

# NOTES

## **Underwater Mortgages for Underwater Homes: The Elimination of Signals in the Coastal Lending Market**

*Climate change and sea level rise threaten to increase the default risk of mortgages on homes in coastal areas. Faced with this reality, small coastal lenders have begun selling more climate-sensitive mortgages to Fannie Mae and Freddie Mac, thereby transferring the risk of climate-induced default off the lenders' books. Fannie Mae and Freddie Mac play a crucial role in supporting America's mortgage finance system by purchasing qualifying private home loans, packaging them into investable security pools, and guaranteeing timely payment of principal and interest to outside investors. Through selling mortgages to Fannie Mae and Freddie Mac, lenders can use their increased liquidity to fund additional mortgages. The effectiveness of this process, however, is dependent on Fannie Mae and Freddie Mac accepting high-quality loans that carry minimal risks of default.*

*This Note argues that absent some form of intervention, small coastal lenders will likely continue offloading their climate-induced default risk until Fannie Mae and Freddie Mac become so overleveraged that they can no longer ensure a functioning secondary mortgage market and taxpayers are forced to bail them out—akin to the 2008 financial crisis. Further, this Note seeks to frame such harmful lending behavior as a general market failure, and, more specifically, as a variation of the Lemons Problem. Using familiar solutions to the Lemons Problem as guideposts, this Note attempts to curtail the asymmetrical offloading of climate-sensitive loans through a mixture of public and private mechanisms aimed at improving the ability of Fannie Mae and Freddie Mac to incorporate climate risks into loan purchasing decisions.*

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## INTRODUCTION

Government actors and mortgage lenders seemingly operate on vastly different time horizons. Due to the long-term nature of their investments, mortgage lenders and investors tend to evaluate a loan's

likelihood of repayment and risk of default over multiple decades.<sup>1</sup> Conversely, politicians and other decisionmakers are often fixated on the present and solving immediate problems.<sup>2</sup> This is not to say that politicians are not forward thinking, but rather they are less likely than mortgage lenders to consistently factor long-term issues with unclear solutions into their decisionmaking process.<sup>3</sup> Unfortunately, this discrepancy may be steadily moving American taxpayers towards a repeat of the 2008 financial crisis but this time in the coastal mortgage market.

The government-sponsored enterprises (“GSEs”) in the housing sector—Fannie Mae and Freddie Mac—acquire mortgages from lenders and are responsible for providing those lenders with immediate liquidity and for providing investors with a secondary market, in turn stimulating the widespread availability of affordable home loans.<sup>4</sup> Yet, the effectiveness of this mission depends heavily upon the ability of Fannie Mae and Freddie Mac to purchase mostly loans that carry a minimal risk of default.<sup>5</sup> Since these GSEs are principally tasked with ensuring a functioning secondary mortgage market, purchasing high-risk loans can threaten liquidity in the entire industry.<sup>6</sup> One emerging

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1. See URB. LAND INST., CLIMATE RISK AND REAL ESTATE: EMERGING PRACTICES FOR MARKET ASSESSMENT 6–7 (2020), <https://knowledge.uli.org/-/media/files/research-reports/2020/climate-risk-and-real-estate-emerging-practices-for-market-assessment.pdf> [<https://perma.cc/844C-XYDF>] (“Valuation has become more urgent for investors considering longer time horizons.”).

2. See, e.g., Roman Krznaric, *Why We Need to Reinvent Democracy for the Long-Term*, BBC FUTURE (Mar. 18, 2019), <https://www.bbc.com/future/article/20190318-can-we-reinvent-democracy-for-the-long-term> [<https://perma.cc/57KT-M28H>] (criticizing the short time horizons of democratically elected politicians); Richard Fisher, *The Perils of Short-Termism: Civilization’s Greatest Threat*, BBC FUTURE (Jan. 9, 2019), <https://www.bbc.com/future/article/20190109-the-perils-of-short-termism-civilisations-greatest-threat> [<https://perma.cc/L68R-9PA4>] (“[I]n politics the dominant time frame is a term of office . . .”).

3. See William D. Nordhaus, *The Political Business Cycle*, 42 REV. ECON. STUD. 169, 187 (1975) (concluding that democratic systems with periodic elections will make short-term decisions against the interests of future generations).

4. See Federal National Mortgage Association Charter Act, 12 U.S.C. § 1716 (“The Congress declares that the purposes of this subchapter are to establish secondary market facilities for residential mortgages . . .”); Christopher L. Peterson, *Predatory Structured Finance*, 28 CARDOZO L. REV. 2185, 2195–96 (2007) (discussing Fannie Mae’s role of providing lenders with immediate liquidity).

5. See Julia Kagan, *Mortgage-Backed Security (MBS)*, INVESTOPEDIA, <https://www.investopedia.com/terms/m/mbs.asp> (last updated Sept. 03, 2021) [<https://perma.cc/P9BB-YWZK>] (noting that the successful operation of the secondary mortgage market depends on each participant correctly doing their job).

6. See Peterson, *supra* note 4, at 2199 (explaining that investors saw mortgage-backed securities (“MBSs”) as a low-risk investment because the GSEs “guaranteed the principal and interest income even when mortgagors defaulted”).

default risk is global climate change.<sup>7</sup> Rising sea levels, increasing coastal flooding, and subsequent environmental degradation may significantly devalue coastal homes over the next several decades and lead homeowners to walk away from their mortgages rather than continue paying.<sup>8</sup> Some alarming current market signals suggest that local banks lending to coastal homebuyers may be selling large numbers of these high-risk loans to Fannie Mae and Freddie Mac, effectively transferring the risk of default due to climate change (“climate default”) to American taxpayers.<sup>9</sup>

This Note proposes a coordinate public and private law solution providing Fannie Mae and Freddie Mac with better mechanisms to evaluate and incorporate climate risk in loan approval guidelines, which would prevent mortgage lenders from asymmetrically offloading climate-sensitive loans onto the GSEs, thereby transferring unequal risk to taxpayers. Part II provides necessary background on the history and structure of Fannie Mae and Freddie Mac and examines the forecasted impacts of climate change on coastal regions. Part III identifies the current information asymmetry as a variation of the lemons problem and establishes three guiding objectives necessary to reduce asymmetries, analyzing the strengths and weaknesses of various public and private law approaches in relation to those objectives. Part IV proposes a multipronged, hybrid solution combining private initiatives with government intervention to close the informational gaps that currently pervade the marketplace and compel lenders and property appraisers to present Fannie Mae and Freddie Mac with more accurate risk assessments.

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7. See Jesse M. Keenan & Jacob T. Bradt, *Underwaterwriting: From Theory to Empiricism in Regional Mortgage Markets in the U.S.*, 162 CLIMATIC CHANGE 2043, 2043 (2020) (underscoring the figure that over \$1 trillion of private, coastal real property is at risk from climate change).

8. See Amine Ouazad, *Coastal Flood Risk in the Mortgage Market: Storm Surge Models' Predictions vs. Flood Insurance Maps*, ARXIV, at 2, <https://arxiv.org/pdf/2006.02977.pdf> (May 2020) [<https://perma.cc/255C-7DZN>] (“Flood risk may cause defaults or prepayments among borrowers, and cause losses among lenders and securitizers.”).

9. Christopher Flavelle, *Rising Seas Threaten an American Institution: The 30-Year Mortgage*, N.Y. TIMES, <https://www.nytimes.com/2020/06/19/climate/climate-seas-30-year-mortgage.html> (last updated Mar. 2, 2021) [<https://perma.cc/977C-7N3A>].

## I. BACKGROUND

## A. Pre-Depression Mortgages

The thirty-year fixed-rate mortgage<sup>10</sup> is currently America's most popular home loan,<sup>11</sup> but this has not always been the case. Prior to the Great Depression, housing finance in the United States mainly consisted of privately funded, short-term renewable loans with large down payments, short maturity dates, and large balloon payments.<sup>12</sup> Additionally, the majority of funding for these loans came from various life insurers, commercial banks, and thrifts.<sup>13</sup> Accordingly, the absence of a national housing market made widespread homeownership difficult since the "availability and pricing for mortgage loans varied widely across the country."<sup>14</sup> Extensive unemployment during the Great Depression finally brought this issue to a head, as nearly a quarter of the nation's home mortgage debt was in default by 1933,<sup>15</sup> and lenders quickly lost confidence in the mortgage-lending system.<sup>16</sup>

## B. Congressional Response

Congress responded to the Great Depression housing crisis with two important creations: the Federal Housing Administration ("FHA")

10. Fixed-rate mortgages differ from other types of home loans in that the borrower's interest rate remains unchanged through the life of the loan, although the amount of interest and principal paid each month may vary. James McWhinney, *Fixed-Rate vs. Adjustable-Rate Mortgages: What's the Difference?*, INVESTOPEDIA, <https://www.investopedia.com/mortgage/mortgage-rates/fixed-versus-adjustable-rate/> (last updated June 29, 2021) [<https://perma.cc/L3GK-P75K>].

11. The Single-Fam. Team, Freddie Mac, *Why America's Homebuyers & Communities Rely on the 30-Year Fixed-Rate Mortgage*, FREDDIE MAC SINGLE-FAM. (Apr. 10, 2017), <https://sf.freddiemac.com/articles/insights/why-americas-homebuyers-communities-rely-on-the-30-year-fixed-rate-mortgage> [<https://perma.cc/67SA-FS2K>] ("[A]bout 90 percent of homebuyers chose the 30-year fixed-rate mortgage in 2016.").

12. OFF. OF INSPECTOR GEN., FED. HOUS. FIN. AGENCY, A BRIEF HISTORY OF THE HOUSING GOVERNMENT-SPONSORED ENTERPRISES 1 (<https://www.fhfaig.gov/Content/Files/History%20of%20the%20Government%20Sponsored%20Enterprises.pdf> (last visited Sept. 12, 2021) [<https://perma.cc/ZH8B-KJ7Z>] [hereinafter GSE HISTORY]. Balloon payments are lump-sum payments that a borrower must make to a lender at the end of a mortgage's term. *Id.* at 2. These payments are comparatively much larger than the regular interest and principal payments that preceded them. *Id.*

13. *Id.* at 1. Thrifts are a type of financial institution that mainly specialize in offering savings accounts and originating home mortgage loans. *Id.* at 2; Julia Kagan, *Thrift Bank*, INVESTOPEDIA, <https://www.investopedia.com/terms/t/thriftbank.asp> (last updated July 31, 2020) [<https://perma.cc/5L5H-KRK2>].

14. GSE HISTORY, *supra* note 12, at 1.

15. *Id.*

16. Robin Paul Malloy, *The Secondary Mortgage Market—A Catalyst for Change in Real Estate Transactions*, 39 SW. L.J. 991, 992 (1986).

and the Federal National Mortgage Association (“FNMA”).<sup>17</sup> The FHA, established in 1934, was tasked with providing federally guaranteed insurance to home mortgage lenders.<sup>18</sup> This government-backed insurance worked to insulate lenders from a borrower’s credit risk, which ultimately facilitated mortgage loans with longer terms, smaller down payments, and lower monthly installments.<sup>19</sup> Four years later, Congress created the FNMA—better known today as Fannie Mae—to provide further stabilization by establishing a secondary housing market.<sup>20</sup> Fannie Mae originally helped augment the work of the FHA by purchasing “nonconventional” FHA-insured loans<sup>21</sup> to provide immediate liquidity to mortgage lenders and thereby encourage their continued market participation.<sup>22</sup> Under this framework, qualifying mortgages were guaranteed, and lenders could assign loans to Fannie Mae for quick cash to recover investments.<sup>23</sup> This interaction between the FHA and Fannie Mae effectively established a secondary market that alleviated many of the lending-security fears which had initially ground the federal housing market to a halt and that ultimately induced various lenders back into the consumer home loan market.<sup>24</sup>

### *C. Privatization and Securitization*

Fannie Mae provided historically unprecedented levels of credit security to Americans in the decades following the Great Depression.<sup>25</sup>

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17. Peterson, *supra* note 4, at 2195–96.

18. *Id.* at 2195. For those loans meeting FHA underwriting criteria, the government promised to pay lenders the difference between the selling price of a repossessed home and the outstanding loan balance. *Id.*

19. *Id.* at 2195–96. Although borrowers were able to obtain mortgages up to thirty years at the agency’s inception, the thirty-year mortgage did not become a staple of FHA policy until the mid-1950s when the FHA moved from twenty-year loans to thirty-year ones to counteract an interest rate increase from the Federal Reserve. Edward Pinto, *The 30-Year Fixed Mortgage Should Disappear*, FORBES (Apr. 26, 2016, 6:30 AM), <https://www.forbes.com/sites/realspin/2016/04/26/30-year-fixed-mortgage/#7a10401c68e1> [<https://perma.cc/7HQ5-G37J>].

20. See Federal National Mortgage Association Charter Act, 12 U.S.C. § 1716 (“The Congress declares that the purposes of this subchapter are to establish secondary market facilities for residential mortgages . . .”).

21. A “nonconventional” loan is one that is backed by the government, while a “conventional” loan is one that is *not* secured by the government. Investopedia Team, *Conventional Mortgage or Loan*, INVESTOPEDIA, <https://www.investopedia.com/terms/c/conventionalmortgage.asp> (last updated June 30, 2021) [<https://perma.cc/XHK5-4VXL>].

22. See Peterson, *supra* note 4, at 2196 (“This secondary market outlet alleviated fears of illiquidity, inducing many mortgage loan companies, insurance companies, and even commercial banks back into the consumer home loan business.”).

23. *Id.*

24. *Id.*

25. *Id.* at 2197.

Credit-security growth was limited, however, by the federal government's desire to further certain policy objectives of its insurance programs, such as improved housing for the military and the elderly.<sup>26</sup> Pressure from mortgage bankers looking to enter the conventional market mounted as a result,<sup>27</sup> and Congress responded in 1968 by splitting Fannie Mae into two separate entities.<sup>28</sup> One entity—the Government National Mortgage Association (“Ginnie Mae”)—continued Fannie Mae's previous mission of purchasing nonconventional FHA-insured mortgages.<sup>29</sup> The other entity retained the FNMA name but became a private, federally chartered corporation.<sup>30</sup> Importantly, Fannie Mae was given a new directive to purchase non-government-insured home loans from private lenders.<sup>31</sup> Two years later, Congress established the Federal Home Loan Mortgage Corporation (“Freddie Mac”) to serve a similar role.<sup>32</sup>

Originally, the housing GSEs managed their holdings under a relatively stagnant framework where mortgages were simply purchased and held in portfolios.<sup>33</sup> This structure, however, dramatically changed with the advent of securitization.<sup>34</sup> Starting in the early 1970s, Ginnie Mae and Freddie Mac (and later Fannie Mae) “began issuing mortgage-backed securities that ‘passed through’ interest income to investors.”<sup>35</sup> Simply put, the agencies would purchase conventional home mortgages, compile a large number of the mortgages into homogenized “pools,” and then sell participation in the pools to institutional investors.<sup>36</sup> These instruments provided investors

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26. *Id.* at 2198.

27. Many mortgage bankers desired to penetrate the conventional loan market but lacked the necessary capital and security to do so. *Id.*

28. Malloy, *supra* note 16, at 993.

29. Peterson, *supra* note 4, at 2198.

30. Private, federally-chartered corporations are also known as GSEs. See Troy Segal, *Government-Sponsored Enterprise (GSE)*, INVESTOPEDIA, <https://www.investopedia.com/terms/g/gse.asp> (last updated Nov. 30, 2020) [<https://perma.cc/2ZJQ-AZAZ>]. Instead of lending money directly to the public, GSEs guarantee third-party loans and purchase loans on the secondary market to increase lenders' liquidity and reduce the risk of capital loss by investors. *Id.* Some examples of other well-known GSEs include the Farm Credit System (agriculture) and Sallie Mae (education). *Id.*

31. Peterson, *supra* note 4, at 2198.

32. See Malloy, *supra* note 16, at 994 (explaining that although Freddie Mac was authorized to purchase FHA-insured loans, it focused primarily on conventional loans).

33. See Peterson, *supra* note 4, at 2197 (Through Fannie Mae, “the government purchased and held consumer borrowers' promissory notes.”).

34. *Id.* at 2198.

35. *Id.*

36. See, e.g., *id.* at 2198–99 (describing how MBSs work); Kagan, *supra* note 5 (defining pass-through MBSs).

with a greater ability to hold large, diversified mortgage portfolios since the GSEs guaranteed the principal and interest income of their securities even when borrowers defaulted.<sup>37</sup> One important limitation of mortgage-backed securities (“MBSs”), however, is that their efficacy is only realized when the principal actors properly perform their jobs to mitigate large-scale default risk.<sup>38</sup> Banks must maintain reasonable standards for accepting loans, borrowers must continue paying on time, and credit rating agencies that review MBSs must perform sufficient due diligence.<sup>39</sup> As evidenced in the 2008 financial crisis, if any of these actors fail to uphold their end of the bargain, the system may crash.<sup>40</sup>

#### D. Loan Selection

Before discussing the basis upon which Fannie Mae and Freddie Mac purchase loans, it is helpful to understand the different mortgage credit classifications. There are three main categories a loan can fall into: prime, Alt-A, and subprime. A prime loan, also known as a conforming loan, is a loan that meets each of the eligibility standards required for purchase by Fannie Mae and Freddie Mac.<sup>41</sup> Conversely, a subprime mortgage is a non-conforming mortgage that fails to meet conforming loan standards by a substantial margin.<sup>42</sup> Between prime and subprime loans are Alt-A loans—those mortgages that fail to meet all conforming standards but only by one of the requirements.<sup>43</sup> Fannie Mae and Freddie Mac primarily deal in the prime mortgage market as these are the only loans the agencies will guarantee and purchase for the secondary market.<sup>44</sup>

As briefly mentioned above, a mortgage must meet a strict set of underwriting criteria determined by Fannie Mae and Freddie Mac before the agencies will purchase it.<sup>45</sup> Although the list of conforming criteria is extensive, there are a few important standards worth

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37. Peterson, *supra* note 4, at 2199.

38. See Kagan, *supra* note 5 (“This process works for all concerned as everyone does what they’re supposed to do.”).

39. *Id.*

40. See *id.* (noting the failures of banks, Fannie Mae, Freddie Mac, and credit ratings agencies in the 2008 financial crisis).

41. David Schumde, *Responding to the Subprime Mess: The New Regulatory Landscape*, 14 *FORDHAM J. CORP. & FIN. L.* 709, 716 (2009).

42. *Id.* at 719.

43. *Id.* at 718. An example of an Alt-A loan is one in which the borrower’s credit score falls below conforming standards but not so low as to classify the loan as subprime. *Id.*

44. Troy Segal, *Conforming Loan*, INVESTOPEDIA, <https://www.investopedia.com/terms/c/conformingloan.asp> (last updated July 12, 2021) [<https://perma.cc/4WVQ-CDM8>].

45. Schumde, *supra* note 41, at 716–17.



highlighting. First, the principal amount of most single-family residential loans may not exceed a general conforming loan limit<sup>46</sup> and must be less than eighty percent of the appraised value of the home.<sup>47</sup> Second, the borrower must have sufficient income and a good credit score.<sup>48</sup> Third, and most important for the purposes of this Note, mortgage lenders must obtain “appraisal reports with reliable opinions of market value” before they can offload the loan.<sup>49</sup> More specifically, Fannie Mae mandates that property appraisals be stated in “factual, unbiased, and specific terms” and consider every factor that may impact value, including the presence of unfavorable environmental and economic conditions.<sup>50</sup> Certain environmental conditions can impose further demands on borrowers and lenders as well. For instance, those obtaining loans located in Special Flood Hazard Areas (“SFHA”)—as designated by the Federal Emergency Management Agency (“FEMA”)—must secure flood insurance before the loans are eligible for purchase by Fannie Mae or Freddie Mac.<sup>51</sup>

While restricting mortgage eligibility based on loan size and on credit scores may help Fannie Mae reduce some default risk, those requirements relating to environmental conditions may not provide Fannie Mae with sufficient information to effectively mitigate default risk in light of a changing global climate and rising sea levels.<sup>52</sup>

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46. *Single-Family MBS Prospectus*, FANNIE MAE 67 (May 1, 2020), [https://capmrkt.fanniemae.com/syndicated/documents/mbs/mbspros/SF\\_May\\_1\\_2020.pdf](https://capmrkt.fanniemae.com/syndicated/documents/mbs/mbspros/SF_May_1_2020.pdf) [<https://perma.cc/6XXU-8RPA>]. The current general conforming loan limit is set at \$510,400 for most single-family residential dwellings. *Id.* As of 2008, the Federal Housing Finance Agency is required under the Housing and Economic Recovery Act to annually review and adjust the general conforming loan limits to reflect changes in the average U.S. home price. Segal, *supra* note 44.

47. 12 U.S.C. § 1717(b)(2). This percentage is commonly understood as the loan-to-value ratio (“LTV ratio”) and describes the relative size of a borrower’s down payment compared to the underlying value of the home. *See* Segal, *supra* note 44.

48. Schmudde, *supra* note 41, at 717.

49. FANNIE MAE, *supra* note 46, at 69.

50. *Selling Guide*, FANNIE MAE, at B4-1.1-02, <https://selling-guide.fanniemae.com/Selling-Guide/Origination-thru-Closing/Subpart-B4-Underwriting-Property/Chapter-B4-1-Appraisal-Requirements/Section-B4-1-1-General-Appraisal-Requirements/1032987331/B4-1-1-02-Lender-Responsibilities-09-04-2018.htm> (last updated Sept. 1, 2021) [<https://perma.cc/HP45-BRUN>]. Although Fannie Mae mandates consideration of all value-related factors, using unsupported assumptions or perceptions about those factors is expressly prohibited. *Id.*

51. Flavelle, *supra* note 9; *see also infra* Part I.F (explaining FEMA flood insurance).

52. OFF. OF FED. HOUS. ENTER. OVERSIGHT, SYSTEMIC RISK: FANNIE MAE, FREDDIE MAC AND THE ROLE OF OFHEO 49 (Feb. 4, 2003) <https://www.ffhfa.gov/PolicyProgramsResearch/Research/PaperDocuments/SYSTEMIC%20RISK.pdf> [<https://perma.cc/D5BF-GNHV>]; *see also infra* Part I.F.

*E. Climate Change and Coastal Communities*

Global sea levels are commonly projected to rise one to four feet over the next century,<sup>53</sup> and most scientists predict this phenomenon will be accompanied by a higher prevalence of extreme weather events and flooding episodes.<sup>54</sup> Such dramatic impacts from sea level rise (“SLR”) and attendant extreme weather events will almost certainly impose a wide degree of economic hardship on American citizens.<sup>55</sup> According to the U.S. Global Change Research Project, “over \$1 trillion of privately held coastal real property is at-risk from climate change in the U.S.”<sup>56</sup> Logically, SLR is more likely to directly impact residents of coastal communities given their proximity to the ocean, although some regions may suffer more damage than others.<sup>57</sup> Many areas are already experiencing the adverse effects of climate-related oceanic changes, like SLR and increased flooding, in addition to changes more tangibly connected to human activities, such as impaired infrastructure development and habitat degradation.<sup>58</sup> Given current trends and the

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53. Lint Barrage & Jacob Furst, *Housing Investment, Sea Level Rise, and Climate Change Beliefs*, 177 *ECON. LETTERS* 105, 105 (2019); see also Michael Oppenheimer et al., *Sea Level Rise and Implications for Low-Lying Islands, Coasts and Communities*, in INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, SPECIAL REPORT ON THE OCEAN AND CRYOSPHERE IN A CHANGING CLIMATE 321, 326–28 (Hans-Otto Pörtner et al. eds., 2019) [https://www.ipcc.ch/site/assets/uploads/sites/3/2019/11/08\\_SROCC\\_Ch04\\_FINAL.pdf](https://www.ipcc.ch/site/assets/uploads/sites/3/2019/11/08_SROCC_Ch04_FINAL.pdf) [<https://perma.cc/V8MF-BWDL>] (projections of future rise in global mean sea level).

54. See Jane Lubchenco & Thomas R. Karl, *Predicting and Managing Extreme Weather Events*, 65 *PHYSICS TODAY* 31, 32 (2012); Timu W. Gallien, Nikos Kalligeris, Marie-Pierre C. Delisle, Bo-Xiang Tang, Joseph T.D. Lucey & Maria A. Winters, *Coastal Flood Modeling Challenges in Defended Urban Backshores*, 8 *GEOSCIENCES* 450, 450 (2018) (“Relatively modest sea level rise (i.e., 0.50 m) will significantly increase flood frequencies.”).

55. See Francesc Ortega & Süleyman Taspınar, *Rising Sea Levels and Sinking Property Values: Hurricane Sandy and New York’s Housing Market*, 106 *J. URB. ECON.* 81, 81 (2018); see also ASS’N STATE FLOODPLAIN MANAGERS, FLOOD MAPPING FOR THE NATION: A COST ANALYSIS FOR COMPLETING AND MAINTAINING THE NATION’S NFIP FLOOD MAP INVENTORY 6 (Jan. 2020) [https://asfpm-library.s3-us-west-2.amazonaws.com/FSC/MapNation/ASFPM\\_MaptheNation\\_Report\\_2020.pdf](https://asfpm-library.s3-us-west-2.amazonaws.com/FSC/MapNation/ASFPM_MaptheNation_Report_2020.pdf) [<https://perma.cc/5MTB-7H39>] (“Financial impacts of flooding are high and will be higher in the future. Trends indicate that the federal taxpayer is paying a greater share of disaster costs than any time in history.”); Gallien et al., *supra* note 54, at 450 (noting a predicted increase in coastal-population flood-risk exposure over the next fifty years and a dramatic increase in assets exposed to 100-year coastal floods in the coming decades).

56. Keenan & Bradt, *supra* note 7, at 2043.

57. Oppenheimer et al., *supra* note 53, at 323 (“Coastal risk is dynamic and increased by widely observed changes in coastal infrastructure, community livelihoods, agriculture and habitability . . .”). The relative impact of rising sea levels on a given coastal community are unlikely to be uniform due to variation in community characteristics. See *id.* at 323–24; Gallien et al., *supra* note 54, at 450 (noting significant variability in regional trends). The absence of identical adverse impacts among coastal areas, however, does not necessarily lead to the conclusion that *no* impact will occur in a given coastal community. See Oppenheimer et al., *supra* note 53, at 324–25.

58. Oppenheimer et al., *supra* note 53, at 328, 371–73.

scientific community's general agreement regarding the likelihood of future impacts, significant action will be necessary in the coming decades to address and adapt to a changing coastal environment.<sup>59</sup>

### *F. Lending Trends and Elimination of Market Signals*

Many players in the real estate market already seem aware of the current and future risks generated by global climate change and have taken some steps towards mitigation. One study in particular has found evidence that mortgage-lending banks are increasingly shifting flood-prone mortgages off their books and onto Fannie Mae and Freddie Mac.<sup>60</sup> Notably, the lenders selling off coastal mortgages the fastest are smaller, local banks situated in coastal areas.<sup>61</sup> These banks likely have a better understanding than larger national banks of which neighborhoods face the greatest climate risk and are using that knowledge to minimize their risk exposure.<sup>62</sup>

Although banks may benefit from the practice, selling flood-prone mortgages to Fannie Mae and Freddie Mac may have long-term damaging effects on the real estate market as a whole. Specifically, the practice may reduce or practically eliminate the accuracy of market signals that investors and other lenders rely on to inform business decisions.<sup>63</sup>

Market signals are indicators that arise when a market insider—a market participant who possesses information other market participants do not have—takes action which triggers buying or selling

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59. See J.A.G. Cooper & C. Lemckert, *Extreme Sea-Level Rise and Adaptation Options for Coastal Resort Cities: A Qualitative Assessment from the Gold Coast, Australia*, 64 OCEAN & COASTAL MGMT. 1, 1, 9–13 (2012) (outlining a range of adaptation options for coastal resort cities to combat SLR and erosion). Although there is a general consensus among scientists that SLR will increase the prevalence of coastal flooding events, there is more disagreement as to which flood modeling methods are the best predictors. See Gallien et al., *supra* note 54, at 451 (discussing different flood modeling methods). This disagreement, however, is largely due to the complex and multifaceted nature of climate modeling. See *id.* at 452 (noting the multitude of variables that must be factored into flood models).

60. Flavelle, *supra* note 9. Since Fannie Mae and Freddie Mac are backed by the federal government, this practice has effectively shifted the inherent climate risk of coastal mortgages to American taxpayers. See *id.*

61. *Id.* In 2009, local banks sold forty-three percent of their mortgages located in areas vulnerable to flooding from SLR. *Id.* By 2017, selling had increased; local banks were selling fifty-seven percent of vulnerable mortgages despite mortgages sales in less vulnerable areas remaining constant. *Id.* Local banks have utilized other tactics to reduce the risk of climate-related losses as well. See *id.* For instance, some banks have begun lending less money to home buyers in vulnerable areas, thus increasing the size of initial down payments. *Id.*

62. See *id.*

63. See Keenan & Bradt, *supra* note 7, at 2044 (describing information asymmetry in coastal lending markets).

behavior by those who lack similar inside information.<sup>64</sup> Put differently, market signaling describes the act of one market participant conveying information to other market participants through the initial market participant's behavior in the marketplace.<sup>65</sup> If the insider sends accurate signals reflecting their enhanced knowledge, the market as a whole should operate more efficiently.<sup>66</sup>

Where there are market signals, however, there are often market failures. Generally, the term “market failure” refers to an inefficient distribution of goods and services in the free market, often resulting in negative externalities that impose costs on non-transacting parties.<sup>67</sup> One prominent cause of market failures is the exploitation of asymmetric information—where “one party to an economic transaction possesses greater material knowledge than the other party.”<sup>68</sup>

Even though most transactions are subject to a certain degree of information asymmetry, exploiting these knowledge gaps can often lead to inefficient transactions and increased risk exposure.<sup>69</sup> Consequently, the efficiency of the market as a whole is largely dependent on insiders sending signals that accurately convey their increased knowledge, so the remaining market participants can adjust accordingly—thereby reducing information gaps.<sup>70</sup>

It follows that the current uneven distribution of SLR flood risk caused by institutional information barriers has potentially contributed to inaccurate determinations of mortgage risk that may not truly reflect long-term asset performance and credit loss in coastal regions.<sup>71</sup> By offloading increasingly flood-prone mortgages to Fannie Mae and Freddie Mac, coastal mortgage lenders have altered market signals such that the signals no longer accurately reflect the riskiness of

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64. *What Is Signaling? Definition and Meaning*, MKT. BUS. NEWS, <https://marketbusinessnews.com/financial-glossary/signaling-definition-meaning/> (last visited Sept. 20, 2021) [<https://perma.cc/K8PQ-8PW3>].

65. *Id.*

66. *Id.*

67. *Market Failures, Public Goods, and Externalities*, LIBR. ECON. & LIBERTY, <https://www.econlib.org/library/Topics/College/marketfailures.html> (last visited Sept. 4, 2021) [<https://perma.cc/K9UX-CXZA>]. Negative externalities occur when the costs and benefits of a good or service are not reflected in its market price and are externalized onto other parties. *Id.*

68. Andrew Bloomenthal, *Asymmetric Information*, INVESTOPEDIA, <https://www.investopedia.com/terms/a/asymmetricinformation.asp> (last updated Jan. 19, 2021) [<https://perma.cc/3X4N-CPJV>].

69. *See id.* (noting the phenomenon of adverse selection—where one party exploits an information asymmetry and ultimately exposes the other party to extreme risk of loss).

70. *See* Liudmila Zavolokina, Manuel Schlegel & Gerhard Schwabe, *How Can We Reduce Information Asymmetries and Enhance Trust in 'The Market for Lemons'?*, INFO. SYS. & E-BUS. MGMT. 1, 21–24 (Feb. 18, 2020) (concluding that buyers had greater valuation success when they were given more accurate product information, thereby reducing information asymmetries).

71. Flavelle, *supra* note 9.

lending to coastal property owners.<sup>72</sup> Coastal lenders with greater private knowledge of localized SLR flooding impacts are capitalizing on an information asymmetry and externalizing their risk at the expense of Fannie Mae, Freddie Mac, and the market as a whole.<sup>73</sup> Unfortunately, a market failure of this type creates a cascade effect. With Fannie Mae and Freddie Mac willingly accepting risky loans on coastal homes, banks are incentivized to continue lending mortgages to owners of properties subject to increased SLR flooding, loans that may suffer substantial loss in value over the next thirty years and that stand at a high risk of default.<sup>74</sup> Moreover, if banks have little reason to curtail risky lending practices, it is conceivable that the availability of borrowing opportunities will remain stable or increase for present and future coastal homeowners, even as the riskiness of such loans grows.<sup>75</sup>

Much of this market-signal interference is rooted in the imprecise flood-insurance mapping of high-risk coastal areas performed by FEMA as part of the National Flood Insurance Program (“NFIP”).<sup>76</sup> The NFIP was originally intended to protect homeowners from expensive flood events at a time when most homeowners did not own flood insurance, and it serves a similar purpose today where homeowners may otherwise opt to forgo such coverage.<sup>77</sup> In short, the federal government offers flood insurance to property owners and at-risk communities in return for a commitment that participating

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72. *See id.*

73. *See id.*

74. Loans for property that depreciate to a value less than that of the loan present a high risk of default because the mortgage is worth more than the property itself, which often leads homeowners to simply walk away. *See* Laura Agadoni, *Walking Away from a Mortgage: An Investor's Guide*, MILLIONACRES, <https://www.millionacres.com/real-estate-financing/mortgages/walking-away-from-a-mortgage-an-investors-guide/> (last updated June 10, 2021) [<https://perma.cc/QP56-ZQAW>].

75. *See* Barbara Neumann, Athanasios T. Vafeidis, Juliane Zimmermann & Robert J. Nicholls, *Future Coastal Population Growth and Exposure to Sea-Level Rise and Coastal Flooding - A Global Assessment*, PLOS ONE, Mar. 11, 2015, at 2, 18 (noting the ongoing trend of migration to the coast and predicting an increase in North American coastal migration in the coming decades); Sarah Pralle, *Drawing Lines: FEMA and the Politics of Mapping Flood Zones*, 152 CLIMATIC CHANGE 227, 228 (2019) (“Flooding is costly and becoming more so as coastal population density increases, development in flood zones continues, and other land use changes exacerbate flood impacts.”). For an analysis and prediction of coastal flooding and population trends in the world’s most populous port cities, *see* Susan Hanson, Robert Nicholls, N. Ranger, S. Hallegatte, J. Corfee-Morlot, C. Herweijer & J. Chateau, *A Global Ranking of Port Cities with High Exposure to Climate Extremes*, 104 CLIMATIC CHANGE 89 (2011).

76. Pralle, *supra* note 75, 229–30; *see* Ouazad, *supra* note 8, at 2 (“New estimates of floodplain boundaries . . . suggest that up to 41 million Americans live within the 100-year floodplain, substantially above the number of Americans living within the 100-year floodplain of FEMA’s flood insurance maps.”).

77. Pralle, *supra* note 75, at 229–30.

communities regulate development in flood-prone areas and enforce flood-mitigating building codes.<sup>78</sup> FEMA is charged with providing flood insurance rate maps (“FIRM”) that delineate areas subject to increased flooding in participating communities.<sup>79</sup> Although participation was initially low, community involvement has risen significantly since Congress mandated flood insurance for properties with federally backed mortgages, which began in the 1970s.<sup>80</sup>

Thus, since flood insurance is required before a loan located in a FEMA SFHA can be considered conforming, inaccurate mapping can further widen the informational gap between lenders, borrowers, investors, Fannie Mae, and Freddie Mac. Major concerns arise regarding the accuracy of FIRMs as such boundaries are often outdated, imprecise, and improperly influenced by political motivations rather than an objective measure of flood risk.<sup>81</sup> Further, FIRMs do not show variations in flood risk throughout and outside designated SFHAs, leading homeowners, lenders, and the GSEs to perceive flood risk as a binary measurement.<sup>82</sup> Additionally, the prospects of affordable flood insurance and a government bailout may distort market signals in a manner that underestimates the true cost of living in flood-prone areas and actually encourages development in coastal communities.<sup>83</sup>

Ultimately, if Fannie Mae and Freddie Mac continue to accept these high-risk loans, much of the risk of default that is usually placed on lenders may shift to American taxpayers.<sup>84</sup> While this Note generally focuses on the offloading of risky coastal mortgages onto the GSEs, it is primarily concerned with those mortgages on properties located outside FEMA SFHAs, as these loans present the highest potential cost to taxpayers in the event of default.<sup>85</sup> Events in recent decades have

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78. *Id.*

79. *See id.* at 230 (discussing FEMA’s role in the NFIP indicating SFHAs—those areas with a 1% chance of flooding in a given year—and base flood elevation levels).

80. *Id.*

81. *Id.* at 229, 233. Some of the mapping imprecision is due in part to the uncertainty of impacts caused by climate change and a lack of accuracy in current prediction models. *Id.* at 229; *see also* ASS’N STATE FLOODPLAIN MANAGERS, *supra* note 55, at 17 (“Over 3,300, or roughly 15%, of NFIP communities have maps over 15 years old, with many of these over 30 years old and still having ‘unmodernized’ paper maps. About 6,550 communities have never been mapped.”).

82. Howard Kunreuther, Susan Wachter, Carolyn Kousky & Michael Lacour-Little, *Flood Risk and the U.S. Housing Market* 8 (October 2018) (Penn. Inst. for Urb. Rsch., Working Paper), [https://penniu.r.upenn.edu/uploads/media/Flood\\_Risk\\_and\\_the\\_US\\_Housing\\_Market.pdf](https://penniu.r.upenn.edu/uploads/media/Flood_Risk_and_the_US_Housing_Market.pdf) [<https://perma.cc/JML4-W8GL>].

83. Pralle, *supra* note 75, at 230.

84. *See* Flavelle, *supra* note 9 (noting the consequences of widespread defaults on mortgages held by Fannie Mae and Freddie Mac).

85. Although taxpayers would still bear the cost of flooding for homes backed by government-sponsored flood insurance, the argument there would be different because the argument would suggest that actuaries need to better price the risk of SLR flooding into their insurance premium

shown that unaddressed information asymmetries in the mortgage market can lead to market failures that taxpayers must finance.<sup>86</sup> During the 2008 financial crisis, taxpayers shouldered the burden of keeping Fannie Mae and Freddie Mac solvent after both agencies acquired too many high-risk loans, to the tune of \$187 billion in public aid.<sup>87</sup> It follows that, without some reform, taxpayers may be faced with a similar burden if Fannie Mae and Freddie Mac continue to accept flood-prone coastal loans that carry a high climate-default risk.<sup>88</sup>

## II. ANALYSIS: REDUCING THE INFORMATIONAL GAP—THREE PRINCIPAL OBJECTIVES

Information asymmetry and risk externalization create a potentially disastrous combination for the GSEs and the mortgage market. A knowledge gap currently exists between small, coastal lenders and Fannie Mae and Freddie Mac regarding the climate-default risk borne by properties along the coast.<sup>89</sup> Thus far, local lenders acting on their greater knowledge have successfully transferred any default risk attached to these properties to the GSEs, and the current legal landscape has tolerated this activity.<sup>90</sup> Although a multifaceted

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pricing. Notably, the risk placed on taxpayers in this realm may be significantly reduced moving forward since the flood-insurance market—an area historically dominated by the federal government—is now more accessible to private insurers. See Loans in Areas Having Special Flood Hazards Rule, 12 C.F.R. pt. 22 (OCC), pt. 208 (Board), pt. 339 (FDIC), pt. 614 (FCA), and pt. 760 (NCUA) (2019) (final rule from major banking regulators).

86. See, e.g., Manoj Singh, *The 2007–2008 Financial Crisis in Review*, INVESTOPEDIA, <https://www.investopedia.com/articles/economics/09/financial-crisis-review.asp> (last updated Jan. 10 2021) [<https://perma.cc/8C5E-HUY4>]; Kimberly Amadeo, *What Was the Bank Bailout Bill?*, THE BALANCE, <https://www.thebalance.com/what-was-the-bank-bailout-bill-3305675> (last updated Oct. 26, 2020) [<https://perma.cc/Z5LQ-AJDS>].

87. Flavelle, *supra* note 9; see Kimberly Amadeo, *Did Fannie and Freddie Cause the Mortgage Crisis?*, BALANCE, <https://www.thebalance.com/did-fannie-and-freddie-cause-the-mortgage-crisis-3305659> (last updated Mar. 4, 2021) [<https://perma.cc/26GG-ZBVB>] (highlighting the risky loans Fannie Mae and Freddie Mac acquired leading up to the 2008 financial crisis). Although the GSEs eventually repaid these funds, both Fannie Mae and Freddie Mac were placed in conservatorships under the direction of the Federal Housing Finance Agency. Segal, *supra* note 30; *History of Fannie Mae and Freddie Mac Conservatorships*, FED. HOUS. FIN. AGENCY, <https://www.fhfa.gov/Conservatorship/Pages/History-of-Fannie-Mae--Freddie-Conservatorships.aspx> (last visited Sept. 20, 2020) [<https://perma.cc/KGD4-2QLM>].

88. See Thomas Combs, Note, *A Proposal for Regulation of the Government-Sponsored Enterprises*, 84 ST. JOHN'S L. REV. 759, 769 (2010) (explaining that market forces alone cannot be expected to protect homeowners, taxpayers, or investors from Fannie Mae and Freddie Mac's considerable market influence).

89. See discussion *supra* Part I.F (discussing the information asymmetry in coastal mortgage markets between the GSEs and local banks); Flavelle, *supra* note 9 (noting that coastal lenders are offloading risky mortgages onto Fannie Mae and Freddie Mac).

90. Flavelle, *supra* note 9.

problem, viewing this asymmetry through an alternative lens can help identify guiding principles for reform that can be used by homeowners, private actors, and government entities alike.

### A. *The Lemons Problem*

An alternative way to describe this problem is as an outgrowth of the “lemons problem,” an economic theory originally proposed by economist George Akerlof.<sup>91</sup> For a paradigmatic example, consider a scenario in which a potential buyer of a used car has an equal chance of buying a “good” car and of buying a “lemon.”<sup>92</sup> If buyers are unable to distinguish between cars that are good and cars that are lemons,<sup>93</sup> sellers with lemons are incentivized to falsely market their cars as “good.”<sup>94</sup> Realizing this incentive, the buyers will offer to pay no more than the average price for any given car to reduce their exposure to loss.<sup>95</sup> By offering an average price, however, the buyers have undervalued any good car purchased and overvalued any lemon purchased.<sup>96</sup> More importantly, since those selling lemons stand to earn a significant premium above their product’s true value, more lemon sellers are incentivized to enter the market, thus driving out any remaining good cars and potentially leading to a total market failure.<sup>97</sup>

We can apply this theory to the coastal mortgage market: GSEs (buyers) purchase mortgages (used cars) from coastal lenders (sellers) who have a greater understanding of whether or not the mortgage is subject to increased SLR flooding and climate default (a lemon).

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91. See George A. Akerlof, *The Market For “Lemons”: Quality Uncertainty and the Market Mechanism*, 84 Q.J. ECON. 488 (1970); James Chen, *Lemons Problem*, INVESTOPEDIA, <https://www.investopedia.com/terms/l/lemons-problem.asp> (last updated Aug. 30, 2021) [<https://perma.cc/TCV9-KEQA>] (defining the origins of the lemons problem and various solutions); Paul M. Healy & Krishna G. Palepu, *Information Asymmetry, Corporate Disclosure, and the Capital Markets: A Review of the Empirical Disclosure Literature*, 31 J. ACCT. & ECON. 405, 407–09 (2001) (describing the lemons problem and solutions in the context of financial regulation).

92. Akerlof, *supra* note 91, at 489. In a general sense, and as used in Akerlof’s article, a “lemon” refers to a bad car (or product). *Id.*; cf. Healy & Palepu, *supra* note 91, at 408 (describing the “lemons” problem as it relates to capital markets).

93. Akerlof’s theory assumes that, due to information asymmetry, the seller of a used car has greater knowledge of whether they own a lemon or a good car than the buyer. See Akerlof, *supra* note 91, at 489. Thus, the seller is the only party to the transaction that knows the true value of the car. *Id.*

94. Healy & Palepu, *supra* note 91, at 408.

95. *Id.*; Chen, *supra* note 91.

96. Healy & Palepu, *supra* note 91, at 408; Chen, *supra* note 91.

97. Akerlof, *supra* note 91, at 489–90; Patrick J. Glen, *Law as Asymmetric Information: Theory, Application, and Results in the Context of Foreign Direct Investment in Real Estate*, 8 BERKELEY BUS. L.J. 116, 119 (2011) (“Market failure is not a necessary end to this process, but it is a possibility, as lower quality goods may increasingly drive out higher quality goods ultimately causing the market for that good to cease to exist at all.”).



Eventually, the good homes (i.e., homes subject to lower SLR flood risk or homes sufficiently covered by appropriately priced flood insurance) transferred to the GSEs will be driven out by the lemons, leaving Fannie Mae and Freddie Mac overleveraged as they continue accepting an increasingly larger share of flood-prone mortgages—lemons.<sup>98</sup>

To be sure, the intent of this analogy is not to ignore the safeguards Fannie Mae and Freddie Mac already have in place, such as an objective appraisal requirement,<sup>99</sup> but rather is to shed light on the nature of the potential market failure and to frame the issue in context of a familiar economic theory—one for which many well-documented solutions exist.<sup>100</sup> In the following subsections, this Note discusses three principal objectives that function as guideposts for resolving both lemons problems generally and the distorted signals in coastal lending markets more specifically. These objectives are (1) improving SLR flood modeling, (2) increasing disclosure of climate-default risk, and (3) providing warranties for risky coastal mortgages. For each objective, public and private means of attainment are analyzed.

### *B. Improve Flood Modeling*

One substantive critique of the lemons problem has suggested that in a market where predictable transaction behavior exists, “we can only be sure that bad products will drive out good if traders are sufficiently shortsighted.”<sup>101</sup> Thus, given the likelihood of market failure, one major goal of any solution offered should be to reduce shortsightedness in the marketplace, which fosters information asymmetry.<sup>102</sup> Improving the accuracy of SLR flood-modeling methods and predictions will be helpful in minimizing legal myopia and developing a clearer picture of the coastal mortgage market’s future for both policymakers and market participants. Although the specific modeling approaches are best left to those with climate-modeling

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98. See Akerlof, *supra* note 91, at 489–90; Flavelle, *supra* note 9.

99. FANNIE MAE, *supra* note 46, at 69.

100. See Akerlof, *supra* note 91, at 499–500 (highlighting institutions that counteract quality uncertainty, such as guarantees and quality assurances); Healy & Palepu, *supra* note 91, at 408 (noting optimal contracts, information disclosure, and information intermediaries as well-known solutions); Chen, *supra* note 91 (pointing to information disclosure and warranties as possible mechanisms for overcoming the lemons problem).

101. Geoffrey Heal, *Do Bad Products Drive Out Good?*, 90 Q.J. ECON. 499, 501 (1976); Glen, *supra* note 97, at 120. Notably, Akerlof agreed with the essence of this claim, although he suggested some counteracting institutions would alleviate any market-failure concerns stemming from shortsightedness. *Id.*

102. See Heal, *supra* note 101, at 501 (“It should be clear that it is sufficient to have just one shortsighted trader in a market for the inefficient outcome to result.”).

expertise, there are various ways in which the public and private legal sectors may provide mechanisms for accelerating modeling improvements and increasing the accuracy of flood hazard maps.<sup>103</sup>

### 1. Increase Funding

One of the more straightforward ways to improve flood-map accuracy is to simply increase funding and appropriations for government-sponsored climate research and SLR flood modeling.<sup>104</sup> At a basic level, setting aside a larger sum of money for climate research may lead to more promising research results<sup>105</sup> and better FIRMs, which may in turn result in more accurate risk assessments that Fannie Mae and Freddie Mac can factor into loan purchasing decisions.<sup>106</sup>

Despite the attractiveness of this simple solution, two major hurdles stand in its way. First, it is difficult to obtain significant federal funding for issues as politically polarizing as climate change.<sup>107</sup> Thus, the likelihood of obtaining funding sufficient to create a noticeable impact on the quality of science and models is slim. Second, budget data for public funds spent on climate change and climate science is virtually nonexistent.<sup>108</sup> Without adequate knowledge of how federal funds have

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103. See sources and discussion *supra* notes 76–83.

104. Necessarily included in this proposal is the federal government continuing to fund current research and climate change projects. As much as new research may be needed, what may be arguably more important is maintenance of, and improvements to, the existing informational infrastructure. See Carolyn Kousky, *Financing Flood Losses: A Discussion of the National Flood Insurance Program*, 21 RISK MGMT. & INS. REV. 11, 28 (2018) (“[I]f FEMA is to be the institution that produces nonregulatory maps for projecting future flood risk . . . then the process for doing so needs to be designed and funded, following recommendations from the [Technical Mapping Advisory Council].”).

105. Cf. Jue Wang & Philip Shapira, *Is There a Relationship Between Research Sponsorship and Publication Impact? An Analysis of Funding Acknowledgments in Nanotechnology Papers*, PLOS ONE, Feb. 19, 2015, at 1, 15–16 (concluding that grant-sponsored articles are more likely to generate research interest and have a higher research publication impact).

106. In addition to increasing the accuracy of FIRMs and SLR projections, additional federal funding for climate research would have positive impacts on climate science as a whole.

107. See Molly E. Reynolds, *This Is Why the Congressional Budget Process Is Broken*, WASH. POST: MONKEY CAGE (Oct. 26, 2017), <https://www.washingtonpost.com/news/monkey-cage/wp/2017/10/27/this-is-why-the-congressional-budget-process-is-broken/> [<https://perma.cc/4KQR-KNQT>] (describing difficulties with the congressional budget process in the current partisan political environment).

108. Maggie Koerth, *How Much Is the Government Spending on Climate Change? We Don't Know, and Neither Do They*, FIVETHIRTYEIGHT (Feb. 8, 2019, 9:55 AM), <https://fivethirtyeight.com/features/how-much-is-the-government-spending-on-climate-change-we-dont-know-and-neither-do-they/> [<https://perma.cc/X9AQ-5KYE>]. This is not to say that significant funds are not designated for climate research each year by the federal government. The Environmental Protection Agency, National Institutes of Health, and Centers for Disease Control and Prevention are just a few of the federal agencies involved in climate-change issues. See generally INST. OF MED., CLIMATE CHANGE, THE INDOOR ENVIRONMENT, AND HEALTH 53–67 (2011) (discussing how and which federal agencies are involved in climate-change issues).

been spent on climate change research in the past, it may be practically impossible to know what level of additional funding is required to generate the desired improvements to coastal SLR flood modeling.<sup>109</sup>

Given the difficulty of securing greater federal funding for climate change research and SLR flood modeling, it may make more sense to seek research grants from the private sector. This alternative may allow research to proceed efficiently, without having to endure the politically exhausting congressional appropriations process, as private organizations often retain the flexibility to raise and spend capital in ways the federal government does not.<sup>110</sup> Additionally, private funding may be easier for individual applicants to obtain since federal funding frequently requires lengthy proposals and complex applications.<sup>111</sup>

Nevertheless, any gains achieved by seeking funding in the private sector may be offset by the smaller size of private awards and the unpredictability of funding renewal.<sup>112</sup> Smaller grants and continual funding uncertainty threaten the ability of researchers to collect meaningful data, and these factors likely also require that significantly more funding opportunities arise in the private sector before funding levels and research quality can match that generated by the federal government. Further, the quality of privately funded climate research may be called into question given the documented relationship between industry funding and pro-industry research conclusions.<sup>113</sup> Even if more accurate flood models were generated through private grants, the peer review system and lobbying efforts would need to be robust enough to convince federal agencies that the research is appropriate for government application.<sup>114</sup> Therefore, while on its face increasing funding may seem the most desirable response to

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109. See Koerth, *supra* note 108.

110. See *What's the Difference Between Public and Private Grant Funding?*, CAYUSE, <https://cayuse.com/blog/public-private-grant-funding-difference/> [<https://perma.cc/E44C-66TJ>] (last visited Sept. 12, 2021) (noting that private grants potentially carry fewer regulations than federal funding).

111. *Id.*

112. See *id.* (noting that funding awards for private research are typically smaller and less likely to cover indirect costs than federal grant awards, which are regularly all-inclusive).

113. Cf. Lenard I. Lesser, Cara B. Ebbeling, Merrill Gozner, David Wypij & David S. Ludwig, *Relationship Between Funding Source and Conclusion Among Nutrition-Related Scientific Articles*, PLOS MED., Jan. 9, 2007, at 41, 44–46 (concluding that scientific articles about common beverages were “approximately four to eight times more likely to be favorable to the financial interests of the sponsors than articles without industry-related funding” and noting other ways pro-industry bias can be introduced into research).

114. See Kunreuther, *supra* note 82, at 10. Until recently, there was little need for private inland flood models due to the prevalence of FEMA’s NFIP. *Id.* at 9. Today, FEMA has authorized two private flood models for use in flood mapping. *Id.* But these private models represent only a fraction of the models currently available. *Id.*

close the informational gap, it may present more problems than it solves and could ultimately result in prolonged inaction.

## 2. Property-Specific Flood Risk Assessments

Another potential way to improve FEMA's flood modeling and close the informational gap between borrowers, lenders, and the GSEs is to update the benchmark by which FEMA determines SFHAs.<sup>115</sup> Currently, FEMA defines the boundaries of an SFHA as "the area that will be inundated by the flood event having a one-percent chance of being equaled or exceeded in any given year."<sup>116</sup> Put differently, an SFHA is comprised of properties that fall within the 100-year floodplain.<sup>117</sup> While FEMA also includes areas falling within a 500-year floodplain in FIRMs (0.2 percent chance of flooding in any given year), these properties are neither included in SFHAs nor are their owners required to hold flood insurance.<sup>118</sup> Though a helpful measurement in a relative sense, delineating flood risk using the 100-year floodplain generates a false belief among all parties to a mortgage transaction that a home's flood risk stops abruptly at the boundary and that properties outside the SFHA are safe from floods and the need to purchase insurance.<sup>119</sup> An example of the harms this misconception can bring is the recent flooding of Houston, Texas, where from 2015 to 2017, the city experienced three 500-year floods, including those generated by Hurricane Harvey.<sup>120</sup> These floods inundated areas situated outside of the 500-year and 100-year floodplains, and in the case of Hurricane Harvey, roughly eighty percent of homeowners did not have flood insurance to protect their losses.<sup>121</sup> Potentially more harmful is the effect that using the 100-year floodplain may have on perceptions of risk

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115. Kousky, *supra* note 104, at 28.

116. *Flood Zones*, FEMA, <https://www.fema.gov/glossary/flood-zones> (last updated July 8, 2020) [<https://perma.cc/E5VK-LKXH>].

117. *See id.* (alternatively describing a one percent annual chance flood as a "100-year flood"); Kousky, *supra* note 104, at 13–14 (describing properties subject to a 100-year flood as falling within the 100-year floodplain).

118. FEMA, *supra* note 116.

119. Kousky, *supra* note 104, at 13. Additionally, FIRMs may not even accurately capture all one percent annual flood risk facing a given area, for instance from localized stormwater drainage. *Id.* at 14.

120. Dara Lind, *The "500-year" Flood, Explained: Why Houston Was so Underprepared for Hurricane Harvey*, VOX (Aug. 28, 2017, 9:40 AM), <https://www.vox.com/science-and-health/2017/8/28/16211392/100-500-year-flood-meaning> [<https://perma.cc/NRE5-BLLG>].

121. Bernard Condon & Ken Sweet, *About 80% of Hurricane Harvey Victims Do Not Have Flood Insurance, Face Big Bills*, USA TODAY, <https://www.usatoday.com/story/money/2017/08/29/hurricane-harvey-houston-flood-insurance-damages-claims/611910001/> (last updated Aug. 30, 2017, 3:03 PM) [<https://perma.cc/X3DT-UWLY>].

over time, as it may not accurately convey dynamic flood risk over the life of a mortgage.<sup>122</sup>

To combat deficiencies in current practices, some academics have proposed transitioning to a property-specific flood risk assessment model, which evaluates and communicates the flood risk faced by each property individually.<sup>123</sup> Instead of delineating SFHA boundaries using generalized measurements of one percent annual flood risk over a given area, properties would be analyzed for their individual flood risk based on the most up-to-date flood models.<sup>124</sup> With more individualized long-term risk assessments, Fannie Mae and Freddie Mac may be able to better determine the riskiness of their purchasing behavior and make appropriate adjustments to their loan selling criteria.

Transitioning from the 100-year floodplain to an individualized assessment, however, would be a costly endeavor, as it would require FEMA to revisit every FIRM—and every property within those FIRMs—to update SFHA boundaries.<sup>125</sup> In fact, the Association of State Floodplain Managers has estimated the up-front cost of providing updated nationwide flood maps to be \$4.5–\$7.5 billion, with annual maintenance costs of \$116–\$275 million.<sup>126</sup> Such significant costs would be difficult to overcome in terms of obtaining necessary funding and government support, though there may be indications that the benefits of such a transition could exceed the costs of updating the FIRMs.<sup>127</sup>

### 3. Coordinate Federal Climate-Information Services

A final way to improve coastal flood modeling—and one equally relevant to Section III.C of this Note—is to create or direct a federal entity to coordinate among federal, state, and local authorities with regard to climate projections, climate observations, and general climate information.<sup>128</sup> Nearly forty federal entities are presently engaged in climate-information efforts, including individual climate programs, initiatives, and information collection systems.<sup>129</sup> While this is certainly good news, the lack of coordination among federal entities engaged in

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122. See *infra* Part III.C.2 (discussing the dynamic nature of climate change and SLR).

123. Kousky, *supra* note 104, at 28.

124. See *id.*; FEMA, *supra* note 116.

125. Kousky, *supra* note 104, at 13.

126. *Id.*

127. *Id.*

128. U.S. GOV'T ACCOUNTABILITY OFF., GAO-16-37, CLIMATE INFORMATION: A NATIONAL SYSTEM COULD HELP FEDERAL, STATE, LOCAL, AND PRIVATE SECTOR DECISION MAKERS USE CLIMATE INFORMATION 47 (2015).

129. *Id.* at 11, 16.

climate-information efforts is troubling and has made it more difficult to meet the needs of decisionmakers in the public and private sectors.<sup>130</sup> Stakeholders in the climate-modeling community have stated that “decision makers are vastly underserved by the current ad hoc collection of federal climate information services.”<sup>131</sup> With various agencies competing with one another and failing to share vital climate information, it is likely that SLR flood modeling is not as robust as it could be if federal agencies cooperated.<sup>132</sup>

One potential roadblock to this solution is that the federal agency directed to coordinate climate-information efforts may already be overextended and thus unable to effectively prioritize creating a cohesive climate-information network.<sup>133</sup> If the agency selected to carry out this task is preoccupied with other projects, it is unlikely that coordination efforts would produce valuable results or that substantive improvements to current flood models would be made.

In any case, the course of action selected to improve flood modeling must effectively balance the need to enhance our current understanding of flood risk with the likelihood of successful adoption. Though some options may be more enticing than others given their prospect of improving flood data, those that are realistic in light of the current social and political climate are preferred.

### *C. Disclose Climate-Default Risk*

One classic solution to information asymmetries and the lemons problem is to simply close informational gaps.<sup>134</sup> Although several gap-closing mechanisms exist, one of the simplest and most direct methods

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130. *Id.* at 16 (“[T]he climate information needs of federal, state, local, and private sector decision makers are not being fully met, which hinders their planning efforts.”).

131. *Id.*

132. *See id.* (“[T]hese programs are uncoordinated, operate as separate information systems, and fail to share information and learn from each other, partly because of turf battles between them.”).

133. *See* Jeff Tollefson, *Can Joe Biden Rebuild the Ravaged US Environmental Protection Agency?*, NATURE, <https://www.nature.com/articles/d41586-020-03585-7#correction-0> (last updated Dec. 17, 2020) [<https://perma.cc/QC9Z-BGUD>] (explaining that before President Biden can implement his desired policies, he must first prioritize restoring the agency’s science-minded focus). Although the EPA is not the only candidate for coordinating climate-information systems, it is certainly the most obvious given its environmental role. Other agencies may be equally suited to guide cooperation throughout the federal government, such as the National Oceanic and Atmospheric Administration (“NOAA”).

134. *See, e.g.*, Healy & Palepu, *supra* note 91, at 408 (“Another potential solution to the information asymmetry problem is regulation that requires managers to fully disclose their private information.”).

is to mandate disclosure of insider information.<sup>135</sup> That is to say, the chances of reaching an optimal outcome increase when sellers are required to honestly inform the buyer as to whether or not the product is a lemon, or at least provide the buyer with information allowing them to make that determination.<sup>136</sup> Similarly, addressing the distortion in coastal mortgage market signals will likely necessitate bringing Fannie Mae and Freddie Mac up to speed on the true value of the home loans they acquire and the risk those loans face.<sup>137</sup>

### 1. Centralize Federal Climate Change Information

As discussed above, one possible approach to reducing information asymmetries between borrowers, lenders, and the GSEs could be to direct a federal entity to coordinate and consolidate climate information. In addition to potentially generating more accurate flood models, concentrating climate information into a more manageable and accessible network could provide decisionmakers access to necessary information that has existed but was previously too fragmented to find.<sup>138</sup> Put differently, much of the climate information that Fannie Mae and Freddie Mac would need in order to identify mortgage loans that face a high climate-default risk has already been collected, but the federal government's failure to provide an effective mechanism for communicating and translating this information to decisionmakers has rendered its use impractical.<sup>139</sup>

An obvious strength of this option is that it directly addresses the information gap that exists between the GSEs and coastal lenders. If one of the major solutions to the lemons problem generally—and the issue this Note raises specifically—is to align the information buyers and sellers have access to, then directing a federal entity to more

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135. *Id.*; see Barclay Palmer, *What a "Lemon" Product Is, and How to Avoid Purchasing One*, INVESTOPEDIA, <https://www.investopedia.com/articles/pf/11/solutions-to-lemon-problem.asp> (last updated Feb. 22, 2019) [<https://perma.cc/ZJT4-4UGE>] (listing solutions to the lemons problem).

136. Healy & Palepu, *supra* note 91, at 408. This disclosure requirement tends toward a more efficient outcome because the buyer is now aware of the true value of the car being purchased and can offer an optimal price in return. *See id.*

137. *See id.* (noting that closing informational gaps through mandatory disclosure of private information is a well-known solution to the lemons problem).

138. *See* U.S. GOV'T ACCOUNTABILITY OFF., *supra* note 128, at 15–16 (“[F]ederal, state, local, and private sector decision makers may be unaware that climate information exists or unable to use what is available, making it harder to justify the current costs of incorporating climate change into planning efforts for less certain future benefits.”).

139. *See id.* at 18 (explaining that although the federal government does an excellent job of collecting and archiving climate data, it has largely failed to effectively communicate this information to decisionmakers).

efficiently coordinate, compile, and disseminate climate information to public and private bodies is a particularly apt way of leveling climate information in coastal mortgage markets. Creating an informational hub, however, may not be as simple as it sounds given many federal agencies may not have the resources to accomplish such a directive.<sup>140</sup>

## 2. Require Future Flood Risk Disclosure

Another possible way to increase disclosure of climate-default risk is to change what aspects of a mortgage's climate risk are shared. As they stand now, FIRMs essentially provide a snapshot of the flood risk a community faces today.<sup>141</sup> Yet, the effects of climate change, and consequently climate-default risk, are dynamic, shifting, and subject to variations over the coming century.<sup>142</sup> As flooding continues to increase in the future, still shots of present-day flood hazards will become increasingly irrelevant.<sup>143</sup> And while it might be helpful to generate more data on future risks, it means little if there are no public or private policy mechanisms in place to alert borrowers, lenders, and the GSEs about how flood hazards will change over the life of a mortgage.<sup>144</sup> Thus, making information about how flood risks will change over the life of a mortgage publicly available, or perhaps even requiring FEMA to research and disclose such findings, would prove useful in equipping Fannie Mae and Freddie Mac (along with borrowers and lenders) with the most accurate information of a loan's evolving risk.

Improved disclosure could be accomplished in a number of ways. A public governance approach could seek to promulgate guidance, rules, or regulations that require FEMA to publicly disclose estimates of future flood risks and the GSEs to incorporate such information into loan selection decisions. This approach assumes that accurate projections of future flood risk already exist in an accessible place and that FEMA would share a useful, albeit complex, array of climate information with the GSEs, rather than less informative metrics.<sup>145</sup>

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140. See source and discussion *supra* note 128.

141. Kousky, *supra* note 104, at 14. Even so, FIRMs may not accurately map today's flood hazards in a community due to outdated modeling techniques. *Id.* at 13.

142. See *id.* at 28 (noting changes in U.S. flood risks projected to occur over the next century).

143. See *id.* (discussing how current FIRM information is not an appropriate indicator of future flood risk given predictions of increased flooding).

144. *Id.* at 14 ("Even when information on future risk may be available, no policy mechanism currently exists to alert residents about how flood risk may change over the time they own a property or over the life of a mortgage.").

145. See *id.* ("Since 2001, communities have been able to request that FEMA show how a fully developed watershed would alter the SFHA, but FEMA has not prepared maps showing how erosion, sea-level rise, or changing precipitation patterns would alter flood risk."). For this option to be effective, the future-flood-risk information must be in an accessible place. It does little good



Additionally, the effectiveness of a regulatory approach is predicated on the belief that a future administration would not end any flood-hazard-disclosure programs.<sup>146</sup>

Increasing disclosure of changing flood risks through the private sector may be a viable option as well. This option could take any number of forms, the simplest being an annual informational campaign alerting certain residents of their homes' flood risks and providing Fannie Mae and Freddie Mac with supplemental statistics to better quantify mortgage risks. Like other private sector solutions, lack of funding and organization may stand in the way of any disclosure efforts.

### 3. Educational Outreach

One final option for increasing default-risk disclosure is to simply tell people about flood risks and the long-term impacts SLR may have on coastal mortgages. Although an educational campaign may not seem as directly helpful in aligning information asymmetries between the GSEs and lenders since it would be directed towards individual homeowners, bringing homeowners up to speed on the probability of climate default may create benefits to the market as a whole (such as decreased purchasing of flood-prone properties) and reduce the need for Fannie Mae and Freddie Mac to take major actions in the future.<sup>147</sup>

FEMA currently has such a marketing campaign in place—FloodSmart—which serves as the main outreach tool for educating residents about their flood risk.<sup>148</sup> FloodSmart is primarily operated through the website FloodSmart.gov but has also run television, radio, and print advertisements to help promote the program's messages.<sup>149</sup> Notably though, it does not seem that any studies have been commissioned to evaluate the effectiveness of the FloodSmart

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if the data and projections exist but are unreachable because the information only becomes useful when it is accessible by the parties who need it.

146. See, e.g., Chris Mooney, Brady Dennis, Darryl Fears & Sarah Kaplan, *The Energy 202: Trump's Budget Seeks Cuts to Climate Research and Renewable Energy Programs*, WASH. POST (March 12, 2019, 8:00 AM), <https://www.washingtonpost.com/news/powerpost/paloma/the-energy-202/2018/06/27/the-energy-202-white-house-seeking-more-clean-energy-cuts-despite-congressional-opposition/5b327bab1b326b3967989c90/> [https://perma.cc/SS8Y-V44L] (highlighting President Trump's proposed budget cuts to climate programs across multiple agencies).

147. See Kousky, *supra* note 104, at 14 (mentioning how the NFIP's current outreach and marketing campaigns have been directed towards residential homeowners since they make up the majority of NFIP policyholders).

148. *Id.*; FLOODSMART, <https://www.floodsmart.gov> (last visited Sept. 12, 2021) [https://perma.cc/4AFX-S2JR].

149. Kousky, *supra* note 104, at 14.

program.<sup>150</sup> Thus, what this option really proposes is a study of the effectiveness of the FloodSmart program, which could help identify shortcomings of the outreach campaign and inform decisionmakers how to better allocate funding within the program.<sup>151</sup>

This alternative is not without weakness. Funneling limited money into studies of a public outreach campaign may not be the best use of funding since there is no guarantee meaningful change will result.<sup>152</sup> At best, a study would uncover weak areas of the FloodSmart campaign and alert decisionmakers to those weaknesses. At worst, the study may simply tell decisionmakers the program works well as advertised and recommend few, if any, changes. While this information is still beneficial, funds may be better spent elsewhere.<sup>153</sup>

#### *D. Warranties and Licensing*

Another prominent solution to the lemons problem, and one suggested by George Akerlof himself, is the implementation of warranties or guarantees that provide various protections and quality assurances for buyers.<sup>154</sup> Importantly, offering warranties shifts the risk from the buyer to the seller of the product, so that the seller is put on the hook for ensuring the quality of the goods.<sup>155</sup> Offering warranties for mortgages subject to SLR flood risk may aid in transferring some of the long-term risk of default from the GSEs (and taxpayers) to the lenders offloading these loans.<sup>156</sup> In a similar vein, licensing may also work to reduce quality uncertainty and counteract the lemons problem.<sup>157</sup> Under a licensing framework, some form of certification is

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150. *Id.* (“As far as this author is aware, no publicly available study has evaluated these campaigns.”).

151. *See id.*

152. *See id.* at 28 (“For such information to be fully internalized by the housing market, a simple marketing campaign will not suffice.”).

153. *See id.*

154. Akerlof originally suggested guarantees as a way of overcoming the lemons problem, but he did so through the lens of brand-name goods. Akerlof, *supra* note 91, at 499–500. To Akerlof, however, brand names seem to provide the same protections as warranties in general—they implicitly assure the buyer of the product’s quality and give the consumer a direct means of retaliation if the quality does not meet expectations. *See id.*

155. *Id.* at 499 (“One natural result of our model is that the risk is borne by the seller rather than by the buyer.”).

156. Note that although transferring risk is an important solution to the classic lemons problem, it may be detrimental to the consumer-mortgage market to transfer *all* risk to the lender, considering the underlying purpose of Fannie Mae and Freddie Mac is to reduce lender risk and free up capital for reinvestment in other loans, thereby supporting and strengthening a national housing market. *See supra* Part I.A–C (explaining how Fannie Mae and Freddie Mac helped create a stable national housing market).

157. Akerlof, *supra* note 91, at 500.

attached to the product, indicating that it has met a certain quality standard from which the buyer can better judge its true value.<sup>158</sup> Developing solutions that include forms of quality assurance is important because it can introduce greater uniformity to the coastal mortgage market and provide safeguards for Fannie Mae and Freddie Mac.<sup>159</sup>

### 1. Private Mortgage Insurance

One warranty that Fannie Mae and Freddie Mac already utilize to some degree is private mortgage insurance (“PMI”).<sup>160</sup> PMI is a form of insurance that borrowers are often required to purchase when making a down payment of less than twenty percent of a home’s purchase price in order to offset the lender’s risk.<sup>161</sup> If the homeowner is unable to make the initial twenty percent down payment, the homeowner can pay a monthly premium for PMI coverage in which a private insurer pays a portion of the balance due to the mortgage lender if the borrower defaults.<sup>162</sup> The coverage and monthly premiums typically end once the mortgage principal balance is less than eighty percent of the underlying property’s value.<sup>163</sup>

When Fannie Mae and Freddie Mac purchase mortgage loans with an outstanding principal balance exceeding eighty percent of the underlying property value, the GSEs’ charters require them to obtain

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158. *See id.* (describing how licensing counteracts the lemons problem, using education and licensing in the labor market as an example).

159. “Safeguards” as it is used here is meant to convey the added security that warranties of mortgage-default risk could provide, since a warranty scheme may allow the GSEs to transfer risk back to the individual lender or borrower in the event of default.

160. *Fannie Mae & Freddie Mac Private Mortgage Insurer Eligibility Requirements (PMIERS)*, FED. HOUS. FIN. AGENCY, [https://www.fhfa.gov/PolicyProgramsResearch/Policy/Pages/Fannie-and-Freddie-Private-Mortgage-Insurer-Eligibility-Requirements-\(PMIERS\).aspx](https://www.fhfa.gov/PolicyProgramsResearch/Policy/Pages/Fannie-and-Freddie-Private-Mortgage-Insurer-Eligibility-Requirements-(PMIERS).aspx) (last visited Sept. 12, 2021) [<https://perma.cc/T4VG-V4CG>] [hereinafter *PMI Eligibility*].

161. Amy Fontinelle, *5 Types of Private Mortgage Insurance (PMI)*, INVESTOPEDIA, <https://www.investopedia.com/mortgage/insurance/> (last updated June 10, 2021) [<https://perma.cc/XN9M-8ZC8>]; *see also PMI Eligibility, supra* note 160 (requiring private mortgage insurance for loans exceeding eighty percent LTV ratio).

162. Barbara Marquand, *What Is PMI? How Private Mortgage Insurance Works*, NERDWALLET (Mar. 8, 2021), <https://www.nerdwallet.com/article/mortgages/pmi-private-mortgage-insurance> [<https://perma.cc/X6RJ-2WPH>].

163. *Id.*

credit enhancement for the mortgage,<sup>164</sup> usually in the form of PMI.<sup>165</sup> The GSEs and lenders require PMI on these types of loans because they present greater risk and, in the event of foreclosure, larger loss.<sup>166</sup> A similar rationale could support amending Fannie Mae's and Freddie Mac's charters to require borrowers to pay for PMI (or some other acceptable form of credit enhancement) on loans that demonstrate a sufficient amount of climate-default risk. Since mortgages located in and around SFHAs carry greater default risk, Fannie Mae and Freddie Mac may need to further insulate themselves from potential losses by requiring homeowners to carry PMI policies.<sup>167</sup> Even though flood insurance is already required for properties located in SFHAs, those properties located outside SFHA boundaries that carry similar future flood risks remain unaccounted for.<sup>168</sup> In the event SFHA maps are inaccurate or unconcerned with future flood-risk exposure, providing another avenue for the GSEs to protect against losses is crucial to their continued success and protecting American taxpayers.

Requiring PMI inherently carries some disadvantages. First, borrowers typically must pay for PMI until they acquire sufficient equity such that the "lender no longer considers them high-risk."<sup>169</sup> Under the Homeowners Protection Act, PMI payments are typically discontinued when the borrower's equity reaches twenty percent of the home's underlying value.<sup>170</sup> PMI payments may still be required on a loan, however, if Fannie Mae's and Freddie Mac's published guidelines determine the loan remains sufficiently risky despite the borrower reaching the twenty percent equity threshold.<sup>171</sup> Due to the long-term nature of SLR, Fannie Mae and Freddie Mac would likely need to amend their selling guidelines to require PMI that extends well into a loan's life in order to sufficiently protect against climate default.

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164. "Credit enhancement" reduces risk by serving as a financial cushion allowing securities backed by a collateral pool "to absorb losses from defaults on the underlying loans." *Credit FAQ: The Basics of Credit Enhancement in Securitizations*, STANDARD & POOR'S 2 (June 24, 2008), [https://fcic-static.law.stanford.edu/cdn\\_media/fcic-docs/2008-06-24%20S&P%20Basics%20of%20Credit%20Enhancement%20in%20Securitizations.pdf](https://fcic-static.law.stanford.edu/cdn_media/fcic-docs/2008-06-24%20S&P%20Basics%20of%20Credit%20Enhancement%20in%20Securitizations.pdf) [<https://perma.cc/YT5M-F2WX>]. In the case of mortgages, the securities are the MBSs, and the mortgages are the underlying loans that credit enhancement provides protection against in case of default. *Id.* at 3.

165. *PMI Eligibility*, *supra* note 160.

166. Fontinelle, *supra* note 161.

167. See Carolyn Kousky, Mark Palim & Ying Pan, *Flood Damage and Mortgage Credit Risk: A Case Study of Hurricane Harvey*, 29 J. HOUS. RSCH. S86, S113–14 (2020) (finding that property damage caused by Hurricane Harvey increased short-term mortgage delinquency and forbearance both inside and outside of the SFHA).

168. See *supra* Part I.F (discussing NFIP insurance requirements and flood risk).

169. Fontinelle, *supra* note 161.

170. 12 U.S.C. § 4901(2).

171. 12 U.S.C. § 4902(g)(1)(a).

Second, requiring PMI in addition to flood insurance for mortgages in SFHAs—essentially levying an additional tax on residents—may discourage growth and hamper economic activities in coastal areas. Aside from potentially dissuading homeowners from migrating to the coast, social and economic concerns may arise as a result of making coastal living more expensive for low-income residents.<sup>172</sup>

## 2. Home Appraisal Standardization

One final option may be to reform the real estate valuation process so that appraisers recognize and incorporate climate change risk into real estate values.<sup>173</sup> Although there may be public governance elements to this approach, standardizing real estate appraisals is most easily completed through initiatives and cooperation from private organizations. Giving real estate appraisers the opportunity to obtain a uniform certificate confirming they have appropriately factored climate change and flood risk into their valuation would help reduce the prevalence of lemons in the mortgage market, especially if Fannie Mae and Freddie Mac were to require the certification before purchasing a loan.<sup>174</sup> Although Fannie Mae and Freddie Mac already require objective real estate appraisals, there are relatively few checks on what qualifies as an objective valuation.<sup>175</sup> Accordingly, the GSEs requiring flood-hazard certification as an additional condition to purchasing loans in SFHAs may reduce information gaps and ensure that Fannie Mae and Freddie Mac accept loans of consistent and predictable quality.<sup>176</sup>

Making the real estate appraisal process uniform sounds realistic in theory, but it may prove more difficult to accomplish in reality. Any standardized appraisal process would need to meet the specifications of Fannie Mae and Freddie Mac, or else it would serve little benefit in appraising the GSEs of climate-default risk. This approach would therefore require significant coordination between private standard-setting bodies and the federal government.

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172. Vanessa Brown Calder, *Zoning, Land-Use Planning, and Housing Affordability*, CATO INST. 2 (Oct. 18, 2017), <https://www.cato.org/sites/cato.org/files/pubs/pdf/pa-823.pdf> [<https://perma.cc/A8FZ-5PNH>].

173. See URB. LAND INST., *supra* note 1, at 8 (“All agreed that valuation is currently lagging behind recognition of climate risk and anticipate this changing in the near future.” (emphasis omitted)).

174. See *supra* Part II.A (explaining how the lemons problem, when unaddressed, often leads to more lemons entering the market).

175. See *supra* note 50 and accompanying text (noting Fannie Mae’s minimal requirements for acceptable appraisals).

176. See *supra* notes 154–156 and accompanying text (explaining how warranties can counteract the lemons problem by providing quality assurances).

Additionally, this approach assumes that an appraisal standard created by a private standard-setting body would be enforced consistently. If the issuing organization failed to maintain uniform application of its appraisal certificate, the certificate would ultimately carry little importance because the GSEs would not trust that the climate risk appraisal was of an acceptable quality.<sup>177</sup>

### III. SOLUTION: REORIENTING AND STANDARDIZING CLIMATE INFORMATION

As this Note has addressed, coastal mortgage markets face a serious problem that deserves increased attention and requires a solution. Fannie Mae and Freddie Mac, the GSEs charged with securing consumer home loans, continue to accept risky loans in coastal regions, subject to default due to SLR and climate change.<sup>178</sup> Local lenders, who have greater access to regionalized information regarding climate-default risk for individual properties, have begun offloading their highest risk mortgages onto the GSEs.<sup>179</sup> While this reduces local lenders' risk, it increases the likelihood that the American taxpayer base will have to shoulder the greater default risk shifted onto Fannie Mae and Freddie Mac.<sup>180</sup> The information asymmetry in the coastal mortgage market can also be viewed as a version of the lemons problem.<sup>181</sup> To resolve this asymmetrical information gap and allow the GSEs to better assess the true value of a coastal mortgage, solutions should focus on three main goals: (1) improving SLR flood modeling data, (2) increasing disclosure of a mortgage's flood risk, and (3) providing the GSEs with warranties and quality assurance. Decisionmakers should further these goals by establishing a centralized climate-information network accessible to government and private actors alike, creating flood-risk maps that convey future changes in flood frequency and severity, and implementing climate appraisal certificates for use by appraisers when valuing a home.

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177. See Michael P. Vandenbergh, *Private Environmental Governance*, 99 CORNELL L. REV. 129, 137 (2013) ("All of this private activity might be meaningless or even harmful if it is just green-washing—private activity designed to give the appearance of environmental benefits without delivering actual benefits.").

178. See *supra* Part I.F.

179. See *supra* Part I.F.

180. See *supra* Part I.F.

181. See *supra* Part II.A.

*A. Looking for Silver Buckshot, Not a Silver Bullet*

Given the complexity of this issue, it is unlikely that a single solution could meet every goal and still have a realistic chance of implementation.<sup>182</sup> Although some may find the solutions this Note proposes unfocused, there is ample evidence that the best approach to solving multi-faceted problems is through silver buckshot rather than a search for a silver bullet.<sup>183</sup> In areas as complex as mortgage regulation and climate change, it is doubtful that a single panacea exists for systemic problems.<sup>184</sup> Thus, a mix of public and private actions, taken in concert and designed to supplement one another, poses the best opportunity to alleviate burdens currently placed on the GSEs and improve the efficiency and long-term resiliency of the coastal mortgage market.<sup>185</sup>

Additionally, a mix of public and private sector responses is necessary for climate change solutions due to an increasingly partisan divide in the United States, especially with regard to how climate change should be addressed.<sup>186</sup> Recent attempts to pass climate-driven policies have demonstrated that climatic issues can further drive a wedge between ideological camps, making enactment of broad reforms a particularly difficult task.<sup>187</sup> Despite efforts to develop new public

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182. See MAXWELL BOYKOFF, CREATIVE (CLIMATE) COMMUNICATIONS: PRODUCTIVE PATHWAYS FOR SCIENCE, POLICY, AND SOCIETY 190–217 (2019) (discussing “silver buckshot” for complex problems); John Lawn, *Silver Bullets vs. Silver Buckshot*, FOOD MGMT. (Aug. 01, 2008), <https://www.food-management.com/market-trends-amp-opinions/silver-bullets-vs-silver-buckshot> [<https://perma.cc/3KV8-P74Y>] (noting “that there are few serious problems that lend themselves to one-shot solutions”).

183. Lawn, *supra* note 182. To help those unfamiliar with gun-related terminology, buckshot refers to a type of shotgun ammunition comprised of many small, tightly packed individual pellets that disperse when fired. As opposed to a bullet which makes a single focused impact on its target, buckshot typically produces many smaller impacts over a wider area.

184. Michael P. Vandenberg & Jonathan A. Gilligan, *Beyond Gridlock*, 40 COLUM. J. ENV'T L. 217, 295–96 (2015). Commonly referred to as a “panacea bias,” strong attractions to a single, cure-all solution can often distract decisionmakers from other, less comprehensive responses. *Id.* (“The attraction of having one measure that promises a comprehensive response to a problem is so compelling that it can induce experts to treat other strategies as distractions or competitors.”).

185. See *id.* at 296 (noting Elinor Ostrom’s contention that decisionmakers who inaccurately conflate their simple solutions with messy reality are unaware of “the diverse institutional arrangements that operate in practice”).

186. Nadja Popovich, *Climate Change Rises as a Public Priority. But It’s More Partisan than Ever.*, N.Y. TIMES (Feb. 20, 2020), <https://www.nytimes.com/interactive/2020/02/20/climate/climate-change-polls.html> [<https://perma.cc/EQ56-CS39>].

187. See Abel Gustafson, Seth A. Rosenthal, Matthew T. Ballew, Matthew H. Goldberg, Parrish Bergquist, John E. Kotcher, Edward W. Maibach & Anthony Leiserowitz, *The Development of Partisan Polarization Over the Green New Deal*, 9 NATURE CLIMATE CHANGE 940 (2019) (examining the increasing partisan divide surrounding the Green New Deal).

governance schemes, no major federal environmental statutes (let alone climate change statutes) have been enacted since the Clean Air Act Amendments of 1990,<sup>188</sup> leaving the likelihood of successful reform through legislation or long-term regulation unpredictable at best. For this reason, involving the private sector in solutions will provide a mechanism for the free market to coerce change when positive law efforts fail.<sup>189</sup>

### *B. Centralize Climate Information*

Of the solutions this Note proposes, centralizing climate information is likely the most important because it lays the groundwork for other silver buckshot in the future. A centralized climate-information network likewise meets multiple goals necessary to address the lemons problem: it facilitates greater access to, and disclosure of, important climate information, and it delegates flood modeling research to those agencies and actors best equipped to conduct that research. As noted above, the fragmentation of federal climate-information efforts has proven a formidable roadblock in the U.S. government's efforts to address the climate change crisis.<sup>190</sup> With numerous federal entities engaging in separate climate activities, and even withholding valuable information from other entities, progress in the public sphere has not been able to reach its full potential.<sup>191</sup> To coordinate climate activities and satisfy informational needs across all levels of governance, lawmakers should direct a federal agency to serve a managerial role and organize the federal government's climate-related efforts.<sup>192</sup> Further, lawmakers should pursue reforms aimed at reducing agency overlap since reducing overlap may free up substantial funds for other projects.

Facing the climate crisis is an inherently interagency activity, and the success of future climate-change programs and reforms will depend on cooperation among various governmental bodies.<sup>193</sup> As the situation currently stands, most climate programs in the federal

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188. Vandenbergh, *supra* note 177, at 131.

189. *See id.* at 138 (“If government is unable to act, an imperfect private governance measure may be preferable to the hypothetical public measure so long as the private measure is efficient and effective, and does not decrease the chance of a better public or private action.”).

190. *See supra* Part II.B.3 (describing the fragmentation of federal climate-information efforts).

191. U.S. GOV'T ACCOUNTABILITY OFF., *supra* note 128, at 16.

192. *See id.* at 46–47.

193. *Id.* at 18.



government are designed to meet individual agency needs.<sup>194</sup> If coordinating climate information is to be prioritized at the federal level, climate-information efforts should be developed with broad applicability in mind. This means developing interagency missions for climate programs, reducing redundancies across the various climate programs, and encouraging collaboration between private and public entities.

Understandably, creating a coordinated climate-information network at the federal level primarily involves distinctly federal actions.<sup>195</sup> Beginning in 2009, the Government Accountability Office recommended “that the appropriate entities within the Executive Office of the President, in consultation with relevant federal agencies, state and local governments, and key congressional committees of jurisdiction, develop a strategic plan to guide the nation’s efforts to adapt to climate change.”<sup>196</sup> In order to streamline the distribution of climate information to decisionmakers, clear roles, responsibilities, and interagency working relationships need to be established among federal, state, local, and private actors.<sup>197</sup>

This initiative is important to improving flood modeling since the federal government is the only entity with the ability to provide “a full suite of forecasting, modeling, observations, and other information.”<sup>198</sup> And although the federal government may hold a high volume of climate research that is easily accessible, the federal government is not nearly as adept at making information useful for decisionmakers.<sup>199</sup> Thus, the need for an integrated climate-information network highlights why simply increasing funding for climate modeling research is an ineffective solution. Even if funds were appropriated to various agencies to generate better flood models, there is no guarantee the updated models would reach decisionmakers in FEMA, Fannie Mae, and Freddie Mac. For future climate information to have a tangible impact and improve the accuracy of SFHAs, a

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194. *See id.* at 15 (“The federal government’s climate information . . . is fragmented across many individual agencies that use the information in different ways to meet their respective missions.”).

195. *See id.* at 41 (mentioning findings that motivating decisionmakers to use climate information is best accomplished through distinctly federal actions like statutory and strategic plans).

196. *Id.*; U.S. GOV’T ACCOUNTABILITY OFF., GAO-10-113, CLIMATE CHANGE ADAPTATION: STRATEGIC FEDERAL PLANNING COULD HELP GOVERNMENT OFFICIALS MAKE MORE INFORMED DECISIONS (2009).

197. U.S. GOV’T ACCOUNTABILITY OFF., *supra* note 128, at 41.

198. *Id.* at 42.

199. *Id.*

comprehensive climate-information network must be developed to ensure future research is not wasted.<sup>200</sup>

Despite the resources available to the federal government, assuming that this approach is entirely within the ambit of the federal government would be inappropriate. In fact, nonfederal, technical assistance in developing a consolidated climate-information network is required due to the federal government's *lack* of resources.<sup>201</sup> In other words, although the government has access to a larger pool of funds than any other single organization, it still does not have the resources to tackle the climate problem on its own.<sup>202</sup> Private sector assistance would minimize the need for a single government agency to possess all necessary expertise and would provide added flexibility to the system.<sup>203</sup> While the specific roles private and public entities play in developing a centralized climate-information hub are best left to individual decisionmakers, public-private cooperation should be prioritized as a single entity cannot be expected to bear the full development burden.<sup>204</sup>

### *C. Provide Future Flood Risk Estimates*

Next, public and private entities need to do a better job of incorporating dynamic SLR flood risk into their industry activities and showing market participants that flood risk is not a static measurement. The best way to accomplish this objective is to include flood-hazard projections in publications and in policy-setting tools, and to do so for properties both inside *and* outside current SFHA boundaries. This serves two purposes: First, it improves the accuracy of flood-hazard tools (like FIRMs and SFHA boundaries) and provides a more complete picture of a property's evolving flood risk.<sup>205</sup> Second, it communicates to residents and decisionmakers that climate-change and SLR risks are constantly changing and that flood hazards are

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200. See *supra* note 145 and accompanying text (discussing the importance of accessible climate information).

201. U.S. GOV'T ACCOUNTABILITY OFF., *supra* note 128, at 44.

202. In this context, "resources" also refers to the relationships, or lack thereof, the federal government has with local communities that would help promote the effectiveness of a centralized climate-information network. See *id.* (noting that the federal government does not have a local presence).

203. *Id.* at 44–45.

204. *Id.* at 44–46. It may be helpful to reference climate networks in other countries when deciding how to structure a U.S. information hub. For instance, the United Kingdom's Climate Ready Support Service operates as a central hub to help decisionmakers use climate information effectively and "provides tools, information, and practical advice to help businesses and other organizations adapt to the effects of climate change." *Id.* at 45.

205. See Kousky, *supra* note 104, at 28 (noting variation in flood risk).

present and likely to grow outside SFHAs over the mortgage's lifetime.<sup>206</sup> This option should also be preferred over an educational marketing campaign. While educational outreach is important, there is already a well-established initiative in place through FEMA's FloodSmart campaign.<sup>207</sup> Limited time and money are better spent on reforms that are more likely to have a direct impact on climate-information disclosure.<sup>208</sup>

Future flood risks should be disclosed at all levels of the market to ensure information asymmetries are narrowed as much as possible. For instance, FEMA should begin including data on future flood hazards in FIRMs, specifically in relation to the effects of SLR, erosion, and changing precipitation patterns.<sup>209</sup> One way to effectively convey this information without substantially altering current FIRMs is to develop "Future FIRMs." Future FIRMs would be maps solely devoted to communicating projected changes in flood risk and allowing present-day decisionmakers to make better long-term policy choices at the federal, state, and local level.<sup>210</sup>

Moreover, Fannie Mae and Freddie Mac need to include future flood risk in their loan selling criteria so they can better account for the true present and future value of a mortgage in purchasing decisions. Fannie Mae may opt to directly update its selling guidelines such that certain data on future flood risk is incorporated in a loan's risk evaluation, or more drastically, the GSEs may require properties in a 500-year floodplain to purchase flood insurance before the properties are eligible for purchase. Conversely, Fannie Mae and Freddie Mac may

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206. *See id.* (discussing communication of flood risk over the life of a mortgage).

207. *See supra* notes 148–153 and accompanying text (describing the FloodSmart marketing campaign).

208. *See Kousky, supra* note 104, at 28 ("For such information to be fully internalized by the housing market, a simple marketing campaign will not suffice."). Rejecting marketing campaigns as an ideal solution should not be taken as rejecting their importance entirely. Educational outreach plays an important role in resolving information asymmetries and increasing public awareness, which may help stimulate government involvement.

209. *See id.* at 14 (discussing FIRMs).

210. *See id.* at 28 ("[N]ew policy tools are needed to link housing and development decisions with information on hazard risks and their projected changes."). It might be helpful to think of Future FIRMs as a parallel to Future Land Use ("FLU") maps—a common tool in the land use planning context that provides community residents and developers with a visual guide to a municipality's future planning. *See Douglas Miskowiak, Citizen's Guide to Future Land Use Mapping*, UNIV. OF WIS.-STEVENS POINT 4 (Aug. 2006), [https://www.uwsp.edu/cnr-ap/clue/Documents/DataMappingGIS/Citizen\\_Guide\\_Future\\_Land\\_Use\\_Mapping.pdf](https://www.uwsp.edu/cnr-ap/clue/Documents/DataMappingGIS/Citizen_Guide_Future_Land_Use_Mapping.pdf) [<https://perma.cc/334Y-FAXF>] (explaining FLU maps). FLU maps are not exact predictions of the future, instead providing an estimation of what a community may look like over a given span of time. *Id.* This principal is important to keep in mind for Future FIRMs, since exact predictions of SLR flood risk are unlikely.

indirectly include future flood risk in their loan evaluations if FEMA sufficiently updates SFHAs and FIRMs to include growing and changing flood risk. If appropriate mechanisms are put in place, the GSEs will be better positioned to reject loans not currently located in SFHAs but which face a high probability of climate default over the loan's lifetime.

To supplement government efforts and ensure dynamic flood-hazard information is widely accessible in the event of political gridlock or routine delays, private entities should also prioritize publicizing future flood risks to borrowers and lenders.<sup>211</sup> This effort may require focusing limited resources on particularly vulnerable coastal communities that pose the highest climate-default risk to Fannie Mae and Freddie Mac. Although these efforts might not be as comprehensive as a federal initiative, providing supplemental information to borrowers and lenders is a potentially helpful way to circumvent the political and economic forces working against public efforts.<sup>212</sup>

#### *D. Standardize the Real Estate Appraisal Process*

Lastly, decisionmakers in the public and private sectors should attempt to standardize how real estate appraisers factor present and future climate risk into property valuations. This standardization would reduce information asymmetry and the lemons problem by acting as a warranty that appraisers and lenders can provide to Fannie Mae and Freddie Mac in order to assure them of loan quality. Creating a uniform climate-risk certification system will likely require some reforms to the industry as it currently exists.<sup>213</sup> Fannie Mae and Freddie Mac currently only require an objective appraisal for a loan to conform.<sup>214</sup> Yet, there is no guarantee an objective appraisal seriously

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211. See Vandenberg, *supra* note 177, at 138 (listing ways in which private-governance mechanisms may serve to counteract or supplement government inaction).

212. See Kousky, *supra* note 104, at 28 (“Unfortunately, there are many political and economic forces working against more stringent land use in high-risk areas.”).

213. Creating a uniform climate-risk certification system is stated as a conditional possibility because it may be more feasible to simply update the Uniform Standards of Professional Appraisal Practice (“USPAP”)—an ethical and performance standard for the appraisal profession adopted by Congress, compliance with which is required for state-certified appraisers involved in federally related real estate transactions. *What is USPAP?*, APPRAISAL FOUND., [https://www.appraisalfoundation.org/imis/TAF/Standards/Appraisal\\_Standards/Uniform\\_Standards\\_of\\_Professional\\_Appraisal\\_Practice/TAF/USPAP.aspx](https://www.appraisalfoundation.org/imis/TAF/Standards/Appraisal_Standards/Uniform_Standards_of_Professional_Appraisal_Practice/TAF/USPAP.aspx) (last visited Sept. 12, 2021) [<https://perma.cc/57D8-XZNB>].

214. See *supra* notes 49–50 and accompanying text (Fannie Mae appraisal requirements).

considers climate risk without some standard or certification assuring the GSEs they are purchasing a loan of acceptable quality.<sup>215</sup>

For climate-risk certification to be effective, certain items need to be addressed. Notably, the certification process must be enforced consistently and must use measurements that accurately quantify current and future flood risks into home valuations. Producing accurate determinations of dynamic flood risks will likely require a partnership between FEMA, Fannie Mae, Freddie Mac, and a private standard-setting body to ensure appropriate measurement techniques are developed and agreed upon by all relevant parties.<sup>216</sup> Moreover, getting the GSEs to accept such standards is necessary to effect widespread change and acceptance in the real estate appraisal community. If Fannie Mae and Freddie Mac require climate-risk certification before purchasing loans, lenders are more likely to seek appraisers who are willing to satisfy climate-risk certification requirements. Thus, involving Fannie Mae and Freddie Mac in the development of a private standard is paramount to stimulating widespread acceptance among appraisers and to creating necessary change in how coastal homes are valued.

While successful implementation of an industry-wide standardization may seem farfetched, it presents a better solution than requiring PMI for properties in SFHAs.<sup>217</sup> PMI would essentially act as an additional tax on coastal homeowners who have minimal control over their homes' individual flood risk. Indeed, PMI may do more harm than good. Introducing additional costs to coastal living may force low-income residents from their homes and increase risk to Fannie Mae and Freddie Mac as homeowners are forced to choose between paying PMI monthly and staying current on mortgage payments.<sup>218</sup> In truth, it may be difficult to successfully implement a widespread warranty system to shift climate-default risk from Fannie Mae and Freddie Mac to individual borrowers. Yet, as previously noted, silver buckshot is what we should be looking for, and reforms of all sizes and complexity that

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215. See *supra* notes 154–159 and accompanying text (noting that providing warranties and quality assurance to the GSEs may counteract the lemons problem).

216. Accordingly, the USPAP may be the most appropriate private standard-setting body since it was previously adopted by Congress in 1989 and is managed under an existing private-public relationship. See APPRAISAL FOUND., *supra* note 213.

217. See *supra* notes 169–172 and accompanying text (noting the weaknesses of requiring PMI).

218. See Fontinelle, *supra* note 161 (cautioning that PMI adds an additional variable monthly cost to mortgage payments since PMI payments are relative to the outstanding loan balance).

better inform Fannie Mae and Freddie Mac of loan risk should be investigated.<sup>219</sup>

### CONCLUSION

Under the current framework, Fannie Mae and Freddie Mac do not have the appropriate mechanisms in place to allow them to successfully assess the climate-default risk of the coastal mortgages they secure.<sup>220</sup> If coastal lenders continue to offload their riskiest loans onto Fannie Mae and Freddie Mac, taxpayers may end up shouldering the consequences as sea levels rise and fewer borrowers are able to continue making mortgage payments.<sup>221</sup> One way to address this issue is by viewing it as a lemons problem. Mortgages subject to increased SLR flooding are “lemons” because they are riskier, and thus less valuable, than the typical mortgage Fannie Mae and Freddie Mac would insure—yet coastal lenders have been able to market them as safe investments.<sup>222</sup> If left unchecked, climate-sensitive loans may increasingly populate the mortgage market and ultimately leave the GSEs overleveraged.<sup>223</sup>

This Note uses well-known answers to the lemons problem as a means of identifying viable solutions to fix information asymmetries in the mortgage market and to identify potential strategies for future decisionmakers. Flood models should be constantly updated and improved to provide Fannie Mae and Freddie Mac with the most accurate information and representations of current and future climate-default risk; accurate measurements of loan risk need to be effectively communicated to borrowers, lenders, and the GSEs to better solve information asymmetries; and warranties or quality guarantees must be developed so Fannie Mae and Freddie Mac can transfer some climate-default risk back onto borrowers and lenders.

Decisionmakers should utilize three separate yet related approaches to meet these objectives. First, public and private actors should work in tandem to centralize climate information and ensure more concentrated and coordinated diffusion of climate information into the hands of policymakers and private entities. This effort will likely result in more efficient risk disclosure to Fannie Mae and Freddie Mac

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219. See *supra* Part III.A (explaining the preference for “silver buckshot” in response to climate issues).

220. See discussion *supra* Part I.F.

221. Flavelle, *supra* note 9.

222. See *supra* Part II.A (discussing the lemons problem).

223. See *supra* Part II.A.

and may encourage development of more accurate flood models.<sup>224</sup> Second, FEMA should publish Future FIRMs that communicate projected changes to properties' flood risks inside and outside SFHA boundaries. Correspondingly, private organizations should take steps to convey similar information to the public and may need to focus disclosure efforts on those communities that pose the greatest risk to Fannie Mae, Freddie Mac, and, ultimately, taxpayers. Finally, attempts should be made to standardize the real estate appraisal industry and develop a certification process that appraisers can use to verify that climate risk has been adequately factored into property valuation.<sup>225</sup> Fannie Mae and Freddie Mac can then require these certifications from lenders as a conforming loan requirement, and the GSEs can better assess the riskiness and underlying value of the loans they choose to purchase.

Although the issues presented in this Note can surely be solved through other mechanisms, approaching information asymmetries in coastal mortgage markets as a variation of the lemons problem may make identifying avenues for reform easier for future scholars and decisionmakers. Regardless, the first step to protecting Fannie Mae, Freddie Mac, and American taxpayers is recognizing that a problem exists. Hopefully, this Note will prompt public and private decisionmakers at all levels to take that step and implement reforms for future economic and environmental adaptation.

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224. See U.S. GOV'T ACCOUNTABILITY OFF., *supra* note 128, at 46–47 (recommending development of a federal climate-information network utilizing both public and private entities).

225. As mentioned previously, the USPAP has already standardized the appraisal profession a substantial amount. See APPRAISAL FOUND., *supra* note 213 (explaining that the USPAP are the “generally recognized ethical and performance standards for the appraisal profession”). Thus, this solution may simply require amending existing standards to reflect the impacts of changing flood risk on property values. See *id.* (“USPAP is updated every two years so that appraisers have the information they need to deliver unbiased and thoughtful opinions of value.”).

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