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March 15th 2021

Dr. Mark Calabria
Federal Housing and Finance Agency
Climate and Natural Disaster Risk Request for Input

Dear Dr. Calabria,

I am delighted to have the opportunity to sketch out my answers to FHFA's important climate change resilience questions.

I am an urban and environmental economist. In recent years, I have been working on the issue of the microeconomics of climate change adaptation. In 2010, I published my book *Climatopolis* and in late March 2021, Yale University Press will publish my new book *Adapting to Climate Change: Markets and the Management of an Uncertain Future*. In my ongoing research with Professor Amine Ouazad, we are exploring several issues at the intersection of real estate finance, real estate resilience and the climate change adaptation challenge.

I will respond to just a few of the FHFA questions. My answers are brief. If these answers interest your team, please email me and I will be happy to elaborate on the ideas expressed below.

Questions

I. Identifying and Assessing Climate and Natural Disaster Risk

1. How should FHFA define climate and natural disaster risk?

My definition of "climate risk" to residential real estate focuses on several objective metrics; flood and fire risk, the annual count of extremely hot days, the annual count of extremely cold days, and the annual count of local severe natural disasters. Finally, the area's average PM2.5 level as a key indicator of local air quality. Reductions in the cost of collecting and assembling data allow us to collect these measures and track them over time and across space. All else equal, all five of these factors will be negatively correlated with local real estate prices. Climate economists often use such econometric estimates to predict the future impact of climate change on key economic outcome variables. If places with high PM2.5 levels feature lower real estate prices and if PM2.5 levels are expected to increase in

certain areas due to climate change, then a standard extrapolation exercise would predict that climate change would lower such an area's future home prices through elevating local PM2.5 levels. This is just one example of the pathways through which climate change can impact real estate prices.

Real estate prices today depend on current local climate conditions, recent past natural disaster shocks, and expected future climate conditions. All else equal, an area that features a beautiful temperate climate will have higher real estate prices. If this area is expected to suffer from severe future weather, then asset prices today will reflect this discounted future risk. If the area has recently experienced severe natural disasters, the damage to the area's public finances and capital stock can have persistent negative effects on local asset prices.

These facts suggest that FHFA should monitor which real estate markets are experiencing persistent extreme weather events and increased exposure to natural disaster shocks.

Real estate has value because of local productivity access and local "consumer city" access and local natural beauty. In our footloose economy, these factors are interconnected. As the educated U.S workforce has greater access to engaging in Working From Home going forward, areas that are unable to maintain their quality of life will suffer a "brain drain" and this will reduce local real estate prices.

Brueckner J, Kahn ME, Lin GC. A New Spatial Hedonic Equilibrium in the Emerging Work-from-Home Economy?. National Bureau of Economic Research; 2021 Mar 8.

Cullen JB, Levitt SD. Crime, urban flight, and the consequences for cities. Review of Economics and Statistics 1999.

Fisher LM, Pollakowski HO, Zabel J. Amenity-based housing affordability indexes. Real Estate Economics. 2009 Dec;37(4):705-46.

In recent decades, real estate close to Silicon Valley has been very expensive due to several factors including proximity to highly productive tech firms such as Apple and Google, proximity to the academic talent clustered at Stanford and UC Berkeley and also due to the great local quality of life (weather, beauty, clean air and water views). When well paid individuals live close to each, this creates a market access effect that attracts great restaurants and this further enhances the local consumer city.

Climate risk and natural disasters threaten the high prices in the area. If the San Francisco area suffers from repeated wildfires that elevate local PM2.5 levels, then this is a direct link between climate risk and lowering local real estate prices as aggregate demand declines.

This logic suggests that FHFA should define climate and natural disaster risk as predictable changes in locational attributes that are capitalized into local home prices. So, if a major reason why San Francisco's real estate is valuable is cool July temperatures and if climate change is going to raise San Francisco's July temperature then this poses a risk to the medium term value of San Francisco real estate because it will lose some of its hedonic appeal.

Albouy D, Graf W, Kellogg R, Wolff H. Climate amenities, climate change, and American quality of life. Journal of the Association of Environmental and Resource Economists. 2016 Mar 1;3(1):205-46.

Gyourko J, Kahn M, Tracy J. Quality of life and environmental comparisons. Handbook of regional and urban economics. 1999 Jan 1;3:1413-54.

Kahn ME. Urban growth and climate change. Annu. Rev. Resour. Econ.. 2009 Jun;1(1):333-50.

A second pathway through which climate change impacts local real estate prices is through natural disasters such as hurricanes hurting local government public finances. Such disasters cause damage and can displace people and jobs as they move to other areas. After Hurricane Katrina, people and jobs moved from New Orleans to Houston. This means that the shock has a medium term effect through the local public finance channel.

Deryugina T, Kawano L, Levitt S. The economic impact of hurricane katrina on its victims: evidence from individual tax returns. American Economic Journal: Applied Economics. 2018 Apr;10(2):202-33.

In my recent co-authored NBER working paper, we document that cities (especially cities with larger shares of minorities and poor residents) suffer a larger hit to tax revenue and must cut back expenditures after natural disasters. Such a decline in local public services reduces the value of local real estate if local school quality declines and policing services decline as the city has less tax revenue. A decline in local home prices could cause some loan defaults among those borrowers who do not have much housing equity.

Jerch R, Kahn ME, Lin GC. Local Public Finance Dynamics and Hurricane Shocks. National Bureau of Economic Research; 2020 Nov 9.

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?

Climate shocks could raise mortgage loan default rates in the future if the climate shocks cause a reduction in local real estate values and/or if the climate shocks injure the labor market prospects for borrowers so that they have a lower ability to pay their monthly mortgage payments.

One important point focuses on the timing of when home buyers purchase a home. For people who are buying homes now in 2021, there is an increased understanding of climate risk and there are new firms such as Jupiter, 427 and First Street Foundation helping home buyers to understand the risks that they are exposing themselves to over the next couple of decades. Shrewd home buyers will bid less aggressively for housing in places that are expected to face risk and this means that they will take on less debt.

Home buyers who purchased 10 years ago were less likely to have been considering the climate change risk issue and those with a 30 year mortgage still have 20 years left on their mortgage. While they are accumulating equity in the home, some will still hold a “ruthless default option” to default if local home

prices fall due to rising risk.

Guiso L, Sapienza P, Zingales L. The determinants of attitudes toward strategic default on mortgages. *The Journal of Finance*. 2013 Aug;68(4):1473-515.

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?

In my joint research with Amine Ouazad, we have employed an event study research design to document how the supply of credit evolves in the aftermath of fifteen major hurricanes. We find that the banks are more likely to issue conforming loans. From the perspective of FHFA, a key issue going forward relates to how such “marginal loans” perform in the future. If salient events (the recent hurricanes), shift the loans sold to the GSEs then the key performance issue is whether these new loans perform worse over time than the counter-factual loans that would have been securitized in the absence of the disaster.

Ouazad A, Kahn M. Mortgage Finance and Climate Change: Securitization Dynamics in the Aftermath of Natural Disasters NBER working paper. Revised 2021 (w26322).

Issler P, Stanton R, Vergara-Alert C, Wallace N. Mortgage markets with climate-change risk: Evidence from wildfires in California. Available at SSRN 3511843. 2019 Dec 31.

Data Gaps

There is widespread agreement that FEMA flood plain maps and many fire zone maps are now out of date. What is the right climate science model to be used to update these maps? Given that there is not a single agreed upon climate science model, there is model uncertainty.

An important competition is now starting to play out among several different entities that seek to provide geographic pinpoint risk assessments about emerging climate risks.

Just as Moodys and Standard and Poor compete for issuing ratings for evaluating asset risks, a nascent climate risk industry is popping up as firms such as Jupiter, First Street Foundation, 427 , Coastal Risk Consulting and others issue their spatial report cards for different areas. We all know that Americans love ratings. Consumer Reports issues its rankings of products. US News and World Report ranks Universities and graduate programs. Americans want a valid ranking of geographic climate risk (and an understanding of the timeline measured in decades of when these risks will materialize) but the devil is in the details!

I am an economist. Thus, I do not have the skills to rank different climate prediction models. There should be a healthy skepticism about the quality of any given climate science prediction model that promises to offer “pinpoint” accuracy about future climate risks. This recent Politico piece does an outstanding job sketching out the challenges that climate risk rivals face in producing high quality

models. <https://www.politico.com/news/2021/03/16/climate-change-murky-models-476316>

In any market, such as cars, toothpaste or climate forecasts, those who produce a higher quality product gain market share and can charge more. In the case of climate forecasts, the challenging issue here is how to verify that a model is of high quality.

If different climate risk assessment firms give different predictions for a given residential property about the risks the property faces over the next 20 years, how should FHFA combine these various forecasts? The answer partially depends on what mistakes is FHFA most eager to avoid.

In evaluating emerging risks caused by climate change for a given geographic area, FHFA will have to decide whether it prefers to make Type I errors or Type II errors. In the classic undergraduate example, a Type I error in a court is to convict an innocent man while a Type II error is to release a guilty man. In the case of labelling a given geographic area as risky or not, does FHFA prefer to make Type I errors (incorrectly labeling a climate safe place as risky)? Or does it prefer to make Type II errors (incorrectly labeling a climate risky area as safe)? If the agency uses a “worst case” climate risk assessment model then some homes will be misclassified as high risk when in fact they face low climate risk. Alternatively, if the agency uses a lenient climate risk standard then homes that are truly at risk will be labeled as low risk.

Resolving the Data Gaps

Given the considerable uncertainty here, I believe the best path forward is for the FHFA to alert the GSEs that their loan performance (and especially loans originated in areas that have faced past climate risks) will be carefully analyzed each year.

Climate change adaptation progress does not hinge on being omniscient. Instead, FHFA needs to monitor the GSEs to watch for “humility” on their part. If these entities recognize that they “know that they don’t know what the future holds” then they will plan out a cautious strategy for proceeding by investing in greater in house expertise to expand their understanding of their loan portfolio’s emerging risks.

FHFA needs to endorse a competition between climate modelling entities and for the entities to critique each other’s work. This scientific approach will iterate and our understanding of emerging climate risk will improve.

FHFA should consider using its regulatory tools to encourage information discovery here. If home buyers are increasingly aware of the “known unknowns” involved in emerging climate risks, then they will be less vulnerable to future scenarios that may occur. The FHFA should inquire whether the GSEs have a proper incentive to research the emerging climate risks and to nudge the bank lenders to share their risk assessments with the households bidding for the homes.

An issue arises concerning how to encourage the climate ratings agencies to do a good job. FHFA could foster a competition between these entities so that society can learn which of these entities is the best at conducting such ratings. A very challenging issue is how to judge the quality of risk assessment for low probability events. If a geographic area has been hit with several hurricanes, is it merely unlucky or do its fundamentals mean that it faces a higher average baseline risk level?

5. How, if at all, should FHFA incorporate into its assessment of the regulated entities' climate and natural disaster risk the potential for abrupt repricing of real estate properties exposed to acute natural hazards?

Under the logic of the Efficient Markets Hypothesis, the value of a property at any point is equal to the present discounted value of its rental stream. Under this logic, climate change impacts a property's price if there is "new news" about the future rental stream caused by climate change. Past research in environmental economics has used "event study" methodology to document how real estate prices can quickly change if there is a locational discovery such as that there is a dangerous Superfund Site close to a property.

Kiel KA, Williams M. The impact of Superfund sites on local property values: Are all sites the same?. *Journal of urban Economics*. 2007 Jan 1;61(1):170-92.

Kiel KA, McClain KT. House prices during siting decision stages: The case of an incinerator from rumor through operation. *Journal of Environmental Economics and Management*. 1995 Mar 1;28(2):241-55.

For an example of this logic applied to the case of urban crime dynamics read this paper;

<https://www.aeaweb.org/articles?id=10.1257/aer.101.3.625>

Since I am an adherent of the Efficient Markets Hypothesis, I believe that real estate markets are forward looking and that current real estate prices do reflect the market participant's expectations about emerging risks. The New York Times and other leading media sources are filled with articles about climate risks. Given this information saturation, only **new news** that the future in Miami will be even worse than what is already predicted can lead to a sharp decline in real estate values there. To appreciate how much "doom and gloom" news coverage there has been, read this Rolling Stone Article from 2013 about the future of Miami.

<https://www.rollingstone.com/feature/miami-how-rising-sea-levels-endanger-south-florida-200956/>

Consider this article's salient headline;

Miami: How Rising Sea Levels Endanger South Florida

By century's end, rising sea levels will turn the nation's urban fantasyland into an American Atlantis. But long before the city is completely underwater, chaos will begin

I claim that real estate prices today already reflect emerging climate risk. Here are several peer reviewed cites;

Bernstein A, Gustafson MT, Lewis R. Disaster on the horizon: The price effect of sea level rise. *Journal of financial economics*. 2019 Nov 1;134(2):253-72.

Murfin J, Spiegel M. Is the risk of sea level rise capitalized in residential real estate?. *The Review of Financial Studies*. 2020 Mar 1;33(3):1217-55.

Ortega F, Taşpınar S. Rising sea levels and sinking property values: Hurricane Sandy and New York's housing market. *Journal of Urban Economics*. 2018 Jul 1;106:81-100.

This discussion suggests that FHFA should carefully study market by market the capitalization of local amenities and disamenities into real estate pricing through using hedonic methods. If an area in California now is expected to face higher PM2.5 levels because of increased climate change induced fire risk, but at the same time there is rising demand to live there because the nation's best fruit can be picked nearby then the rise in the disamenity may not cause a default crisis because of the unique other features of the area that are capitalized into the price of local real estate. It may also be possible that adaptation progress such as improvements in masks and fire fighting help to reduce the PM2.5 damage caused by wildfires there. In this case, even if climate change increases the quantity and severity of wildfires, improved access to self protection reduces the economic damage caused by the wildfires. Under this optimistic scenario, the impact of wildfires on local home prices would decline over time and this would mean that the GSE's loan portfolio faces less default risk.

A final point to note here is that homes are differentiated products. In a unique amenity place such as California, there are so many wonderful features of California that an increase in PM2.5 from wildfires due to climate change may not cause a large reduction in local quality of life. This logic suggests that for those geographic locations where there are perfect substitutes (so Iowa for Kansas) that a negative shock to such a place will cause a greater price reduction because there aren't offsetting unique features to the place that people inelastically demand.

Brueckner JK, Neumark D. Beaches, sunshine, and public sector pay: theory and evidence on amenities and rent extraction by government workers. *American Economic Journal: Economic Policy*. 2014 May;6(2):198-230.

II. Enhancing FHFA's Supervisory and Regulatory Framework

9. How should FHFA evaluate the adequacy of a regulated entity's ability to assess and manage the impacts of climate and natural disaster risk, particularly in light of the significant uncertainties and data limitations?

Human capital plays a fundamental role in helping a family, a firm, or a government agency or GSE adapt to emerging climate change risk. For any entity that FHFA regulates, I suggest that FHFA demand to see an annual listing of who is employed by the GSE to work on the climate risk issue. What are the qualifications of such individuals and what are their responsibilities? Are the GSEs investing in skilled people who research the emerging challenges? FHFA could strongly nudge the

GSEs to invest in more climate change experts to work for them with explicit responsibilities to remain up to date in evaluating emerging risks and studying the recent climate performance of the GSE's portfolio of loans and the correlation structure of risks embedded in MBS assets.

Given that climate adaptation ideas are public goods, FHFA should encourage the GSEs to hold annual conferences with academics to foster idea exchange.

In the aftermath of major natural disasters, FHFA could require a GSE meeting to conduct a type of ex-post autopsy to see whether MBS pools suffered high levels of defaults for those loans issued that were directly affected by the geographic shock. This approach would create good incentives for learning and create greater accountability. If the "autopsy" reveals that natural disaster shocks are associated with a rising level of defaults, then FHFA can nudge the GSEs to consider new "rules of the game" to nudge the bank lenders to refine the loan terms to provide borrowers with incentives to invest in "climate proofing" their assets. For example, in flood zones --- homes can be put on stilts. In fire zones, there are other costly protective investments that can be made. As objective risks rise, these investments offer a positive expected present discounted value and help to protect the GSEs from default risk.

17. What, if any, additional periodic or episodic reporting requirements for the regulated entities should FHFA consider to improve the publicly available information on the regulated entities' management of climate and natural disaster risk?

If the GSEs employ a climate science officer and a climate economist, these two individuals could issue an annual report on what shocks their portfolio faced and how they ex-ante prepared for such shocks and ex-post what have been the impacts on their MBS performance. By encouraging the GSEs to invest in house climate analysis capability, FHFA encourages these entities to accumulate more human capital in managing climate risk and to create transparent ways for these entities to report their findings to the market and the public.

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?

In my new book *Adapting to Climate Change* (Yale University Press 2021), I argue at length that one strategy for both reducing home buyer risk exposure to climate risks and preserving housing affordability is to change local land use zoning rules. In particular, we need to encourage local jurisdictions to up zone so that less land is zoned for single family homes. In geographic areas that face less natural disaster risk from flooding, sea level rise and fires, we need to encourage up zoning to allow taller multi-family housing to be built. This effort would offer a double benefit. First, more people would live in the more climate resilient parts of geographic areas. Second, the increase in the

supply of housing units (relative to the counter-factual where the area is zoned for single family housing) would increase the likelihood of housing affordability even in desirable areas.

To appreciate the social costs associated with the current low density in areas such as San Francisco, read this piece. Enrico Moretti's 2017 New York Times piece is worth reading.
<https://www.nytimes.com/2017/11/03/opinion/california-fires-housing.html>

Does FHFA have financial tools at its disposal to encourage local areas to change their zoning codes? What role could an integrated Federal Government response play to encourage localities to more efficiently use their land to nudge economic activity to "higher ground" and away from fire zones? Such efforts would reduce concerns about "climate gentrification" because under our current land zoning for mostly single family homes, a type of "zero sum game" emerges because there aren't that many of such homes that can be built on higher ground.

19. Minority borrowers exhibit higher rates of delinquencies for longer durations following natural disasters. Are there policies the regulated entities could pursue to mitigate such adverse effects for minority borrowers exposed to climate and natural disaster risk?

This is a very important issue that merits experimentation and "outside the box" approaches. FHFA is right to worry about the following three facts; 1. On average, minority borrowers buy homes in areas that face more climate risk. 2. Minority borrowers are more likely to face loan repayment challenges because they have less wealth than white borrowers. 3. Climate change exacerbates risk levels in areas where minorities are more likely to live in. Thus, climate raises the risk that the loan repayment gap between whites and blacks could rise!

What is FHFA's best response to achieve its dual goals of building up climate resilience and making the American Dream more affordable for all Americans?

Could FHFA consider piloting a program where it partners with the GSEs to encourage some minority borrowers to borrow using a 15 year mortgage? On its own this would raise the monthly mortgage payments for the same home at a given interest rate. To counter this, FHFA could pilot encouraging more borrowers to participate in a Housing Partnership (shared appreciation mortgages) (see the Caplin et. al. reference below). I can imagine a setting where the home buyer owns ½ of her house and the Housing partner owns the other ½. My proposal features home buyers financing the home using equity (supplied by the Housing Partner) and less debt.

By encouraging such housing equity partnerships, FHFA would play a role as a market maker. This would be an "opt in" approach so that those who want to have a partner who has both capital and expertise in mitigating risk would partner with the home buyer. The housing partnership would have the scale of operations to invest in experts in adapting to new risks. Home owners tend to be amateurs and don't have the expertise to anticipate and invest to offset emerging risks.

If minorities tend to have few liquid cash resources, they may face short run financing constraints for

offsetting risk. By partnering with a housing partnership, this inefficiency would vanish.

Financial economists have also emphasized the importance of financial education in improving investment approaches. In a similar spirit, FHFA could partner with the climate rating firms to devise a climate financial education program and encourage home buyers who seek to have their loans securitized to the GSE to take it.

Relevant readings

Bayer PJ, Bernheim BD, Scholz JK. The effects of financial education in the workplace: Evidence from a survey of employers. *Economic Inquiry*. 2009 Oct;47(4):605-24.

Caplin A, Tracy J, Chan S, Freeman C, Tracy JI. *Housing partnerships: A new approach to a market at a crossroads*. MIT Press; 1997.

Caplin A, Carr JH, Pollock F, Yi Tong Z, Tan KM, Thampy T. Shared-equity mortgages, housing affordability, and homeownership. *Housing Policy Debate*. 2007 Jan 1;18(1):209-42.

Hastings JS, Madrian BC, Skimmyhorn WL. Financial literacy, financial education, and economic outcomes. *Annu. Rev. Econ.* 2013 Aug 2;5(1):347-73.

Lusardi A, Mitchell OS. The economic importance of financial literacy: Theory and evidence. *Journal of economic literature*. 2014 Mar;52(1):5-44.

Murphy JA. A practical analysis of shared-appreciation mortgages. *Housing Policy Debate*. 1991 Jan 1;2(1):43-8.

Sanders AB, Slawson Jr VC. Shared appreciation mortgages: Lessons from the UK. *Journal of Housing Economics*. 2005 Sep 1;14(3):178-93.

20. What type of organizational structures should FHFA and the regulated entities consider adopting for themselves to support the management of climate and natural disaster risk?

There should be an academic blue ribbon collection of scholars who are honest about their consulting and potential conflicts of interest to provide impartial advice at annual conferences to discuss best practices and to bring in academics working on relevant topics.

21. What specific issues or topics should FHFA consider for future research on climate and natural disaster risk to the regulated entities and the national housing finance markets?

A key issue in adapting to climate change is the risk perception of individual home buyers. Do their perceptions deviate from the level of the emerging actual risk? What is fascinating and scary about climate change is that the risk reality is changing over time and leading climate science firms and academics are trying their best to measure this reality.

We need new research measuring for potential home buyers, their “perceptions” of this moving climate risk target. Are current home buyers aware of the emerging risks? What are their subjective expectations concerning fire risk? Flood risk? And extreme weather events? Here the work of Charles Manski could be used to build surveys to elicit subjective expectations of emerging risks. FHFA could commission new surveys similar to the University of Michigan’s Survey of Consumer Expectations. FHFA could conduct surveys of prospective home buyers to learn about the baseline knowledge of such buyers.

https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=charles+manski+subjective+expectations&btnG=

<http://www.sca.isr.umich.edu/>

When people bid a lot of money for a home in a risky place, what motivates them? Do they love the property and have few alternatives? Are they naïve about the emerging climate risk? Are they risk lovers? Are they optimistic that if a disaster occurs that the Federal Government’s FEMA will bail them out (so the relevance of moral hazard)?

If home buyers are “ignorant” about the emerging climate risks, then this suggests that home buyers should be encouraged to take a short Internet “climate change education”. Frank Wolak and I have created such an education for educating home owners about the increasing block tariff they face when paying for electricity in California.

Kahn ME, Wolak FA. Using information to improve the effectiveness of nonlinear pricing: Evidence from a field experiment. California Air Resources Board, Research Division; 2013.

Conclusion

This letter has sketched out a new set of “rules of the game” that if adopted would help the residential real estate sector to become more resilient in the face of emerging climate risk. My microeconomic approach prioritizes information discovery and diffusion so that fewer buyers and sellers have ex-post regret about their investments. In my public lectures about the economics of climate change adaptation, I often talk about “who is the adult in the room?”. The point of this letter is that FHFA has the unique opportunity to be this adult!

A central issue here is to encourage the GSEs to build up “in house” human capital in building up climate resilience. If the GSEs invest in such climate expertise then they can nudge the bank lenders to “do their homework” in researching the possible default risk associated with a given loan. If banks issue more 15 year loans and require lower LTVs then this lowers default risk due to climate change. If FHFA encourages the growth of the housing partnership pathway to home ownership then this reduces concerns about denying access to housing for under-represented groups.

The decentralized approach I have sketched out helps to fuel microeconomic behavioral change which in aggregate strengthens the real estate sector’s overall resilience in the face of a scary emerging threat. The anticipation of a challenge creates the possibility of adapting to the risk!

Sincerely,

A handwritten signature in black ink, appearing to read 'Matt Kahn', with a stylized flourish at the end.

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