





STRESS-TESTING ALIEN INVASION

ARE FINANCIAL MARKETS MISPRICING THE BIGGEST SYSTEMIC RISK EVER?

"Five kinds of extreme environmental risks exist (...) An invasion by non-peace seeking aliens that seek to remove the planet's resources or enslave/exterminate human life." TOWERS WATSON, GLOBAL INVESTMENT CONSULTING FIRM, 2014

"Extra-terrestrial environmentalists could be so appalled by our planet polluting ways that they view us as a threat to the intergalactic ecosystem and decide to destroy us" NASA & PENNSYLVANIA UNIVERSITY 2011

"And yet I ask you, is not an alien force already among us?"
RONALD REAGAN IN A SPEECH TO THE UNITED NATIONS, 1987

"Where are they?"
NICK BOSTROM, PROFESSOR OXFORD UNIVERSITY, 2016

"Earth could be at risk from massive ships which could try to colonise our planet and plunder our resources" STEPHEN HAWKING, 2014

This report is the first report of the FERMI'nvesting Initiative (Fii), the research program launched by the 2° Investing Initiative designed to track financial risks related to the invasion of aliens, in partnership with Extra Terrestrial Advisors (ET Advisors), the leading consultancy on aliens risks.

Authors: Jakob Thomä, Stan Dupre.

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Bill Clinton: Aliens exist in Area 51 | UFO Sightings



Obama's Last Comments About Aliens

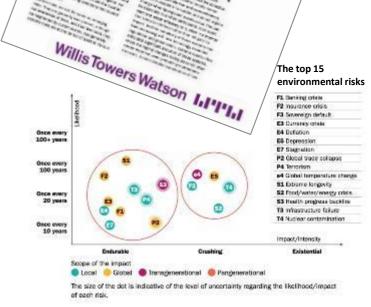
Reagan's ALIEN speech to UN

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MAINSTREAM INVESTMENT CONSULTANTS WARN ABOUT ALIENS RISK. There is a growing body of evidence that an alien invasion is increasingly likely. Leading policymakers (Ronald Reagan, Barack Obama), industry leaders (Elon Musk), academic experts (Stephen Hawking), and investment consultants (Towers Watson¹) have flagged the potential threat this risk may create to both civilization generally and financial portfolios specifically. Towers Watson for example, a leading global investment consultancy, has identified alien invasion as one of the top 5 extreme environmental risks.

RISK OF SHORT TERM MATERIALIZATION. These experts conclude that not only is an alien invasion likely to happen at some point in the future, there is a growing probability that it will occur in the near future². One notable piece of evidence for this is the fact that even though we barely have achieved manned space travel to the moon, we are actively sending out radio signals trying to contact aliens³. As highlighted by the President of the United States Donald Trump, such activities are "bad", although Donald Trump also claimed that "we have the best signals! Nobody signals better than us."



¹⁻https://www.towerswatson.com/en-AU/Insights/Newsletters/Global/emphasis/2014/pandemic-and-alien-invasion-not-on-your-radar and alien-invasion-not-on-your-radar and alien-invasion-your-radar and alien-invasion-not-on-your-radar and alien-your-radar and alien-your-radar and alien-your-radar and alien-you

^{2 -} Notably see how the rise of artificial intelligence is likely to trigger alien invation: http://waitbutwhy.com/2015/01/artificial-intelligence-revolution-2.html

^{3 -} Details as to the impact of Trump's proposed budget cuts on these type of activities at this stage have not been disclosed and thus have not been considered in the analysis

MISPRICING BY FINANCIAL MARKETS. Despite this growing body of evidence around the risk, an analysis of current financial risk models and investment processes suggest that these risks are currently not integrated into investment decisions¹. One prominent piece of evidence for this is the relatively low volatility given these potentially seismic impacts. Moreover, as highlighted later in this report, existing asset allocation strategies and benchmark indices may actually overweight highly exposed sectors and asset classes.

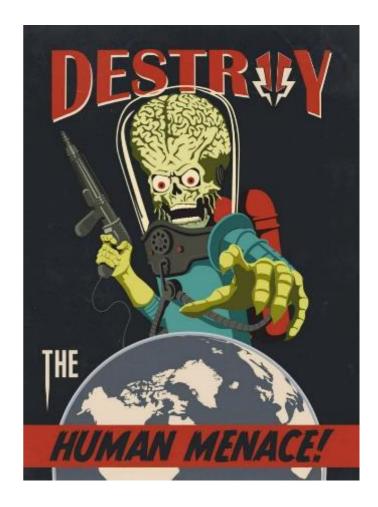
CLIMATE-RELATED RISKS DISTRACT INVESTORS. While an analysis of publicly available risk models suggests little traction among institutional investors, this may be in part due to the growing attention on climate change issues, which impacts their ability to address other long-term risks. Our analysis suggests that despite this potential 'distraction', the similarities between the risks (e.g. the need for carbon footprinting, litigation risks, climate change as a risk driver) may suggest transferability of learnings and economies of scale.

RATING AGENCIES TO BE BLAMED. One key gap is the fact that research is lacking (for both credit and equity) on the potential magnitude of the risks associated with an alien invasion, in particular with regard to the question which asset classes and sectors are likely to be particularly affected. This report represents the first attempt to quantify these risks. It concludes that, should an alien invasion occur, this is likely to create systemic risk for financial institutions and a high degree of stranded assets (as well as potential stranded aliens).

CARBON FOOTPRINT AS A FIRST STEP: Given the expected magnitude of these risks should they occur, we call for:

- **Carbon footprinting** of investment portfolios. It is not exactly a risk metric for alien risk exposure, but can be used as a proxy and a first step towards proper risk analysis³.
- The integration of alien invasion risk into mandatory **stress**tests by central bank.
- The launch of a civil society led Aliens Finance Dialogue to discuss these issues, support NGOs working on the topic on strategy and communication.
- The launch of a **Task Force on Aliens-related Financial Disclosures** (TAFD chaired by William Smith).
- The introduction of Art. 51 legislation for company and financial institutions reporting on alien risks (already mandatory in Nevada, discussed by the new US administration).

The report is organized as follows will first discuss the evidence of why we think an alien invasion and why it may happen soon. It will then present our current knowledge about alien invasions scenarios and subsequently present the first attempt to quantify these risks. The conclusion will discuss key recommendations.

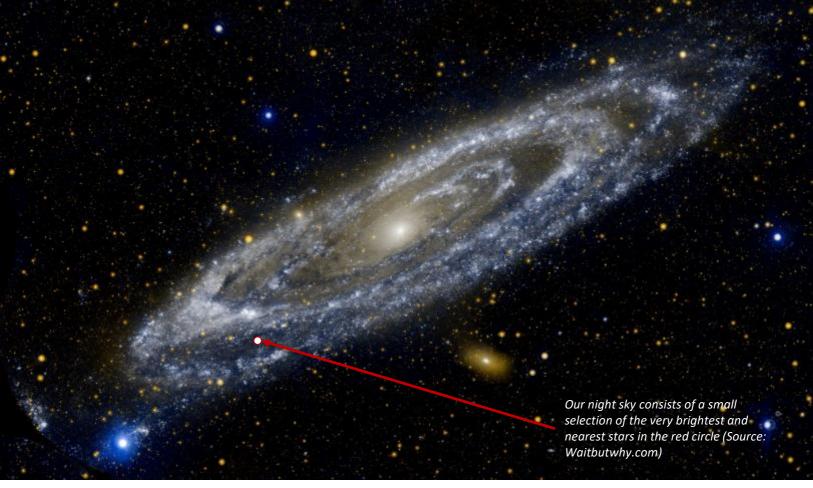


Extreme environmental risks are threats to human safety and well-being arising from a disruption to planet Earth's environment. Two of these risks (alien invasion and cosmic threats) are exogenous to Earth and largely beyond our control (...) In considering our list of environmental risks, one could easily question the seriousness of including alien invasion. We would respond to this question by suggesting that risk management is planning in advance the actions one would take in response to events, and the value of the exercise is in scanning the horizon with the broadest possible mind. At the assessment stage, it is likely that many organizations might have filters that would work to drop alien invasion from further consideration.

WILLIS TOWERS WATSON, 2014²

 $^{2. \} https://www.towerswatson.com/en-AU/Insights/Newsletters/Global/emphasis/2014/pandemic-and-alien-invasion-not-on-your-radar and alien-invasion-not-on-your-radar and alien-invasion-not-on-you$

^{3.} See draft report from TCFD on recommended metrics for asset owners and asset managers

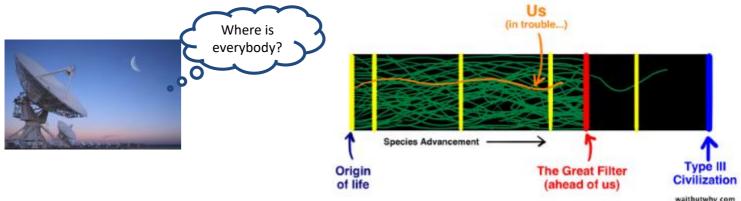


WHY AN ALIEN INVASION IS LIKELY AT SOME POINT?

POINT-IN-TIME RISK. While the private and public sector – at least publicly – largely turn a blind eye to the risk of an alien invasion, a survey of scientists working on potential life on other planets suggest a consensus rivalling that on climate change that an alien invasion is likely to occur at some point in the history of planet Earth. Indeed, the confusion in the academic literature is not as to *whether* this will happen or not, but why it hasn't already happened¹.

FERMI PARADOX. This confusion is generally labelled the "Fermi Paradox", developed by the nuclear physicist Enrico Fermi. The basis of this assumption is that there are about 100 to 400 billion stars in our galaxy alone, and perhaps the same number of galaxies in the universe. This comes to a generally accepted range in the academic literature of 10^{22} to 10^{24} total stars (about 10,000 for every grain on sand on earth). Among these stars, around 5-20% are sun like, so a bare minimum of 500 billion billion. Adding assumptions around what percentage of sun-like stars are linked to earth-like planet, we end up with a conservative assumption of 100 billion earth like planets (100 for every grain of sand). If only on 1% of these planets life advances to intelligent civilizations, there are 10 million billion intelligent civilizations in the universe.

WHERE IS EVERYBODY? There are a range of theories as to why we haven't been contacted yet, a number of which suggest that our current situation on earth means its likely we will be contacted soon. Indeed, according to the scientific website waitbutwhy.com, arguable the only other two options are that we are unique in overcoming a 'great filter' related to civilizational development (unlikely) or that we are close to hitting the 'great filter' and thus extinction (see Fig. on bottom right). Barring one of those options, it seems contact with aliens is likely to happen in the near future.





WHY IT IS LIKELY TO HAPPEN SOON?

TIPPING POINT. There are a number of reasons why an alien invasion is likely to happen soon:

- Artificial intelligence. Aliens have been monitoring us to date and haven't bothered contacting us until we are near interstellar space travel. Given the likelihood of the development of artificial intelligence and super artificial intelligence in the next few decades, we are likely to be perceived as a threat in the near future, which may trigger a pre-emptive invasion¹;
- **Global warming**. As outlined by NASA, climate change may trigger both signals to aliens regarding technological progress and anger them given our negative impact on the intergalactic ecosystem (linked to this is also the trash we start to put into space, notably out of service satellites). This may trigger an invasion (*NB*: While not the core focus of this paper, this risk is bizarrely ignored in the categories of risks described by the Financial Stability Board's Task Force on Climate-Related Financial Disclosures, an issue highlighted as part of the consultation process by the 2° Investing Initiative);
- Sending signals. We are sending out radio signals to space seeking to contact aliens (NB: As will be outlined later in the report, initiators of such signals and the companies providing technology to support this work may be subject to litigation risk should these contact attempts prove successful and trigger an invasion).

EARLY SIGNS. In addition to these potential tipping points, there are growing early signs suggesting that the invasion is about to start. One example identified by scenarios is to weaken the ability of the governments to develop a coordinated response. In this respect, research suggest that Brexit, and the US elections, may be linked to external tampering.³ Based on the open-source, IP-rights free models produced by Fii, estimation of the probability of risks within the next 10-20 years is between 0.2%-87.1%. Given the apparent growing urgency with regard to this topic, the key next question is – when the invasion does take place – how it is likely to play out. The blaming of Russia in the context of the US election may – following this line of thinking – constitute a sophisticated decoy.

Humanity may just now be entering the period in which its rapid civilizational expansion could be detected by an Extra-Terrestrial *Intelligence because our* expansion is changing the composition of Earth's atmosphere (e.g. via greenhouse gas emissions), which therefore changes the spectral signature of Earth. While it is difficult to estimate the likelihood of this scenario, it should at a minimum give us pause as we evaluate our expansive tendencies. NASA/PENNSYLVANIA UNIVERSITY, 2011¹

1. http://waitbutwhy.com/2015/01/artificial-intelligence-revolution-2.html

- **2** Would Contact with Extraterrestrials Benefit or Harm Humanity? A Scenario Analysis https://arxiv.org/pdf/1104.4462.pdf
- **3** The question as to whether aliens interfered in the US election hinges at least in part on which aliens we expect to see. As highlighted by online experts, such behavior would be inconsistent for example with what we know about the Ferangi, an alien type: "The Ferangi while greedy have never hurt anyone and don't care about politics, in fact war is good for commerce so it was in the best interests of the Ferangi empire to let Hillary win." (Source:

http://www.abovetopsecret.com/forum/thread11 55689/pg1)



HOW CAN SCENARIO ANALYSIS HELP QUANTIFY RISKS?

ET RISK TOOLBOX. The first step to quantifying financial risks associated with an alien invasion is developing scenarios. This framework mirrors the framework required for 'transition risk' modelling (see the report from our sister organization 2ii on the "Transition Risk Toolbox"). As part of this report, Fii has conducted a comprehensive review of the written and visual scientific literature with the objective of defining a 'central scenario' around how an alien invasion would play out. Sources include primarily Hollywood alien movies and authoritative online sources.¹

The following summarizes the general, high-level assumptions of the central scenario.

WE WILL WIN. A review of the evidence, in particular that provided by Hollywood movies, is that humans win against aliens close to 100% of the time. We should point out that given the likely technological imbalance, on its face this seems totally unrealistic. However, it is critical to follow a science-based approach and thus this assumption will not be challenged (*NB: If this assumption is wrong, we will probably be exterminated or enslaved, in the case of which this exercise doesn't really become relevant anymore*).

THE UNITED STATES IS PATIENT ZERO. Over 90% of the surveyed literature assumes that the first attack of the aliens will be on the United States, which will likely be patient zero. Even if the United States survives the attack, the carnage and damage of the attack is likely to be particularly focused on this country and thus affect associated financial assets (e.g. US Treasuries, US stock market).

THERE ARE WINNERS. Some actors are set to benefit from the alien invasion, notably the defence sector, materials (e.g. for constructing walls against the aliens), and lawyers set to benefit from the litigation arising from litigation risks..



Would Contact with Extraterrestrials Benefit or Harm Humanity? A Scenario Analysis

Seth D. Baum, Jacob D. Haqq-Misra, & Shawn D. Domagal-Goldman, *Acta Astronautica*, 2011,

^{1 -} E.g. www.ufostalker.com

^{2 –} Although independent research suggests that the CIA facilitated the election of D.J. Trump because he was the most capable of addressing an alien invasion. http://www.vulture.com/2016/06/trump-for-president-if-aliens-attack-earth.html



TYPOLOGY OF RISKS

ALIEN-RELATED FINANCIAL RISKS. As any good NGO, policymaker, or research institute will tell you, the first step for any analyst worth his or her salt on risk assessment is to create a *TYPOLOGY OF RISKS*. We have decided to pursue the same approach. Under an alien invasion, we have identified three key risk types: physical risks, transition risks (both policy and technology), and litigation risks. Each of these types will be discussed in turn:

TYPES	DEFINITION
Physical risks	Physical risks include all of the risks associated with the direct impact of the alien invasion e.g. destroyed cities, transport & energy infrastructure, and just general damage from things getting blown up. This type of risk is likely to be the most material and most ignored in the analysis (based on evidence from climate-related risks).
Transition risks	Transition risks include both risks and opportunities related to policy responses (e.g. defense industry, etc.) and technological risks (e.g. aliens bringing breakthrough new technology related to zero-carbon electricity).
Litigation risks	Somebody always gets sued for something. If for example it turns out that aliens invaded because of global warming, this may trigger litigation against oil & gas majors and other high-carbon companies.

LINK WITH CLIMATE-RELATED RISKS. An avid reader might notice that this typology mirrors one to one that of the FSB Task Force. According to NASA research (see page 8), the alien related-risks are indeed correlated with climate risks:

- **Litigation risks**. The main carbon emitters are likely to be held responsible for the attraction and attack of aliens (see NASA article) and are likely to face litigation after the war.
- Physical risks. Aliens might directly target the sources of emissions, as a way to reduce access to energy for humans
 in the context of an attack.
- **Transition risks**. Aliens are likely to bring advanced weapons and propulsion technologies that are not powered by fossil fuels. When these technologies will be exploited, after the war, all fossil fuels and nuclear will get stranded.

As a result, we recommend the future Task Force on Alien-Related Financial Disclosure to mirror the TCFD recommendations on the carbon footprint of portfolios as a proxy for alien-risk exposure.



Figure 1: Sightings of UFOs in Norther America
Source: http://metrocosm.com/ufo-sightings-map.html

COUNTRY RISK ANALYSIS

USA AT RISK. The geographic scenario analysis relies on a combination bottom-up, crowd-sourced big data related to UFO sightings and of forecasting alien invasions in hollywoodian literature. According to the literature, over 90% of the alien invasions suggested that the United States would be the first target, notably Washington D.C, New York City and Los Angeles. This suggests a highly concentrated risk with over half of UFO sightings concentrated in 10 states (see Fig. 1 and Fig. 2).

UK / NETHERLANDS EXPOSED. At the same time, UFO sightings data also suggests Northern Europe as a particular target, notably the United Kingdom (Fig 1). This correlates with the recent political turmoil in the United States and the United Kingdom, lending further credence to the immediacy of the risk. Given the thought leadership of the central banks in these countries on climate risk, these financial sectors may be well equipped to identify this risk early.

THE REVOLUTION OF BIG UFO DATA. Traditional analysis of alien invasions has focused on a combination of top-down assumptions around countries (e.g. the United States and the United Kingdom as primary targets) and at best some urban area information (e.g. Washington D.C., New York City, Los Angeles). New big data techniques around UFO sightings allow for a significantly higher degree of granularity in terms of real-time geo-locational information on the potential epicentres of impact. More granular scenarios in turn will facilitate more precise risk analysis in terms of exposures of companies production sites and markets to these risks. This data revolution is mirrored at company side, given the growing momentum around asset level data disclosure.

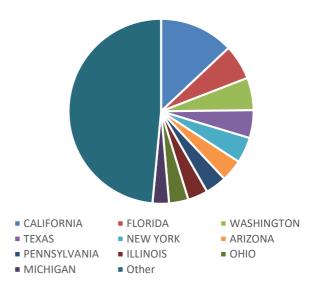


Figure 2: Count of UFO sightings by state
Source: http://www.nuforc.org/webreports/ndxloc.html



WINNERS AND LOSERS

The following briefly summarizes the potential winners and losers:

COUNTRY WINNERS. Israel (home to defense industries), Switzerland (given their neutrality and access to alternative weapon systems¹.

COUNTRY LOSERS. United States² and United Kingdom (see discussion previous page), Germany (given historic preponderance to pick the losing side of a war), the Netherlands

SECTOR WINNERS. Defence, pharmaceuticals, materials (in particular sectors involved in building walls), legal services, renewable power, bottled water

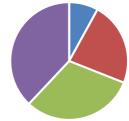
SECTOR LOSERS. Oil & gas (given litigation risks as a result of triggering global warming and thus signalling to aliens to invade), coal mining, financial institutions

See figure on right for overview of sectors at risk of downgrade

ALIEN CARBON BUBBLE: One black swan for fossil fuel companies in the context of the alien invasion involves the potential stranding of fossil fuel assets given the competitiveness of renewable alternatives in military conflicts of the future.³ According to Fii, this could lead to as much of two-thirds of fossil fuels becoming stranded, with associated financial impacts.

1 - E.g. https://www.victorinox.com/uk/en/Products/Swiss-Army-Knives/c/SAK),

Figure 1: Sectors at risk of ET downgrade (Source: Aliens Global Invaders)



- Immediate elevated risk of downgrade
- Emerging elevated risk of downgrade
- Moderate risk of downgrade
- Low risk

Figure 2: Alien carbon budget remaining (Source: Fii), based on the weighted average probability of data of invasion

Remaining fossil fuel reserves (~2.795 billion tons of CO₂)

Pre-invasion carbon budget (~565 billion tons of CO₂)

^{2 -} Some expert analysis suggests that Donald Trump may be particularly well equipped to lead the US response to an alien invasion (http://www.vulture.com/2016/06/trump-for-president-if-aliens-attack-earth.html).

 $^{{\}tt 3-\underline{http://oilprice.com/Energy/Energy-General/Why-The-US-Military-Is-Fully-Backing-Renewables.html}}$

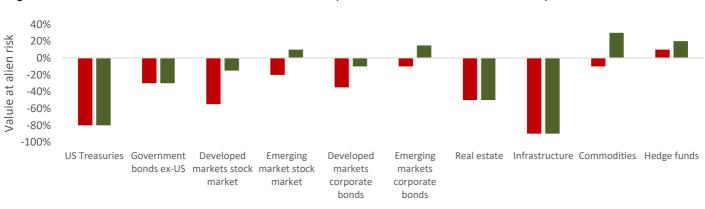


MEASURING THE VALUE AT ALIEN RISK

E-TRIPS MODEL. This section represents the first attempt known to the authors to quantify the potential risks of an alien invasion to financial portfolios. The analysis is based on the open-source, IP rights free, forward-looking *E-TRIPS model* (extra-terrestrial risk for investment portfolios model) developed by ET Advisors. The model covers the three risks framed in the typology above (physical, transition, litigation) and seeks to integrate the scenario described above in traditional risk models. In terms of data, the model calculates security level specific exposures by mapping UFO sightings data over asset-level data.

STRANDED ASSETS. The figure below shows the results of the analysis for a typical cross-asset portfolio as well as a low-carbon alternative, involving the reduction of Scope 1 and Scope 2 emissions by 50%. The results imply a potential alien bubble for US treasuries as well as developed markets equities, bonds. They also find potential stranded assets for infrastructure. The impact on bonds is somewhat more muted given considerations around the maturity of bonds (see also the 2ii project on the Tragedy of the Horizons).

SYSTEMIC RISK. The results suggest risks systemic risks for financial institutions. The ultimate scale of these risks depends of course on the specific portfolio breakdown, in terms of asset allocation and sector exposures. Thus, the results also suggest however that risk can be significantly reduced by reducing the Scope 1 + 2 emissions in a portfolio across key asset classes. Low-carbon strategies thus outperform by over 40%, despite a low tracking error of 1 basis point.



■ Low-carbon strategy

Figure 1: Alien invasion simulation - Source: E-TRIP Model (Aliens Global Invaders & ET Advisors)

Mainstream



BARRIERS TO ET RISK ANALYSIS

This report represents the first attempt to quantify potential risks associated with the alien invasion. It demonstrated the potential immediacy of the risk and options around developing alien risk scenarios. It also represented the first attempt known to the authors to quantify these risks. At the same time, it also identified a number of key barriers moving forward for more sophisticated risk analysis and the integration of these risks into investment processes and financial regulatory frameworks. These include notably:

LACK OF DISCLOSURE: A review of over 10,000 annual reports did not find a single mention of the risk of alien invasion and the potential financial impact to companies. A lack of disclosure thus prevents financial institutions from allocating capital in light of these risks. Moreover, given the adage of 'what you measure, you manage', disclosure may also drive internal risk management processes.

LACK OF HISTORICAL DATA: Given the lack of historical role models with regard to alien invasions, models cannot rely on historical evidence in terms of scenario and model calibration. Scenarios developed by Hollywood script writers can be used as an alternative but are not yet validated by prudential authorities in most countries. This calls for a reform of Solvency II and Basle III.

LACK OF CAPACITY IN CRA & EQUITY RESEARCH: Our research concludes that there is very little capacity among financial institutions in terms of dealing with this risk. Few analysts surveyed had processes in place to track the risk. Indeed, a frequent response in the survey resembled that of 'alien deniers' and alien apologists claiming that alien invasions were not real or that a controlled limited amount of alien intervention could actually be positive. This despite the over-whelming scientific evidence regarding the likelihood of an alien invasion

ALIEN-WASHING: Many of the initiatives that were identified seemed to resemble 'alien-washing'. For example, despite the fact that Towers Watson communicated on alien invasion as one of the top 5 extreme environmental risks, there is no evidence that this risk is considered in the context of investment consulting services offered by Towers Watson.



RECOMMENDATIONS

In response to these barriers, Fii proposes the following recommendations for policymakers and further research:

- 1. Encourage the use of **carbon footprinting** of investment portfolios as a first proxy and bridge to more sophisticated metrics.
- 2. Launch a **Task Force on Aliens-related Financial Disclosures** (TAFD) chaired by Christian Thimann from AXA (given existing experience) and William Smith to respond to the growing demand from investors.
- 3. Setting up a G20-level Alien Finance Study Group (AFSG) under the auspice of the UNEP Inquiry.
- 4. Provide financial support to the multi-stakeholder ADI (Alien Detection Initiative) to ensure early identification of risks and potential responses based on asset-level data and UFO detection maps.
- 5. Replace the word "Environment" in ESG with "Extra-Terrestrial" and shift the emphasis from environmental to extra-terrestrial risks.
- 6. Launch a civil society led **Aliens Dialogue** to discuss these issues, support NGOs working on the topic on strategy and communication.
- 7. The introduction of Art. 51 on **mandatory alien-related risk disclosure** for company and finance sector (already mandatory in Nevada, discussed by the new US administration).
- 8. The integration of alien invasion risk into **mandatory stress-tests** by central banks. This work will also require coordination on alien invasion scenarios.
- 9. Explore the integration of Alien-related risks into **the calculation of capital requirements** for the insurance sector and banks.
- 10. Support the development of the **Greens' Bonds market**, to refinance the production of rockets allowing to send back green guys on their planet when they will get stranded on Earth.

ABOUT FERMI INVESTING INITIATIVE

The Fermi investing initiative is a new 3-year 3 million program of 2° Investing Initiative [2°ii] supported by Aliens Global Invaders. 2°ii is a multi-stakeholder think tank working to align the financial sector with 2°C climate goals. We are the leading research organization on climate-related metrics for investors. Our research work seeks to align investment processes of financial institutions with climate goals; develop the metrics and tools to measure the climate friendliness of financial institutions; and mobilize regulatory and policy incentives to shift capital to energy transition financing. The association was founded in 2012 and has offices in Paris, London, Berlin, and New York City.

CONTACT

Email: phonehome@fii.com Website: www.fii.com

New York: +1917 325 6312 205 E 42nd Street, 10017 NY

Paris:+336 339 666 92 97 rue Lafayette, 75010 Paris

London:

40 Bermondsey Street, London SE1

Berlin:

Am Kufergraben 6A, 10117 Berlin

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