Long-Term Property Insurance

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Abstract

This paper proposes long-term insurance (LTI) as an alternative to the standard annual property insurance policy. LTI offers significant benefits to many stakeholders by reducing insurers' administrative costs, lowering search costs, providing stability to consumers and incentivizing property owners to invest in risk-reducing measures. A simple two-period model illustrates situations that would make a long-term contract attractive to both insurers and consumers under competitive market conditions. Recognizing potential difficulties in modifying regulatory systems in 50 states, and using the history of the development of long-term mortgages in the United States as a benchmark, we discuss the applicability of long-term contracts for reforming the federally-run U.S. National Flood Insurance Program (NFIP). Multi-year flood insurance policies would encourage investments in cost-effective mitigation measures and provide stability to the program, in view of the large number of homeowners who cancel their annual policies after just two or three years. The paper concludes with issues and questions that need to be addressed for multi-year property insurance policies to be considered by private sector firms.

Key Words: Long-term insurance; mortgages; catastrophic risks; property insurance; flood insurance
JEL Classification: G1 (general financial markets), G2 (financial institutions and services), G22 (insurance)

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Introduction

It is well known that insurance costs increase significantly following large-scale natural disasters such as major hurricanes and earthquakes. In the aftermath of the seven major hurricanes that made landfall in the United States in 2004 and 2005, the average homeowner's premium in the state of Florida more than doubled, from $723 at the start of 2002, to $1,465 in the first quarter of 2007 (Klein, 2009; Kunreuther and Michel-Kerjan, 2009). In coastal areas, insurers were permitted by regulators to triple or even quadruple their premiums for some homeowners.

While the market price of insurance has significantly increased in coastal areas (especially Florida), insurers are still concerned that their long-term earnings will be negative in high-risk areas, leading some to refuse to renew policies in coastal areas subject to hurricanes. In February 2007, State Farm, the largest homeowner insurer in Mississippi, stopped selling new policies on homes and small businesses there (Treaster, 2007). Allstate, another giant provider of residential insurance, announced it would restrict new homeowners' policies in New Jersey, Connecticut, Delaware and New York City (Vitello, 2007). In January 2009, State Farm announced that it would pull out of Florida's insurance market over the next two years unless it was granted a significant increase in its homeowners' premium by the insurance regulator. The insurance company, which stopped writing new homeowners policies in Florida in 2008, said it was left with little choice but to abandon the property line. Only after Insurance Commissioner Kevin McCarty allowed State Farm to drop 125,000 policies and granted it a nearly 15 percent increase did the insurer agree to remain in the state. Had State Farm pulled out of Florida, 806,000 households would have been looking for coverage (Miller, 2009).

Following catastrophes, residents often wonder why insurance companies increase their rates so dramatically from one year to the next, given their expertise in quantifying risk. Many are also concerned as to whether they will have access to insurance coverage against these risks in the future. These uncertainties on the part of homeowners suggest the following question: How can the cost of coverage be smoothed over time to avoid the radical changes in the insurance market from year to year? To address this question, we need to find ways to reduce insurers' earnings volatility while assuring those residing in high-risk areas that their provider will not cancel their policies, or double or triple their premiums after a disaster. If the recent past is any indication as to what the future might bring, these questions are likely to remain important in the United States. As shown in Table 1, 17 of the 25 most costly catastrophes experienced by the insurance industry worldwide between 1970 and 2008 occurred in the United States, 12 since 2001.

Table 1
The 25 Most Costly Insured Catastrophes in the World[5], 1970-2008

$ Billion	Event	Victims (Dead or missing)	Year	Area of Primary Damage
46.3	**Hurricane Katrina**	**1,836**	**2005**	**USA, Gulf of Mexico, et al.**
35.5	**9/11 Attacks**	**3,025**	**2001**	**USA**
23.7	**Hurricane Andrew**	**43**	**1992**	**USA, Bahamas**
19.6	**Northridge Earthquake**	**61**	**1994**	**USA**
16.0	**Hurricane Ike**	**348**	**2008**	**USA, Caribbean, et al.**
14.1	**Hurricane Ivan**	**124**	**2004**	**USA, Caribbean, et al.**
13.3	**Hurricane Wilma**	**35**	**2005**	**USA, Gulf of Mexico, et al.**
10.7	**Hurricane Rita**	**34**	**2005**	**USA, Gulf of Mexico, et al.**
8.8	**Hurricane Charley**	**24**	**2004**	**USA, Caribbean, et al.**
8.6	Typhoon Mireille	51	1991	Japan
7.6	**Hurricane Hugo**	**71**	**1989**	**Puerto Rico, USA, et al.**
7.4	Winterstorm Daria	95	1990	France, UK, et al.
7.2	Winterstorm Lothar	110	1999	France, Switzerland, et al.
6.1	Winterstorm Kyrill	54	2007	Germany, UK, NL, France
5.7	Storms and floods	22	1987	France, UK, et al.
5.6	**Hurricane Frances**	**38**	**2004**	**USA, Bahamas**
5.0	Winterstorm Vivian	64	1990	Western/Central Europe
5.0	Typhoon Bart	26	1999	Japan
5.0	**Hurricane Gustav**		**2008**	**USA, Caribbean, et al.**
4.5	**Hurricane Georges**	**600**	**1998**	**USA, Caribbean**
4.2	**Tropical Storm Allison**	**41**	**2001**	**USA**
4.2	**Hurricane Jeanne**	**3,034**	**2004**	**USA, Caribbean, et al.**
3.9	Typhoon Songda	45	2004	Japan, South Korea
3.6	**Thunderstorms**	**45**	**2003**	**USA**
3.5	**Hurricane Floyd**	**70**	**1999**	**USA, Bahamas, Columbia**

Sources: Kunreuther and Michel-Kerjan (2009).
Note: this table excludes payments for flood by the U.S. National Flood Insurance Program.

There are relevant issues on the demand side as well. The *natural disaster syndrome*, a common behavioral pattern, explains why homeowners, private businesses, and public-sector organizations in hazard-prone areas fail to adopt cost-effective loss-reduction measures voluntarily, making them highly vulnerable and unprepared should a severe hurricane or other

[5] By "catastrophes" we mean disasters inflicting insured losses above $38.7 million or total losses above $77.5 million, the definition used by Swiss Re.

natural disasters occur (Kunreuther, 1996). Prior to a disaster, many individuals perceive its likelihood to be sufficiently low that it is below their threshold level of concern. Many are not willing to incur the high upfront investment cost of risk mitigation measures that far exceeds the relatively small premium discount reflecting the reduction in expected annual insured claims from future disasters. It is only after suffering losses that these same individuals claim they should have purchased insurance and invested in mitigation measures (Kleindorfer, et al., 2009; Kunreuther, Meyer and Michel-Kerjan, forthcoming).

The lack of interest in financial protection is highlighted by data from the Department of Housing and Urban Development (HUD) revealing that 41 percent of damaged homes from the 2005 hurricanes were uninsured or underinsured. Of the 60,196 owner-occupied homes with severe wind damage from these hurricanes, 23,000 did not have insurance against wind loss (U.S. Government Accountability Office, 2007).

The empirical evidence regarding investments in mitigation is also revealing. A 1974 survey of more than 1,000 California homeowners in earthquake-prone areas revealed that only 12 percent of the respondents had adopted any protective measures (Kunreuther et al., 1978). Fifteen years later, there was little change despite the increased public awareness of the earthquake hazard. In a 1989 survey of 3,500 homeowners in four California counties at risk from earthquakes, only 5 to 9 percent of the respondents in these areas reported adopting any loss reduction measures (Palm et al., 1990). Similar reluctance by residents in flood-prone areas to invest in mitigation measures was found by Burby et al. (1988) and Laska (1991). Even after hurricanes caused extensive damage to large parts of the U.S. Atlantic and Gulf coastlines during the 2004 and 2005 hurricane seasons, a large number of residents had still not invested in relatively inexpensive loss reduction measures with respect to their property, nor had they undertaken emergency preparedness measures. A survey of 1,100 adults living along the Atlantic and Gulf Coasts undertaken in May 2006 revealed that 83 percent of the responders had not taken any steps to fortify their home, 68 percent had no hurricane survival kit and 60 percent had no family disaster plan (Goodnough, 2006).

To address the dual problem of volatility of insurance premiums and homeowners' failure to properly insure or protect their property against future damage from disasters, we propose the following modification of current contractual arrangements: provide homeowners' coverage through long-term insurance (LTI) policies that would be attached to the property. The length of the insurance policy could be 5, 10, or even 20 years. Prices could be fixed or adjustable every *n* years. To our knowledge, no systematic analysis has been undertaken on the pros and cons of such multi-year insurance contracts to cover natural hazards and how these policies could be regulated and sold. Multi-year catastrophe insurance could also become a natural complement to proposals for a federal natural disaster insurance plan that have been introduced in Congress in recent years. [See U.S. Government Accountability Office (2007) and Oxford Analytica (2010)].

The paper is organized as follows. Following a discussion on the need for LTI we develop a simple two-period model to capture key features in designing an LTI contract and compare its performance to one-period insurance policies. We then apply the historical lessons from the mortgage market that evolved from one-to-three year contracts in the 1920s to the 30-year mortgages in the market today. This case study suggests how regulatory interventions can create highly valuable and long-lasting changes in a financial contract.

While there are differences between mortgages and insurance, this example suggests starting with a federally-regulated program as a benchmark for introducing LTI by private sector insurers.[6] The federal National Flood Insurance Program (NFIP) is a natural first step in making the LTI concept attractive to private insurers and the insurance commissioners who currently regulate premiums in the 50 states. We then suggest how the NFIP could be redesigned to provide long-term insurance tied to property rather than the homeowner. The paper concludes with a brief summary and a set of issues and questions that need to be addressed for multi-year property insurance to be considered by private sector insurers.

The Need for Long-Term Insurance (LTI)

Property insurance for residential properties has always been provided as annual contracts renewable at the option of the insurer. In some cases, legislation has restricted insurers from canceling policies in order to assure residents that coverage will continue to be available. Following the Northridge earthquake of 1994, California, in effect, imposed an exit fee on insurers that no longer wished to offer earthquake coverage to homeowners by requiring these firms to provide the initial capitalization for the newly created California Earthquake Authority (California State Auditor, 2001)

In Florida, the occurrence of Hurricane Andrew in August 1992 led the state legislature to enact a bill in November 1993 that insurers could not cancel more than 10 percent of their homeowners' policies in any county in one year and that they could not cancel more than 5 percent of their property owners' policies statewide for the next three years. During the 1996 state legislative session, the law was extended until June 1, 1999 (Lecomte and Gahagan, 1998). In 2002 Florida established a state-operated assigned risk pool—Citizens Property Insurance Corporation—as a stop-gap measure for those hurricane risks that the private insurers were unwilling to accept individually. According to the state law, Citizens can recoup its deficit *ex post* against all other private insurers in the state, who in return would levy a surcharge against all their policyholders. Given that insurers have restricted the sale of homeowners' coverage, policyholders cannot help but worry that their existing insurance might be subject to unexpected cancellation or very significant premium increases or *ex post* recoupment, particularly if a natural disaster creates severe damage in the near future.

One-year insurance policies impose significant costs on policyholders as well as insurers. Many individuals voluntarily purchase insurance against a given type of hazard (e.g., flood, earthquake) only after a major disaster occurs, and then cancel their policies a few years later if they have not suffered another loss. This practice occurs with flood insurance even when individuals are required to purchase coverage as a condition for obtaining a federally insured mortgage. Banks and financial institutions often fail to enforce this requirement, first because few of them are ever fined, and second because the mortgages are often transferred to banks (and then to the secondary market) in non-flood-prone regions of the country, where there is less awareness of either the flood risk or the requirement that homeowners may have to purchase this coverage (Kunreuther and Michel-Kerjan, 2010).

[6] The most noteworthy distinction is that the collateralization of mortgage loans should reduce the maximum loss to significantly less than the mortgage value, whereas the insurance obligation generally corresponds to the full property value. Of course, the subprime crisis has revealed many cases where the mortgage loss is in excess of fifty percent of the property value. Another distinction is that the long-term mortgage protects the borrower against fluctuations in both market interest rates and his or her credit rating. Long-term insurance, in contrast, provides the policyholder protection against fluctuations in insurance premiums that may arise from a change in the expected loss or other factors.

Consider the August 1998 flood that damaged property in northern Vermont. Of the 1,549 victims of this disaster, FEMA found that 84 percent of the homeowners in Special Flood Hazard Areas (SFHAs) did not have insurance, even though 45 percent of these individuals were required to purchase this coverage (Tobin and Calfee, 2005). On a much broader scale, a recent study of flood insurance tenure in Florida revealed that of the one million residential NFIP flood insurance policies in place in 2000, only one third had been renewed by 2005 (Michel-Kerjan and Kousky, forthcoming).

Moreover, evidence from recent disasters reveals that residents who fail to adequately protect their home and/or purchase insurance create a welfare cost to themselves and a possible cost to all taxpayers in the form of government disaster assistance.[7] The dramatic increase of the number of U.S. Presidential disaster declarations over the past 50 years is striking: there were 162 during the period 1955-1965, 282 during 1966-1975, 319 during the period 1986-1995 and 545 during 1996-2005 (Michel-Kerjan, 2008).[8] In response to Hurricane Katrina in 2005, two emergency supplemental appropriations bills (P.L. 109-61 and P.L. 109-62) were enacted by Congress that provided $62.3 billion for emergency response and recovery needs. In 2006, another $19.3 billion was appropriated in supplemental legislation (P.L. 109-234) for recovery assistance (in 2006 dollars). Taken together, this $81.6 billion in federal relief is more than the combined total insurance claims paid by private insurers for damage due to wind, and payments by the NFIP for flood damage caused by Katrina.

Multi-year insurance policies attached to the property, not to the homeowner, promise to overcome these problems. By stretching the time horizon for low-probability, high-consequence events, one might be able to make them more salient and make insurance much more attractive to many than it is today as shown by recent studies.[9] An LTI insurance policy could be coordinated with long-term home improvement loans to reduce insurance premiums and to smooth the cost of the mitigation investment.[10] This would encourage residents in disaster-prone areas to make their houses more resilient to floods, hurricanes or other type of hazards. The benefits from such investments could be significant in that there will be less damage to property, a reduction in the losses for natural disaster insurance lines, more secure mortgages and lower costs to the government for disaster assistance.[11]

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[7] Under the current U.S. system, the Governor of the state(s) can request that the President declare a "major disaster" and offer special assistance if the damage is severe enough.

[8] Despite this evolution, data on federal expenditures and obligations for disaster relief and recovery have never been presented in a comprehensive manner (U.S. Congress, 1998). As noted by the Congressional Research Service, "Each department or agency uses a variety of reporting formats in appropriations justifications. However, considerably more information is available on federal expenditures for Hurricanes Katrina, Rita, and Wilma than for disasters in previous years, in large part because of the mandate in P.L. 109-62 that requires specified agency heads to provide data on a weekly basis on the allocation and obligation of the funds appropriated in that statute. To the extent known, this was the first time such a reporting requirement has been attached to Disaster Relief Fund supplemental funding." (U.S. Congressional Research Service, 2006).

[9] For instance, individuals perceive a specific risk as much more threatening when presented with information that within 40 years there is a 33 percent chance of a flood with a 100 year return period than when told that the chances of a flood next year is 1 percent (Keller et al. 2006).

[10] Since both banking and insurance require operating charters, it is not a trivial matter for a bank to begin writing insurance policies or for an insurer to start what might be considered a banking business. An alternative would be for banks to make the loans independently of LTI. While they could do so today, many do not. We feel that having a package long-term insurance/long-term home improvement loan might be a more attractive proposal. We thank one of the referees for pointing this out.

[11] Mooney (2001) has argued for long-term homeowners' policies for this reason.

A Simple LTI Model

This section looks at the type of LTI contracts that could be developed as an alternative to existing annual contracts in a competitive market where insurers are free to charge premiums that reflect risk. We briefly discuss the relevant literature and then propose a simple two-period model that captures the basic features of LTI.

Relevant Literature

An extensive literature in economics, insurance and finance provides insight into the optimal design of financial securities and contracts. This literature generally assumes a specific economic decision-making environment with actions of the various agents affected by such variables as income, consumption and balance sheet constraints. Other features of the market, such as transaction costs, incomplete contracts and asymmetric information are also specified. The proposed solution is a contract where consumers are assumed to maximize their expected utility subject to the above constraints. This often has a highly mathematical and abstract form. A real-world approximation to the abstract optimal contract is then proposed.[12] The following LTI contract is in the spirit of this literature. We have intentionally developed a simple model to demonstrate the superiority of the long-term contract over one-period insurance policies.

A Two-Period Model for LTI

To provide the rationale for LTI over annual contracts we develop a two-period model that highlights the tradeoffs facing insurers and policyholders who have the option to purchase either a long-term (LT) policy at a fixed premium for each of the two periods or two one-period contracts. For such a comparison to be meaningful, it is necessary that insurance premiums reflect the actual risk.

Assumptions

We assume a competitive market in which insurers are homogenous, risk neutral, and maximize expected profits.[13] At first, we put aside any marketing or search costs (for insurers and policyholders alike) and any operating costs for the insurers. Consumers are homogenous and buy full coverage for periods 1 and 2. Insurers offer a long-term (LT) policy that covers both periods, or they offer two one-period policies. At the beginning of period 1, experts provide a single estimate of a disaster occurring in period 1; however, they are uncertain as to whether there is a high (H) or low (L) probability of a disaster in period 2.[14] At the end of period 1, insurers and consumers both learn whether the probability of a disaster in period 2 is H or L (noted p_{2H} and p_{2L}, respectively).

[12] See Allen and Gale (1994) for a book-length survey.

[13] The assumptions imply that insurance premiums are set equal to the expected loss on each policy. The assumption of risk neutrality is well motivated if insurers have the ability to diversify their risks fully. However, this may not be true for certain classes of natural disasters. In these cases, the basic force of our results still hold as long as the insurers are more risk tolerant than their policyholders.

[14] In addition to the actuarial departments of the insurance companies, there are now a number of consulting firms that specialize in providing estimates of the losses that can be expected from any insurance portfolio at risk to any of the major natural disasters. For more details see Grossi and Kunreuther (2005).

Notation

Z_1 = insurance premium in period 1 for a one-period policy, determined at the beginning of period 1
Z_2 = insurance premium in period 2 for a one-period policy, determined at the beginning of period 2
Z(LT) = fixed insurance premium per period for LT coverage determined at the beginning of period 1
D = insured damage if a disaster occurs
p_1 = probability of D in period 1
p_{2H} = high probability of D in period 2
p_{2L} = low probability of D in period 2
a = weight placed by experts in period 1 on the likelihood of p_{2L} in period 2. We therefore assume that $p_2 = a\, p_{2L} + (1\text{-}a)\, p_{2H}$
C = penalty cost to consumer if s/he cancels an LT policy at the end of period 1

Premiums Charged by Insurer for One-Period Insurance

$Z_1 = p_1 D$ (1a)
$Z_{2L} = p_{2L} D$ with likelihood a (1b)
$Z_{2H} = p_{2H} D$ with likelihood (1-a) (1c)

Premium Charged by Insurer for LT Insurance

For simplicity but without loss of generality the discount factor is assumed to be zero for evaluating period 1 and period 2 costs. If the consumer purchases an LT contract then s/he will pay the same premium Z(LT) in each of the two periods, which is:

$$Z(LT) = \tfrac{1}{2}\{ [p_1 D + a\, p_{2L} D + (1\text{-}a)\, p_{2H} D]\} \qquad (2)$$

The insurer marketing an LT contract knows that if the probability of a disaster in period 2 is p_{2L} then a consumer will be able to purchase coverage more cheaply from an insurer offering a separate policy to cover losses in period 2. Consumers are given the right to cancel an LT contract at the end of period 1 but at a cost C paid to the insurer who provided coverage for the first period. In a competitive insurance market, this penalty will equal the expected loss in premium income suffered by the insurer, namely:

$$C = Z(LT) - (p_{2L})D \qquad (3)$$

Policyholder Demand for Long-Term Insurance

We believe consumers will prefer a LT policy rather than two one-period policies for the following reasons:

- For risk-averse homeowners offered an actuarially fair, fixed premium, an LT policy will always be preferable to an equivalent set of one-year policies with fluctuating premiums.
- Consumers believe that there is some likelihood that the insurer may cancel the one-period policy at the end of period 1.
- There is a search cost for a new policy in period 2 if either the insurer cancels the policy or the consumer decides to look for a cheaper policy in period 2.

- Consumers considering mitigation investments that will lower their premiums will prefer LT policies that lock in the reduced premium for two periods.
- Consumers view the option to cancel the policy at the end of period 1 to be a benefit, even though it requires the payment of the cancellation fee C.
- LT polices create stability and peace of mind for consumers. They know that they will continue to be protected against damage from disasters for the length of the contract.

Insurer Supply of Long-term Insurance

We also believe LT policies can be designed to be attractive for insurers. Perhaps most importantly, there will be lower administrative and marketing costs (related to gaining new consumers or re-gaining older consumers who have left the company) associated with LT policies than a sequence of one-period policies. Some of these cost savings will also be passed on to policyholders, an additional factor motivating LTI demand. On the negative side, LT policies may create higher capital costs if there is considerable uncertainty with respect to the loss distribution in period 2. However, this additional expense can be offset and even reversed by two factors. First, as just noted, LT policies will have lower administrative and marketing costs. Second, insurers may be able to achieve greater flexibility in pricing by introducing LT policies. As noted earlier, insurers already face severe regulatory confrontations in raising premiums following a major disaster. Regulators, however, may allow the premiums on LT policies to be set high enough to compensate insurers for taking on the additional risk. Regulators may also be more enthusiastic toward LT policies if insurers agree to continue to offer one-period policies as well. Insurers may also deal with the uncertainty of future loss distributions by offering long-term policies with adjustable premiums. Put more generally, LT policies will expand the range of policies that can be offered by insurers and thereby enhance regulatory flexibility with respect to risk-based premiums.

Long-Term Insurance: Contract Length and Fixed versus Adjustable Premiums

There are many detailed contract design questions that need to be addressed in consultation with insurers and regulators, but they are beyond the scope of the present paper. However, we do comment here on two fundamental and related issues: contract length and fixed versus adjustable premiums.

The market for term life insurance illustrates the options concerning contract length and adjustable premiums that may be offered in an insurance market. For life insurance, the contract length determines the span of time over which the insurer is willing to provide protection independent of any change in the insured's medical condition. In practice, contracts are available for periods as short as one year or as long as until death. Longer-term policies can then be combined with alternatives for fixed versus adjustable premiums. In the extreme, a fixed premium can be set for the entire contract. This structure is generally beneficial to the insurer: the probability of death is rising, so any cancellation by policyholders is a gain for the insurer. In practice, it is common for insurers to offer contracts that combine a degree of guaranteed renewability with premiums that adjust at a predetermined interval (often every five years) according to a schedule specified in the contract. Since the premiums are adjusting to the policyholder's age in a predetermined manner, the actual frequency of the premium changes is generally of secondary importance. Instead, the fundamental issue concerns the term over which the contract holds, independent of any changes in the insured's medical condition.

We now apply these considerations to catastrophe insurance, using flood insurance as our example. If the premium is fixed over the contract length, then the policy offers benefits that are comparable to the life insurance policy just discussed. However, adjustable premiums affect flood insurance very differently than life insurance. For life insurance, premium changes primarily depend on the age of the insured. For flood insurance, premiums would likely change as the result of new information regarding the expected loss that could be partially determined by actual disasters and also by new scientific evidence (e.g., projected sea level rise due to climate change).[15] An adjustable premium flood insurance policy would have to contain a formula indicating how premiums would change as a result of new information with respect to the nature of the risk. Regulatory permission to offer such an LTI policy would require that the specified factors were external ones so that they could not be manipulated by the insurer or any other stakeholder. The adjustable premium contract would need to be transparent and understandable to prospective policyholders. Consumers would then choose from a menu of fixed and adjustable premiums, trading off the benefits of longer terms of fixed premiums versus their likely higher total cost.

An Illustrative Example

To highlight the tradeoffs between an LT contract and two one-period insurance policies consider the following example where D = 100, p_1 = .2, p_{2H} = .3, p_{2L} = .1, and a = .4. The premiums charged for two one-period contracts, given by (1a), (1b) and (1c) respectively, are Z_1 = 20, Z_{2L} = 10 with likelihood .4 and Z_{2H} = 30 with likelihood .6.

The fixed premium per period for an LT policy given by (2) would be Z(LT) = 21 so that total premiums over the two periods would be 42, identical to the expected premium for two one-period contracts. The cancellation cost if a policyholder decided to cancel his LT insurance after period 1 would be C = 11 as determined by equation (3).

If there were no administrative, search or transaction costs in this insurance market, then a rational policyholder would always want to buy an LT policy if he was risk averse since his premium is stable over time. He would be indifferent to canceling his LT policy after period 1 if the probability of a loss in period 2 was determined to be p_{2L} =.1 since his premium savings would be 11 (21 minus 10) and the costs of canceling would be C=11.[16]

Social Welfare Implications

Based on this two-period model, one can determine the social welfare implications of providing long-term insurance (LT) insurance contracts to consumers in a manner similar to analyses undertaken by Arrow (1963) in his path breaking study on the welfare benefits of

[15] Most homeowner policies also adjust premiums based on changes in the value of the insured structure in order to keep the amount of insurance approximately constant in real terms. It is worth emphasizing that these premium changes apply only to changes in the structure value, not the land value, since the land value is not insured.

[16] Our formula for the cancellation cost C reflects the amount that insurers would require to break even if they offer a two-period insurance contract and the insured opted out after period 1. If policyholders with two-period contracts incurred additional administrative or search costs in addition to C upon switching to a one-period policy, they would, from a cost-standpoint, prefer to remain with the long-term contract.

insurance markets. Although Arrow's paper is written in the context of the market failure for medical insurance, it is remarkable that almost all his points apply today to similar market failures with respect to the provision of coverage against catastrophic losses. For example, Arrow's discussion focuses on such issues as the welfare loss when insurance markets or contracts are incomplete, when there are search costs and administrative costs, when there can be high variability in the risk level, and when there is informational asymmetry or moral hazard. He also emphasizes the welfare loss that occurs when the absence of insurance markets causes individuals to forgo activities that they would otherwise pursue. He also mentions the benefits of "insurance with a longer time perspective" that might have level premiums as illustrated by life insurance (p. 964).

As noted in the previous section, LTI can encourage individuals who are myopic in their thinking to invest in cost-effective mitigation measures. To illustrate this point in the context of the above example, suppose that a person can invest in a cost-effective mitigation measures at an upfront cost of M = 15 and that it would reduce losses by 45. If premiums reflected risk, then the reduced premium in period 1 would be 9 and the expected reduced premium in period 2 would be 9.9.[17] Those individuals who were myopic by considering only the benefits in the next period would not invest in the mitigation measures. An insurer who marketed a two-period LT policy might also be the natural lender to provide a two-period loan to cover the cost of the mitigation measure.[18] To be clear, insured individuals will have a financial incentive to invest in mitigation measures only if the investment cost is less than the present value of the reductions in the insurance premiums. For this to be true, it is essential that the insurance premiums be risk-based and therefore are reduced to reflect the lower expected loss if the mitigation investment is made.

A key question for LTI is, of course, how to provide an impetus so that it will actually be implemented in a Pareto efficient manner so that everybody's welfare is improved. We take up this issue in the remainder of the paper. We start in the next section with a brief review of how U.S. mortgages achieved a comparable transition from short-term to long-term contracts during the 1930s. As we will see, government intervention and regulation were essential for this innovation to occur. While there are of course important differences between mortgages and insurance, as discussed in the introduction, the evolution of the mortgage market provides an interesting benchmark for considering the role that regulation can play in facilitating the introduction of long-term insurance. It is also worth noting that although the recent performance of the U.S. mortgage market has been dismal in the context of the subprime mortgage crisis, the innovations we are about to discuss did not appear to play a role in creating or expanding this crisis.

A Benchmark for LTI: Lessons from Mortgage Markets

Until the Great Depression, long-term (20- or 30-year maturity) mortgages were rare in the United States. American bank mortgages were commonly short-term (maturities 1 to 4 years) with the full principal due at maturity. This arrangement worked well because, in practice, the loans were regularly renewed at each maturity date. However, as the Great Depression took hold, depositors left the banks no choice but to require full repayment as each mortgage matured.

[17] The reduction in expected loss in period 1 is .2 (45). In period 2 it is determined by combining the likelihood of a low and high probability of a loss, that is, {[.4(.1) +.6(.3)] 45} = 9.9.

[18] Electric utilities also have started programs to finance energy efficient investments. See American Public Power Association (2009).

Many borrowers had to default, and bank sales of the properties added to the collapse of house prices that was already occurring under the dire depression conditions. A vicious circle ensued, as falling house prices begot more mortgage defaults and mortgage defaults begot greater declines in house prices (Jaffee and Quigley, 2007).

In 1933 the federal government intervened to curtail this process. The federal Home Owners Loan Corporation (HOLC) was created that year to modify the failing home mortgages, anticipating the government programs now being proposed to deal with subprime mortgages. The HOLC also modified the mortgages into longer-term, fixed payment, and fully amortizing instruments. This mortgage design innovation was taken over by the Federal Housing Administration (FHA), established under the National Housing Act of 1934 to create a program of home mortgage insurance against default (Aaron, 1972).[19]

The entry of the FHA greatly facilitated the long-term mortgage innovation. It is plausible that the actions of the HOLC and FHA hastened the standardization of long-term mortgages in the U.S. by at least two decades relative to what private markets would have achieved on their own.[20] The long-term FHA mortgages were also the basis for creating the Government National Mortgage Association (GNMA) mortgage-backed security (MBS) in 1968, the first MBS to be widely traded in the United States. Both the FHA mortgages and the GNMA MBS have always had the full faith backing of the U.S. Treasury and neither contributed to the subprime crisis. Indeed, both programs are now at the center of government policies to stabilize the U.S. mortgage market.

The history of the FHA program provides a very useful template for the role that government and regulators can play in the creation of a new long-term insurance market. First, it illustrates that in the absence of coordination, private markets may fail to initiate an important financial innovation. The government intervention was not only of value for its own sake, but it provided a variety of external benefits, including the GNMA MBS market. Jaffee and Quigley (2007) further suggest that the FHA program was instrumental in allowing the reestablishment of a private mortgage insurance industry starting in 1956, since the success of the FHA program demonstrated that it was feasible to insure long-term home mortgages.

More generally, the later development of the private mortgage insurance industry and the private market for mortgages further indicate that a government program, such as the FHA, will not crowd out private competitors. A key factor here is that the FHA is required to set actuarially fair insurance premiums. In other words, its premiums should reflect the risk. A related factor was the willingness of the FHA to cede to private mortgage lenders and insurers the primary responsibility for later mortgage contract innovations such as adjustable rate mortgages.

[19] Aaron (1972) provides a useful discussion of the role played by various government agencies in the development of the U.S. mortgage market during the 1930s.

[20] The advent of a private mortgage insurance industry is one benchmark for measuring the acceleration in the adoption of long-term mortgages created by the government intervention. A private mortgage insurance industry had existed during the 1920s, but the firms all failed in the early stages of the Great Depression. It was not until 1956 that state laws were first modified to allow the re-chartering of private mortgage insurers. See Jaffee (2006) for further discussion of the history and regulation of the private mortgage insurance industry.

A Pilot Program: Long Term Flood Insurance

Why Start with the NFIP?

In this section we propose using the National Flood Insurance Program (NFIP) as the starting point for the implementation of long-term property insurance in much the same way that the FHA stimulated the innovation of long-term mortgages. A key reason for focusing on federal flood insurance as the starting point for the LTI innovation is that the program is already being considered for major regulatory reforms. [See U.S. Government Accountability Office (2009)].

By way of background, the NFIP was created in 1968 because insurers viewed flood risk as uninsurable and refused to cover it.[21] As of December 2008, the NFIP sold over 5.5 million policies annually (compared to 2.5 million in 1992) and covered nearly $1.2 trillion in assets (compared to only $237 billion in 1992) (Michel-Kerjan and Kousky, forthcoming).

How an LTI Program Would Work

We propose that the NFIP move to 5- 10- or even 20-year flood insurance contracts attached directly to the property, rather than to the homeowner. If a homeowner moved to another location, the flood insurance policy would remain with the property. One might also consider requiring everyone in flood-prone areas to take out the insurance, just as those who own a car are required to take out automobile insurance. A long-term flood insurance program would offer homeowners currently residing in flood-prone areas a fixed premium per dollar coverage for a specified period of time.[22] If the homeowner sold his or her property before the end of the policy period, then the insurance policy would automatically be transferred to the new owner at the same rate.

The NFIP is managed under the Federal Emergency Management Agency (FEMA) (U.S. Department of Homeland Security) which determines insurance premiums nationally. This makes the regulation of long-term flood insurance much easier than having to deal with 50 different state regulatory systems, as is the case for homeowners' insurance today. The NFIP would set these premiums for LTI, and policies would be offered in the form of a fixed-price contract (FPC) for the full term of the policy (e.g., 5, 10, or 20 years) or an adjustable premium contract (APC) with guaranteed renewal for the term of the policy. FPC premiums would likely be somewhat higher than APC premiums to protect the NFIP against an increase in the risk during the contract period. This behavior would be similar to the pricing of fixed-rate mortgages relative to adjustable-rate mortgages. For APC it is critical that the premium variations be based on an external and transparent index, comparable to the Treasury bill rate used for adjustable-rate mortgages. There may also have to be caps on how much the premium can change year to year, just as there are limits on how much the interest rate and payment amounts can change annually on adjustable-rate mortgages (ARMs).

The NFIP could also be integrated with a loan plan to finance home improvement projects that would make insured properties more resilient to future floods. As discussed earlier, the combination of long-term flood insurance and long-term loans for reducing future flood

[21] For more details on the National Flood Insurance Program, see Pasterick (1998) and Michel-Kerjan (forthcoming).
[22] One could modify the coverage limit over time to correct for inflation.

losses promises to improve both individual and social welfare. From the perspective of the relevant stakeholders—homeowners, FEMA, banks and other financial institutions, and the taxpayers—there are a number of reasons why such long-term flood insurance policies attached to the property would be a great improvement over annual policies. Flood insurance premiums set at a fixed price per dollar coverage would provide homeowners with financial stability. Long-term flood insurance would also ensure the spread of risk within the program, since most properties in flood-prone areas would be covered. This would be an important shift since today many flood policies are held for just a few years. (Michel-Kerjan and Kousky, forthcoming). If flood insurance were required for all properties located in hazard-prone areas, then there would be even greater risk spreading. This type of requirement would provide much-needed financial revenue for the program over time because it would create a much larger policy base than is currently available. Homeowners would have no concern for the financial solvency of their insurer since the NFIP has a continuing backstop with the U.S. Treasury, another parallel to the FHA mortgage agency.

Summary and Future Research Questions

Insurance costs fluctuate significantly after catastrophes causing residents in exposed areas uncertainty as to how much they will have to pay for coverage from one year to the next. Furthermore, many residents in exposed areas do not purchase sufficient insurance *ex ante*, thus require federal relief when hurricanes or major flooding occurs. Only after a severe disaster do they purchase coverage, but they then often cancel the policy after a few years in the absence of another loss. Hurricane Katrina demonstrated this natural disaster syndrome very clearly.

To address these issues, this paper proposes the development of long-term insurance (LTI) with either fixed or variable premiums that would be attached to the property, not the individual.[23] Based on the history of the mortgage market we suggest that the federal government can play an important role in facilitating the development of a long-term private insurance market on homeowners' coverage by offering multi-year flood insurance policies tied to the property through a modification of the National Flood Insurance Program.

There are several important questions related to the development of a LTI market that need to be analyzed further should one want private insurers to sell long-term property insurance as well.[24] These include the following issues:

- **Premium setting.** How will these premiums compare with annual contracts? How will insurers deal with risk patterns that are likely to change over time due to external phenomena such as global warming? What role would the uncertainty about the level of risk in 10 or 20 years play?
- **Risk index.** Whether the LTI contract uses fixed or adjustable premiums, one of the challenges will be in establishing a transparent mode of evaluating risk exposure for the period of time covered. In that context, what is an appropriate risk index to price an adjustable premium contract? What would be the most legitimate organization to calculate and publish this index?

[23] Another possibility would be to fold LTI payments into the mortgage themselves, forcing the borrower to purchase such coverage *ex ante*. The insured could choose which insurer to use, which would provide incentives for competitive pricing. We thank one of the referees for pointing this out.

[24] See Goss and O'Neil (2010) for an analysis of the potential and challenges of offering our concept of LTI contracts by the private sector in the United Kingdom in the context of the flood risk.

- **Insurance regulation**. How will LTI be regulated by the states? For an LTI policy to be feasible for private insurers, the premiums need to reflect risk and cover all administrative costs (including the cost of capital that can be high for catastrophe risks), so insurers can make a profit. Today, due to political pressure, homeowners' insurance prices are frequently restricted by state regulators to be artificially low in hazard-prone areas. The result is that the risks most subject to catastrophic losses also become the most unattractive for insurers to market.
- **Rating agencies.** How will rating agencies treat LTI policies? How much capital would they require insurers to hold to protect policyholders against losses during the term of the contract?

In the end, creating long-term insurance that will be attractive to insurers, homeowners, regulators and other relevant stakeholders depends on the market conditions that are associated with this new instrument. What is clear, however, is that we need innovative programs that involve the combined strengths of the public and private sectors for reducing future losses from disasters.

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