Equity Risk, Conversion Risk, and the Demand for Insurance

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February 17, 1999

[1]In recognition of valuable comments, we thank David Nickerson and other participants at the 1998 meetings of the American Risk and Insurance Association.

Abstract

The paper studies optimal property insurance in the presence of equity risk and conversion risk. Equity risk is randomness of the value of a property. It tends to raise demand for conventional insurance on the property by effectively increasing the risk aversion of the property owner. In contrast, conversion risk is randomness in the value the property would have if, after severe damage, it were converted to the highest-valued use. It is distinct from equity risk because the current use is typically not the one that has highest value. Conversion risk may raise or lower the demand for property insurance. Insurance contracts that fail to address conversion tend to undermine the orderly disposition of obligations and reduce the gains from reallocation of risks through insurance.

1 Introduction

When property is destroyed it is typically not replaced by a replica of itself but by something different – something more up-to-date, more efficient, or more suitable. This general observation is most apparent when the destruction is the result of a disaster and conversion extends over the whole vicinity. For instance, each of the disastrous fires and earthquakes in San Francisco led to a significant rearrangement of business and residential districts. The area of the Oakland fire has been rebuilt in far grander residential structures than the ones destroyed. In some of the areas stricken by the Northridge earthquake, new building is already being remarked as an improvement on what was lost. Such examples show the prevalence of conversion over replacement.[1]

A well-informed consumer knows about conversion and wants to factor it into her demand for insurance. The difficulty is that the values behind the conversion decision depend upon the economic environment at the time of loss and hence are themselves random variables. The risks of change in the economic environment are, briefly, externality risks. Disaster is an obvious source of externality risk. After disaster, the neighborhood rebuilds. If it becomes a retail furniture district, the value of apartments is compromised. If it regentrifies, converting a property to low-income housing is unwise. If it is taken for a stadium, a parking lot may become the best land use. Other sources also contribute, for in the normal course of events, a neighborhood may upgrade, deteriorate, or simply change, altering the surroundings of an insured structure and thus the values behind the decision to replace or convert. Moreover, values can fluctuate as the result of economy-wide variations, creating risks of the type discussed here.

Neighborhood conversion can help or hurt the individual land-owner, depending on circumstances. Predominantly, it helps. The reason is a reduction in constraints. When only a single property is converted, choice is constrained by the age and character of the existing neighborhood. That constraint vanishes when all properties are converted together, and owners can attain higher values. Certainly failures of coordination and costs of bargaining may also affect conversion, but in the main neighborhood change raises values. In the case that change is triggered by disaster losses, it tends to soften their impact.

Externality risk has two components: **equity risk** and **conversion risk**. Equity risk is variability in the value of the currently existing property. Demand for insurance

[1] The phenomenon is recognized by, for instance, Douglas Dacy and Howard Kunreuther (1969) in a long section that reads, in part . "In fact, a disaster may turn out to be a blessing in disguise...there is an opportunity for commercial establishments and homeowners to improve their facilities." (p. 168). They illustrate the general principle with observations from disaster recovery in several cities.

depends upon property values, and the fact that property values are risky also has an effect.

Conversion risk is uncertainty about the values of structures that could replace the current one if it were badly damaged. It is less obvious than equity risk because sales of comparable properties, which testify to the equity risk, are more numerous than conversions that document the conversion risk. Conversion opportunities, and hence the conversion risk, are central in the demand for insurance because conversion limits the amount of wealth that can be lost.

2 Upper limits and conversion

This paper develops a model specifically for studying externality risk. It has two characteristics that are desirable for the purpose: The insurance contract is written in terms of damage to property, and the choice variable for the consumer is the upper limit on the amount insured. As in other models, consumers demand insurance for the purpose of limiting variations in wealth. The difference is that here variations in wealth are connected to the conversion opportunities. Garratt and Marshall (1996) used a similar model without considering the new sources of risk that are the topic here.

Making the model depend on damage seems obvious, but the concept of damage is complex. The best definition is that damage from an event is the cost to restore the property to its pre-event condition. The definition is subject to careful interpretation because of the difficulty in restoring property without simultaneously renewing or improving it. Restoration with new materials and fresh paint is normally cheaper than restoration with used materials and weathered paint, if the latter restoration were even possible. Therefore, in some practical instances, damage is understood slightly differently. It is viewed as the least cost to return the property to a state no worse than its pre-damage state. In other instances, damage is interpreted strictly, as when insurers refuse to bear costs of complying with current building and zoning codes when the damaged property met older, less onerous ones. The problem of how to make the contract pay for damage, and not for something else, is inherent in the idea of property insurance. A contract in damage as defined here is the ideal that actual contracts resemble more or less closely.

Notation is needed. Look at the situation that exists when an event has caused damage. The realization of the random variable for damage is t. The property in undamaged condition would have a value of v, which is also the realization of a random variable. When the owner of damaged property restores it, he attains wealth $v-t$. On the other hand, there is some best option for converting the property. The conversion chosen by the property owner is the one that maximizes net value. Let the value of the land and improvements in the highest valued use be v^*, and let the cost of building the best improvements be c. Among the conversion options, the greatest attainable net value is $v^* - c$, which is also the value of the land. The decision to restore or convert is the decision to select the greater of $v - t$ and $v^* - c$. At the critical level of damage, $q = v - (v^* - c)$, the options are equally valuable. After some rewriting, the option to convert becomes the option to possess $\max[v - t, v - q]$ or, equivalently, $v - \min[t, q]$. Thus, $v - q$ is a floor beneath which wealth cannot fall, no matter the extent of damage. The second expression is convenient and equally intuitive. It says that the loss of wealth due to damage is no more than q.

In choosing an insurance contract, the consumer selects the upper limit, which is denoted by b and thought of as "bound." There is no coinsurance or deductible. Under these conditions, the insurance payment is $\min[b, t]$, and its expected value is the fair premium which is, given a probability density function of damage $h(t)$,

$$P(b) = \int_0^b th(t)dt + b \int_b^\infty h(t)dt. \tag{1}$$

Combining the pre-insurance wealth with the insurance variables, insured wealth is

$$v - \min[q, t] + \min[b, t] - P(b). \tag{2}$$

The expression captures the two key features of property insurance: the option to convert appears in the second term, and the indemnity with upper limit is in the third term. Other features are standard.

Expected utility. The consumer of insurance is a risk averse maximizer of expected utility with utility function u. Some results depend on the assumptions that absolute risk aversion and absolute prudence are decreasing in wealth. The goal is to choose b to maximize

$$Eu(v - \min[q, t] + \min[b, t] - P(b)) \tag{3}$$

The function being optimized has some unusual features. The presence of the convex function $-P(b)$ in the objective suggests that the objective might not be globally concave in b, and that is in fact correct. Lack of global concavity is characteristic of insurance having upper limits. The prevalence of upper limits in real contracts suggests that markets are unconcerned about non-concavity and that insurance theory should deal with it, as is done in the following section.

3 Optimum upper limits

The first task is to establish the necessary condition for the upper limit to be optimizing. For intuition, consider increasing b. That has different effects depending on the realization of damage t. For $t \leq b$, the increase lowers wealth by increasing the premium. For $t > b$ it raises wealth by raising indemnity more than the premium. Thus raising b is beneficial if the conditional expectation of marginal utility in the wealth-receiving states is above that in the wealth-losing states. Or rather, that is the case under fair pricing. When premia are loaded, the benefit should be reduced by a factor dependent on loading.

To justify the intuition, some notation is needed. As before, the unconditional probability density of damage is $h(t)$. Given t, the conditional probability density of v and q is $g(v, q|t)$, the support of which is contained in $[v_0, v_1] \times [q_0, q_1]$. Because damage is the only random variable in the insurance contract, the premium function is independent of q and v and is still given by equation (1). The joint density of v, q and t is $g(v, q|t)h(t)$. If there is loading, it is represented by the parameter $\lambda \geq 0$ and the whole premium is $(1 + \lambda)P(b)$. Insured wealth is then

$$v - \min[q, t] + \min[b, t] - (1 + \lambda)P(b) \tag{4}$$

The contract has a single upper bound that applies regardless of the realization of v and q. In this case, the goal of the consumer is to choose b to maximize the objective

$$T(b; \lambda) =$$

$$\int_{t=0}^{\infty} \left[\int_{v=v_0}^{v_1} \int_{q=q_0}^{q_1} u(v - \min[t, q] + \min[b, t] - (1 + \lambda)P(b))g(v, q|t)dvdq \right] h(t)dt \tag{5}$$

The conditional expected marginal utilities are

$$E[u'(\cdot)|t \leq b] =$$

$$\int_{t=0}^{b} \left[\int_{v=v_0}^{v_1} \int_{q=q_0}^{q_1} u'(v - \min[t, q] + \min[b, t] - (1 + \lambda)P(b))g(v, q|t)dvdq \right] \frac{h(t)}{\int_0^b h(t')dt'} dt \tag{6}$$

and

$$E[u'(\cdot)|t > b] =$$

$$\int_{t=b}^{\infty} \left[\int_{v=v_0}^{v_1} \int_{q=q_0}^{q_1} u'(v - \min[t, q] + \min[b, t] - (1 + \lambda)P(b))g(v, q|t)dvdq \right] \frac{h(t)}{\int_b^\infty h(t')dt'} dt \tag{7}$$

Now the basic result is contained in

Lemma 1 *Let $E[u'(\cdot)|t \leq b]$ and $E[u'(\cdot)|t > b]$ be the conditional expectations of marginal utility of wealth in the intervals $[0, b)$ and $[b, \infty]$, respectively. Let $T(b; \lambda)$ be expected utility and assume that $\int_b^\infty h(t)dt < 1/(1+\lambda)$. Then*

$$sign[T_b(\lambda, b)] = sign[E[u'(\cdot)|t > b] - \left(1 + \frac{\lambda}{1-(1+\lambda)P'(b)}\right) E[u'(\cdot)|t \leq b]] \quad (8)$$

The condition $\int_b^\infty h(t)dt < 1/(1+\lambda)$ requires that the upper limit b should not be too close to zero. It is best understood by recognizing that, from equation (1),

$$\int_b^\infty h(t)dt = P'(b) \quad (9)$$

The condition on b is then $(1+\lambda)P'(b) < 1$, which requires that the premium increase less rapidly than the indemnity. It matters because, as discussed after the proof, the premium grows faster than the indemnity at low values of b.

Proof. The derivative is

$$T_b(b; \lambda) = P'(b) \cdot$$

$$\left[\begin{array}{c} \int\limits_{t=b}^{\infty} \left[\int\limits_{v=v_0}^{v_1} \int\limits_{q=q_0}^{q_1} u'(v - \min[t, q] + \min[b, t] - (1+\lambda)P(b)) g(q|t) dv dq \right] \frac{h(t)}{P'(b)} dt \\ -(1+\lambda) \int\limits_{t=0}^{\infty} \left[\int\limits_{v=v_0}^{v_1} \int\limits_{q=q_0}^{q_1} u'(v - \min[t, q] + \min[b, t] - (1+\lambda)P(b)) g(q|t) dv dq \right] h(t) dt \end{array} \right]$$

$$= P'(b) \left[\begin{array}{c} E[u'(\cdot)|t > b] - \\ (1-P'(b))(1+\lambda)E[u'(\cdot)|t \leq b] - (1+\lambda)P'(b)E[u'(\cdot)|t > b] \end{array} \right] \quad (10)$$

Factor in a convenient way to yield,

$$\begin{aligned} T_b(b; \lambda) &= P'(b)(1-(1+\lambda)P'(b)) \cdot \\ &\left[E[u'(\cdot)|t > b] - \left(1 + \frac{\lambda}{1-(1+\lambda)P'(b)}\right) E[u'(\cdot)|t \leq b] \right] \end{aligned} \quad (11)$$

Under the hypothesis that, given the loading λ, b is not too near to zero, the first two terms are always positive, implying that the sign of the derivative is that of the term in square brackets. ■

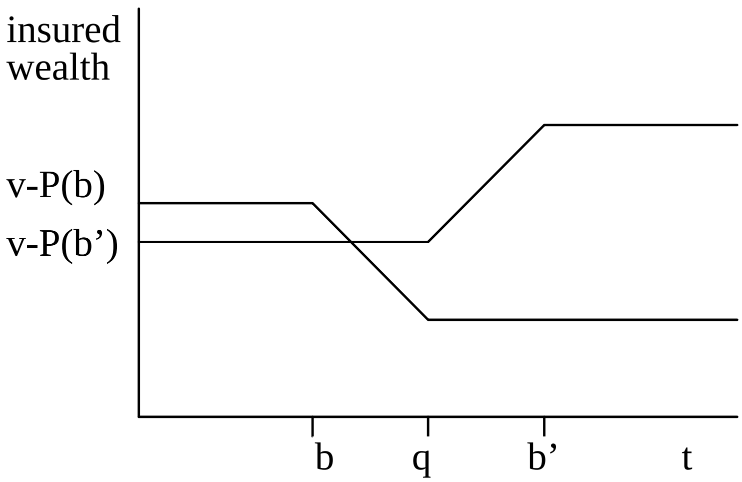

Figure 1: Insured wealth with two upper limits.

Fair pricing. As a starting point for the analysis of later sections, consider the case of fair pricing and no externality risk, that is, $\lambda = 0$, $q = \bar{q}$ and $v = \overline{v}$. Expected utility is

$$T(b; 0, \overline{v}, \bar{q}) = \int_{t=0}^{\infty} u(\overline{v} - \min[\bar{q}, t] + \min[b, t] - P(b))h(t)dt \tag{12}$$

At the point $b = \bar{q}$, the consumer is fully insured, and the full-insurance point is known to be the maximum of utility available at fair premiums when the consumer is free to insure in markets that are complete. The full-insurance point is also available under the more constrained, upper-limit style of insurance, and it is, a fortiori, the maximum there.

An alternative proof of the same thing has the advantage that it can be generalized. Start with the lemma. Look at any value of $b \in (0, \bar{q})$. Wealth has a profile like that of the decreasing function in Figure 1. Wealth is constant at $v - P(b)$ on the interval $t \in [0, b]$, it falls at a 45 degree angle on $t \in (b, \bar{q})$, and it is again flat on $t \in [\bar{q}, \infty)$.

Since marginal utility rises as wealth falls, the profile of marginal utility is a mirror image, high for high values of damage and low for low values of damage, with a monotone (but not linear) segment connecting the two plateaus. Splitting the graph at $t = b$, all marginal utilities to the right of b are higher than all marginal utilities to the left. Consequently the conditional expectation of marginal utility is greater on the right. From the lemma, the objective is increasing in this range.

Turning to the domain in which $b \in (\bar{q}, \infty)$, wealth has a profile like that of the increasing function in Figure 1 and through arguments like those above, the conditional expectation of marginal utility on the left is greater than on the right. In this domain, the objective is decreasing. Clearly $b = \bar{q}$ must be the optimum. Such thinking is relatively awkward in the case of fair prices and no externality risk, but it is the basis for analysis in the general case.

The lemma also reveals that expected utility has another critical point at $b = 0$. From equation (9), $P'(0) = 1$, and hence from equation (11) it follows that

$$T_b(0; 0) = 0 \tag{13}$$

The critical point at $b = 0$ is a minimum. As such, it is a point of convexity and demonstrates that the expected utility function is not globally concave in b. It is, however, strictly quasi-concave on $(0, \infty)$.[2]

Loading. As a second application of the lemma, consider the case of a loaded premium. There is no externality risk. To avoid trivial cases, assume that

$$P'(\bar{q}) < \frac{1}{(1+\lambda)} \tag{14}$$

which means, from equation (9), that $\bar{q}$ is not too close to zero. Substituting $\bar{q}$ in the optimality condition for loaded premiums yields

$$\begin{gathered} sign[T_b(\bar{q}; \lambda, \bar{v}, \bar{q})] = \\ sign\left[E[u'(\cdot; \bar{v}, \bar{q})|t > \bar{q}] - \left(1 + \frac{\lambda}{1 - (1+\lambda)P'(\bar{q})}\right) E[u'(\cdot; \bar{v}, \bar{q})|t \le \bar{q}]\right] \end{gathered} \tag{15}$$

At the point $b = \bar{q}$, the observations in the previous section assure that,

$$E[u'(\cdot; \bar{v}, \bar{q})|t > \bar{q}] = E[u'(\cdot; \bar{v}, \bar{q})|t \le \bar{q}]. \tag{16}$$

[2] A function $f(b)$ is strictly quasi-concave if for any b_1 and $b_2 \neq b_1$ in the domain of the function, and for any $\alpha \in [0, 1]$,

$$f(\alpha b_1 + (1-\alpha)b_2) > \min[f(b_1), f(b_2)]$$

Given differentiability, strict quasi-concavity on an open interval $(0, \infty)$ will imply that the maximum of $f(b)$ is unique and occurs where $f'(b) = 0$.

Hence, it follows that $T_b(\bar{q}; \lambda, \bar{v}, \bar{q}) < 0$, which means that at loaded premia, the maximum is somewhere to the left, at a value $b < \bar{q}$. Therefore optimum upper-limit insurance is less than full, as expected.

A fully optimum insurance contract for this case would have a deductible (Raviv 1979), after which insurance would be full up to $\bar{q}$, a reduction of coverage in the low end of the loss spectrum. Raviv (1979, pp. 91-92) provides one explanation for why deductibles might not be available. He suggests that upper limit policies may result from regulatory constraints on insurers. In that view, the insurers choose to reduce expected indemnities by truncating high-magnitude losses rather than in any other way – for instance, by using larger deductibles. There are numerous other reasons to consider that deductibles are not available. The main reason is that in many types of property insurance the deductible is a small magnitude sufficient to discourage trivial claims. The result above shows that when a deductible is not available, the consumer instead reduces coverage at the high end.

A surprising fact is that when the upper limit is near zero, the marginal value of increased insurance is negative. At $b = 0$, using equation (11),

$$T_b(0; \lambda, \bar{v}, \bar{q}) = -\lambda E[u'(\cdot; \bar{v}, \bar{q}) | t > 0] < 0, \tag{17}$$

so the objective is falling in the vicinity of $b = 0$. At such low values of the upper limit, additional insurance does more harm by raising premiums than it does good by reducing risk.

4 Optimum upper limits

When a deductible is not available, the consumer instead reduces coverage at the high end. A perhaps surprising fact is that when the upper limit is near zero, the marginal value of increased insurance is negative. At $b = 0$, using equation (11),

$$T_b(0; \lambda, \bar{v}, \bar{q}) = -\lambda E[u'(\cdot; \bar{v}, \bar{q}) | t > 0] < 0, \tag{18}$$

so the objective is falling in the vicinity of $b = 0$. At such low values of the upper limit, additional insurance does more harm by raising premiums than it does good by reducing risk.

4.1 A comparison model of insurance

In some other insurance models, the objective is globally concave. For instance, consider the copayment style of insurance. In that type of insurance, a fairly priced contract has no upper limit and pays ϕt when damage is t. The choice variable for the consumer is ϕ. Define expected loss as

$$Et = \int_{t=0}^{\infty} th(t)dt$$

The fair premium is ϕEt, a linear function of ϕ, and the consumer maximizes

$$K(\phi) = \int_{t=0}^{\infty} u(\overline{v} - t + \phi t - \phi Et)h(t)dt \tag{19}$$

One readily computes that

$$K'(\phi) = \int_{t=0}^{\infty} (t - Et)u'(\overline{v} - t + \phi t - \phi Et)h(t)dt \tag{20}$$

which is, at $\phi = 0$, a strictly positive number. The second derivative

$$K''(\phi) = \int_{t=0}^{\infty} (t - Et)^2 u''(\overline{v} - t + \phi t - \phi Et)h(t)dt \tag{21}$$

is always negative. The objective function is globally concave.

Lessons from the comparison. The first lesson is that insurance markets are no respecters of concavity. In property-insurance markets, the copayment style without an upper limit is rare but the upper-limit style is common. Copayments are of considerable importance in health insurance, but that's not relevant here because, as numerous papers have shown, the proper model of health insurance involves utility functions that vary with the state of health.

It is interesting to compare the copayment contract with the upper limit contract. Near the point of full insurance, the policies are similar, for both are locally concave. The differences are at the extremes, where insurance is either negligible or grossly excessive. Insurance suppliers have their own reasons for disliking the extremes of under- and over-insurance, but here the topic is demand. At increasingly excessive values of copayment insurance, the utility of insurance falls away without bound because the function is globally concave. The upper-limit policy is better in this range because utility is bounded from below. If the consumer must err on the side of too-high insurance, the upper limit policy is a better choice. At very low values of the choice variable – b or ϕ – the consumer is essentially without insurance. In this neighborhood the upper-limit policy has, as shown in the derivations, vanishingly low or negative (in the case of loading) marginal benefit while the copayment policy has, because of concavity, substantial positive marginal benefit. Thus for a person who must remain extremely under-insured for some reason, the copayment style is the better choice.

5 Equity risk

The purpose of this section is to examine equity risk in isolation, assuming that conversion risk does not exist. The situation is reasonable empirically, as may be judged by an example: Consider a neighborhood of single-story homes for which the highest-valued conversion is to two-story homes. Either type of home becomes more valuable as its neighborhood is increasingly made up of two-story homes. Suppose in addition that the increase in value as the neighborhood improves is exactly the same for both types of homes. In notation, the conversion point is $q = v - (v^* - c)$, and the cost of conversion c is constant. The value of an existing, one-story home is v, and that of a new two-story home is v^*. The assumption is that the difference $v - v^*$ is invariant as both values vary randomly. When these assumptions are not too violently disobeyed, the situation is very nearly one of pure equity risk.

To understand equity risk, return to the consumer who purchased full insurance when $q = \bar{q}$ and $v = \overline{v}$ were deterministic. Now in addition to the insurable risk of physical damage, she faces an uninsurable risk in the random variable v, the equity in her home. Her uninsured wealth is

$$v - \min[\bar{q}, t] \tag{22}$$

The substitution of the random v for the fixed $\overline{v}$ is very much like the addition of a second, uninsurable property. Wealth is the sum of two random components, only one of which is insurable. Such situations are studied by Doherty and Schlesinger (1983) and Kimball (1990), who call the uninsurable additive component a background risk.

Applications of background risk to insurance are examined by Doherty and Schlesinger (1983) and by Kimball and Eeckhoudt (1992). Their work creates expectations for the present situation. Doherty and Schlesinger found that at loaded prices, a background risk that is independent of the insurable risk boosts demand for insurance. Kimball and Eeckhoudt extend the finding to a more general setting and show that the optimum deductible is also raised by an independent background risk. The task here is to confirm that similar results hold in the upper-limit contract, given independence of the equity risk.

To that end the following notation is employed. The probability density function of value v is $g(v)$, which is independent of t. The consumer has utility function u. The fair premium is $P(b)$, as specified in (1) and it is loaded by a factor $(1 + \lambda)$. State-contingent wealth of the consumer after choosing insurance is

$$v - \min[\bar{q}, t] + \min[b, t] - (1 + \lambda)P(b) \tag{23}$$

Loading matters because, in its absence, the optimum choice of upper limit would be full insurance, in spite of any randomness in equity. Because of the loading, the optimum upper limit is less than full insurance, which was demonstrated in section 3 above for the case of deterministic equity. The following derivations show that insurance is again less than full when premiums are loaded and equity is random, but the main result is that the variability in equity raises the amount of insurance demanded.

The objective of the consumer is to choose b in order to maximize

$$\int_{t=0}^{\infty} \left[\int_{v=v_0}^{v_1} u(v - \min[\bar{q}, t] + \min[b, t] - (1+\lambda)P(b))g(v)dv \right] h(t)dt \qquad (24)$$

The key player here is a surrogate consumer who behaves in the absence of equity risk just as the original consumer would in its presence. The surrogate has utility

$$\hat{U}(w) = \int_{v=v_0}^{v_1} u(w + (v - \overline{v}))g(v)dv \qquad (25)$$

It is clear that $\hat{U}(w)$ is increasing and concave in w. Substitute the expression

$$w = \overline{v} - \min[\bar{q}, t] + \min[b, t] - (1+\lambda)P(b)$$

into equation (25). The result is

$$\hat{U}(\overline{v} - \min[\bar{q}, t] + \min[b, t] - (1+\lambda)P(b)) =$$

$$\int_{v=v_0}^{v_1} u(v - \min[\bar{q}, t] + \min[b, t] - (1+\lambda)P(b))g(v)dv. \qquad (26)$$

The right hand side is the same as the inner term in the objective function in equation (24). Therefore equation (24) can be rewritten

$$\widehat{T}(\lambda, b; \overline{v}, \bar{q}) =$$

$$\int_{0}^{\infty} \hat{U}(\overline{v} - \min[\bar{q}, t] + \min[b, t] - (1+\lambda)P(b))h(t)dt. \qquad (27)$$

In other words, when fixed equity is replaced by risky equity, the effect is the same as if the consumer were replaced by another, slightly different consumer, who still solves a fixed equity problem.

The new consumer is risk-averse and for reasons given in section 3 chooses less than full insurance when prices are loaded. The question is whether the new consumer chooses more or less insurance than the original one chose. The question is answered through the use of an interesting lemma by Kimball showing the consumer represented by $\hat{U}(w)$ is, under reasonable conditions, more risk averse than the one who had $u(w)$.

In posing the lemma, risk premium $\pi(v,w)$ and precautionary premium $\psi(v,w)$ are needed. They are defined by

$$u(w-\pi(v,w)) = E[u(w+(v-\overline{v}))] \tag{28}$$

and

$$u'(w-\psi(v,w)) = E[u'(w+(v-\overline{v}))]. \tag{29}$$

The assumption of decreasing absolute risk aversion is equivalent to $\partial\pi(v,w)/\partial w < 0$, and the assumption of decreasing absolute prudence is equivalent to $\partial\psi(v,w)/\partial w < 0$. See Kimball (1990) and Kimball and Eeckhoudt (1992) for discussion of the equivalence.

Lemma 2 *(Kimball) Suppose the utility function u exhibits decreasing absolute risk aversion and decreasing absolute prudence. Then $\hat{U}$ is absolutely more risk averse than u at all points w.*

Proof. (From Kimball and Eeckhoudt (1992), who credit Gollier for improvements in the proof.) The risk premium is positive because the random variable $v-\overline{v}$ has mean zero and utility is risk averse. The precautionary premium is also positive because given decreasing absolute risk aversion, it is greater than the risk premium (Kimball and Eeckhoudt, 1992). Now write

$$\hat{U}'(w) = E[u'(w+(v-\overline{v}))] = u'(w-\psi(v,w)).$$

It follows that

$$\hat{U}''(w) = (1-\frac{\partial\psi(v,w)}{\partial w})u''(w-\psi(v,w)),$$

and hence,

$$-\frac{\hat{U}''(w)}{\hat{U}'(w)} = \left(1-\frac{\partial\psi(v,w)}{\partial w}\right)\left[-\frac{u''(w-\psi(v,w))}{u'(w-\psi(v,w))}\right].$$

The term in round parentheses is greater than unity because absolute prudence is decreasing. Absolute risk aversion falls when wealth rises by the amount $\psi(v,w)$. Hence, for all w

$$-\frac{\hat{U}''(w)}{\hat{U}'(w)} \geq -\frac{u''(w)}{u'(w)}.$$

■

Lemma 2 is used to prove that the introduction of equity risk raises the optimum upper limit. The logical sequence is clear: Introducing equity risk makes the consumer more risk averse, and a consumer who is more risk averse demands a higher upper limit. The process of proving it leads to additional insights. The proposition is limited to a mathematical neighborhood in which the consumer buys insurance in spite of loading and, moreover, the objective function is quasi concave. The neighborhood might be small if the consumer is very risk-tolerant or the conversion-point is very near to zero, because in such cases the consumer leaves the market at low levels of loading. The proposition applies when the consumer is not liable to be driven from the market, and the neighborhood in which that is true contains all of the points at which insurance is purchased. The proposition represents expected utility by the notation

$$T(b;\lambda,\overline{v},\bar{q}) = \int_{t=0}^{\infty} u(\overline{v} - \min[\bar{q},t] + \min[b,t] - (1+\lambda)P(b))h(t)dt \qquad (30)$$

Proposition 3 *Suppose the risk-averse utility function u exhibits decreasing absolute risk aversion and decreasing absolute prudence. The conversion point $\bar{q}$ is deterministic. The premium is loaded by a factor $(1+\lambda)$. Equity risk v is independent of the insurable risk t. Let the optimum upper limit under equity risk be $b^v(\lambda)$. When the equity risk is replaced by a certainty value $\overline{v} = Ev$, the optimum upper limit is $b(\lambda)$. Assume that $T_{bb}(\bar{q};0,\overline{v},\bar{q}) < 0$. Then there is a neighborhood in b,λ-space containing the point $(b,\lambda) = (\bar{q},0)$ such that for λ, b in that neighborhood, the functions $b(\lambda)$ and $b^v(\lambda)$ exist, and $b(\lambda) < b^v(\lambda) < \bar{q}$.*

The assumption that $T_{bb}(b(0);0,\overline{v},\bar{q}) < 0$ is not essential and is made for convenience only. The essential feature is strict concavity at $b(0)$, and that is guaranteed because $b = b(0)$ is an optimum and the consumer is strictly risk averse. Strict concavity assures that the first non-zero derivative of the form $T_{bb\ldots b}(b(0);0,\overline{v},\bar{q})$ must be negative, assuring in turn that the second derivative is strictly negative in a neighborhood of $(b(0),0)$, except possibly at $(b(0),0)$ itself. That condition is sufficient to complete the proof, but not without an argument that greatly complicates it. The increase in generality is slight, and hence the assumption.

Proof. For a given λ, and fixed values $\bar{v}$ and $\bar{q}$, a critical point of b is one for which

$$T_b(b;\lambda,\overline{v},\bar{q}) = 0$$

The equation defines the solution function $b(\lambda)$. Note that the defining function is twice continuously differentiable in b and λ and that there is a solution $b(0) = \bar{q}$ at $\lambda = 0$. By assumption, $T_{bb}(\bar{q}; 0, \bar{v}, \bar{q}) < 0$. Existence of the implicit function depends upon the quantity $T_{bb}(b; \lambda, \bar{v}, \bar{q})$ remaining nonzero. By continuity, there is a neighborhood N_1 of $(b, \lambda) = (\bar{q}, 0)$ in which variations in b and λ preserve concavity for the objective, that is, on N_1,

$$T_{bb}(b; \lambda, \bar{v}, \bar{q}) < 0 \tag{31}$$

Hence, the solution function $b(\lambda)$ is well-defined in the neighborhood $N_1$of $(b, \lambda) = (\bar{q}, 0)$. In this neighborhood, incidentally, $sign[\frac{\partial}{\partial \lambda} b(\lambda)] = sign[T_{\lambda b}(b; \lambda, \bar{v}, \bar{q})] < 0$.

By continuity of the objective $T(b; \lambda, \bar{v}, \bar{q})$, there is a neighborhood N_2 of $(b, \lambda) = (\bar{q}, 0)$ in which variations in b and λ preserve the superiority of near-full insurance over no-insurance, i.e.,

$$T(b(\lambda); \lambda, \bar{v}, \bar{q}) > T(0; \lambda, \bar{v}, \bar{q}) \tag{32}$$

Let $N = N_1 \cap N_2$. In the neighborhood N of $(b, \lambda) = (\bar{q}, 0)$, $b(\lambda)$ exists and is a global maximizer over b of the objective function $T(b)$.

Likewise, there exists a neighborhood N^v of the point $(b, \lambda) = (\bar{q}, 0)$ in which $b^v(\lambda)$ exists and is for each λ a global maximizer over b of the objective function $\widehat{T}(b; \lambda, \bar{v}, \bar{q})$ found in equation (27), namely

$$\widehat{T}(b; \lambda, \bar{v}, \bar{q}) =$$

$$\int_{t=0}^{\infty} \left[\hat{U}(\bar{v} - \min[\bar{q}, t] + \min[b, t] - (1 + \lambda) P(b)) \right] h(t) dt \tag{33}$$

In the neighborhood $\tilde{N} = N^u \cap N^v$ of the point $(b, \lambda) = (\bar{q}, 0)$, the comparison of $b^v(\lambda)$ and $b(\lambda)$ can be made because in $\tilde{N}$, both maximum-value functions are concave.

Look at the situation for a fixed value of λ. The first order condition for the optimum upper limit is

$$E[u'(\cdot; \bar{v}, \bar{q}) | t > b] - \left(1 + \frac{\lambda}{1 - (1 + \lambda) P'(b)} \right) E[u'(\cdot; \bar{v}, \bar{q}) | t \leq b] = 0 \tag{34}$$

The solution is $b^u = b(\lambda)$.

The task is to show that the derivative of the objective using $\hat{U}$ is still positive evaluated at b^u– the optimum for the risk-tolerant u. That is, show that

$$E[\hat{U}'(\cdot; \bar{v}, \bar{q}) | t > b^u] - \left(1 + \frac{\lambda}{1 - (1 + \lambda) P'(b^u)} \right) E[\hat{U}'(\cdot; \bar{v}, \bar{q}) | t \leq b^u] > 0. \tag{35}$$

The first step is to make u and $\hat{U}$ agree in value and in slope at the point where $t = b^u$. At that point, $\bar{v} - \min[\bar{q}, t] + \min[b^u, t] - (1+\lambda)P(b^u) = \bar{v} - (1+\lambda)P(b^u)$. Without loss of generality, $\hat{U}$ may be multiplied by an appropriate positive number so that

$$\hat{U}'[\bar{v} - (1+\lambda)P(b^u)] = u'[\bar{v} - (1+\lambda)P(b^u)]$$

and an appropriate constant can also be added so that

$$\hat{U}[\bar{v} - (1+\lambda)P(b^u)] = u[\bar{v} - (1+\lambda)P(b^u)]$$

holds true. Now the more risk averse function $\hat{U}$ lies everywhere below the less risk averse u, with a tangency at the point $\bar{v} - (1+\lambda)P(b^u)$.

Looking at the tangency point $\bar{v} - (1+\lambda)P(b^u)$, it is graphically apparent and easy to prove that for any $w < \bar{v} - (1+\lambda)P(b^u)$ – at a point below the tangency – the more risk averse utility has a higher marginal utility, i.e., $\hat{U}'(w) > u'(w)$. For all $t > b^u$, damage is more than the upper limit of insurance and consequently

$$\bar{v} - \min[\bar{q}, t] + \min[b^u, t] - (1+\lambda)P(b^u) < \bar{v} - (1+\lambda)P(b^u)$$

It follows that the first terms in equations (34) and (35) satisfy

$$E[\hat{U}'(\cdot; \bar{v}, \bar{q})|t > b^u] > E[u'(\cdot; \bar{v}, \bar{q})|t > b^u] \tag{36}$$

That takes care of $t \in (b^u, \infty)$.

Look at $t \in [0, b^u]$. When $t \leq b^u$, damage is less than the conversion point and also less than the upper limit. Thus wealth reduces to $\bar{v} - (1+\lambda)P(b^u)$, the wealth at the tangency point. Then the second terms in equations (34) and (35) bear the relation

$$E[\hat{U}'(\cdot; \bar{v}, \bar{q})|t \leq b^u] = E[u'(\cdot; \bar{v}, \bar{q})|t \leq b^u] \tag{37}$$

Use the results from equations (36) and (37) to compare equations (35) and (34). Clearly the expression in equation (35) is positive. By Lemma 1 the objective is increasing, and hence that the optimum upper limit is greater for the consumer who is more risk averse. This holds for each value of λ in $\tilde{N}$. Therefore $b(\lambda) < b^v(\lambda) < \bar{q}$. ■

5.1 Endogenous equity risk

The result proved above assures that an exogenous increase in equity risk increases demand for insurance of the upper-limit type. It is expected from parallels in the literature, but it should be interpreted with caution because consumers might actively choose the level of equity risk instead of accepting it as an unavoidable nuisance. Such consumers are interesting because in practice the equity risk is to a greater or lesser extent a choice variable. A property owner can choose less equity risk by owning less property, building less expensive structures, moving to a different location, engaging in another type of land use, or participating in markets that hedge the equity risk in the chosen structure, location, and use.

Taken to the extreme, the choice of equity risk is a portfolio decision comparable to the choice of a risky stock or bond. From the proposition above, it is apparent that the portfolio decision interacts in some way with the insurance decision. In fact, Mayers and Smith (1983) first developed conditions for independence between the decisions. Those conditions include lack of covariance between the insurable risk and portfolio risks – as is natural in the context of the mean-variance utility model they used. In case of disaster it is typical that equity covaries positively with damage, meaning that equity risk is, to some extent, a natural insurance. Thus the decision to accept equity risk and the decision to buy insurance are not separable.

Markets in equity risk have in fact been proposed by Case, Shiller and Weiss (1993).[3] They would involve exchange of futures contracts on indexes that estimate average property values in each mail delivery (zip code) district. The home-owner hedges by, in essence, selling futures in his local index, profiting on the hedge when the index and his property value fall, losing on the hedge in the contrary case. The market in equity risk is a clear instance of choice of equity risk.

In hedging the equity risk, owners face some unfairness of prices, just as in the insurance market. Given the costs of hedges and insurance, owners follow diverse strategies. Some choose high equity risk, perhaps because of higher wealth or greater risk-tolerance. Such motives for higher equity risk are also motives for less insurance. It stands to reason that the owner who chooses to bear some risk would diversify risks by carrying some risk to equity and some risk of uninsured damage. Those who bear higher risk still diversify, bearing more of each type of risk. Thus there is an argument suggesting that when higher equity risk is chosen, less insurance will also be chosen.

When markets in equity risk are lacking, the logic carries over somewhat imperfectly. More examples occur to show that the relation of equity risk and underinsurance could fall either way. For instance, consider the person who chooses high equity risk because of a consumption preference for a particular type of home, that is, for reasons outside the present model. Such a person could well demand more insurance rather than less. The same logic applies to a job seeker who accepts work in an area in which equity risks are higher. The upshot is that insurance and hedging can be positively or negatively associated in real-world data.

[3] In addition, see Shiller and Weiss (1998).

5.2 Disasters and equity risk

The results can be interpreted for the equity risk associated with disasters. As argued in the introduction, disasters are a source of equity risk, and that risk is in addition to the equity risk that every home owner thinks about. Represent the "usual" equity risk by $v_\perp$ – read v orthogonal – and consider it to be probabilistically independent of t. All dependence between equity risk and damage t is captured in v_d, which is mainly the externality risk associated with a disaster. Now pre-insurance wealth is

$$v_\perp + v_d - \min[\bar{q}, t] \tag{38}$$

The independent orthogonal risk has the effects attributed to it in the preceding sections. To the extent that it is unavoidable, it increases demand for loaded insurance, and to the extent that it is a choice variable, it plays the more complex role described immediately above.

The question here is the additional role of the disaster-related component. In examining that role it is essential to remember that disaster coverages are associated with specific perils such as flood or earthquake, and that these perils can cause losses well short of total destruction of neighborhoods. Over the entire range of severity, the response of v_d is J-shaped – mild losses depress values, severe ones raise them again to levels higher than in the no-damage state. In a disaster with mild losses, the slightly damaged properties are restored, not converted, and by their numbers they prevent any change of character of neighborhoods. Destroyed properties are rebuilt, if at all, in accordance with the status quo. In case of extremely high losses, the reduction of constraints leads to an increase in neighborhood values, the tall stem of the J. Overall, the association of v_d and t is probably positive, the equity risk is a natural insurance of the catastrophic peril, and as such it reduces the demand for market insurance. Thus the possibility of appreciation may help explain the very large deductibles that are prevalent in earthquake insurance. With such large deductibles, a partial loss is hardly contemplated, and the deductible is in effect a decrease in coverage.

6 Conversion risk

Conversion risk is uncertainty about the values of the alternative structures that could be built in place of the current one. Because these values govern the conversion decision, they bound the loss of wealth, and as a consequence are quite important in the demand for insurance. Predicting conversion options and values is an interesting and challenging part of writing a property insurance contract, and it has not received enough attention in the literature.

Following the practice of the previous section, this one examines conversion risk in isolation, meaning that the value of the existing property is regarded as being fixed. Such situations arise under plausible, interesting conditions. In one scenario, the consumer who has both types of risk has hedged the equity risk in some manner, perhaps in a market like the one proposed by Case, Shiller and Weiss. That done, she confronts the conversion risk.

Alternatively, equity risk may be absent for technical reasons. Think of the cement plants located near the waterfront in Santa Barbara. No single owner tears down his plant to build housing amid the other dusty workplaces. However, if the neighborhood is devastated by an earthquake and rebuilt entirely as residences, the value of a remaining cement factory is the same as before, but the value of converting it to housing is much higher. The general description of this situation is that the value in the existing use is not affected by the neighborhood but the highest valued conversion is to a use that does depend on it. In such cases, disaster stimulates conversion by lowering the conversion point.

Randomness of q may also arise from variations in the cost of conversion c. A disaster can lead to a boom in reconstruction that raises costs and discourages conversion. The cost variation then tends to offset the variations described above, but only partially. The stimulative effects are more likely and more compelling and are the predominant ones needing study. In the absence of disaster, of course, the costs and values of alternative structures may change and thus induce a conversion risk.

The problem for the consumer is to select a binding upper bound on damage at fair prices, in the presence of uncertainty about q. The decision is easy using contracts that distinguish the payments according to the value of q. Such contracts make the insurance market essentially complete and allow the consumer to demand a contract having an upper bound of q in every q-state. She is, as usual, fully insured at fair prices.

When consumers buy one contract for fire and another for earthquake, they are taking a small step toward approximating the complete-markets solution. Because disaster lowers the conversion point, less insurance is demanded in the disaster state. Some empirical confirmation of this idea may be present in the very large deductibles that prevail in earthquake insurance. Because the deductible is so large, partial losses are hardly contemplated, and the deductible is, in effect, a decrease in total coverage. This explanation is wholly consistent with the one given above, that the deductibles are encouraged by disaster-induced increases in the value of equity. Both features mitigate disaster losses. The increased equity value helps the owner whose property is partially damaged and merely restored, and the reduced conversion point helps the owner whose property is badly damaged and therefore converted. The alternative idea, that the deductibles are dictated by suppliers of insurance, might also contribute to explaining the large deductibles, but that seems not to have been examined in the literature.

Markets that give different insurance for difference values of q are in theory complete and in practice uncommon. The more realistic case is that of a contract with a single upper bound that applies regardless of the realization of q. In response to the conversion risk, the consumer must somehow choose an upper limit when the conversion point, which would ordinarily be the target, varies randomly. The general principle still applies: given fair premiums, the expected marginal utility in the zone below the upper limit should equal the expected marginal utility in the zone above it. In the course of further describing this optimization, interesting applications arise.

The variation of q is limited to a finite interval $[q_0, q_1]$. Intuitively the optimum b should lie between q_0 and q_1, but some derivations are needed to confirm the intuition. The significant assumption is that variation in v is nil and thus $v = \overline{v}$. The unconditional probability of insurable loss t is $h(t)$. The probability distribution of conversion risk depends in some way on t, and is denoted $g(q|t)$. Other notation is as before: The option to convert is the option to achieve $\overline{v} - \min[t, q]$. Insurance of damage has neither deductible nor copayment, but it does have an upper limit b selected by the consumer. The indemnity is $\min[b, t]$, and as before a fair premium $P(b)$ is paid for it.

The consumer's wealth is

$$\overline{v} - \min[t, q] + \min[b, t] - P(b)$$

The goal of the consumer is to choose b to maximize the objective

$$\int_{t=0}^{\infty} \left[\int_{q=q_0}^{q_1} u(\overline{v} - \min[t, q] + \min[b, t] - P(b)) g(q|t) dq \right] h(t) dt \tag{39}$$

The optimum is found by choosing b to equate the conditional marginal utility of wealth in the two events, $[0, b)$ and $[b, \infty)$. The conditional expectations of marginal utility of wealth are given in equations (6) and (7). The result $b \in [q_0, q_1]$ would be easy to demonstrate if the usual second-order conditions were satisfied. One would check the slope of the objective at q_0 and q_1, but once again, concavity is lacking. Hence, the proof involves checking the slope of the objective throughout the domain of b.

Proposition 4 *Let u be risk averse and $\bar{v}$ deterministic. For all t, let the probability density function $g(q|t)$ of q have support contained in $[q_0, q_1]$ and mean contained in (q_0, q_1). Then the optimum upper limit on insurance, b^*, satisfies $q_0 < b^* < q_1$. In the limit as $q_0 \to q_1$, b^* approaches $q_0 = q_1$.*

Proof. Consider $b \in [0, q_0]$. On $t < b$, expected marginal utility is constant at

$$u'(\bar{v} - P(b)) = \int_{q=q_0}^{q_1} u'(\bar{v} - P(b))g(q|t)dq \tag{40}$$

and rises to higher levels on $t > b$ because losses in excess of the upper limit will reduce wealth and raise marginal utility. In this range

$$E[u'(\cdot;\bar{v})|t > b] - E[u'(\cdot;\bar{v})|t \leq b] > 0 \tag{41}$$

By Lemma 1, that means the slope of the objective is positive for all $b < q_0$.

Consider $b \in [q_1, \infty)$. On $t < q_0$, expected marginal utility is constant at $u'(\overline{v} - P(b))$ as before. On $t \in [q_0, q_1]$, marginal utility as a function of t is

$$\int_{q=q_0}^{q_1} u'(\overline{v} - \min[t, q] + t - P(b))g(q|t)dq \tag{42}$$

The argument of $u'(\cdot;\bar{v})$ on this domain is an equal or smaller quantity because wealth is rising in at least some of the realizations of q. On $t \in (q_1, b)$, marginal utility is falling because for all values of q, wealth is rising. On $t \in [b, \infty)$, wealth is constant and so is marginal utility, at the minimum level achieved at $t = b$. Conditional marginal utilities therefore satisfy

$$E[u'(\cdot;\bar{v})|t > b] - E[u'(\cdot;\bar{v})|t \leq b] < 0 \tag{43}$$

By Lemma 1, that means the slope of the objective is negative for all $b > q_1$.

It is clear that b^* must be somewhere in the interval $[q_0, q_1]$. The behavior in the limit as $q_0 \to q_1$ is obvious. ■

6.1 Underinsurance in disasters

The proposition has practical significance. Consider the investigations usually made in the wake of disaster for the purpose of determining whether the victims were properly insured. The usual finding is that most of them were not, and the present model can be applied to try to explain that finding.

Suppose the conversion-point variable q takes on only the two extreme values q_0 and q_1. Disaster normally encourages conversion of the neighborhood, often making it more desirable, and that means that the conversion point is lower in a disaster than otherwise. Hence the low value of $\bar{q}$ applies to disaster losses and the high value corresponds to non-disaster losses. The conventional basis for judging the adequacy of insurance is the non-disaster state in which the conversion takes the high value, and the conventional standard of full insurance is insurance up to that value. Even after a disaster occurs, the available market data are from before the disaster and the disaster-induced values of land and improvements are unobservable until sometime in the future. By Proposition 2, the consumer chooses optimally an upper bound below the non-disaster value and thus is under-insured by conventional standards. Paradoxically, the optimizing consumer is over-insured in the disaster state because the optimum upper limit is higher than the low, disaster-related, conversion point.

6.2 Does demand increase?

An independent equity risk leaves unchanged the demand for insurance at fair prices. In contrast, an independent conversion risk can either raise or lower demand, depending upon the distribution of losses. This fact is illustrated through an example.

Look at the following comparison of two situations. In the initial situation, the conversion point is deterministic at $\bar{q} = 1$. The optimum upper limit is $b = \bar{q} = 1$. Compare that to the situation in which the conversion risk is $q = 0$ or $q = 2$ with equal probability, a distribution with a mean of 1, the same as in the initial situation. The distribution of damage in both cases is the negative exponential $h(t) = e^{-t}$. Consequently, $P(b) = 1 - e^{-b}$. Utility is the time-honored $u(\cdot) = \ln(\cdot)$, and $\bar{v} = 4$. The goal of the consumer in the second case is to choose b to maximize

$$Eu(\bar{v} - \min[t, q] + \min[b, t] - P(b)) =$$

$$.5\left[\int_0^b \ln[3 + e^{-b} + t]e^{-t}dt + \int_b^2 \ln[3 + e^{-b} + b]e^{-t}dt + \ln[3 + e^{-b} + b]e^{-2}\right] \tag{44}$$

$$+.5\left[\int_0^b \ln[3 + e^{-b}]e^{-t}dt + \int_b^2 \ln[3 + e^{-b} - t + b]e^{-t}dt + + \ln[3 + e^{-b} - 2 + b]e^{-2}\right] \tag{45}$$

The optimum is achieved at the point $b = 1.401$. That demonstrates the possibility that an independent conversion risk can raise the demand for insurance, here by forty percent.

Alternatively, the situation may be changed by using a distribution of damage equal to $h(t) = 4e^{-4t}$, which has the effect of shifting probability weight from higher to lower levels of damage. In that case, the optimum upper limit is $b = .515$, a decrease in demand of 48 percent. Thus, as promised, the independent conversion risk can either raise or lower demand for the underlying insurance.

7 Concluding remarks

Equity risk is seen continually in the fluctuations of real estate markets, but conversion risks are hidden. In theory the conversion risk is observable as a fluctuation in the difference between property value and land value, but in practice markets in vacant land are thin and prices in them are not publicized. Moreover, conversion issues are not part of the informal insurance education that consumers absorb from their insurance agents.

Conversion is an issue when losses are large, and large losses account for a substantial fraction of indemnities paid in most lines of property insurance. It would seem to follow that conversion is central to insurance decisions, but property insurance contracts do not address it. Because conversion is not treated in the contract, issues that should be part of the agreement are left to be negotiated after the event. Certainly every major loss will end with some negotiation between the insurer and the client. Such post contractual negotiation is at best costly and at worst an invitation to abuse. In one gambit, heavy damage occurs and the best decision is to convert. The client makes a claim based upon an estimate of the damage – an estimate, that is, of the cost to restore the property. The insurer disputes the amount and challenges the client to prove the justice of his higher claim by actually restoring the property, a challenge both parties know is highly unappealing and wasteful. Each party has a motive to distort, leading to a conflict of the sort that contractual relations are supposed to prevent. How contracts might be changed to address conversion value is unclear and a worthwhile area for further study and innovation. Meanwhile, the one palliative is for clients to under insure by amounts sufficient to prevent post-loss disputes.

Conversions are typically more marked in disaster losses than in others. Thus disasters are an extreme case in which the contracts are inappropriate, and it is expected that post-event negotiation will be common. The Oakland fire is a highly publicized example. In that case, curiously, the outcome favored the clients. Although insurers could have argued that losses were less than they seemed, they did not do so, perhaps because the absence of any mention of conversion in the underlying contracts gave them no grounds.

Insurers sometimes offer a homeowner's policy that pays "replacement cost." The idea is that the cost to restore the property might turn out to be higher than the upper limit cited in the contract, and the insurer promises in that case to pay the higher cost. Such policies have limited value to the client when conversion occurs, since the "replacement cost" cannot be verified.

Recently homeowners' contracts offer a rider to cover the extra cost of upgrades that are required to meet current building codes, a cost that is reported to be substantial. The rider is an explicit recognition that conversion of at least one type is typical. At the same time, the rider is retrograde in assuming that the conversion will consist solely of code upgrades needed to replace the existing structure, and in that way it preserves the adjuster's leverage to dispute the replacement cost when the client chooses to convert. Separating the coverages is a theoretical improvement in contracts because it enables planning for conversion. As such it illustrates the gains that are available from explicitly recognizing conversion.

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