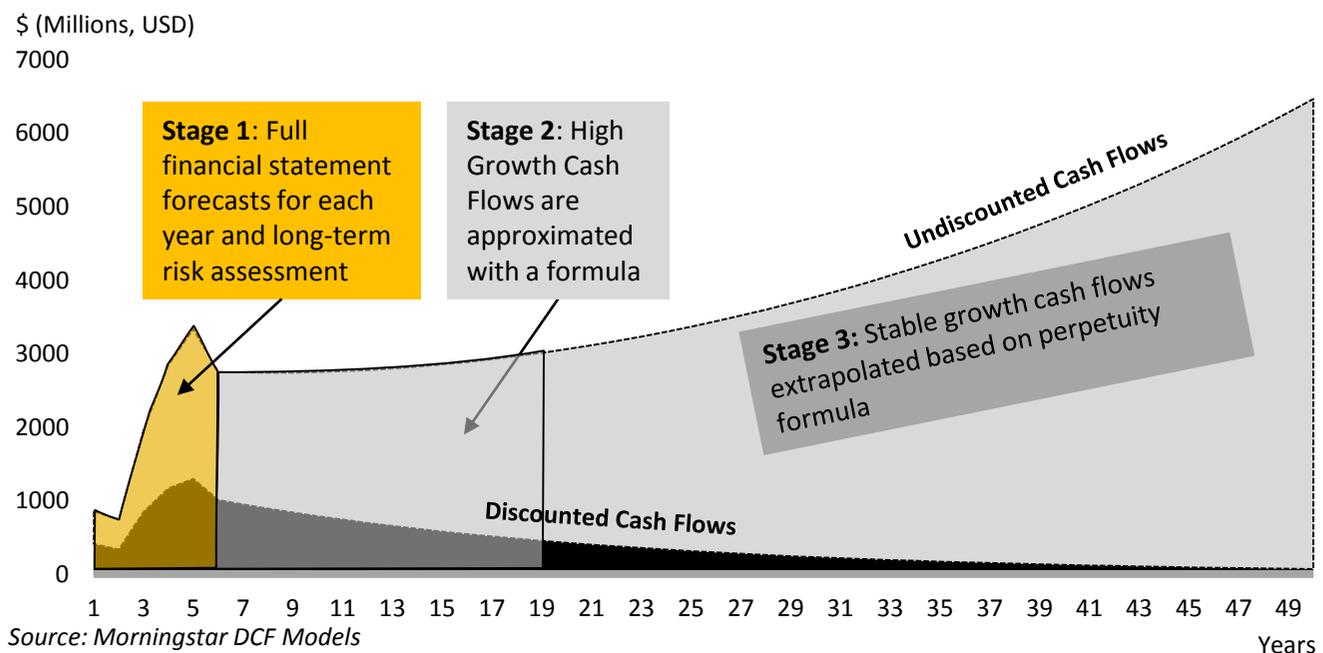
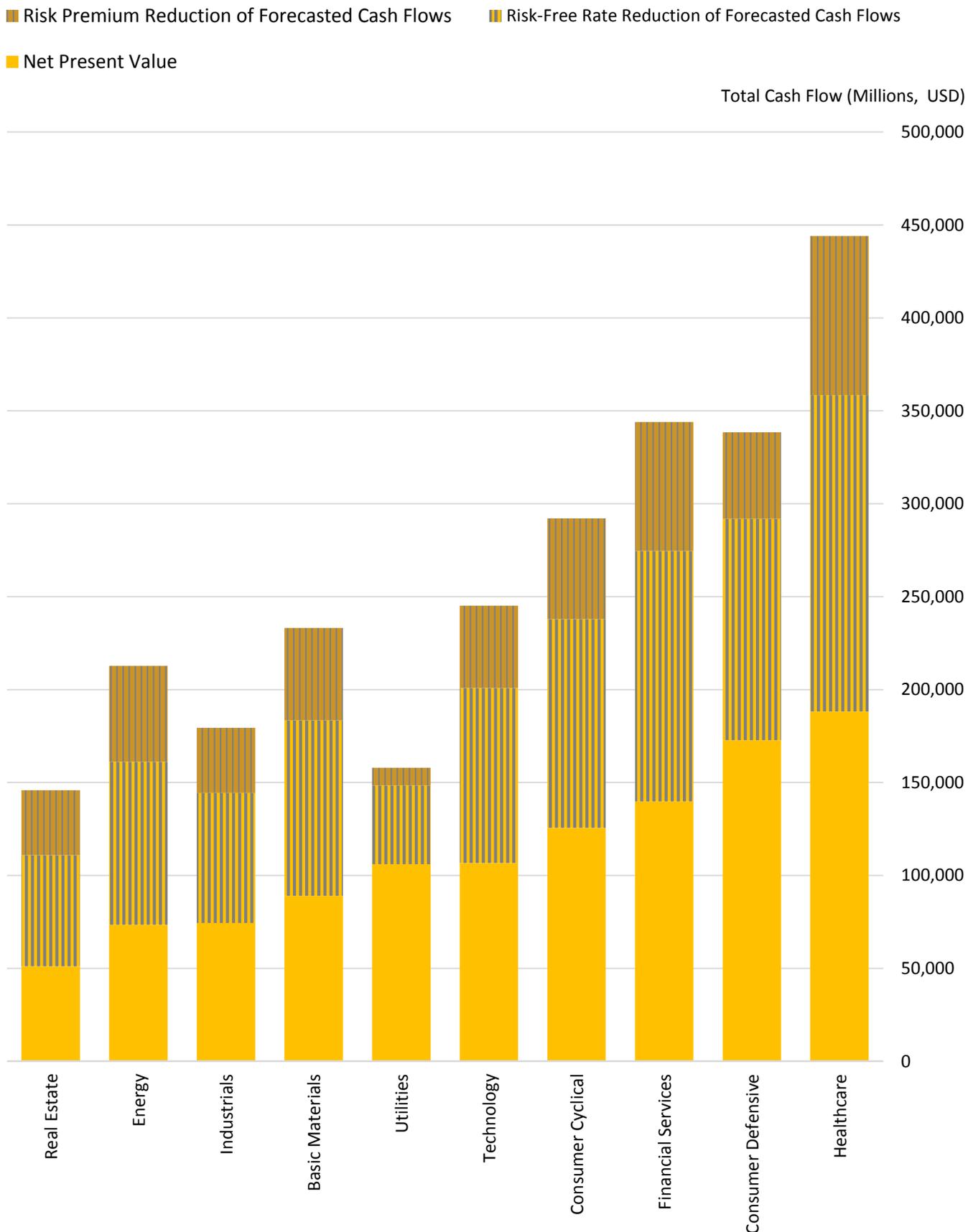


Fig. 49: Effect of Discount Rate and Risk Premium by Industry Sector

Risk Premiums are Backward-Looking and Miss Future Risks

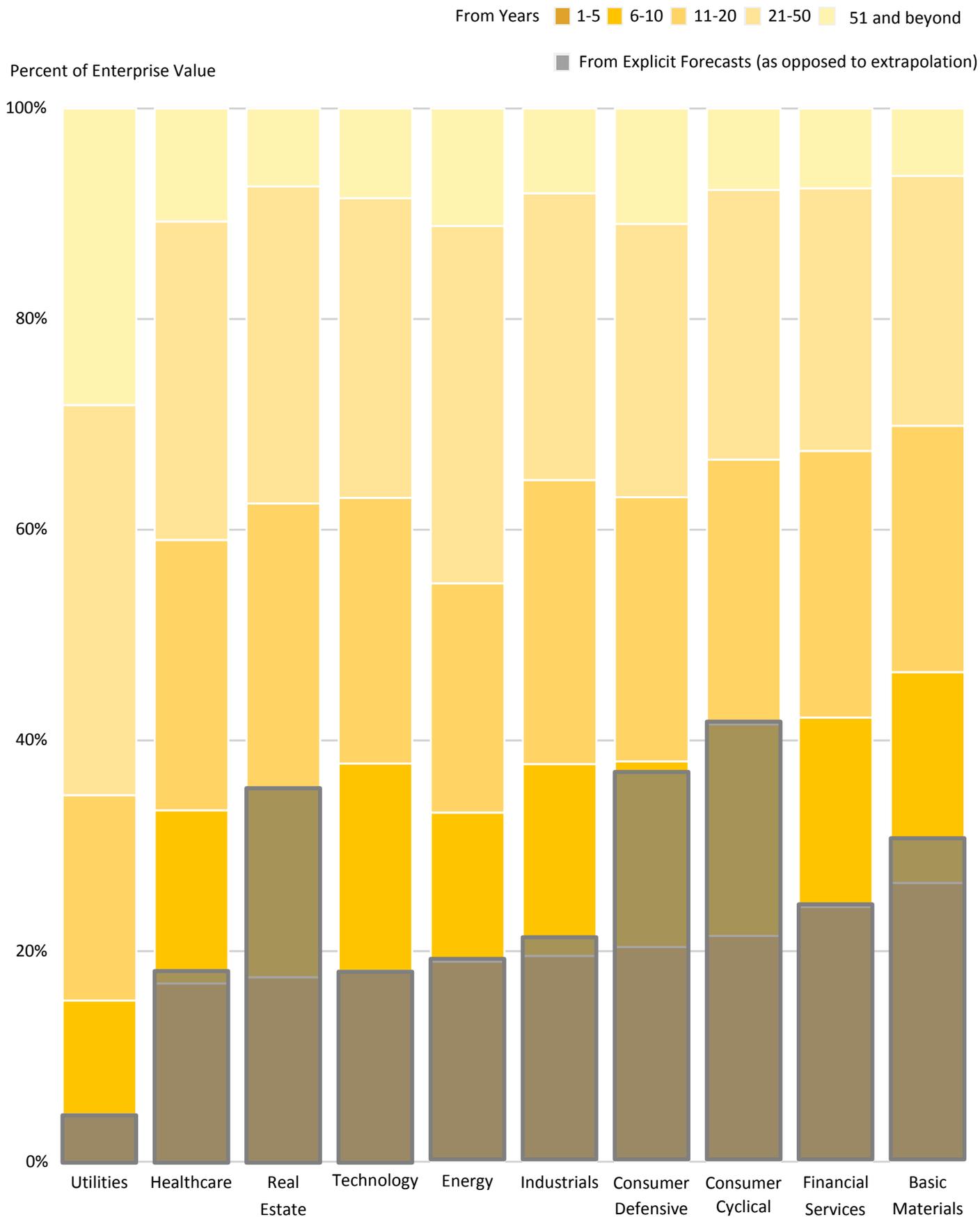
Note: The sum of the cash flows discounted by risk-free rates and risk premiums exceeds the net present value in 8 out of 10 sectors. This discounting of the future limits the value of long-term risk assessment and may expose investors to long-term risks



Source: Authors from Morningstar DCF Models 2016

Fig. 50: Enterprise Value Attributable to Time Period and Explicit Cash Flow Forecasts

Value is primarily based on the growth and discount rate assumptions used to calculate terminal value-- not on Explicit Forecasts.



Source: Authors 2017, from Morningstar DCF Models 2016 (n=107)

3.5 ANALYSTS' EXPLICIT CASH FLOW FORECASTS FOCUS ONLY ON THE NEXT 5 YEARS

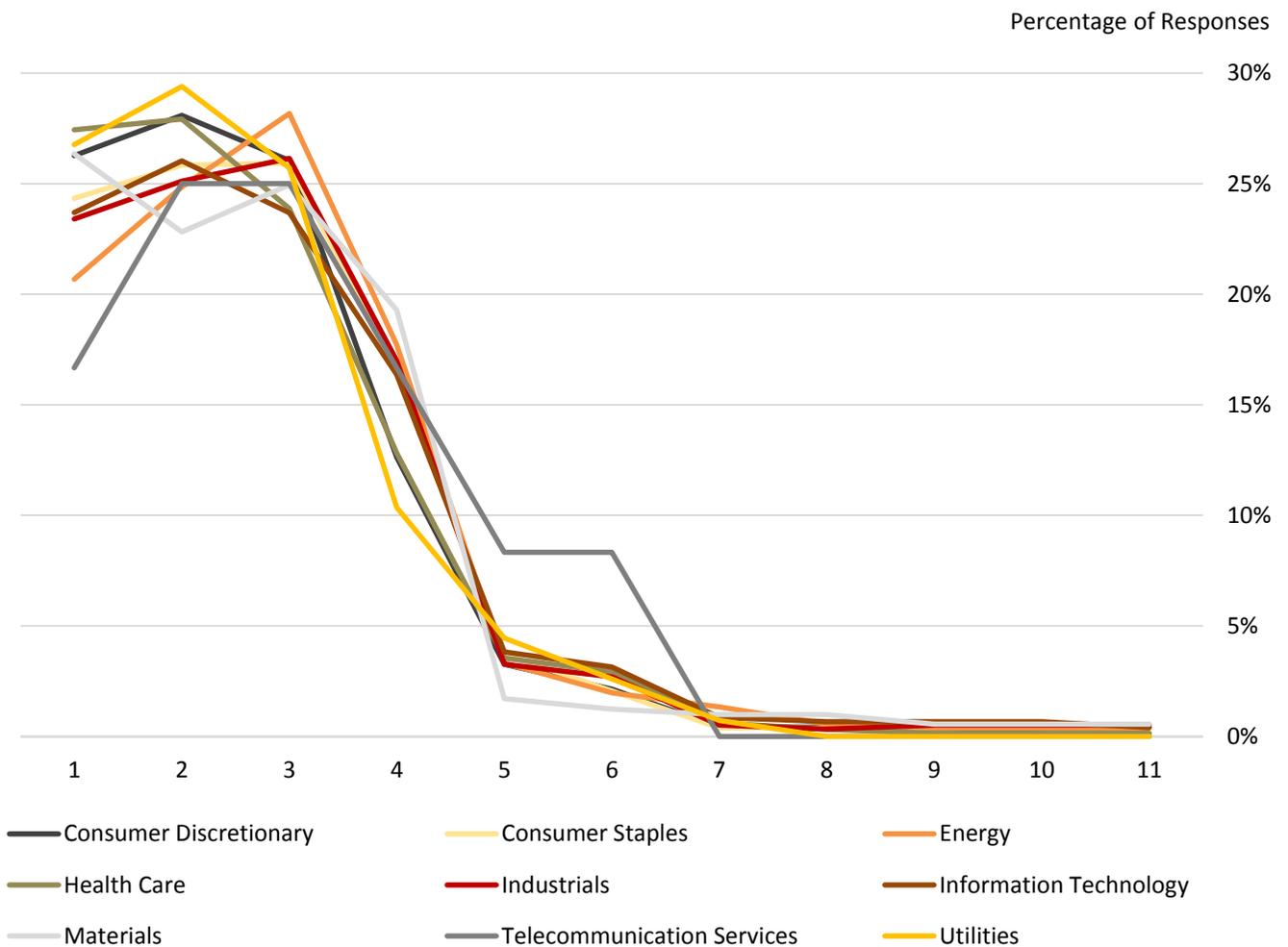
Analysts focus their forecasts on the short-term. To quantify industry consensus, Bloomberg issues a survey on earnings estimates to equity research analysts. The responses listed in their database tail off after 5 years, with 74% of analyst forecasts made in the first three years and 94% in the first 5 years. Less than 1% of forecasts in this sample are made 10 or more years ahead, mainly in the Health Care, IT, and Telecom sectors. This demonstrates analysts issue nearly all of their explicit cash flow forecasts for the

next 1-5 years, although, as previously shown, only around 15% of the value of the stock comes from this timeframe. This leaves a large gap between the materiality period for stocks and analyst time horizons

The consequence of this gap is that most of future cash flows are extrapolated, not explicitly forecasted. Based on Morningstar's models from 2016, around 74% of cash flows in models are from extrapolation, even after discounting (see Figure 50, previous page). This means that the majority of equity valuations do not come from analysts' forward-looking analysis but backward-looking and standardized assumptions.

Fig. 51: Analyst Cash Flow Forecast Entries in Bloomberg Terminal by Forecast Year

Analysts' Explicit Cash Flow Forecasts Focus Only on the Next 5 Years



Source: Authors 2017, from Bloomberg Data 2015

3.6 RISK SECTIONS ARE NOT LONG-TERM

Even the most forward-looking analysis on the sell-side does not look beyond 5 years. Some equity research firms qualitatively discuss long-term risks in long-term outlook sections. These sections increasingly incorporate Environmental, Social, and Governance concerns. Even these sections, though, only look at the next five years. They commonly rely on market research analyzing new technology growth projections over 5 years. There may be an opportunity to discuss long-term risks in these qualitative disclosure sections but currently the risk sections is constrained by the time horizons of the valuation models. Decoupling risk analysis from price targets may increase the scope of long-term risk assessment.

3.7 CREDIT RISK ASSESSMENTS LARGELY FOCUS ON THE NEXT 3-5 YEARS

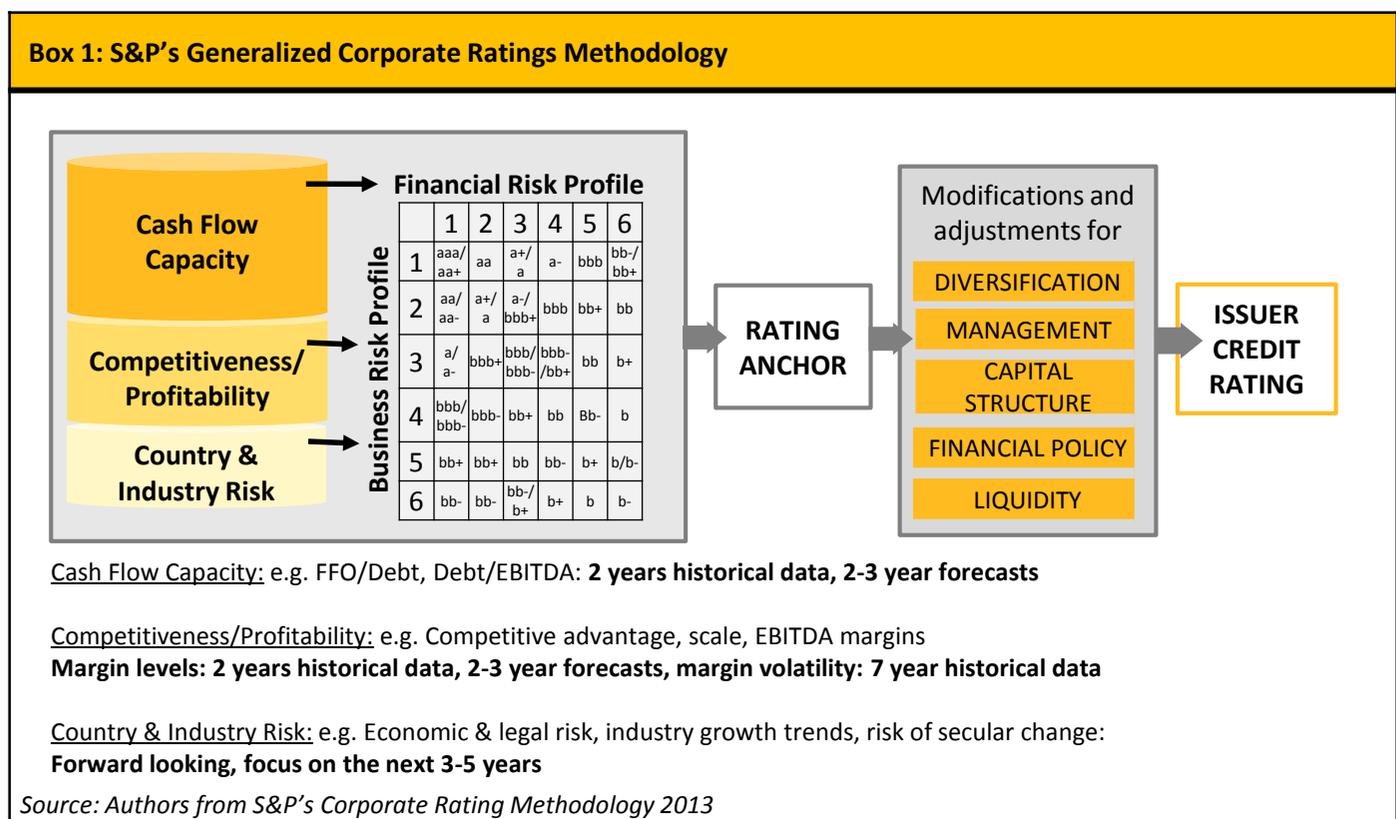
The visibility of a debt issuer’s financial cushion imposes a limit on the time horizon of credit ratings. Credit ratings (long-term corporate ratings) do not have a formal time limit attached to them. Ideally, ratings represent an issuer’s general creditworthiness (issuer credit rating) or his ability to service debt until maturity (issue credit rating). In practice, however, ratings are based on quantitative and qualitative assumptions, the validity of which declines as longer horizons are considered. Most importantly, these assumptions concern the size and sustainability of the ‘financial cushion’, which reflects an issuer’s financial health and thus his ability to repay debt in periods of stress.

The financial cushion of an issuer plays a key role in credit risk assessment but indicates financial health for no more than 3-5 years. Credit factors that indicate the size of an issuer’s financial cushion play a decisive role in corporate credit risk assessments. Moody’s, for example, places heavy weights on leverage and coverage ratios when determining an issuer’s ‘grid indicated rating’ (Box 2 next page). Similarly, when examining corporate credit risk, S&P emphasizes the role of an issuer’s financial risk profile, which is derived from various cash flow and debt ratios such as Funds from Operations/Debt or Debt/EBITDA (Box 1 below). Such cash flow metrics are typically assessed from a mixture of historical data and results that are projected over the short-term. These metrics are constrained by company earnings guidance, which is typically focused

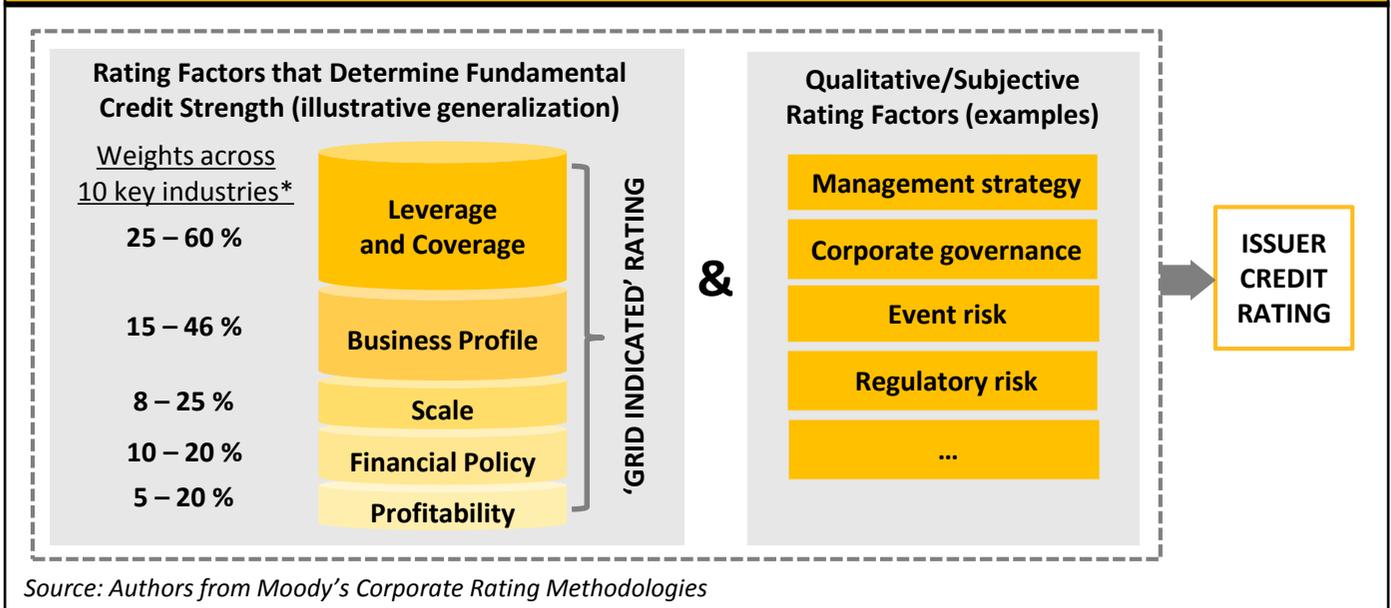
on the next 2 years or less (See more on the drivers of short-term metrics on page 54).

S&P generally determines the financial risk profile of an issuer from 5 year averages of cash flow ratios, including 2 years of historical data and 2-3 years of financial forecasts (S&P’s Corporate Rating Methodology 2013). Slightly longer forecast periods can be employed for issuers that operate in particularly stable markets, such as the utilities industry. Similarly, S&P focuses on EBITDA margins over the last 2 and coming 2-3 years when assessing an issuer’s profitability—a key indicator for the sustainability of the financial cushion.

Moody’s does not communicate explicit time horizons for the assessment of financial metrics such as coverage and leverage ratios, but only states that both historical and projected financial results are used in the rating process (see Moody’s industry specific corporate rating methodologies). However, the financial metrics that go into Moody’s rating process are very similar to those employed by S&P. They are restricted by the data that companies provide and uncertainty around long-term risks and business strategy. In view of the restricted forecast horizons of an issuer’s financial cushion, the implicit time horizon of corporate credit ratings is regularly stated to be 3-5 years for investment grade issuer’s that operate in a stable business environment (e.g. S&P, Fitch).⁵¹ For speculative grade issuers, the visibility of financial metrics, and thus the implicit time horizon of credit ratings, is typically even shorter.



Box 2: Moody's Generalized Corporate Ratings Methodology



3.8 EMERGING RISKS AND TRENDS BEYOND 5 YEARS ARE UNLIKELY TO IMPOSE RATING ACTION TODAY

Corporate credit ratings are derived from a base case scenario that reflects the most likely developments over the next 3-5 years. S&P derives the core input to its ratings, namely cash flow forecasts, from an expected base case scenario which incorporates “current and near-term economic conditions, industry assumptions, and financial policies” (S&P Corporate Rating Methodology 2013). This base case scenario reflects S&P’s current expectation on the most likely developments over the next 3-5 years. When expectations on what constitutes ‘the most likely scenario’ over the next 3-5 years change, credit ratings are adjusted dynamically. Such adjustments may be preceded by a ‘rating outlook’, which indicates that a rating may be changed in the next 6-24 months due to potential changes in fundamental economic or business conditions. Thus, the rating outlook indicates the potential direction of a credit rating over the next 2 years, but does not reveal expectations about the long-term trajectory of credit risk.

Long-term risks and trends are sometimes assessed in credit risk analysis but are unlikely to induce rating action today. Exogenous risks and trends are most likely to induce rating action today if they affect the current base scenario, i.e. if they are highly likely to materialize in the next 3-5 years. Risks with a low chance of coming into effect in the short- or medium term, but a high likelihood of materialization beyond 5 years may be assessed in credit risk analysis, but will be reflected in current ratings only if they are believed to pose a material threat or opportunity to an issuer.⁵² However, such beliefs are seldom strong enough to induce rating action today. Exogenous risks such as the

energy transition and artificial intelligence go along with limited confidence in the risk itself and with a restricted predictability of their impacts on fundamental credit metrics.⁵³ Moody’s asserts that the harm of many “incremental, episodic” risks is uncertain. The impacts on credit can be delayed and are likely to be “curbed or offset” by countervailing forces over time.⁵⁴ Also, specific timing for regulatory initiatives is required to change ratings. Long-term risks may be ignored because of their uncertainty.

Qualitative assessment of the long-term is not a well defined process. In our workshops, credit analysts stressed that ratings methodologies do not stop with grid-indicated ratings. Instead, the ratings grid may just be the starting point for discussion. Grid-indicated ratings go to a ratings committee that deliberates on qualitative factors including governance and adaptive capacity (see Box 2). The methodologies do not specify the factors and questions discussed on this topic. The interview with rating agencies did not point towards additional specific documents on the factors and questions addressed, suggesting a lack of specific and sophisticated frameworks to assess governance and adaptive capacity when companies face long-term risks such as the Energy Transition and Artificial Intelligence.

Environmental risk assessment may extend the time horizon. Moody’s and S&P are developing methodologies to assess the risk of climate change (e.g. Moody’s Environmental Risk Heatmap 2015, Moody’s to Analyze Carbon Transition Risk 2016). As part of this, credit analysts may assess the risk of decarbonization over the next 20-30 years. However, even if such risks are evaluated in credit risk analysis or related publications, the likelihood that they will have a decisive effect on current credit ratings is small.

Figure 52: Effect of Moody’s Environmental Risk Heat Map on Rating Actions

Credit Ratings Reflect Environmental Risk Only if the Risk Already Has Material Implications

Assigned Risk Category	Examples	Characteristics of Risk Exposure and Materiality	Materiality of Risk	Rating Action Implied?
Immediate elevated risk	Coal Mining, Unregulated Power Generation	Direct exposure to market impacts of environmental regulation; implications for cash flows, revenues and margins already felt	Already material	YES Already occurred or likely within 3 yrs.
Emerging elevated risk	Oil and Gas Refining, Automobile Manufacturers	Clear exposure to environmental risk; material impacts unlikely in the next 3 years; flexibility to adapt	next 3-5 years	NO But possible beyond 3 years.
Emerging moderate risk	Integrated Oil and Gas, Regulated Electric and Gas Utilities	Clear exposure to environmental risk; material impacts unlikely in the next 5 years; uncertainty about the implications for credit quality; high flexibility to adapt	5 or more years	NO But possible beyond 5 years.
Low risk	Mass Transit, Retail and Apparel	No sector wide exposure to environmental risk or consequences not likely to be material to credit quality	Limited materiality	NO Unlikely in the next 7 years.

Source: Authors based on Moody’s Environmental Risk Heat Map 2015

3.9 NO EVIDENCE OF A CLEAR FRAMEWORK TO DISTINGUISH A 'KODAK' FROM A 'GE'

The assessment of adaptive capacity relies on largely generic assumptions. When equity and credit analysts 'extrapolate' near-term (3-5 year) prospects and cash/debt ratios over long horizons (10-30 years), they often assume companies will *adapt* over the long-term.

This adaptation process can occur at the business segment level (e.g. car manufacturers switch from ICE to electric engines and integrate auto-pilot functions without changing their core business) or through diversification away from the old business (e.g. utilities develop distributed renewable capacity and energy efficiency programs and sell their coal-fired capacity):

- For many industries with long-term assets involving locked-in emissions, the first dimension can be evaluated via an analysis of fixed assets, CapEx plans, R&D expenditures and long-term contracts.
- The second dimension is more difficult to evaluate since it mostly depends on the ability of the management to buy and sell business segments at the *right time*: before they get discounted by the market. Some companies might lose the race for adaptation to new technologies like Kodak and some might reinvent themselves constantly like GE.

Limited analysis of locked-in effects and disruptive innovation potential. Analysts commonly assess diversification of the product portfolio, the flexibility of contracts and the level of R&D investment. However, we did not find evidence of in-depth analysis of the inertia related to fixed assets and investment plans. A good illustration of this is the power sector:

- The sector is highly exposed to technology and policy risks related to the energy transition and subject to a locked-in effect due to the long-term nature of the fixed assets (e.g. power plants).
- Databases on power plants (including technology, age, planned additions, etc.) have existed for years, allowing estimation of the expected cash flows from each type of energy asset over the long-term.
- Credit rating agencies have only recently acknowledged the value of asset-level data for environmental risk assessment in infrastructure credit ratings.⁵⁵ This practice can be expanded.
- Similarly, the R&D budget of companies exposed to disruptive changes is rarely analyzed in terms of investment in breakthrough technologies: almost no companies report this and few analysts ask about it.

Our analysis suggests that limited resources are mobilized assessing locked-in effects and innovation.

The second dimension of adaptation is the ability to diversify away from a 'doomed core business' via divestitures and acquisitions before the emerging risk gets priced in by the market.

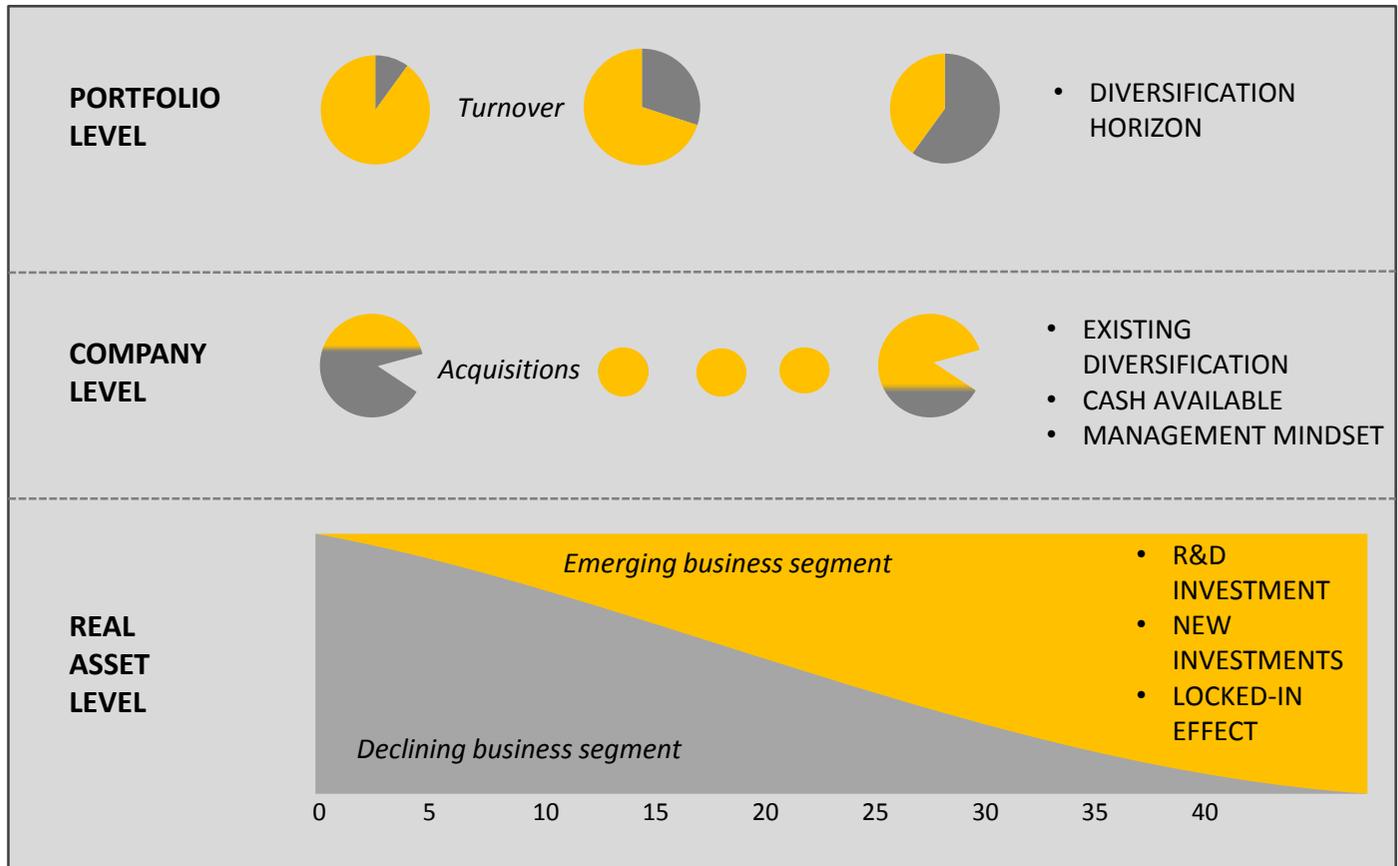
Ability to finance acquisitions. Near-term financial metrics such as cash flow to debt ratios indicate the ability of the companies to finance such evolutions if they decide to. Both credit and equity research analysts put emphasis on this dimension when it comes to assessing the adaptive capacity of a company. However these financial ratios are usually based on backward-looking or near term prospects (3-5 years) regarding costs and revenues and can therefore deteriorate if this structure changes dramatically. For credit ratings, our understanding of the S&P and Moody's methodologies is that the rating actions primarily take place when these ratios start to deteriorate, suggesting a 3-5 year horizon for the analysis of this dimension.

Ability to make the decision at the right time. The other key question is whether the management will make the decision at the right time or too late. Moody's, for example, emphasizes that management strategy constitutes a key consideration when assessing a company's exposure to carbon transition risk.⁵⁶ Similarly, S&P highlights management's important role when dealing with strategic and operating risks, such as those related to ESG factors (see S&P (2015): ESG Risks in Corporate Credit Ratings -An Overview).

In view of the short-term focus by which company management and shareholder-investee dialogues are often characterized, however (see page 39), it seems reasonable to assume the ability of management to reinvent the company over the long-term (to be a 'GE' rather than a 'Kodak') is only one dimension of 'good management.' Rating methodologies and the information provided to us during workshops by credit analysts do not provide details on how this dimension is specifically addressed, suggesting that it is not a major focus of the analysis and mostly based on a subjective judgment call of the analyst. The same conclusion applies to equity research, where we did not find evidence of sophisticated approach to the topic. This topic would, however, require further research on both existing and emerging practices on the topic. It will certainly be a key focus of the future developments regarding Energy Transition risk assessment (see page 55).

Fig. 53: Adaptive Capacity from the Investor's perspective

There are three levels by which investors can assess susceptibility of portfolios to long-term risks



Source: Authors

Section	Feedback Summary	Supporting Quotes
<p>TIME HORIZONS IN EQUITY RESEARCH</p>	<p>Analysts generally agreed with our assessment that forecast horizons in equity research seldom go beyond 3-5 years, where cash flows outside of this focus are merely extrapolated. Long-term risks are thus not genuinely accounted for in valuation models, but are at best approximated by a tweaking of assumptions such as growth rates. Several analysts highlighted that time horizons and valuation methods employed vary across sectors and across research firms. That is, there is considerable variation in actual forecast horizon between 0 and 5 years. Further, an equity research Managing Director mentioned that his department employs forecasts of up to 7 years, yet this appears to be an outlier. As a result, the short-term focus of equity research was validated.</p>	<p><i>“It’s fair to say that analysts make short-term assumptions and extrapolate long-term growth.”</i> - Buy-side Analyst</p> <p><i>“Analysts integrate long-term risks by adjusting the long-term growth rate by 1-2%.”</i> - Senior Sell-side Equity Research Analyst</p> <p><i>“I base my valuation on the current stock price”</i> - Sell-side Equity Research Analyst</p>
<p>THE PREVALENCE OF VALUATION MODELS</p>	<p>Analysts challenged our assumption that equity analysts’ time horizons are primarily reflected in valuation models. Equity valuation models and price targets are one important channel through which long-term risks can enter investment decisions. Yet, assessment of management quality and qualitative risk disclosures also inform equity research products, and should thus be examined when studying the time horizons of equity analyst.</p>	<p><i>“Valuation models are one of a suite of tools for analysts. They are not a summation of the whole investment process.”</i> - Buy-side Analyst</p> <p><i>“The integration of long-term risks into investment decisions may occur at a sector allocation rather than individual security level.”</i> – Buy-side Analyst</p>

PART IV

THE DRIVERS BEHIND THE LOW BEAMS

SECTION SPOTLIGHT

- Key obstacles to longer time horizons in financial analysis relate to the availability of data from issuers, the lack of framework for long-term risk assessment, the limited demand from investors, and the cost-benefit attached to more sophisticated analyses.
- Frameworks for long-term risk analysis are emerging but remain scattered.

4.1 ANALYSTS FACE MULTIPLE OBSTACLES TO A LONG-TERM VIEW

Financial analysts’ time horizons are restricted by multiple factors. One important obstacle to the integration of long-term risks in securities research is the shortage of relevant data from issuers. Company disclosures are often backward looking or cover only the near-term future, thereby depriving analysts of the metrics needed to build expectations on the long-term prospects of a security. Similarly, analysts are generally not well equipped with frameworks that enable financial projections over the long-term. Methodological innovation—such as the best practices showcased in section 4.3—is required on a broader scale, and for a variety of long-term risks. Yet, even with increased availability of long-term data and risk-assessment frameworks, the additional cost attached to sophisticated long-term analysis may not

be affordable in the current economic environment of equity research. Last but not least, our analysis suggests that there is currently simply no demand for long-term financial analysis. Given that the average portfolio holding periods for even long-only equity managers is just 21 months (see page 58), it seems questionable whether investors in general – and ‘long-term’ investors in particular – follow investment strategies that necessitate the consideration of long-term risks, thus kicking the can even further down the road. Furthermore, interviews with sell-side equity research and credit rating agencies suggest that the primary clients of financial analysis are short-term traders. Internally, analysts face pressure to deliver short-term results. In a 2014 survey of 365 sell-side equity analysts, 44% reported that generating investment banking fees was important to their compensation.⁵⁶ Analysts face powerful pressures on their time horizons.

Figure 54: Obstacles to Long-term Risk Analysis

Analysts face four key obstacles to long-term risk assessment

Source: Authors



4.2 COMPANY DISCLOSURES FOCUS ON THE SHORT-TERM

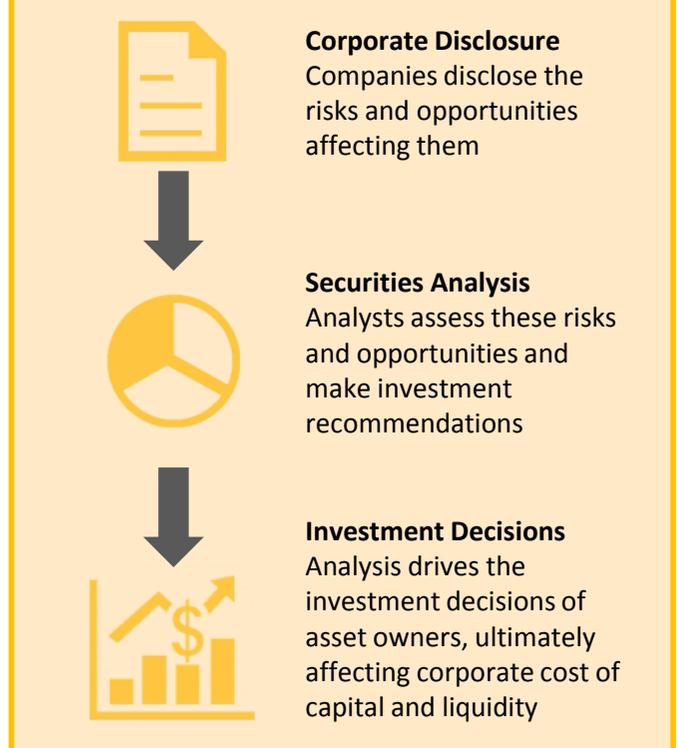
The limited time horizons of corporate disclosures restrict analysts' ability to transmit long-term risk signals to asset owners. Financial analysts – and, ultimately, asset owners - rely on corporate disclosure to value companies and assess risks around their credit profile (see right). Such information is communicated through various channels, including annual or quarterly reports, direct conversation between analysts and management, and press or financial releases. To some extent, these channels cover forward-looking disclosures: They can contain a company's expectations on future earnings (earnings guidance), a presentation of potential risks that may harm the company (e.g. section 'Risk Factors' in 10K), and a discussion of management's strategy to deal with risks and trends. However, even such forward-looking information is short-term. Earnings guidance is mostly focused on estimated revenues, earnings, margins, or capital spending for the next quarter, and seldom looks beyond 1 year. Similarly, discussions of risks and strategies are largely centered around short-term developments and expectations.⁵⁷ With such restricted information on long-term company metrics, risks and strategy, analysts' ability to integrate long-term risks into their models – thus informing long-term investment decision-making - is limited.

4.3 ESG FACTORS OVERLAP WITH LONG-TERM RISK

A taxonomy of ESG Risks has been developed across sectors. Since the late 1990s, a new type of research has experienced exponential growth: the assessment of Environmental, Social and Governance (ESG) factors. ESG analysts primarily score companies on multiple factors, sometimes complimented by a set of qualitative backward-looking data like consolidated carbon emissions. The field's development has driven the development of ESG reporting by companies and the development of related standards.

ESG analysis is primarily used by socially responsible investors. 'ESG integration' is often presented by agencies and investors as a way to integrate long-term risks into investment decisions given that most environmental and social issues are often not covered by short-term risk assessment frameworks. In practice, ESG scoring primarily serves the need of socially responsible investors who use these scores and data to screen companies or reweight portfolios. It is also used to a lesser extent by some 'mainstream' investors to report on the ESG profile of their portfolio or marginally integrate the results of the analysis into portfolios (e.g. exclude companies that make cluster bombs).

Fig. 55: How Company Level Risks are Transmitted to Investment Decisions



Source: Authors

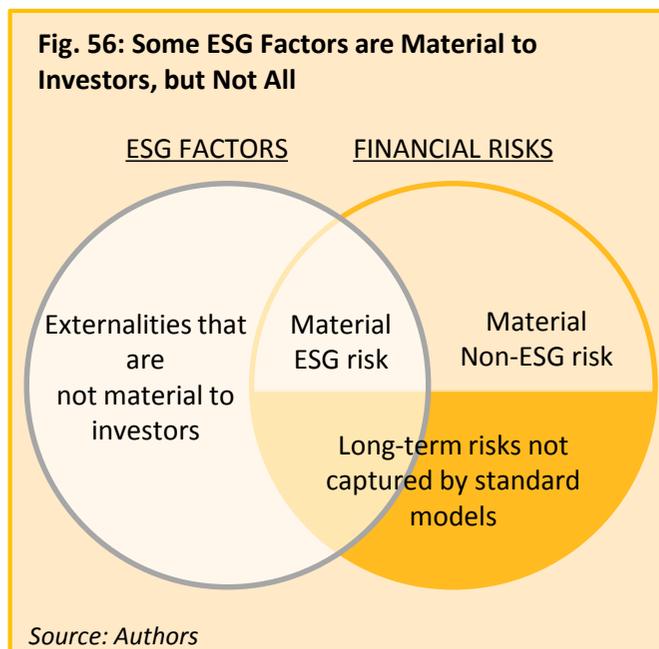
In equity research, ESG analysis is usually ancillary to fundamental research. ESG analysis is not core to the work of equity analysts. In equity research departments, ESG research typically serves three principal purposes:

- **Risk characterization:** ESG analysis encourages analysts to make a taxonomy of risks where they otherwise might not. To capture the impact of uncertain risks and opportunities outside the realm of traditional analysis, analysts must categorize risks using factors like time horizon, severity, and probability, factors that may not be associated with other kinds of risk.⁶⁰
- **Scoring and ratings:** Tracking performance on ESG factors can help analysts produce ratings for socially responsible investors. Certain socially responsible investors may only invest in securities with high ESG ratings.
- **Twining fundamental analysis:** ESG analysis can help analysts model specific drivers commonly affected by ESG risks include terminal growth rates and discount rates. These are two out of the three key variables in DCF models but do not affect the last cash flow estimate (see page 42). Further, analysts can construct scenario and sensitivity analyses around ESG risks. These processes are not core to fundamental valuation, however.

More generally, ESG analysis alone is not sufficient to address all types of long-term risk we might consider to be ‘white swans that appear black in the dark’. As such, ESG assessment may differ from long-term risk assessment in the following ways:

1. The scope is usually not limited to material risks. Most scoring systems capture all major social and environmental issues associated with companies' activities regardless of their financial materiality. Some frameworks prioritize material issues, though (e.g. SASB, see auto industry example in Fig. 57).
2. The scope is usually limited to environmental, social and governance-related issues, leaving many long-term risks, e.g. technological developments such as autonomous cars, out of scope.
3. The output of ESG analysis is usually not translated into quantitative metrics that can be easily factored in assumptions regarding long-term cash flows of companies, risk premiums or risk factors in credit rating.
4. Finally, ESG integration does not induce changes in target prices or rating action in standard practice but some models have line items for ESG factors. Some advances are being made in this area but are not mainstream in credit ratings or equity research.

Empirically, ESG factors are tangentially connected to financial and forward-looking factors. For example, SASB's taxonomy of ESG risks in Automobile sector bears a limited relationship to financial and forward-looking risks. Factors like Materials Efficiency & Recy-



-cling have no impact on asset value and cost of capital (see Fig. 57). Further, this factor does not present high magnitude risks nor externalities to society. Other factors, such as Materials Sourcing, bear direct relationships to earnings, asset value, and cost of capital while also presenting risks with high probability and magnitude.

ESG Risks and Financial Risks overlap in some cases to produce Material ESG risks. Many risks in our taxonomy might not overlap with ESG externalities (see above). Further, not all material risks are necessarily long-term. In a small percentage of cases, however, long-term financial risks overlap with ESG factors. Thus, ESG analysis is not a silver bullet to categorize and measure long-term risks, but it is a first step. Several best practices in ESG analysis show how this practice can be extended to the long-term.

Figure 57: SASB’s Materiality Map: Sustainability Topics Likely to be Material for the Auto Industry

Issues likely to be material for the Automobiles Industry	Earnings	Asset Value	Cost of Capital	High Probability/Magnitude	Externalities
Materials Efficiency & Recycling	X				
Labor Relations	X	X			
Fuel Economy, Use-phase Emissions	X	X		X	X
Product Safety	X	X	X		
Materials Sourcing	X	X	X	X	

Source: SASB 2016

Proposed ESG frameworks from credit rating agencies could extend the focus of risk assessment beyond 5 years. S&P’s proposal for ESG ratings defines the medium term as 2 to 5 years and the long-term as beyond 5 years. To determine the ESG risk profiles of issuers, they plan to assess the medium- and long-term environmental and social risk exposure with the medium-term weighted more highly than the long-term.⁶⁰ While this type of analysis could factor into credit risk assessment, it is not by itself a credit rating and thus may not extend the overall time horizon of ratings.

Some equity research firms have quantified the financial effects of an ESG taxonomy via valuation model inputs. One example is the framework described in Morgan Stanley’s new report “Embedding Sustainability into Valuation: Global Framework for Analyzing ESG risks and Opportunities.”⁶⁰ The framework identifies the most material ESG factors for each sector and applies these factors to the individual inputs of valuation models including volumes, pricing, revenue, capex, asset lifespan, etc. As such, the framework applies ESG factors and translates them into quantitative valuation impacts that can apply to any valuation model. This approach expands the types of risk that can be included in valuation models and thus might capture some non-linear risks we consider to be ‘white swans that appear black in the dark’.

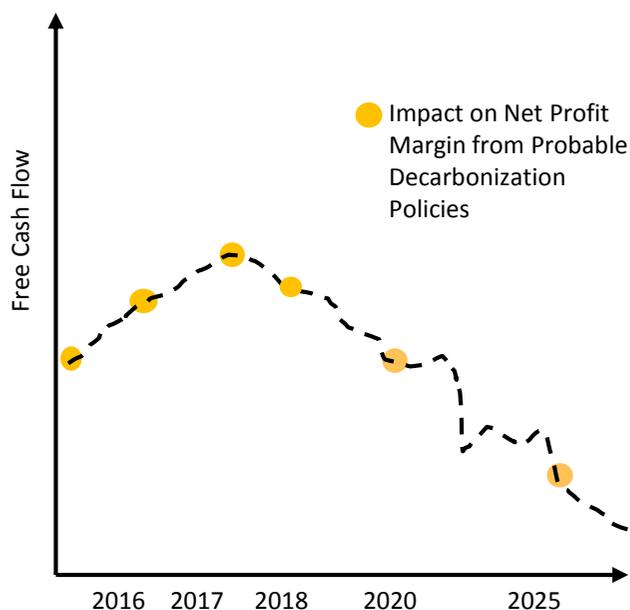
4.4 DEVELOPING NEW VALUATION METHODS

Energy Transition risk analysis opens the door to long-term valuation techniques. More specifically, in the context of international climate negotiations, the question of 'energy transition risks' has become more prominent on the agenda of the finance sector:

- The Financial Stability Board convened an industry-led Task Force on Climate-Related Financial Disclosures (TCFD) to assess the numerous climate disclosure regimes and come up with recommendations on how to disclose and assess climate-related risks. The first report concludes that most climate-related disclosure initiatives are largely disconnected from financial risk assessment.⁶¹
- The European Commission finances a consortium (Energy Transition Risk) involving S&P Global, Kepler Cheuvreux, the University of Oxford, Carbon Tracker Initiative, CO-Firm, I4CE and 2^oi (lead) to develop a methodological framework and a suite of tools to assess long-term energy transition risks. The first results are expected in 2017.

The long-term risk assessment framework under development for energy transition risks may apply to more sectors. The first findings of these two work streams revealed the need for *risk scenarios* that can be used by analysts as inputs to build assumptions on companies’ long-term margins and cash flows. Models calculate the impact of carbon and energy regulation on the net profit margin of companies at specific points-in-time, which can be used to forecast operating cash-flow (see Fig. 58). The ET Risk consortium is currently developing such a scenario. It includes a set of 30-40 parameters, often regional and sector specific.

Fig. 58: Experimental Approaches to Long-Term Risk Integration



Source: 2^oi ET Risk Project Briefing 2015

Asset-level data. To further develop such approaches, methodological research discovered the need for country-specific analysis, and therefore the necessity to mobilize *real asset level databases* (e.g. power plants, oil fields) to aggregate forward-looking and country specific data on corporate long-term assets, which are largely missing from corporate annual reports. Such a database is under development in the ET Risk project.

Advanced quantitative techniques. Advanced statistical methods may enhance the utility of such data. Monte Carlo models create a probability distribution of possible outcomes based on thousands of simulations of valuations under multivariate assumptions.⁶³ This kind of model may enable analysis of multiple long-term variables if sufficient data exists. Based on this analysis, equity analysts could provide a range of probabilistic estimates of future cash flows.

DCF Impacts. Using a simplified set of mostly global parameters, the *Bloomberg Carbon Risk Valuation* tool (Fig. 59), launched in 2015 and available on the Terminal, offers five scenarios to describe the pathways for oil companies in a low carbon future. The scenarios alter cash flows for oil companies in DCF models. Bloomberg’s scenarios include lower oil prices and decarbonization policies. The tool allows analysts to adjust assumptions on, for example, oil prices, gas prices, oil & gas production, reserves, and extraction costs and suggest a revised stock price.

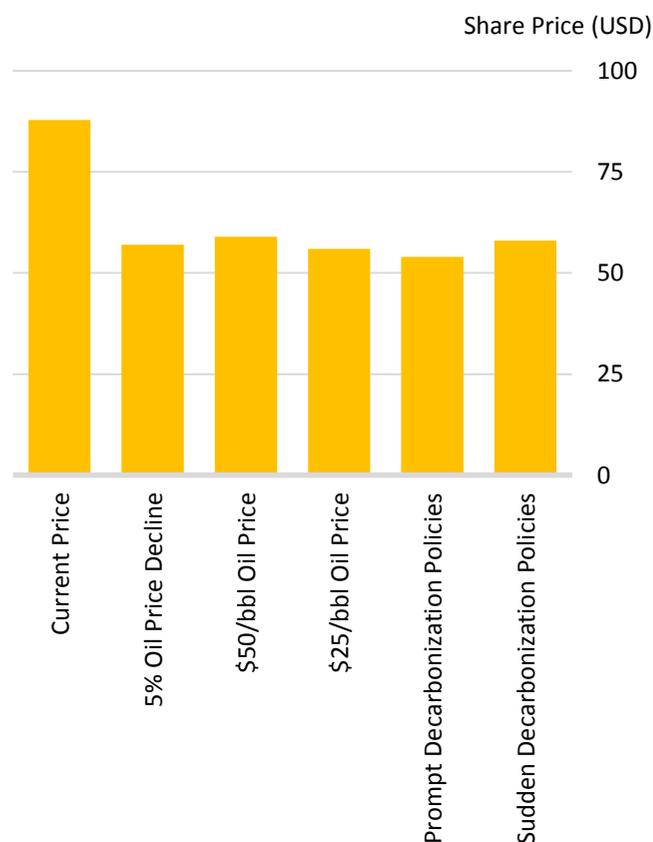
4.5 ASSESSING ADAPTIVE CAPACITY

One of the main obstacles identified in the context of these methodological developments relates to the assumptions to be made regarding the adaptive capacity of the companies. Most long-term risk analysis to date focuses on the risks affecting the revenues derived from long-term physical assets like power plants and oil fields, putting emphasis on the locked-in effect associated with their lifetime. This approach informs the magnitude of potential write-offs faced by the owner but cannot be translated 1:1 into a value-at-risk for the related stock. In certain cases companies can retrofit the physical assets at risk, sell them to competitors at a reasonable price before the risk gets priced in, acquire other companies to diversify away from risky activities, or simply innovate to gradually re-orient their business lines. As indicated on page 49, our research suggests that analysts capture 'adaptive capacity' as a qualitative heuristic, and sometimes reflect it 'informally' by adjusting the risk premium, but do not use a formal framework to systematically assess and value this dimension.

As a proxy for adaptive capacity, analysts tweak the risk premium directly to reflect the uncertainty of core business sustainability. Risk premiums that are used to assess the net present value of a company are typically based on past volatility of share prices, thus ignoring the ability of a company of a company to adapt to future risks (see section 3.9). Emerging approaches such as Carbon Tracker’s (CTI’s) analysis of NPV sensitivity to volatility in oil prices tackle this issue.⁶² CTI compares the net present value of the upstream oil industry in two different scenarios: A business as usual scenario and a 2°C aligned scenario. CTI shows that the BAU scenario is more sensitive to oil price volatility, which implies a higher risk premium to discount future cash flows (“Fossil Fuel risk Premium”, Fig. 60), and thus potentially a higher NPV for oil and gas majors in the 2°C scenario in which high cost projects are not approved. By adjusting the risk premium in this way, CTI integrates the future risk profile of oil and gas majors into valuation techniques.

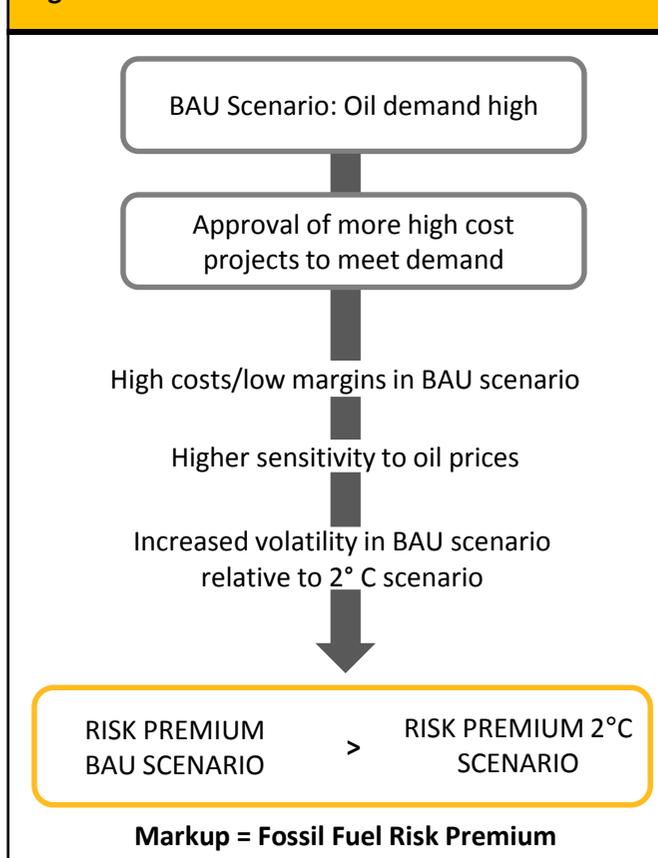
Fig. 59: Bloomberg Carbon Risk Valuation Tool Scenarios’ Effect on Exxon Mobil Share Price

Valuations are sensitive to long-term scenarios



Source: Bloomberg New Energy Finance 2013

Fig. 60: The Fossil Fuel Risk Premium



Source: Authors based on Carbon Tracker 2016

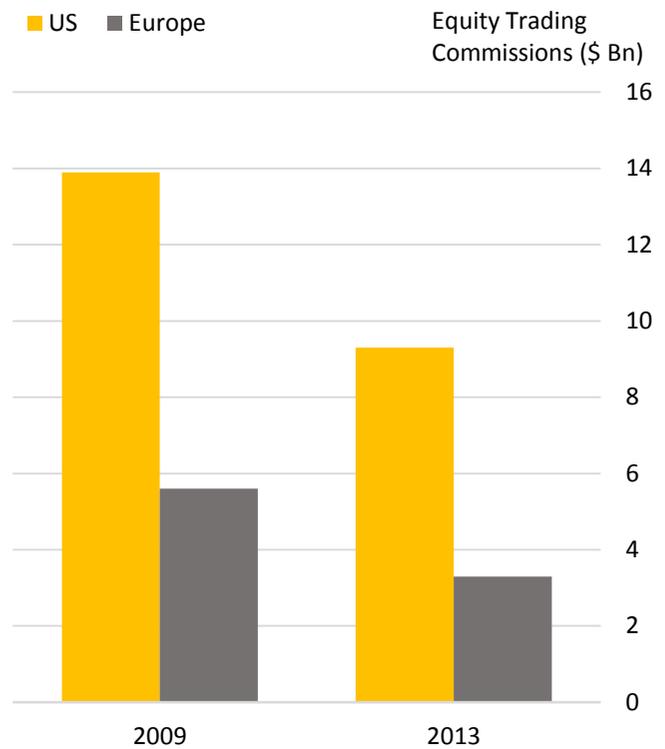
4.6 RESEARCH BUDGETS PLACE LIMITS ON LONG-TERM RISK ASSESSMENT

Sophisticated long-term risk assessment is likely to increase research costs. Given their nascent nature, there is still a lot of uncertainty on the additional cost related to long-term risk assessment. However, the extension of forecast periods, the use of multiple scenarios and the access to physical asset level data are likely to imply additional costs, even if marginal.

The contraction of budgets has forced equity research departments to focus on their most profitable activities. The demand for sell-side equity research has decreased since the Global Financial Crisis. Increasing access to information and decreasing asset flow into actively managed funds since 2008 have limited investors' demand for research and lowered equity research revenues (see Figs. 61 and 62). As a result, heads of research have been forced to cut costs.⁶⁴ Recent cost-cutting measures, such as reductions in the size of analyst teams, further decrease the viability of innovative approaches for long-term risk integration in research departments. Long-term risk assessment may present an opportunity cost for lean analyst teams. Thus, additional research may be unfeasible for overstretched analysts who already cover 15-20 stocks. The European Commission's proposal for an update of the Markets and Financial Instrument Directive, MiFID II (likely effective Jan 2018), will require brokers to charge fees for their research, creating clearer demand and triggering differentiation strategies among research firms. Regulations like MiFID may encourage innovation in equity research.

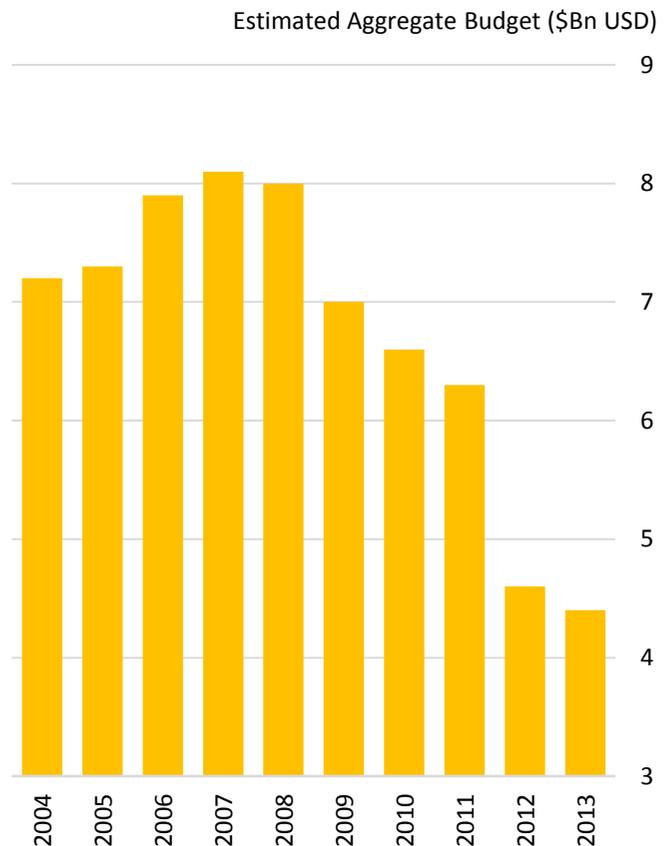
Long-term risk assessment is likely to require the publication of multiple ratings and valuations. The extension of time horizons involves more uncertainty and the use of scenarios. First experiments suggest that these long-term risk assessments will be used by investors to inform 'sensitivity tests' rather than basic asset valuation. They will therefore require the publication of multiple results based on different scenarios, thus adding complexity to analyst reports. Even if a unique scenario is used, the 'long-term' credit rating or a target price is likely to be different from the standard ones, which are primarily designed for short-term investors (see next page). Indeed even if an analyst anticipates a sharp drop in value in 5 to 7 years, it would still make sense to recommend buying and holding the security for the next few months to clients who turn over their portfolio regularly. This increase in complexity is likely to drive communication-related costs up, on top of the additional research costs. It is also likely to face regulatory hurdles given that the recent emphasis of regulations has been on the user-friendliness of the information.

Fig. 61: Equity Trading Commissions Decrease
Trading commissions have decreased since 2009



Source: Greenwich Associates, 2013

Fig. 62: Budget of Sell-Side Equity Research Firms
Sell-side research budgets have decreased since 2007



Source: Frost Consulting, 2013

4.7 A LACK OF DEMAND FOR LONG-TERM ANALYSIS DRIVES SHORT-TERMISM IN THE ANALYSIS

Demand is heavily tilted towards short-term. Our first workshops with sell-side equity research and credit rating analysts suggest that both categories primarily serve investors with short term horizons. For sell-side research, revenue correlates with transaction volume, giving hedge funds and other investors with high trading volume a lion's share of their total revenues despite their relatively lower weight in assets under management. According to our interviews with credit analysts, one rating agency perceived bond traders as their main audience, even though their business model does not depend on audience interest. Another agency viewed their ratings as equally applicable to all types of investors but empirically few truly long-term investors exist.

There is no demand for long-term risk assessment even from long-term investors. Institutional investor stock holding periods have remained flat at around 1.4 years since the 1980s (see Fig. 63).⁶⁵ A 2°ii/Mercer (2016) research on turnover rates of long-only equity fund managers revealed average annual turnover rates of 58%, implying average holding period of 21 months (see Fig. 64). In the bond market, corporate debt is only held for 1.5 years on average (see Fig. 64). The short time horizon of investors therefore offers little incentive for analysts to produce long-term research.

It is unclear whether high portfolio turnover drives the lack of demand for long-term risk assessment or results from it. With investor demand for annual and even quarterly returns, fund managers might not have any appetite for investments spanning multiple years. But, on the other hand, short-term research may decrease the holding period of funds that would otherwise be more long-term.

Fig. 63: Mean Dollar-Weighted Holding Period of Institutional Investors

Institutional investors hold stocks for 1.5 years on average

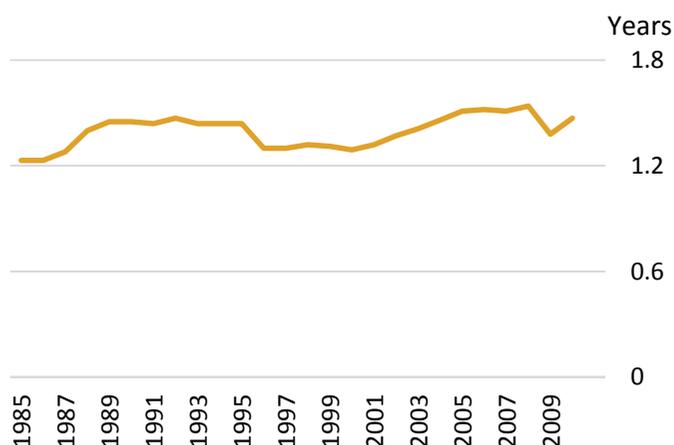
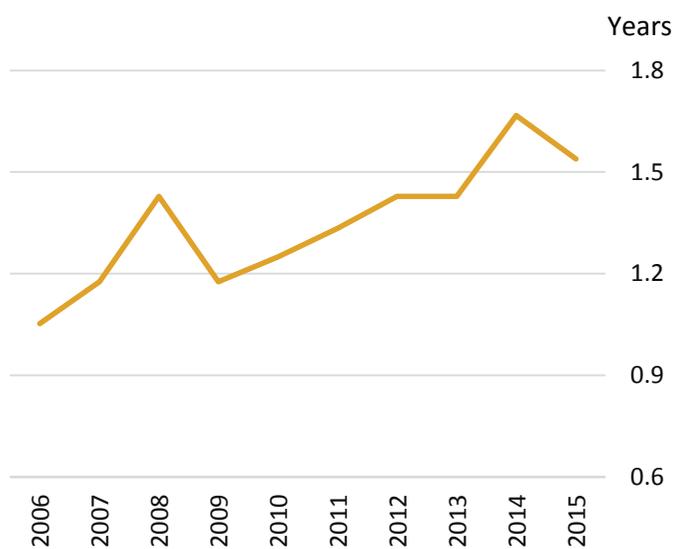


Fig. 64: Average Corporate Bond Holding Period

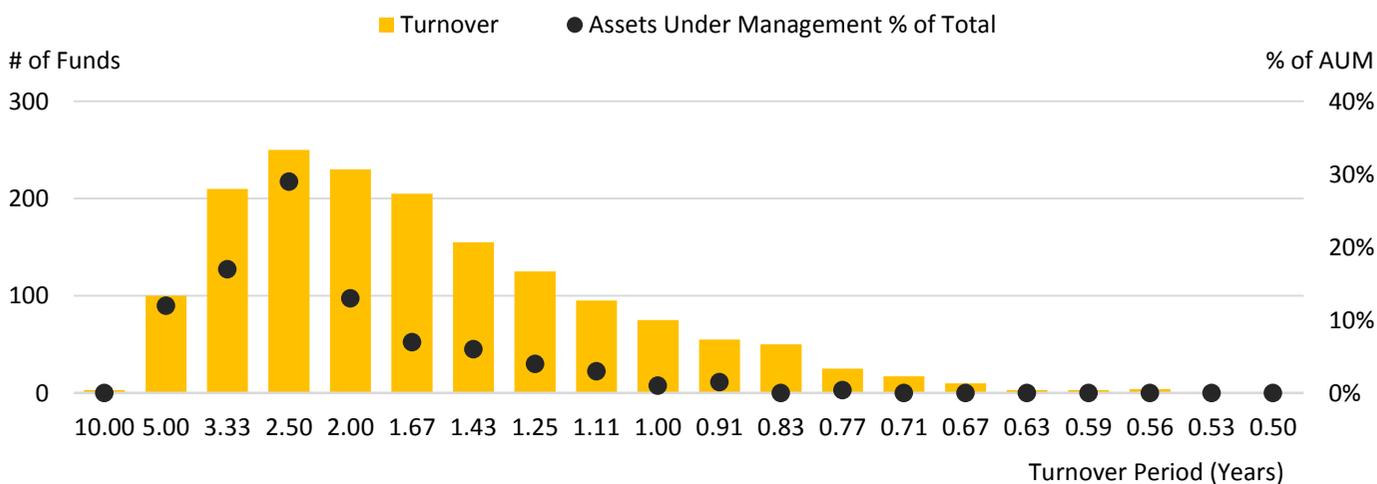
Average corporate bond holding period is 1.5 years



Source: BlackRock 2016

Fig. 65: Portfolio Turnover of Long-only Mutual Fund Managers

The average equity fund manager portfolio holding period is only 1.7 years



Source: 2°ii, Mercer & The Generation Foundation 2017

FEEDBACK FROM INDUSTRY ENGAGEMENT WORKSHOPS: THE DRIVERS BEHIND THE LOW BEAMS

Section	Feedback Summary	Supporting Quotes
CORPORATE DISCLOSURE	<p>Analysts completely agreed that corporate disclosure is insufficient to assess long-term risks to their business models. Existing risk disclosures were criticized for being too high level. Clearly, companies could provide better data on the risk facing their businesses.</p>	<p><i>“A thorough discussion of a small number of key risks would be preferable to a very high-level presentation of all kinds of risk.”</i> - Equity analyst</p> <p><i>“Spending time assessing very long-term risks might be difficult to justify to clients if the risks are not very likely to materialize.”</i> - Senior sell-side equity research analyst</p>
HIGH COST OF ANALYSIS	<p>Analysts partially disagreed with our hypothesis that long-term risk assessment is too costly to pursue. On the buy-side and in credit risk analysis, it would be pursued if it could be done feasibly. There, the issues are more technical. In sell-side research, however, costs are an issue and centralized long-term risk providers could lower costs across the industry.</p>	<p><i>“Given the limited capacities of sell-side analysts, a development of a methodological framework for long-term risk integration may be more likely on the buy-side.”</i> - Managing Director, Sustainable Finance</p>
LACK OF TOOLS FOR LONG-TERM ANALYSIS	<p>Analysts agreed that long-term risk assessment may not work within current methodologies. Valuations or credit risk assessments might require advanced computation that analysts do not currently perform. Further, calculating the probability of a range of scenarios may be outside the scope of current analyst methodologies.</p>	<p><i>“Long-term risk analysis requires the use of sophisticated methods such as Bayesian statistics, this may be too challenging for analysts; further investors may not be prepared to evaluate results based on such analyses.”</i> - Buy-side analyst</p> <p><i>“Our analytics team could analyze scenarios but we don’t do that.”</i> - Credit Risk Officer</p>
DEMAND FOR LONG-TERM ANALYSIS	<p>The lack of demand for long-term risk assessment was controversial. Sell-side analysts indicated that their biggest and fastest growing client base is the hedge fund industry, which pushes analysts to be short-term. Further, several analysts confirmed our view that the lack of demand for long-term analysis is a key obstacle, and highlighted that a push towards longer time horizons needs to come from investors. Yet, managing directors of credit agencies and research firms pushed back on the lack of demand, saying their mandate is to produce the most accurate research. Hence, even if client demand focuses on short-term information, analysts should perform long-term analysis. This contributes to our view that analysts should lead the dialogue on long-term risk assessment.</p>	<p><i>“The highest volume customers of sell-side equity research are hedge funds. This prevents a stronger focus on long-term risks.”</i> - Vice President of ESG Research</p> <p><i>“Asset managers will pay for sell-side research if asset owners ask for it”</i> - Senior Sell-Side Equity Research Analyst</p>

Section	Feedback Summary	Supporting Quotes
ADAPTIVE CAPACITY	<p>Analysts stressed that assessment of adaptability is critical to understanding the long-term. They pointed out that this topic was understudied in our research. A framework for understanding adaptability seems to be missing, though. ESG analysts said that advanced governance metrics, which can be used to assess adaptive capacity to an extent, have been developed but are not widely used. A Buy-side Investment Strategist indicated that analysts commonly assess management quality but that this is only a subset of governance analysis.</p>	<p><i>“Governance is a gateway to assessing environmental and social risks” - Vice President of ESG Research</i></p> <p><i>“Soft indicators such as management quality or risk management practice are sometimes employed to approximate a company’s flexibility or ability to detect impending risks, yet such factors are difficult to incorporate into financial models in a standardized manner.” - Sell-side ESG analyst</i></p>
ESG	<p>Analysts thought that ESG analysis could help close the gap on long-term risk assessment. But there was controversy on whether these assessments could contribute to price targets or credit ratings. ESG sections typically bear no relation to the recommendation so do not solve the long-term equation.</p>	<p><i>“ESG analysis can act as a safe space for analysts to point to long-term risk factors without changing price targets.” - VP of ESG Research</i></p>

PART V
CONCLUSIONS & DIRECTIONS
FOR FURTHER RESEARCH



5.1 CONSEQUENCES

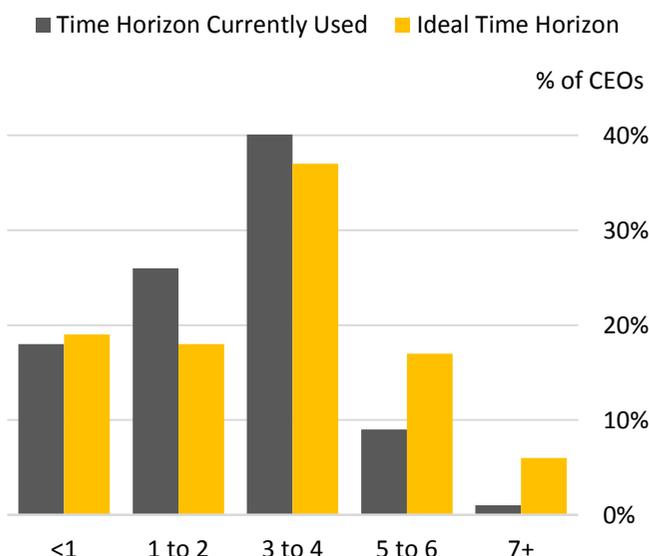
Short-term bias in corporate investment decisions.

The most obvious consequence of this report's findings relates to the pressure faced by corporate managers to focus on short-term value creation at the expense of long-term value creation. Analysts place pressure on managers through their emphasis on short-term performance. The direct consequence is short term bias in corporate capital expenditure decisions and risk management. As evidenced by a Focusing Capital on the Long-term survey, corporate executives make strategic plans over a shorter time horizon than they would ideally employ (see Fig. 66). This mismatch leads to capital misallocation in sectors facing non-linear long-term risks, such as those related to the transition to a low carbon economy.

Mispricing of securities. Our analysis suggests that 70 to 80% of the NPV of listed companies as calculated by analysts is based on extrapolations involving very limited analysis of long-term, non-linear, non-cyclical risks. Since their analysis and recommendations play a key role in the formation of stock prices, this situation is likely to lead to a mispricing of stocks. More precisely, businesses meant to decline due to long-term non-linear risks are likely to be overpriced. This phenomenon is reinforced by the rise of passive investment and 'closet indexing', in which investors replicate or track very closely the composition of cap-weighted stock indexes. Businesses that enjoy a significant market capitalization due to past success and good short-term prospects but are overpriced in light of long-term risks automatically benefit from a strong base of 'blind' owners of their shares.

Fig. 66: Strategic Planning Time Horizons of Corporate Management Teams

CEOs focus on the next 4 years at most



Source: Focusing Capital on the Long-term 2016

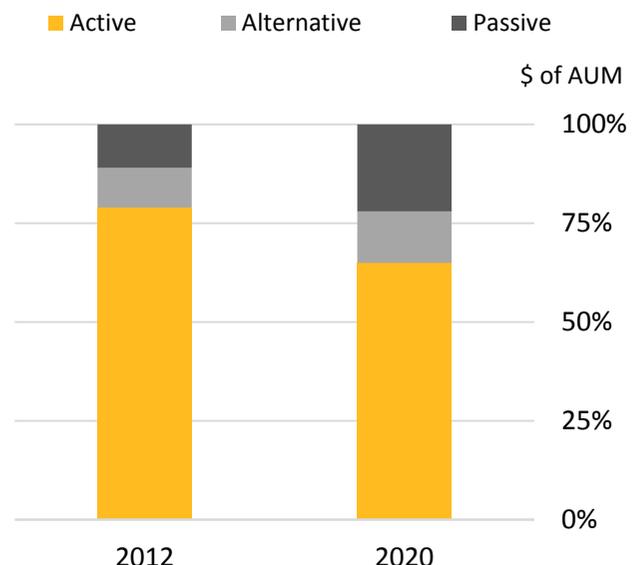
Artificial volatility. This mispricing of securities can lead to the formation of asset bubbles, but also contribute on a more regular basis to the 'artificially inflated' volatility of stock markets: certain risks that can be anticipated and priced in principle are ignored for years, and then can be re-priced suddenly when they are eventually captured by the low beams of financial analysts.

Lack of long-term investment strategies. The other side of the coin is the lack of long-term investment strategy. Investors with long-term liabilities, who have an interest in adopting long-term buy and hold strategies, are encouraged to turn their portfolios over frequently and align their horizon with the horizon of financial analysis. This deprives financial markets of a potential factor of stability.

Lack of monitoring system for long-term risks. Last but not least, the short-term focus of financial analysis leaves governments and financial authorities largely unequipped to assess long-term, non-linear risks. These authorities perform macroeconomic analysis to inform public policymaking and manage financial stability. However, they rely to a very large extent on the infrastructure of private financial analysis (including equity research and credit rating agencies) to deliver the microeconomic risk analysis. This lack of long-term financial analysis has recently been highlighted as it relates to climate-related risks by the Governor of the Bank of England, Mark Carney, and has led the FSB to create the private sector Task Force on Climate-related Financial Disclosures (TCFD). However, the gap in long-term financial analysis might be a broader issue.

Fig 67: Share of Passive Management in Global Assets under Management

Assets are increasingly managed passively



Source: PwC 2014

5.2 DIRECTIONS FOR FUTURE RESEARCH

Extension of this report. This report will be used as an input in a consultation process involving workshops with equity research, ESG research, credit rating agencies and a quantitative online survey. The report will be extended through the research of several key topics in partnership with the financial research industry:

- **Long-term Analyst Best Practice Guide:** Mapping the best practices and avenues for further improvement related to long-term financial analysis as well as the additional cost associated with the extension of the time horizon of analysis. This Best Practice Guide will be produced in concert with analyst industry groups.
- **Corporate Disclosure Report:** Identifying the requirements related to data and corporate disclosure that would provide analysts with sufficient inputs for long-term financial models.
- **Adaptive Capacity Report:** Examining the drivers of adaptive capacity and developing tools for analysts to assess this topic on a more systematic basis.

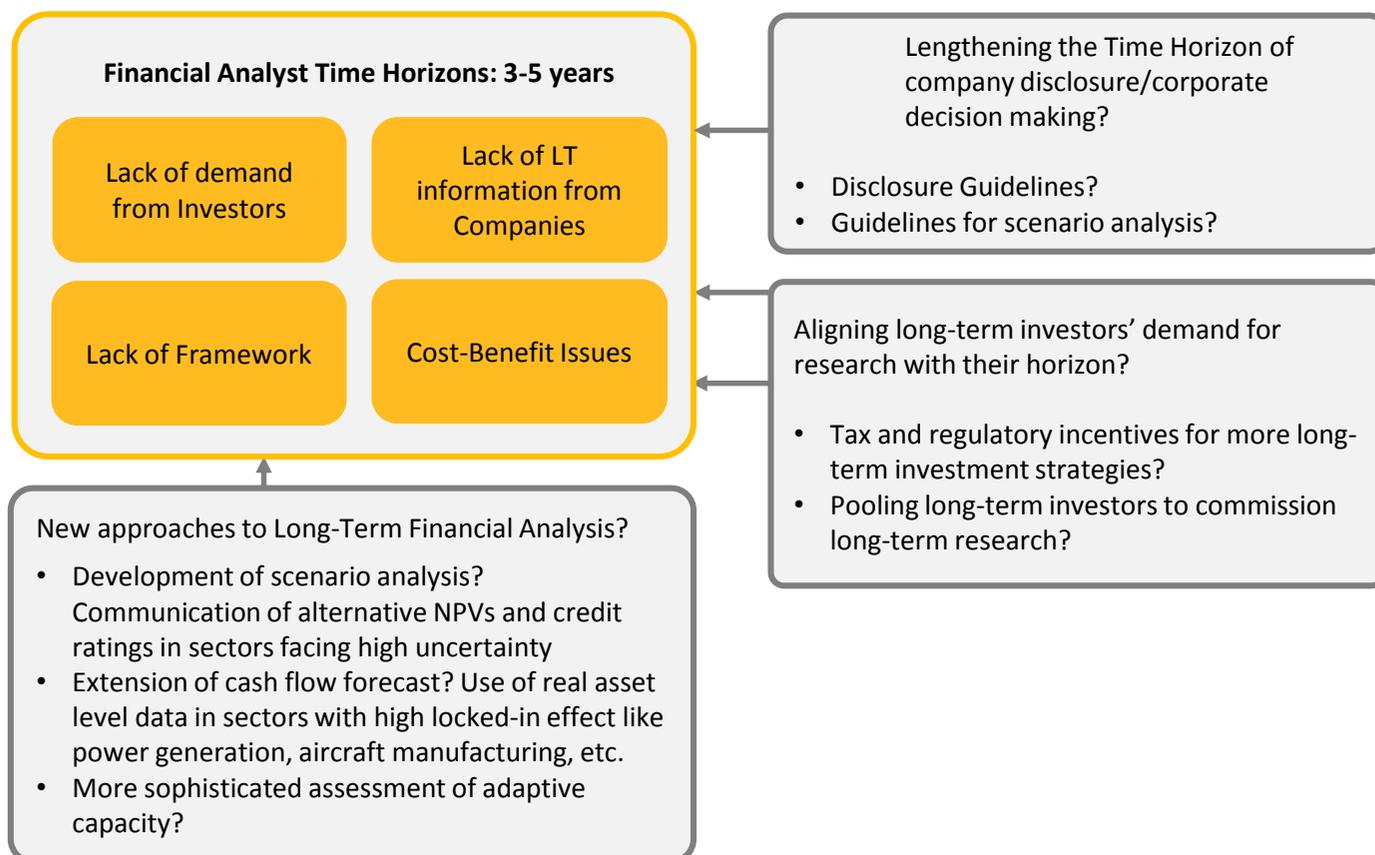
Beyond our own research, we will develop partnerships with academic researchers to further explore certain aspects of this report, notably case studies and the quantitative survey.

Exploring the demand side. A Tragedy of the Horizon report, entitled “The Long and Winding Road: How Long-only Equity Managers Turn Over Their Portfolios Every 1.7 Years,” has been written in partnership with the investment consultancy Mercer. The aim of this report is to further study the practices of equity managers regarding portfolio turnover and the related implications in terms of need for long term analysis. The report finds that even long-term investors turn over their portfolios frequently. Thus, there may be no demand for long-term analysis.

Exploring the implications for corporate decision-making. Another Tragedy of the Horizon report will deal with the decision-making process within companies exposed to long-term risks. The research will focus on the focus of risk management frameworks, risk disclosure and investment decision-making processes. The report will more specifically explore the influence of financial analysis in the shortening of top managers’ horizons.

Fig. 68: Mapping Potential Solutions For Longer-Term Risk Assessment in Financial Analysis

New research methods can extend the time horizon of analysis



Source: Authors

5.3 MAPPING POTENTIAL SOLUTIONS

Pre-mapping for acupuncture therapy. While this paper focuses on the work of financial analysts specifically, the purpose of the broader research project is to connect the dots between the practices of the different players across the investment chain to identify ‘acupuncture points:’ simple actions in different parts of the chain that can trigger bigger changes if they are implemented in a coordinated way. At this stage of the research, the following ‘potential solutions’ should be interpreted as material for further debate rather than recommendations.

Climate risk assessment as a proof of concept. The topic of climate-related risk management is currently gaining traction among investors, financial regulators and financial service providers in the wake of the Paris Agreement and the launch of the Financial Stability Board’s Task Force on Climate-Related Disclosures. Moving forward, we see the developments on this topic (new methodological frameworks, data and rating offers, disclosure frameworks, policies, etc.) as pilot programs: the solutions that will be developed on the climate topic are likely to be applied to other long-term risks such as those identified in Part I.

Figure 69: Potential Solutions for Long-term Risk Assessment in Securities Research

Source: Authors

Target	Potential Solution	Problem Addressed	Solution Mechanism	Ongoing Developments, Research Needs
Equity Research	Long-term Outlook Section in Research Reports	Qualitative risk sections address risks to the price target, which carries a constrained embedded time horizon	Analysts can write risk sections with longer time horizons than their price targets	Morgan Stanley ESG is writing ESG sections for 1,000 reports in 2016. Centralized research on long-term risks beyond ESG might be needed to expand this practice.
	Long-term Price Targets (5+ years)	Equity analysts’ recommendations focus on price movements in the next 12-18 months, thus not providing assessments of long-term performance	Longer-term explicit cash flow analysis using long-term economic roadmaps and longer-term discussions with management	For certain sectors with high inertia (e.g. utilities) real asset-level data can be mobilized. Long-term price targets are set on the buy-side but further research is needed to determine the extent of this practice.
	Sensitivity analysis based on alternative scenarios	Equity analysts’ price recommendations are usually based on a single scenario	Probability distributions of long-term risk scenarios would inform markets about the sensitivity of price targets and recommendations to scenarios that may increase in importance over the long-term	Some analysts currently construct Base, Bull, and Bear cases for stocks in their coverage. On an experimental basis, Bloomberg introduced an interactive DCF with different climate scenarios. Scenarios with multiple variables could produce a probability distribution through a Monte Carlo model. Such statistical methods remain limited in equity research and credit ratings and deserve further research.
Credit Ratings	Alternative Ratings Based on Multiple Long-Term Scenarios	Credit ratings reflect the most likely developments over the next 3-5 years but do not inform about potential credit risk developments over the longer-term	Ratings that are based on various long-term scenarios could inform investors about the sensitivity of their investments to diverse long-term risk trajectories	Moody’s examination of credit implications in various carbon transition scenarios yields insights on scenario specific credit implications on a sector level; currently these scenarios are not translated into alternative rating scenarios for companies (sub-sector level only). Such alternative ratings might be useful in the context of ‘climate stress tests’ currently being developed by central banks (France, UK, NL, etc.).

	Potential Solution	Problem Addressed	Solution Mechanism	Ongoing Developments, Research Needs
Disclosure from issuers	Guidelines for Long-Term Corporate Disclosure	Company reports (e.g. 10Ks) lack a useful reporting on long-term risks and strategies, thus making it difficult for analysts to assess companies' long-term prospects.	Reporting Standards (voluntary or mandatory) that focus on long-term risks and strategies could enhance the time horizon of company disclosure and enhance the usability of long-term metrics by analysts.	Initiatives such as the TCFD or SASB will likely foster long-term disclosure, but solutions focus on climate/sustainability related risks rather than long-term risks in general, and are mostly voluntary to date.
	Guidelines for Company-Level Scenario Analysis	Companies are increasingly employing scenario analyses to assess long-term risk exposure, but scenarios are of limited informational value for analysts	Guidelines or Best-Practice Handbooks could help companies to conduct scenario analyses that are not only useful for their own long-term decision making but are also usable by financial analysts	The TCFD currently explores the use of scenarios by companies and will likely make suggestions for improvement; further research is needed to expand the scope beyond climate related risks
Business Model of financial analysis	Fee Structure For Equity Research Reports	Sell-side research reports are currently free of charge. This incentivizes sell-side analysts to focus on clients that trade frequently	Charging an explicit fee for research reports could shift analysts' attention to clients with a lower trading volume and longer-time horizons, and create a niche market for long-term risk assessment.	In Europe in 2018, MiFID 2 will likely introduce a fee structure for research reports. More research is needed to explore the pros and cons of various business models for financial analysts
	Investor-pay or government pay model for credit rating	In an issuer-pays model, there is no incentive for the issuer to ask for ratings based on alternative adverse scenarios	The emerging demand from regulators and a niche of investors might create an emerging demand for such <i>alternative ratings</i>	Both S&P and Moody's are currently exploring the development of new climate-change risk related products which may be based on an investor-pays model.
Boost demand from investors	Long-term Dividends	Long-term value is not adequately represented by returns	Companies can offer long-term shareholders a higher dividend than short-term shareholders. ⁶⁶	Long-term Stock Exchange (LTSE) is exploring incentives for long-term shareholders
	Pooling Budget for Long Term Research	The large number and heavy weight of investors with long-term liabilities does not create explicit demand for long-term external analysis, due to the short term focus of most portfolio strategies	Long-term asset owners increasingly express their concerns regarding the mispricing of climate change risks by financial markets, but they do not pay for proper financial analysis on the topic or other long term risks.	A potential solution could be to pool budgets to finance the development of research capacity on selected long-term risks to inform buy-side research, in line with what happened with ESG research about 10-15 years ago.
	Tax incentives for long-term investing strategies	Even 'long-term' investors frequently turnover their portfolios every 1-3 years creating a lack of demand for long-term risk assessment	In several countries, tax schemes attempt to explicitly incentivize long-term investing including lower capital gains tax for long-term shareholders.	This issue has not been studied comparatively across countries. 2 ⁱⁱ and the French government plan to release a report on how the French tax scheme influences long-term investment in 2017.

5.4 CONCLUSIONS

Securities research largely ignores risks materializing beyond 3-5 years. Valuation models used in equity research typically have a 'time horizon' of no more than 3-5 years and recommendations focus on the next 12 months. Credit risk assessments can extend beyond that horizon, but ratings actions are unlikely to follow from risks likely to materialize beyond 3-5 years. Non-linear, long-term risks (White Swans in the Dark) materializing outside of this focus are, therefore, unlikely to be reflected in current equity valuations and credit ratings. The development of long-term analysis seems technically feasible but faces a number of methodological, data-related, and commercial hurdles.

The focus of financial analysis is disconnected from the horizon associated with investors' liabilities. A large share of assets under management is owned by long-term investors with an average horizon exceeding 10-15 years. Our findings suggest that current financial analysis for stocks and corporate bonds is not designed to help these investors optimize their returns over such long-term horizons without high portfolio turnover.

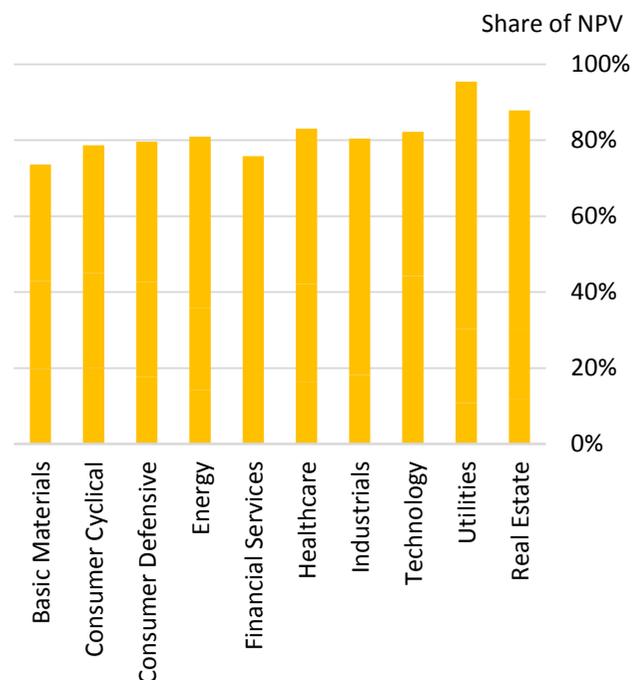
The focus of financial analysis is disconnected from the 'window of materiality' of the securities. In most sectors more than 70% of the net present value of a company is based on long-term cash flows, reflecting the long-term nature of the underlying physical and intangible assets (Figure 70). Similarly, for most corporate bonds, the value derives from cash flows beyond 5 years (Figure 71). These findings suggest a substantial disconnect between the analysts' focus and management's focus with regard to value creation and risk management.

Most fund managers do not want more long-term research, however. Analysts' 3-5 year focus is consistent with the holding period of most investors. The average holding periods for equity and bond investors are only 1.7 and 1.5 years, respectively (see page 60). Even the longest-term compensation for buy-side equity research analysts extends only to 5 years. Our preliminary findings therefore suggest that there is little incentive for long-term risk assessment, if any.

Thus, analysts' ability to fix these disconnects is constrained. Even if analysts asked better questions to company management and developed tools to create long-term forecasts, they would not necessarily become more successful immediately. Analysts would need superior data from companies and increased client demand for long-term analysis. Further research will be needed to assess how these factors can be aligned with investor interests.

Fig. 70: Share of Net Present Value beyond 5 years in Morningstar DCF Models by Sector

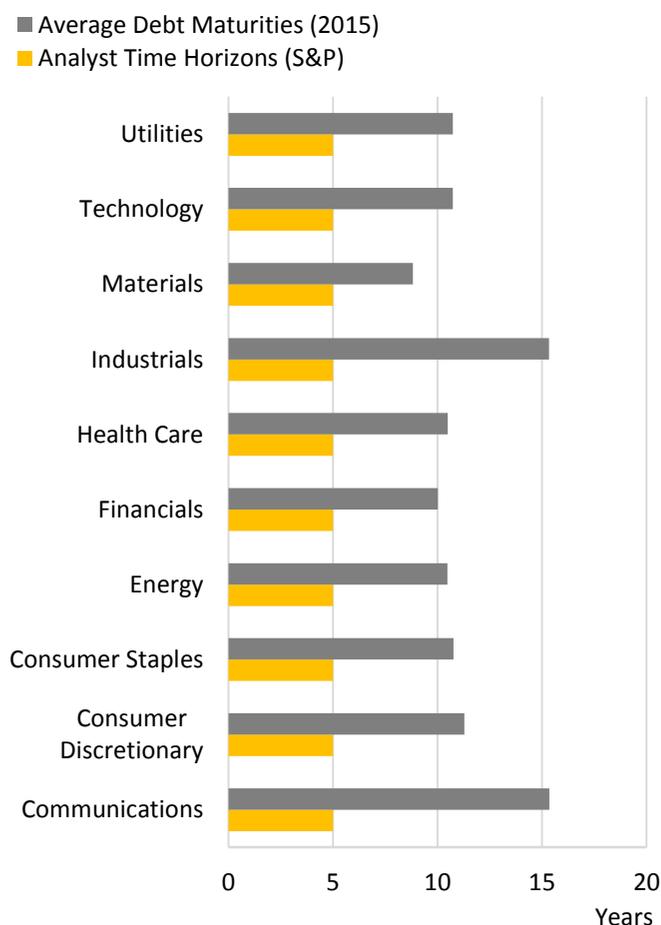
Long-term cash flows constitute the majority of NPV



Source: Authors from Morningstar DCF Models 2016

Fig. 71: Time Horizon Gap for Credit Analysts based on Maturity of Debt

Credit analysts should align their time horizon with the maturity of bonds



Source: Authors from Bloomberg 2015

ENDNOTES

PART I: WHITE SWANS MAY LOOK BLACK IN THE DARK

- ¹Papakroni, Jorida, The Dispersion Anomaly and Analyst Recommendations, SSRN, 2012.
- ²Hong, Harrison et al., "Security Analysts' Career Concerns and Herding of Earnings Forecasts," RAND Journal of Economics Vol. 31 No. 1, Spring, 121-144, 2000.
- ³Moody's Investor Services, "A Comprehensive History of the Performance of Moody's Corporate Credit Ratings," 2015; S&P Ratings Services, "Guide to Credit Ratings Essentials," 2015
- ⁴Moody's Investor Services, "A Comprehensive History of the Performance of Moody's Corporate Credit Ratings," 2015.
- ⁵Moody's Investor Services, "A Comprehensive History of the Performance of Moody's Corporate Credit Ratings," 2015; S&P Ratings Services, "2015 Annual Global Corporate Default Study and Rating Transitions," 2015.
- ⁶Moody's Investor Services. "Corporate Default and Recovery Rates, 1920-2015," 2015; S&P Ratings Services "2015 Annual Global Corporate Default Study and Rating Transitions," 2015.
- ⁷Moody's Investor Services. "Analyzing the Tradeoff Between Accuracy and Stability: Special Comment," 2007
- ⁸Moody's Investor Services. Glossary of Moody's Ratings Performance Metrics, 2011. In some cases stability measures do not capture the full volatility and magnitude of ratings changes. Common stability measures such as upgrade/downgrade and transition rates are calculated based on the net change in ratings over a given time period. In these cases intra-period ratings changes are excluded, potentially underestimating actual volatility. Further, when ratings are both upgraded and downgraded within a time period only the net impact is recorded, which obscures the magnitude of the individual movements. ²ii research based on S&P ratings changes indicates that stability metrics calculated in this way do somewhat understate intra-period volatility and the magnitude of changes.
- ⁹Moody's Investor Services, "Analyzing the Tradeoff Between Accuracy and Stability: Special Comment," 2007; Moody's Investor Services, "A Comprehensive History of the Performance of Moody's Corporate Credit Ratings," 2015.
- ¹⁰Taleb, NN. The Black Swan: The Impact of the Highly Improbable. New York: Random House. 2007.
- ¹¹Sikich, GW, "Are we seeing the emergence of more White Swan events?" Logical Management Systems, Corp. 2010.
- ¹²Thamotheram, Raj. Preventable Surprises. 2016
- ¹³CERES, ² Investing Initiative, Energy Transition Advisors and Carbon Tracker Initiative. "Carbon Asset Risk: from rhetoric to action." 2015; WRI and United Nations Environment Programme Finance Initiative. "Carbon Asset Risk: Discussion Framework." 2015; Task Force on Climate-Related Financial Disclosures: "Phase 1 Report of the Task Force on Climate-Related Financial Disclosures." 2016 PRI/UNEP, "Greening Institutional Investment, 2015.
- ¹⁴Furman, Jason, "Is This Time Different? The Opportunities and Challenges of Artificial Intelligence," 2016.
- ¹⁵Analysis Group, "Global Economic Impacts Associated with Artificial Intelligence," 2016.
- ¹⁶Analysis Group, "Global Economic Impacts Associated with Artificial Intelligence," 2016.
- ¹⁷Barclays Research Insights, "Disruptive Mobility: A Scenario for 2040," 2015.
- ¹⁸"VW Presentation in '06 Showed How to Foil Emissions Tests, New York Times, 2016.
- ¹⁹"Volkswagen Says 11 Million Cars Worldwide Are Affected in Diesel Deception," New York Times, 2015.
- ²⁰"Volkswagen Test Rigging Follows a Long Auto Industry Pattern," New York Times, 2015.
- ²¹"White House to Toughen Fuel Standards for Heavy-Duty Vehicles," New York Times, 2014; US Sets Higher Fuel Efficiency Standards," New York Times, 2012; Heavy Trucks to be Subject to New Rules for Mileage; New York Times, 2011; "Obama Mandates Rules to Raise Fuel Standards," New York Times, 2010.
- ²²Volkswagen Test Rigging Follows a Long Auto Industry Pattern, New York Times, 2015.
- ²³International Council on Clean Transportation, From Laboratory to Road, 2013.
- ²⁴International Council on Clean Transportation, From Laboratory to Road 2014 Update, 2014.
- ²⁵European Federation for Transport & Environment, "Realistic real-world driving emissions tests: the last chance for diesel cars?," 2015.
- ²⁶Peabody Energy 10-K, 2011.
- ²⁷EIA, US Natural Gas Gross Withdrawals.
- ²⁸Carbon Tracker Initiative, "US Coal Crash: Evidence for Structural Change, 2015," pages 26-27.
- ²⁹EIA, US Natural Gas Gross Withdrawals.
- ³⁰Carbon Tracker Initiative, "US Coal Crash: Evidence for Structural Change, 2015," pages 26-27.
- ³¹Resources for the Future, Review of Shale Gas Development in the United States, 2013, pages 14-16.

- ³²Carbon Tracker Initiative, “US Coal Crash: Evidence for Structural Change,” 2015, pages 26-27.
- ³³Morningstar Direct: Corporate Credit Ratings.
- ³⁴McLean, B; Nocera, J, *All the Devils Are Here: The Hidden History of the Financial Crisis*. 2010.
- ³⁵Nicolais, T, “How to Use Real Estate Trends to Predict the Next Housing Bubble,” Harvard Division of Continuing Education, 2014.
- ³⁶Moody’s Investor Service, “Testimony of Raymond W. McDaniel Chairman and Chief Executive Officer of Moody’s Corporation And Yuri Yoshizawa Senior Managing Director Moody’s Investors Service before the United States Senate Permanent Subcommittee on Investigation,” 2010.
- ³⁷Business Insider, “10 million self-driving cars will be on the road by 2020.” 2016.
- ³⁸Lux Research, “Self-driving Cars and \$87 Billion Opportunity in 2013, Though None Reach Full Autonomy,” 2014.
- ³⁹The Boston Company, “Automobiles and the Age of Autonomy,” 2015; ELP, “Self-driving Cars: Disruptive vs. Incremental,” 2014.
- ⁴⁰Institute of Mechanical Engineers, *Autonomous and Driverless Cars*, 2016.
- ⁴¹The Boston Company, *Automobiles and the Age of Autonomy*, 2015.
- ⁴²Schoettle, B et al., “Potential Impact of Self-Driving Vehicles on Household Vehicle Demand and Usage,” 2015.
- ⁴³Public Citizen, *Price-Anderson Act: The Billion Dollar Bailout for Nuclear Power Operators*, 2004.
- ⁴⁴Schoettle, B et al. “Potential Impact of Self-Driving Vehicles on Household Vehicle Demand and Usage,” 2015.
- ⁴⁵Public Citizen, “Price-Anderson Act: The Billion Dollar Bailout for Nuclear Power Operators,” 2004.
- ⁴⁶SlickCharts, MSCI World Index as of Feb 28, 2016.

PART II: THE RATIONALE FOR LONG-TERM ANALYSIS: EXPOSING THE WINDOW OF MATERIALITY

- ⁴⁷Ocean Tomo, “Annual Study of Intangible Asset Market Value from Ocean Tomo, LLC,” 2015.

PART III: HOW FINANCIAL ANALYSTS EQUIP INVESTORS WITH LOW BEAMS

- ⁴⁸Damodaran, Aswath, *The Dark Side of Valuation: Valuing Young, Distressed and Complex Businesses*, Upper Saddle River, NJ: FT Press, 2009.
- ⁴⁹Maubossin, Michael, “Common Errors in DCF Models,” Maubossin on Strategy, 2006.
- ⁵⁰Damodaran, Aswath, *The Dark Side of Valuation: Valuing Young, Distressed and Complex Businesses*, 2009.
- ⁵¹S&P Global Ratings, “The Time Dimension Of Standard & Poor’s Credit Rating,” 2010.
- ⁵²Fitch Ratings, “Inside the Ratings: What Credit Ratings Mean,” 2007.
- ⁵³S&P Global Ratings, “ESG Risks In Corporate Credit Ratings – An Overview,” 2015.
- ⁵⁴Moody’s, “Moody’s Approach to Assessing the Credit Impacts of Environmental Risks,” 2015.
- ⁵⁵S&P Global Ratings, “Guest Opinion: How Asset Level Data Can Improve The Assessment Of Environmental Risk In Credit Analysis,” 2016.

PART IV: THE DRIVERS BEHIND THE LOW BEAMS

- ⁵⁶Brown et al., “Inside the Black Box of Sell-side Financial Analysts,” *Journal of Accounting Research*, 2015.
- ⁵⁷Brochet, F; Loumiotis, M; Serafeim, G, “Speaking of the short-term: Disclosure Horizon and Capital Market Outputs,” 2014.
- ⁵⁸Kepler Chevreux, “The Responsible Investor Playbook,” 2016. Not published.
- ⁵⁹S&P Global Ratings, “Proposal For Environmental, Social, And Governance (ESG) Assessments,” 2016.
- ⁶⁰Morgan Stanley, “Embedding Sustainability into Valuation: Global Framework for Analyzing ESG risks and Opportunities,” 2016. Not public.
- ⁶¹TCFD, Phase I Report of the Task Force on Climate Related Financial Disclosures, 2016.
- ⁶²Kepler Chevreux, “The Responsible Investor Playbook,” 2016. Not Published; Posner, Kenneth, *Stalking the Black Swan: Research and Decision Making in a World of Extreme Volatility*, 2010.
- ⁶³Financial Times, “Equity research undergoes big structural changes,” 2014.
- ⁶⁴Sautner, Zacharias, Martijn Cremers, and Ankur Pareek, “Stock Duration and Misvaluation.” Presented at the Society for Financial Studies Cavalcade and Geneva Summit on Sustainable Finance, 2013.
- ⁶⁵McKinsey and CPPIB, “Short-termism: Insights from Business Leaders,” 2013.

PART V: CONCLUSIONS AND DIRECTIONS FOR FURTHER RESEARCH

- ⁶⁶Generation Foundation, Mercer, and Stikeman Elliott, “Building a Long-Term Shareholder Base: Assessing the Potential of Loyalty-Driven Securities,” 2013.

GENERAL INDUSTRY FEEDBACK

The key findings of this paper received support from across the equity research and credit rating industries. The workshops included 150+ equity research firm and credit rating agency representatives, including both analysts and managers from 30+ institutions (see page 4).

Equity Research. The findings of the equity research portion were largely validated by the industry; analysts and managers agreed that the focus of analysis is short-term (typically limited to 3-5 years). However, the proposed solutions to this problem were somewhat more contentious. For instance, the technical feasibility and the associated cost-benefit of pursuing methodological improvements to existing valuation techniques remains to be seen. Moreover, the models are only part of the story; herd mentality and confirmation biases among analysts can have a bigger impact on the embedded timeframe and value of price targets than the models themselves. Further, some industry participants placed the burden on analysts to develop new solutions, while others cited the lack of client demand from investors themselves as a major obstacle to undertaking longer-term analysis.

Credit Rating. On the credit rating side, our findings were more contentious. Some credit rating agency managers acknowledged the 3-5 year focus of the analysis, stressing that ratings are intended to be 'dynamic' and will change before long-term risks materialize. On the contrary, others disputed our framing of a short-term time horizon altogether, arguing that they do have a long-term focus and incorporate long-term risks as far as it is allowed by the availability of data from issuers and the general uncertainty that increase on the long term. Thus, our paper has not gained universal validation in the credit ratings industry.

Some respondents chose not to be quoted. The quotes from those who accepted are presented below:

"For years, the industry has been peeling back the layers of the long-term investing onion. This report makes a significant contribution in interrogating time horizon considerations in sell-side financial analysis, and presents practitioners with some noteworthy challenges and opportunities. Contemplating and pricing risk in new ways is critical, given the growing and changing nature of global risks."

Jane Ambachtsheer, Partner, Mercer Investments

"Investors and financial industry leaders are increasingly recognizing the need to adopt to a longer-term investment focus. This much needed report helps provide the missing tools and incentives to get there."

Stephen Freedman, Head of Thematic & Sustainable Investment Strategy, UBS

"S&P Global Ratings shares common vision to enhance the systematic and transparent considerations of long-term risk factors, such as ESG, in the assessment of creditworthiness. In this regard, we welcome the opportunity to collaborate with the 2 Degrees Investing Initiative among others to help better identify and understand such risks"

Mike Wilkins, Managing Director, Environmental & Climate Risk Research, S&P Global Ratings

"This is an impressive report that sheds light on how endemic short-termism in financial analysis can result in stranded assets. Significant value will be lost and opportunities missed unless these biases are addressed proactively by financial institutions. Doing so will also help to make finance better aligned with global environmental sustainability."

Ben Caldecott, Director of the Sustainable Finance Program at the University of Oxford

CONTINUED OVERLEAF

GENERAL INDUSTRY FEEDBACK (CONT.)

“Every risk manager knows that ignoring a risk doesn’t make it disappear. That’s why it’s so important to find the right assessment tools to identify and characterize long-term risks so investors are more aware and accountable for their investment decisions. The findings of this report enlighten everyone about the current lack of long-term risk-assessment, and we look forward to building on the recommendations to help secure a more sustainable allocation of capital for a decarbonized future”

Romain Poivet, Climate Program Officer at the French Environmental & Energy Agency

“This report reveals why most investors miss obvious technological innovation and societal signals that lead to trillions in losses. Investors who ignore the recommendations from this report put both the planet and their profits at risk!”

Ian Monroe, President at Etho Capital

“With ‘All Swans Are Black in the Dark’, the 2° Investing Initiative & The Generation Foundation have made an important contribution to understanding how long-term investors can better manage their exposure to long-term risks and balance these with the short-term risks their portfolios face every day. In particular, their suggestion that incorporating scenario analyses into the investment process, promises to help address the difficult challenge of managing the risks investors’ cumulative decision-making poses to the broad systems – environmental, societal, and financial – upon which their investments depend.”

Steve Lydenberg, Partner at Domini Social Investments

“Through sophisticated graphics and careful research, this report illuminates challenges and solutions to avoiding the Tragedy of the Horizon. It’s consumable by leaders of a variety of backgrounds and thus is poised to influence better-informed financial analysis that results in forward looking projects for our stronger future.”

Joyce Coffee, President of Climate Resilience Consulting

“By understanding the key characteristics or risks that are incorrectly or only partially priced by the market, research analysts are able to focus on a smaller set of themes which are likely to be financially relevant. This in turn supports the development of targeted tools to complement financial modelling, such as scenario analysis or intangible asset valuations. This report and the Tragedy of the Horizons project makes a valuable contribution in this respect.”

Julie Raynaud, Senior Research Analyst at Kepler Cheuvreux

“With this report, the 2° Investing Initiative and The Generation Foundation perfectly sum up – in a very clear, comprehensive way – the issues faced by investors for long-run analysis and risk-assessment. As such, this report makes an important contribution to the debate on long-term risk-assessment, providing helpful solutions to position ourselves against not only the threats of climate change, but other sustainability and financial risks and opportunities of the future.”

Valery Lucas-Leclin, President & Founder of Grizzly Responsible Investment



2dii and The Generation Foundation welcome comment and discussion on this study. For more information please visit www.tragedyofthehorizon.com

CONTACT:

Mona Naqvi, Program Manager

mona@2degrees-investing.org

www.2degrees-investing.org

205 E 42nd Street, 10017 NY (M Grand Central)