

## Milliman Response FHFA Climate and Natural Disaster Risk Management at the Regulated Entities Request for Input

### Executive Summary

Milliman recognizes the importance of climate change and the impact climate change may have on housing markets. We support the Federal Housing Finance Agency (FHFA) interest in understanding this risk by issuing the Request for Input (RFI) regarding climate and natural disaster risk management at the regulated entities. We believe that quantification of credit risk through translation of climate and natural disaster risk modeling is important for the regulated entities as well as market participants to ensure a safe and sound housing finance market. Additional data releases and reporting transparency on such risks from the regulated entities will help them fulfill their missions.

### Response to FHFA questions

The sections below are Milliman's responses to specific questions asked in the RFI. The responses are ordered as they appear in the RFI.

#### *Question 1: How should FHFA define climate and natural disaster risk?*

While there is a relationship between climate and natural disaster risk, FHFA should define (and evaluate) climate and natural disaster risk separately. Natural disaster risk can be defined as the risk that catastrophic natural events adversely impact an asset, often through direct physical damage to a property and/or its community. Climate risk is the risk that asset values will be adversely impacted by a repricing of future natural disaster risk. In either case, risk should be defined by the modeling of scenarios reflecting a range of possible future climate states impacting natural disaster risk such as changes in sea level, severe weather, heat/drought conditions, etc.

With respect to the regulated entities, the risk should be further defined as a potential credit loss due to mortgage defaults from loan guarantees by the respective entity caused by natural disasters or responses to climate change. This risk should be evaluated over multiple time horizons, such as 1 year, 5 year, and over 10 year periods.

#### *Question 2: What are the climate and natural disaster risks to the regulated entities, including long- and short-term risks, and how might such risks change over time? To what extent, if any, could such risks now or in the future impede the ability of each regulated entity to operate in a safe and sound manner, fulfill its statutory mission, or foster liquid, efficient, competitive, and resilient national housing finance markets?*

There are both explicit and implicit climate and natural disaster risks to the GSEs. Explicit risk is born from direct property damage to properties serving as collateral to the GSEs' guaranteed mortgages due to flooding, hurricanes, sea level rise, wildfire, wind/hail, winter storms, etc. Implicit risk includes negative property value impacts such as lower (or negative) home price appreciation to homes subject to climate and natural disaster risks relative to like properties, all else equal. Implicit risk can be attributed to buyer perceptions of the subject property location or migration trends stemming from previous natural disasters. If the ultimate costs to the GSEs through mortgage credit losses prove to be greater than anticipated or accounted for in the guarantee fees or lender interest rates, capital erosion could occur on the GSEs' balance sheets such that housing finance markets could be disrupted. Quantifying the costs to the GSEs' portfolios is key to understanding if the current housing market would prove resilient to climate and natural disaster risks.

#### *Question 3: What methodologies, datasets, variables, assumptions, future climate scenarios, and measurement tools are used to measure and monitor climate risk to the national housing finance markets? Describe any gaps in available data that limit the ability to measure such risks. How could such data gaps be resolved?*

While relationships between mortgage performance and past natural disasters can be measured, empirical analysis on natural disasters is of limited use to predict future natural disasters. The insurance industry has evolved based on this understanding to use catastrophe models for pricing natural disaster risk (which do leverage historical experience, but do so in a manner appropriate for predicting near-term future events). Catastrophe models can be used to produce probabilistic predictions of future losses to properties from catastrophic events such as hurricanes, floods, wildfires, and severe convective storms using a simulated set of events. These event sets can be modified to quantify the impacts of different conditions resulting from climate change, such as increased precipitation intensity, sea level rise, and higher hurricane wind speeds.

Catastrophe models use different methodologies, assumptions, data sources, and model inputs. Model output can vary widely between models, and even within a model depending on the inputs and assumptions used for a given model run. As such, it is best to use multiple models, independently vet them to assure they are appropriate for the intended purpose, and gain an understanding of their strengths, weaknesses, and limitations. Catastrophe models that are not fully probabilistic are limited in their ability to project the full distribution of future natural disasters, which hinders their ability to be useful in forecasting complex, downstream risks such as mortgage defaults. Finally, catastrophe models will need to be linked to climate modeling science and adapted for future climate scenarios, which is not a standard capability for most currently available catastrophe models.

Location data gaps currently inhibit direct translation of climate and natural disaster risk to credit risk such as the risk assumed by the GSEs with their guaranteed mortgage portfolio. The mortgage data released to the public by the GSEs presents location of properties serving as collateral for the mortgage guarantees at the zip code 3 and Metropolitan Statistical Area (MSA) level. This prohibits translating direct climate and natural disaster risk modeling output to credit risk impacts at the address or street level with full accuracy. Climate and natural disaster risk can be concentrated on a very specific location or group of properties. This data limitation results in the required use of a sampling approach to translate risks downstream to mortgages. If the GSEs were to present address or street level data in a sanitized way such that individual borrower information was not released, then translation of risks to mortgage credit losses could be modeled in a more direct way without the need for sampling loans. This type of approach would result in more accurate quantification of climate and natural disaster risk for the regulated entities.

*Question 6: With respect to the foregoing questions, FHFA invites interested parties to submit any studies, research, data, or other qualitative or quantitative information that supports a commenter's response or is otherwise relevant to the regulated entities' climate and natural disaster risk.*

Milliman was commissioned by the Society of Actuaries to author a paper on quantifying risks of climate change. Along with the flood modeling firm KatRisk, Milliman quantified the risk of flooding to single-family homes in the United States, how it might change due to climate change, and the extent that flood insurance is expected to cover current and future flooding.

A substantial portion of the paper focused on developing an estimate of the exposure of recent credit risk transfer (CRT) securities from Freddie Mac. Milliman and KatRisk estimated flood risk for a large percentage of U.S. homes, applied existing mandatory purchase requirements and voluntary purchase rates for flood insurance, and coherently related the flood risk output to existing loans. Then, Milliman used our proprietary mortgage analytics tool to effectively stress test the securities, its derivatives, and impacts to individual homeowners. The paper can be found at the following link, with an executive summary of the mortgage specific results shown on page 6:

<https://www.soa.org/globalassets/assets/files/resources/research-report/2020/soa-flood-report.pdf>

We highlight this paper for the following reasons because we believe that this level of sophistication is needed to develop a high quality, forward-looking estimate of climate exposure to the regulated entities. Such quantification should adhere to the following principles:

- Use well vetted and fully probabilistic flood models, with the ability for adaptation to future climate states
- Analyze detailed, property-level data, including the latitude and longitude of the property. For our paper a sampling method had to be used, which introduces uncertainty into the results.
- Integration of flood modeling data with mortgage models, and the ability to stress test impacts to loans based on different assumptions. Our paper explored a single assumption, that the property value would decline in relationship to the flood damages to the residence.

The results of the paper highlighted that while the risk of several selected events to an entire portfolio were small, they illustrated that individual loans and specific geographies can be materially impacted from a flooding event. Further, our analysis only covered two sample portfolios, relied on a sampling method due to the aforementioned data limitations, and only reviewed several selected flood events. The study could be enhanced by including a longer exposure horizon, more granular data, and include additional natural disasters.

Our study showed that individual homeowners are highly susceptible to flood risk, to the point where an event could stress a loan to where homeowners historically default at relatively high rates. FHFA should consider the climate risk for individual homeowners. A safe and sound housing market should ensure that individuals are provided with proper risk signals, both for risk today and in the future.

*Question 9: How should FHFA prioritize the various climate and natural disaster risks to the regulated entities?*

FHFA should first prioritize how regulated entities and market participants can be incentivized to define and quantify climate and natural disaster risks.

Quantification should not be limited to firm or portfolio-level risk of regulated entities and market participants. As we know that flood and other climate-exposed risks are highly variable by geography, FHFA cannot ensure that risk is properly signaled and/or disparate impacts are avoided if regulated entities and market participants are not measuring such risk at an individual level. A safe and sound housing market means that sustainable investment is encouraged, requiring transparency of risk from the consumer level to the regulated entity level.

*Question 13: Should FHFA implement a stress testing, scenario analysis, or similar program to assess the regulated entities' climate and natural disaster risk? If so, what factors should FHFA consider in defining the purposes, design, and scenarios of any such programs?*

We do not believe there is a single methodology that should be promulgated for measuring risks to regulated entities and market participants, given that this is an emerging and scientifically complex area of study. However, the principles we outlined in our response to Question 6 are our view of a minimum standard for such quantification.

As discussed in our response to Question 9, FHFA should also consider the risk for individual transactions and not simply an entire portfolio.

Finally, consistent with insurance entities with similar exposures, FHFA could consider requiring the regulated entities to obtain an Actuarial Opinion (or similar validations) of their climate and natural disaster risk. In such opinions, a credentialed professional performs an independent analysis of the exposure, ultimately producing a range of reasonable results to verify the quantification of the exposure is within the range of reasonable results. As climate and natural disaster risk are difficult to estimate with a single scenario, such a framework provides for more flexibility and a more thorough review of the process and results used to estimate the exposure.

*Question 14: Are there alternative risk mitigation strategies, including but not limited to insurance or insurance-based financial instruments, that could transfer risk from the regulated entities' portfolios or products or assist with the market pricing of climate and natural disaster risks?*

Yes, insurance-linked securities that pool climate and natural disaster risk would allow investors to participate and share in the risk with the regulated entities. This type of financial vehicle through the capital markets allows for the regulated entities to tap into additional financial protection from these risks along with providing another source of capital for the entities. This security could be structured similarly to the bonds offered through the GSEs' credit risk transfer program with a focus on climate and natural disaster risk. Institutional investors would be the likely participants of these financial securities. There exists a market and precedence for such securities for natural disaster events, and these bonds are known as Cat Bonds. In addition, there exists a precedence for a specific natural disaster bond linked to mortgage credit risk - <https://www.artemis.bm/news/sierra-cat-bond-targets-parametric-quake-cover-for-mortgage-asset-manager/>.

Homeowners property insurance and flood insurance requirements today already transfer a portion of the explicit risk with respect to wind, fire, and flood perils of the regulated entities' portfolios. However, FHFA should determine if the flood insurance requirements are sufficient for the growing flood risk within the United States. Further, property insurance products do not protect regulated entities' portfolios from climate risk as we defined it in Question 1, and in fact, rising future costs of property insurance could negatively impact the property value of locations exposed to climate change risks.

*Question 16: Market discipline could potentially supplement FHFA's supervision and regulation of the regulated entities' climate and natural disaster risk appetite and management. Market discipline depends in part on the information that is available to shareholders, creditors, and other counterparties. Is the existing publicly available information sufficient for shareholders, creditors, CRT and other investors, and other counterparties to understand and exercise market discipline over a regulated entity's appetite for and management of climate and natural disaster risk? If not, what changes are needed? Should each regulated entity be required to disclose additional information, including but not limited to the extent to which its underwriting practices take into account climate and natural disaster risk?*

Current publicly available information of regulated entities exposure to climate and natural disaster risk is insufficient for market participants to make informed decisions allowing for market discipline to augment the regulated entities' management of such risks. As we have mentioned above, additional location data including property or street level detail of the collateral properties of the GSEs' guaranteed mortgages would allow market participants to perform independent analyses to inform their participation in the market. Further, indication of whether there is earthquake or flood insurance on a property (and the amount of any applicable coverages) in the publicly available data sets would increase market participants understanding of the enterprises' exposure to earthquake and flood driven credit losses.

Quantification of credit losses due to climate and natural disaster risk for properties that serve as collateral for the GSEs' guaranteed mortgages would also provide valuable information to market participants. This type of analysis could be presented in the GSEs' financial statement disclosures. Summaries such as nationwide, regional, and state level expectations of credit losses across a spectrum of climate change scenarios would be beneficial. Finally, in addition to disclosing expected or baseline credit losses due to these risks, providing stress test results of the GSEs' portfolio would also be helpful to determine what level of capital could sustain such losses. A standard test could be enforced to allow for recognition of changes in risk over time and across each of the entities' portfolio. These metrics would prove valuable for market participants and would allow the regulated entities to understand the magnitude of climate and natural disaster risk for each loan they guarantee. This quantification could be useful in the underwriting process and the analysis of the existing in-force portfolios.

*Question 18: Policies to manage climate and natural disaster risk could increase the cost of housing, making it more difficult for lower income households in some areas to obtain affordable housing. Are there*

*policies the regulated entities could pursue to mitigate such adverse effects for lower income households in vulnerable areas without undermining efforts to manage climate and natural disaster risk?*

The first step should be to define and quantify climate and natural disaster risks. Optimal decisions on how to manage and/or subsidize these risks can only be made with an understanding of the risk itself. Pricing for the risk can be designed for specific policy objectives following a robust quantification of the risk.

Current and prospective homeowners are in need of risk signals to improve future buying choices. Definition and quantification of climate and natural disaster risks would also allow FHFA and its regulated entities to promulgate incentives for developing affordable housing solutions in less risky areas.

*Question 22: What data or housing market information would be beneficial for FHFA to make available, to the extent permitted by privacy considerations, to researchers and other interested parties to support the assessment of climate and natural disaster risk to the regulated entities or the national housing finance markets?*

As we have mentioned above in our responses to Questions #3 and #16, more specific location data such as address, street, or latitude and longitude coordinates will help with translating climate and natural disaster risk to credit risk for researchers and analytical firms. Additionally, indication of the presence and amount of earthquake and flood insurance on mortgages guaranteed by the GSEs would also be useful in quantifying potential credit losses.

*Question 23: What factors should FHFA consider in determining whether to formally participate in or informally partner with organizations or groups focused on climate and natural disaster risk management?*

The use of a catastrophe model is a requirement for properly measuring many natural disaster risks. FHFA should look to leverage catastrophe models, particularly those with the ability to robustly model future climate states.

As numerous firms produce catastrophe and climate models, FHFA should look to independent experts for model review, validation and implementation. FHFA should also consider that the intended purpose of catastrophe and climate modeling in this context is not to only measure the physical damage risks, but the implicit risk to regulated entities and market participants. An ideal partner for FHFA would have significant housing market experience, but also be able to provide independence, peril level modeling knowledge, and the ability to solve complex problems.

## **Conclusion**

Milliman recognizes the significant efforts of FHFA in developing guidance to the regulated entities regarding climate and natural disaster risk. This RFI is a significant step in regulating large and systemically important market participants in the housing market.

Milliman's response details our thoughts and recommendations for FHFA's consideration. We believe that quantification of credit risk through translation of climate and natural disaster risk modeling is important for the regulated entities as well as market participants to ensure a safe and sound housing finance market. Additional data releases and reporting transparency on such risks from the regulated entities will help them fulfill their missions. We are available to discuss or further clarify our responses with FHFA at your convenience.

## *About Milliman*

For more than 70 years, Milliman has pioneered strategies, tools and solutions worldwide. As one of the largest consulting and actuarial firms in the world, we are recognized leaders in the markets we serve. Milliman insight reaches across global boundaries, offering specialized consulting services in employee benefits, healthcare, life insurance and financial services, and property and casualty insurance. Within

these specialties, Milliman consultants serve a wide range of current and emerging markets. Clients know they can depend on us as industry experts, trusted advisors, and creative problem solvers.

We serve a full spectrum of business, financial, government, union, education, and nonprofit organizations. In addition to our consulting actuaries, Milliman's body of professionals includes numerous other specialists, ranging from clinicians to economists.

We serve our clients to protect the health and financial well-being of people everywhere. One part of this mission is to provide our clients with analytic tools and consulting services that assist them in developing and maintaining an affordable and sustainable housing system both domestically in the United States and internationally. Our analytic tools and consulting services help clients with two key aspects to achieve this goal: ensuring they hold adequate capital to maintain the availability of credit through economic cycles and ensuring mortgage credit risk is priced commensurate with the risk, i.e. that the prices are actuarially sound. By actuarially sound, we mean the credit risk charge is reasonable and not excessive, and the expected value of the risk premium is sufficient to cover expected losses and expenses plus a reasonable rate of return.

Recent work by Milliman in providing such consulting services include:

- Assisting the National Association of Insurance Commissioners (“NAIC”) in developing a countercyclical and risk-based capital framework for the mortgage insurance industry;
- Providing actuarial services to the Federal Housing Administration;
- Providing actuarial services to State Housing Finance Agencies with mortgage insurance funds;
- Providing actuarial services to various mortgage insurance companies;
- Licensing Milliman M-PIRe to various participants providing capital or otherwise engaged in the CRT market (additional detail is found below);
- Measuring flood risk for the insurance industry, including numerous flood actuarial services and being the lead actuaries for the NFIP Risk Rating 2.0;
- Reviewing catastrophe models on behalf of mortgage industry participants, insurance industry clients, and regulators;
- Educating state insurance regulators on ways to close the flood protection gap and how to evaluate catastrophe models; and
- Assessing flood and other catastrophe risks for the National Association of Realtors.

Milliman developed a web-based mortgage analytics tool, the Mortgage Platform for Investments and Reinsurance, or M-PIRe, which is a turnkey solution to analyzing mortgage investment opportunities, including credit risk transfer. The platform includes the data, models (loan-level performance models and cash flow waterfalls), business intelligence dashboards, and other reporting tools to holistically manage and value a portfolio of mortgage exposures. The platform is updated monthly with revised economic information and mortgage performance data for the \$1.3 trillion (5.7 million by loan count) of original unpaid principal balance (UPB) underlying the CRT market. Among Milliman's core clients for the platform are various reinsurance companies. These companies have committed sources of long-term capital to the mortgage market.

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