

Dietrich, Alexander M.; Leer, John; Schoenle, Raphael

Research Report

Consumer expectations, natural disasters, and stock market participation

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Consumer expectations, natural disasters, and stock market participation

We quantify consumers' expectations about natural disasters in an international survey. Consumers across several countries expect the likelihood of natural disasters to increase over the next few decades. What's more, national differences in disaster expectations correlate with the heterogeneous risk exposure of individual countries. Finally, we show that for high-income consumers, higher subjective disaster expectations correlate with a lower likelihood of stock market participation. This may raise the demand for safe assets and potentially weigh on the natural rate of interest in the future.

Written by

Alexander Dietrich
Research Economist
Danmarks Nationalbank

amdi@nationalbanken.dk
+45 3363 6193

John Leer
Chief Economist,
Morning Consult

Raphael Schoenle
Professor of Economics,
Brandeis University



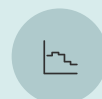
Consumers expect climate change-related natural disasters to become more likely

We found that consumers across countries expect the probability of natural disasters caused by climate change to increase over the next few decades. Younger respondents are more pessimistic, expecting disasters to be significantly more likely compared to older respondents. Heterogeneity in expectations across various countries correlates with differences in exposure to climate change and natural disaster risk.



Subjective disaster expectations correlate with individual stock market participation

For high-income consumers, we find that a higher expected probability of natural disasters correlates with a lower likelihood to participate in the stock market. Conversely, for low- and middle-income consumers, there is no significant correlation between stock market participation and subjective disaster expectations.



Consumer expectations could have implications for the natural rate of interest

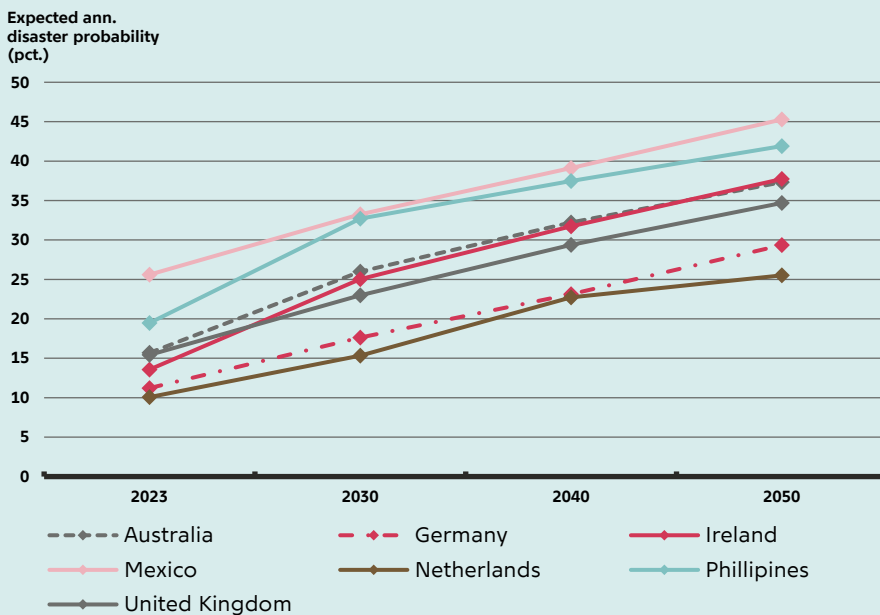
As high-income consumers expect costly natural disasters to be more likely and thus reduce their stock market participation, the demand for safe assets increases, putting downward pressure on the natural rate of interest. The natural rate of interest, i.e. the interest rate consistent with stable inflation and output at its potential, is a guide for the conduct of monetary policy. Among other factors, consumer expectations shape the natural rate of interest.

Why is this important?

Natural disasters are one of the most salient features of climate change. Subjective expectations over the likelihood of such disasters in the future are an important driver of personal savings decisions. Following insights from the economic literature, as consumers expect costly natural disasters to be more likely, they choose to build up precautionary savings and move towards safer assets less exposed to the economic consequences of potential natural disasters. Both factors may increase the demand for safe assets and lower the natural rate of interest, which is the risk-free interest rate that is consistent with stable inflation and output at its potential.

Main chart

Consumers expect natural disasters to become more likely

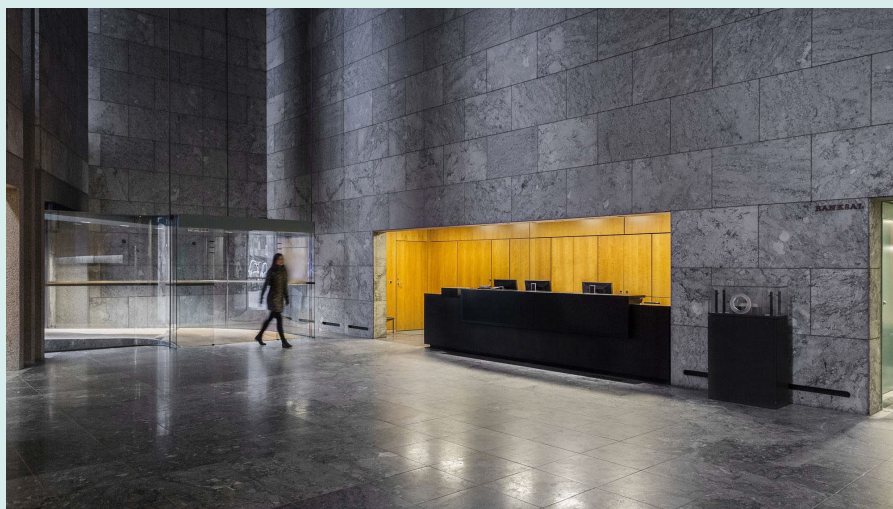


Note: The chart displays average disaster probability as Huber robust and survey weighted mean on the vertical axis. The horizontal axis represents the time horizon of the survey question. 2023 refers to the "next 12 months" question.

Source: Morning Consult and own calculations.



On average, European survey respondents expect a 20% chance of a major natural disaster in 2030. Over the next few decades, consumers expect the likelihood of natural disasters to increase.



Keywords

Climate

Economic activity

Savings

01 Introduction¹

A growing body of research focuses on consumer expectations and their relation to economic decision-making. The subjective expectations of consumers have been found to play a crucial role for business cycle dynamics and therefore monetary policy. With the increasing significance of climate change in the public debate, natural disasters are at the forefront of consumer attention (Dietrich et al., 2024). Indeed, as natural disasters – extreme weather events – are arguably one of the most salient manifestations of climate change, many consumers consider it likely that the frequency and severity of natural disasters will increase. This may have multiple economic ramifications. The subjective perceived risk of rare, but major, adverse events has been found to affect not only *macroeconomic* business cycle dynamics (Gourio, 2012), but also asset prices (Barro, 2006) and consumers' *individual* financial decisions (Heimer et al. 2019).

Against this backdrop, this economic memo aims to quantify the expectations of consumers of natural disasters around the world in seven different countries. To do so, we conduct a large-scale international consumer survey. The survey data provides a connection between subjective expectations for the likelihood of natural disasters and survey respondents' personal stock market participation. The research in this economic memo builds upon the work of Dietrich et al. (2024) who quantify subjective natural disaster risk expectations of US consumers in a cross-sectional consumer survey, emphasizing the role of media consumption and regional risk exposure for consumer disaster expectations.

This economic memo specifically relies on data from nationally representative consumer surveys, conducted by Morning Consult in seven different countries around the world. Several important insights arise: Firstly, consumers in multiple countries around the world expect the likelihood of natural disasters to be high and to significantly increase over the next decades. Secondly, their subjective disaster expectations correlate strongly with the objective exposure of various countries to natural disasters. Thirdly, across countries and for any horizon, younger individuals are more concerned about climate-change related natural disasters than older survey participants. Fourthly, for high-income consumers, we found a significant negative correlation between natural disaster expectations and the likelihood of stock market participation. In contrast, we did not find a significant correlation between disaster expectations and stock market participation for low- and middle-income respondents.

Our results demonstrate the rising concern of consumers around the world with regard to natural disasters that are expected to become more likely with climate change. This might have important economic implications, not only for the aggregate savings behaviour of consumers, amplifying precautionary savings, but also for the willingness of consumers to invest in risky assets. Our finding that subjective disaster expectations correlate negatively with the likelihood of stock market participation of high-income consumers provides suggestive evidence on this risk-taking channel. Via a negative impact on the natural rate of interest, these developments in consumer savings behaviour are of relevance for macroeconomic business cycle dynamics (Barro, 2006; Gourio, 2012).

¹ Acknowledgements: The authors wish to thank Thomas Harr, Marcus Mølbak Ingholt, Niels Framroze Møller and Morten Spange for valuable feedback and discussions. We thank Caroline Smith (Morning Consult) for technical assistance collecting the survey data. The data was collected by Morning Consult as part of a joint research project between the authors. Views and opinions presented in this paper are those of the authors and do not reflect views and opinions of Danmarks Nationalbank or Morning Consult.

Several papers have discussed the role of consumer natural disaster expectations for business cycle outcomes: Dietrich et al. (2024) document that climate change related natural disaster expectations depress the natural interest rate but may also affect business cycle dynamics and monetary policy via increased volatility. Cantelmo (2020) and Batten et al. (2020) study the effect of climate change and actual disasters on the business cycle. Branner and Ingholt (2023) discuss this effect as a potential challenge for energy supply and monetary policy.

Several papers have investigated the role of natural disasters for stock market participation. For instance, Bharath and Cho (2023) show that among US consumers, those affected by natural disasters are more risk averse and less likely to participate in the risky asset markets. Hu and Zhao (2024) provide similar evidence for Chinese private investors.

The literature highlights two mechanisms through which disaster expectations affect personal savings behaviour. Firstly, consumers expecting a costly disaster to be likely might choose to hold precautionary savings, as other insurance mechanisms might provide insufficient insurance against potential income or asset losses (e.g., Heimer et al., 2019; Gourio, 2012). Secondly, expecting that asset prices, such as the value of stocks, might be negatively affected by disasters, consumers might move into less risky assets, such as, for example, cash holdings. This mechanism could imply that some consumers ultimately choose to not participate in the stock markets (e.g., Bharath and Cho, 2023).

This economic memo is structured as follows: In section 2 we discuss the survey methodology and data. In section 3 we discuss results on the expected disaster probability and its correlation with stock market participation. Section 4 discusses consequences for the natural rate of interest and concludes.

02

Methodology

Using Morning Consult's global survey capabilities (Morning Consult, 2023), we conducted a survey in the following 7 countries around the world: Germany, Australia, Ireland, the Netherlands, the Philippines, the United Kingdom and Mexico. The survey module was fielded between June 27 and 28, 2023, as part of a larger survey on a variety of topics. Survey respondents were asked several questions in their national language. In each country, a stratified sample of consumers was collected representative of the national population according to age, gender and education comprising 1,000 respondents per country. We then applied post-stratification weighting to conduct population inferences in each country, making statistics exactly representative of the respective national population. To do so, we use an iterative proportional fitting approach to create post-stratification weights after completion of the survey ("raking", see for example Bishop et al. (1975) or Idel (2016)). Weighting is based on socio-demographic characteristics (age, gender, education) and the respondents' region.

The survey elicits subjective disaster probabilities from consumers within their respective countries of residence, following the question wording by Dietrich et al., (2024). Specifically, we asked, the following question:

"As a result of climate change, the risk of natural disasters (such as hurricanes, tropical cyclones, droughts, wildfires, or flooding) is likely to increase. The economic damage of such disasters may be sizable. Considering [time horizon], what do you think is the probability of a large disaster causing damage of about 5 percent of GDP?"

The probability of a large disaster will be _____ percent."

Each respondent was asked to state their subjective disaster expectation for four different time horizons, from "the next twelve months", up to "the year 2030", "the year 2040" and, "the year 2050", respectively. The questions are deliberately designed to always refer to the probability of a natural disaster within a 12-month time horizon, but at different points of time in the future.

In addition, survey respondents in five countries, Germany, Mexico, the Netherlands, the United Kingdom and Australia, were asked about their stock market participation, i.e. whether they have money invested in the stock market or mutual funds, including also pension funds.

"Do you have money invested in the stock market and mutual funds, including personal retirement accounts?"

Respondents were presented with multiple answer choices, including "No, no money invested" or several broad ranges of asset holdings, in their respective national currency. In the following, we exploit a measure of personal stock market participation by classifying respondents who indicated a positive amount of money invested as participating in the stock market. Besides these questions, the survey also recorded a set of demographic characteristics, such as the level of income, age, gender or educational attainment.

03 Results

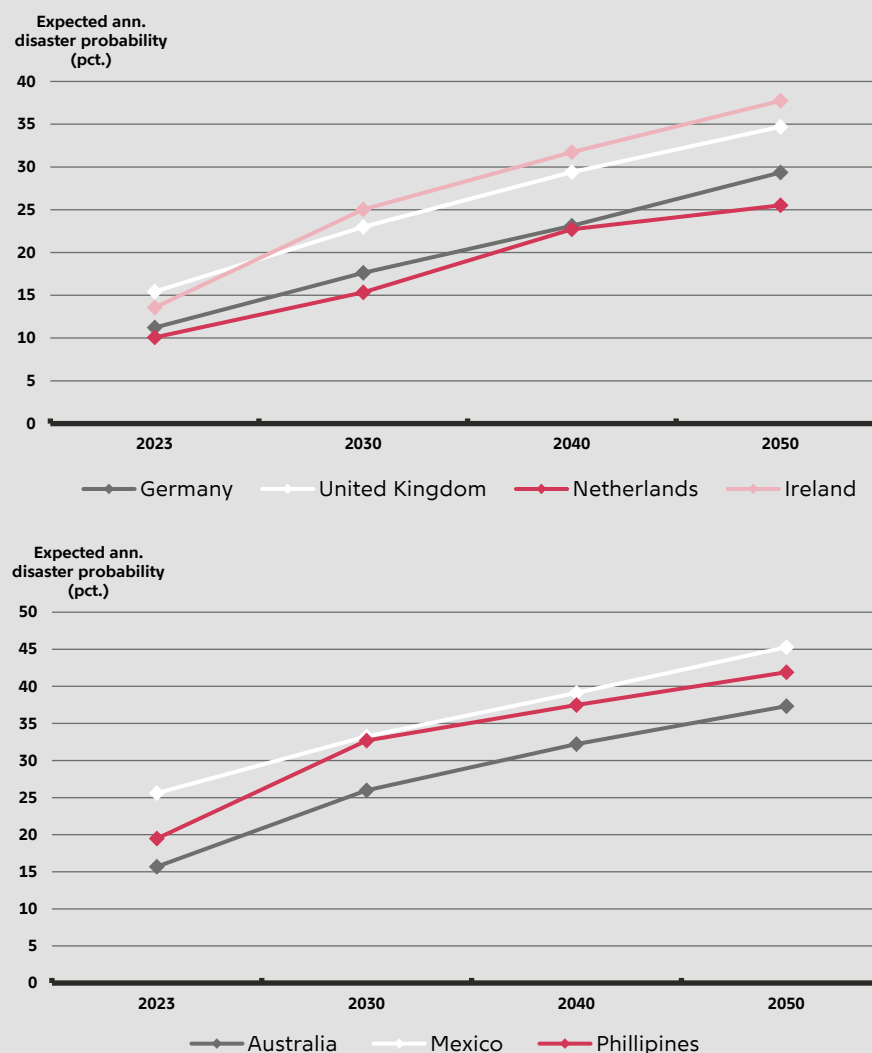
Several new empirical findings emerge, as chart 1 shows. Firstly, in all countries, consumers expect the likelihood of major natural disasters that have a significant impact on national GDP to increase over time, as captured by the answers to the main survey question. The mean expected probability ranges from 10% (Netherlands) to 26% (Mexico) for the next 12 months, i.e., between June 2023 and June 2024. The expected probability is also significantly elevated for future time horizons. In the year 2050, between January 2050 and December 2050, the mean expected disaster probabilities range from 26% (Netherlands) to 45% (Mexico). The rising trend in consumer disaster expectations consistently across all 7 countries might reflect beliefs that climate change, and therefore also related natural disasters, might be increasingly more prevalent in future decades.

Secondly, the level of subjective probabilities (i.e., with averages above 10%) appears to be high for the disaster described in the survey question, causing damage of around 5% of GDP. Yet not only are results in line with documented expectations in Dietrich et al. (2024) for the US; an extensive literature has also documented that consumers tend to overestimate the likelihood of rare, negative events (i.e., Lichtenstein, 1978; Fischhoff, 2010; Heimer et al. 2019). Nevertheless, Fox and Tversky (1998) suggest that individuals tend to act upon these subjective beliefs; furthermore, prospect theory proposes an overweighting of rare negative events in human decision-making (Tversky and Kahneman, 1992, or, specifically for financial decision making, Barberis, 2013).

CHART 1

Consumers expect natural disasters to become more likely

By country



Note: The chart displays average disaster probability as Huber robust and survey weighted mean on the vertical axis. The horizontal axis represents the time horizon of the survey question. 2023 refers to the "next 12 months" question.

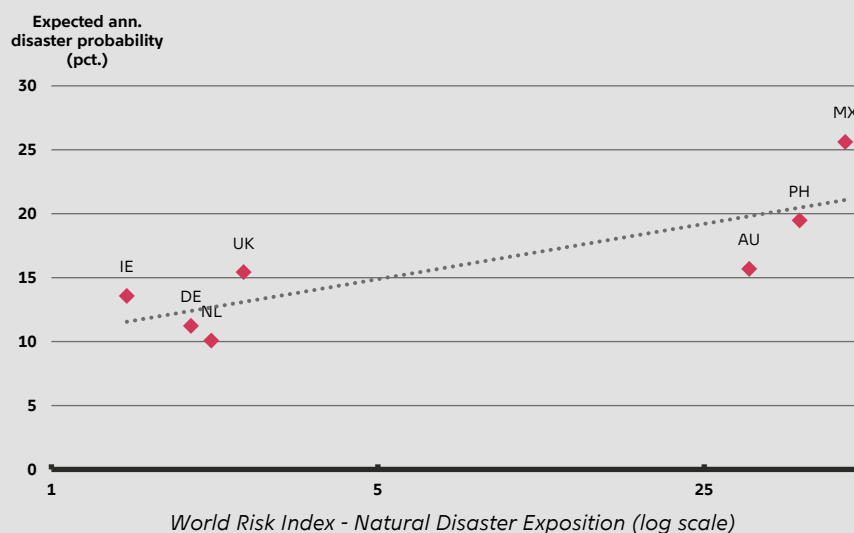
Source: Morning Consult and own calculations.

Thirdly, our results indicate that subjective consumer expectations – even though quantitatively potentially biased and prone to overestimation – are indeed a reflection of actual objective risk. This insight follows from chart 2, which correlates mean subjective disaster expectations within the countries in our sample to a measure for the exposure of countries to natural disasters linked to climate change. Here, we rely on the Exposure subindex from the World Risk Index, a measure compiled by the United Nations University Institute for Environment and Human Security (UNU-EHS, 2022), indicating the exposure of different countries to climate change-related risk from various natural disasters. The significant correlation visible in chart 2 suggests that subjective consumer expectations might indeed reflect actual objective risk.

CHART 2

International heterogeneity in disaster expectations reflects national risk exposure

By country



Note: The chart displays average disaster probability as Huber robust and survey weighted mean on the vertical axis. Natural disaster exposition risk refers to World Risk Index data from the United Nations University Institute for Environment and Human Security (UNU-EHS, 2022). Dashed line represents a linear trend.

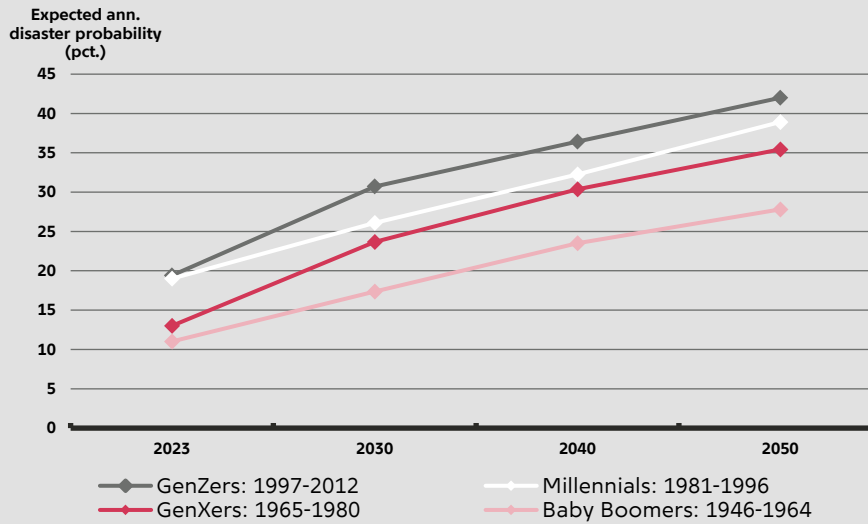
Source: Morning Consult, UN (2024) and own calculations.

Fourthly, significant generational differences in climate expectations arise when we pool subjective disaster probabilities across countries but split the dataset by generations instead. Chart 3 reveals that survey participants born between 1997 and 2012 ("Generation Z") expect disasters be most likely, not only in the short run, but also in the future. Conversely, members of the "Baby Boomer" generation (born 1949 to 1964) state on average the lowest likelihood for major natural disasters.

CHART 3

Younger generations expect disasters to be more likely

By generation.



Note: The chart displays average disaster probability as Huber robust and survey weighted mean on the vertical axis. The horizontal axis represents the time horizon of the survey question. 2023 refers to the "next 12 months" question.

Source: Morning Consult and own calculations.

What is the relation between stock market participation and disaster beliefs? In a second step of analysis, we use regression analysis to provide an answer, relating disaster expectations over the next 12 months to the self-reported stock market participation of survey respondents. Specifically, we estimate the following probit relation:

$$\Pr(S_i = 1|x_i) = \Phi(\alpha_0 + \sum_j \beta_j [p_i^{ND} \times I(\text{income}_i = j)] + \gamma \text{age}_i + \varphi \text{income}_i + \delta \text{gender}_i + \theta \text{country}_i),$$

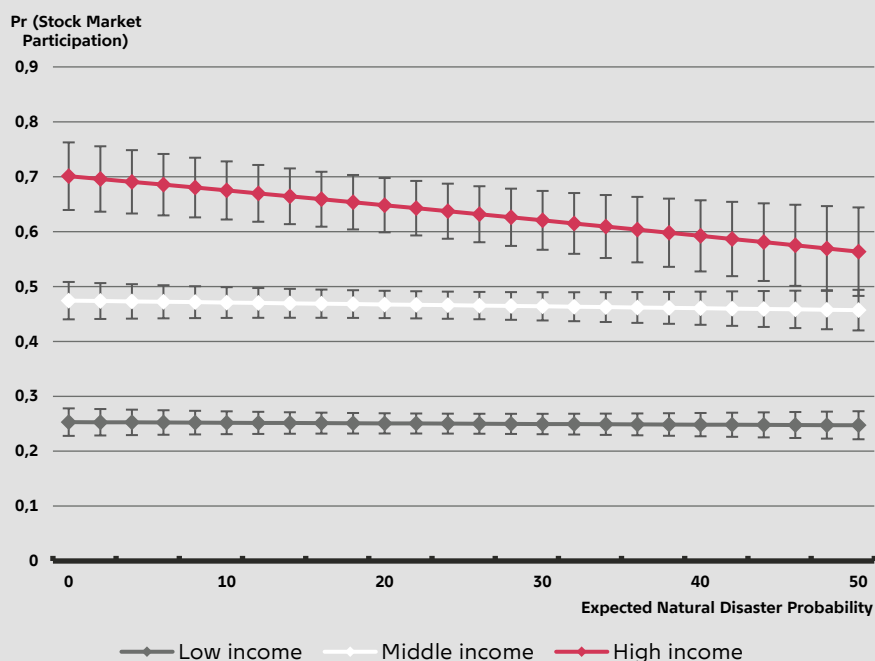
where S_i is an indicator variable for stock market participation of individual i and x_i represents a vector of regressors. Similarly, p_i^{ND} represents the natural disaster expectation of i . $I(\text{income}_i = j)$ denotes an indicator variable equal to unity if respondent i 's income belongs to income group $j \in \{\text{Low}, \text{Medium}, \text{High}\}$. The model controls for age, gender, income, and country of residence.

On the one hand, our analysis shows no significant relation between perceived short-term natural disaster risk and stock market participation for low- and medium-income consumers. On the other hand, we do find a statistically and economically significant, negative relation for high-income individuals. With a higher perceived subjective probability for large natural disasters, high-income respondents in our sample are less likely to participate in the stock market, i.e. own stocks or mutual funds.

CHART 4

Predicted likelihood of stock market participation, based on disaster expectations

By income.



Note: The chart displays the predicted marginal probability for levels of subjective natural disaster probabilities (horizontal axis), by income group. Underlying probit model controls for income, gender, country of residence and age group. Whiskers indicate 95% confidence bounds based on heteroskedasticity robust standard errors.

Source: Morning Consult and own calculations.

Chart 4 illustrates the marginal effect of the subjective disaster probability on the likelihood of stock market participation. The grey, white and red lines represent the effect on low-, middle- and high-income consumers respectively. Several insights stand out: Firstly, irrespective of the subjective disaster probability, the predicted probability to invest increases with income – from close to 20% stock market participation for low-income consumers to around 70% for high-income consumers. Secondly, we find that for high-income consumers, arguably the most represented group of private investors, the subjective risk of natural disasters appears negatively correlated with stock market participation: Individuals assuming disasters to be more likely are less likely to invest in stock markets compared to others.

04

Implications for saving and the natural rate of interest

This economic memo provides international evidence on the subjective probability of rare natural disasters, drawing on novel data for several countries around the world. We document that consumers – consistently across countries and ages – assume the likelihood of natural disasters to increase over the next decades. Strong generational level differences in beliefs also exist. In addition, we provide correlational evidence that among high-income consumers, stock market participation is lower for individuals with elevated disaster expectations. The rising subjective disaster expectations of consumers, as well as the documented effect on individual savings behaviour, may have implications for monetary policy and business cycle dynamics, via the natural rate of interest.

The natural rate of interest is a relevant benchmark for the effect of monetary policy on business cycle dynamics, describing the short-term interest rate in an economy that is consistent with stable inflation and output at its potential. In contrast to the real interest rate that is driven by monetary policy, the natural rate of interest is solely driven by structural factors in the economy, such as demographic trends and expectations about the future, such as beliefs about future productivity growth or the likelihood of costly disasters (e.g., Jordà and Taylor, 2019). The natural rate of interest can be understood as the equilibrium interest rate on a risk-free asset. In practice, the natural rate of interest in itself is unobservable and can only be estimated with uncertainty. A large literature has studied both the empirical estimation of the natural rate of interest (e.g., Laubach and Williams, 2003; Hetland, 2023) as well as its theoretical determinants (e.g., Rachel and Summers, 2019), implications for monetary policy and business cycle dynamics (e.g., Woodford, 2003).

Several papers document the relation between consumer disaster expectations and the natural rate of interest (see, e.g., Gourio, 2012; Dietrich et al. 2024). The studies find that more pessimistic consumer expectations over the likelihood of potential future disasters reduce the natural rate of interest as consumers aim to build up additional savings as a precaution against future income losses caused by disasters. In addition, consumers might want to move out of risky asset classes that are more exposed to natural disasters, which would further reduce the natural rate of interest. This economic memo provides suggestive evidence of this mechanism: We document that for high-income consumers, the likelihood of stock market participation correlates negatively with subjective disaster expectations.

A reduction of the natural rate of interest might pose a challenge for monetary policy, by narrowing monetary space, making monetary policy more likely to reach the effective lower bound.

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Danmarks Nationalbank
Langelinie Allé 47
2100 Copenhagen Ø
+45 3363 6363



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