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Abstract

This paper examines uberrimae fidei (utmost good faith) with adverse selection in an insurance market. If consumers know their risk type (they know their expected loss), and if they understand the concept of uberrimae fidei, adverse selection is completely eliminated. However, if uberrimae fidei is strictly enforced by the courts, insurers have no incentive to do any underwriting whatsoever. Therefore, whether consumers know their risk type or not, and whether they understand uberrimae fidei, is of paramount importance. If consumers don't know their risk type or don't understand uberrimae fidei, then the (equitable) non-strict enforcement (judicial ruling) of contracts of insurance can be efficiency enhancing as it can create an ex-ante incentive for insurers to underwrite. With an ex-ante positive probability that a court may rule equitably in favor of the insured, the insurer engages in underwriting as part of its profit maximization objective, helping insureds to discover their risk type and/or educating potential insureds on the requirements of a contract of uberrimae fidei. This paper therefore contributes a new theory of underwriting.

Introduction

Models of adverse selection assume that individuals withhold information from insurers so as to maximize their utility—that asymmetric information between consumers and insurers persists. While withholding information in self-interest is a reasonable economic assumption, western legal systems make this action, within insurance markets, incompatible with the maximization of any normally-behaved utility function.

Contracts of insurance are contracts of the utmost good faith (uberrimae fidei). Since at least Lord Mansfield's 18th century ruling in the case of Carter v. Boehm, full disclosure of all material facts known to the insured has been a requirement for the validity of insurance contracts in legal systems based on the common-law. The withholding of material information by the insured (regardless of whether the insurer requests the information or not) warrants a contract of insurance void, rendering an insured his reservation level of utility. A contract of utmost good faith is different from a standard buyer-beware (caveat emptor) contract in that the parties to the contract must disclose all material information that they are aware of, whether it is requested by the other party to the contract or not. In a standard contract (buyer beware), the parties must act in good faith, but not in the utmost of good faith, which imposes a higher standard.

As shown by Dixit (2000), the concept of utmost good faith applied to a Rothschild and Stiglitz (1976) adverse selection model eliminates adverse selection, improving efficiency. If a consumer knows that any lying/misrepresentation will void his insurance contract, he will always tell the truth as part of his utility-maximization objective. Utmost good faith can also help reduce transaction/verification costs, as an insurer can expect that a consumer is not lying.

Given the potential for utmost good faith to reduce asymmetric information and therefore adverse selection in insurance markets, and also reduce transaction costs in insurance markets, it would *prima facie* appear to be the case that courts of law ought to vigorously enforce insurance contracts as a means of improving social welfare (on any normally behaved social welfare function). Additionally, Levine (1998) found that countries which rigorously enforce contracts (generally, not specific to insurance) have better developed banks and, as an exogenous component, higher per capita growth, physical capital accumulation, and productivity growth.

Unfortunately, the outcome of an improvement in social welfare through the strict enforcement of insurance contracts, at law, has two necessary conditions:

(i) Consumers must know their risk-type, that is, they must know what their probability distribution of loss is.
(ii) Consumers must understand the implications of the concept of utmost good faith.

Necessary condition (i) can be interpreted broadly or narrowly, as desired, but could include the possibility that consumers do not know what is *material* to the estimation of their probability of loss distribution.

If either of the two necessary conditions don't hold, it is possible to construct a scenario whereby the strict enforcement of insurance contracts does *not* lead to an improvement in social welfare. Indeed, with transaction costs, it could actually lead to a decrease in social welfare. The balance

of this paper models this intuition and provides a motivation for why courts of law do not always vigorously enforce insurance contracts—the result may be surprising.

Literature Review

Dixit (2000) placed the concept of uberrimae fidei into the Rothschild and Stiglitz (1976) model and recognized that uberrimae fidei is Pareto-improving. Dixit (2000) also recognized that, with transaction costs to verify information, high-risk types get full insurance without investigation.

Picard (2002) analyzed costly verification of risk type when consumers have a duty of good faith. Picard characterizes the conditions under which an equilibrium exists when insurers are unable to pre-commit to their risk verification strategies.

Dixit and Picard (2002) analyzed the role of uberrimae fidei in insurance contracting and that the concept is implemented, under common law and statute law, with unequal strictness. Dixit and Picard (2002) extend the Rothschild and Stiglitz (1976) model with the assumption that consumers receive signals about their risk type and that costly verification of the risk type is possible by the insurer.

Zazzaro (2005) analyzed legal system efficiency on the functioning of credit markets and found that the more efficient legal systems were, the less important it became for banks to properly select borrowers. Similar to this current paper, Zazzaro's findings suggest that the relationship between legal strictness and due diligence on the part of the more sophisticated party to the contract is negative.

The Model

By definition, a consumer who knows his probability of loss distribution is said to "know his risk-type," that is, he is well-informed of his riskiness in regard to the risk he would like to be insured against. We can normalize the severity of an accident and assume that there are only two risk types, high and low, and therefore state that the consumer who knows his risk type is one that knows his probability of having a loss, that is, his loss frequency. Therefore, the consumer is said to have materially with-held information from the insurer if he does not tell the insurer his honest risk-type, either high or low. For simplicity, it is assumed that the true probability of loss is revealed to the insurer costlessly in the event that the consumer has a loss. A transaction cost to reveal the risk-type and/or improve the accuracy of the insurer's estimate of the consumer's risk-type can also be modeled and will be discussed.

The basic model follows the framework of Rothschild and Stiglitz (1976). Consider an individual with wealth W if he has no economic loss. If an event occurs for which the individual failed to insure, his wealth decreases by d such that his new wealth is $W-d$. The individual can buy insurance coverage against the possible loss by paying an insurance premium of α_1. In the event of a loss, the indemnity paid will be $\hat{\alpha}_2$. Without insurance his wealth in the two states of the world (loss, no loss) will be $(W, W-d)$. With insurance coverage, his wealth in the two states of

the world will be $(W - \alpha_1, W - d + \alpha_2)$ where $\alpha_2 = \hat{\alpha}_2 - \alpha_1$. The vector $\alpha = (\alpha_1, \alpha_2)$ completely describes the insurance contract.

Let W_1 denote wealth if no loss and W_2 denote wealth if a loss. The expected utility of an individual is then:

$$\hat{V}(p, W_1, W_2) = (1-p)U(W_1) + pU(W_2) \tag{1}$$

Where $U(\cdot)$ is the utility of wealth such that $U'' < 0$ and p is the probability of a loss (with severity of d fixed). Consumer demand for insurance may be derived from (1).

A contract of insurance α is valued at $V(p, \alpha) = \hat{V}(p, W - \alpha_1, W - d + \alpha_2)$. From the contracts offered the individual chooses the one that maximizes $V(p, \alpha)$.

Proposition 1: If the individual consumer knows his risk type and understands the concept of *uberrimae fidei*, he will truthfully reveal his true risk type, his probability p of a loss, and there will be no asymmetric information in the market.

Proof: For all given consumers i with probability of loss p_i, the individual has three choices. The consumer can, (A) tell the insurer that his probability of loss is lower than it actually is, $p' < p_i$, (B) tell the insurer that his probability of loss is higher than it actually is, $p'' > p_i$, and (C) tell the insurer the truth, that his probability of loss is p_i. By showing that option (C) is the only option consistent with utility maximization, the proof will be complete.

Option (A) will leave a consumer with a level of utility that is no greater than his reservation level of utility from not having insurance, $V(p, 0) = \hat{V}(p, W, W - d)$. If the consumer has a loss, he will have no indemnity if he lied to the insurer. Option (B) will ensure that the consumer has valid insurance, but he will have it at a price which is higher than the attainable actuarially fair price. Therefore, option (C) is the one which maximizes a consumer's utility function. □

With no asymmetric information, insurers know that the information provided to them from consumers is truthful. Assuming that insurers are risk-neutral profit maximizers, any contract that is demanded and expected to earn non-negative profit will be supplied. The profit of an insurer can therefore be represented as:

$$\pi(p, \alpha) = (1-p)\alpha_1 - p\alpha_2 = \alpha_1 - p(\alpha_1 + \alpha_2) \tag{2}$$

Given profit maximization by firms such that $\pi \geq 0$, and given utility maximization by consumers, there is no asymmetric information in this market and a first-best Pareto-optimal outcome is achieved. This result was previously found by Dixit (2000).

If courts of law strictly enforce insurance contracts, insurers do not have to do any underwriting as they know that the information provided to them by consumers is true. Interestingly, if we consider that one or both of the original assumptions regarding consumer rationality do not hold:

either consumers do not know their risk type and/or they do not understand the implications of the concept of utmost good faith, then this same outcome regarding insurer investment into underwriting holds. Regardless of whether consumers know their risk type or not, insurers have no incentive to underwrite so long as courts strictly enforce contracts of insurance. Regardless of whether consumers understand utmost good faith or not, insurers have no incentive to underwrite if courts are strict.

Even more harrowing, when consumers don't know their risk-type and/or don't understand utmost good faith, it will actually be preferable to insurers that they do not underwrite even when underwriting is costless. In this way, insurers will be able to earn economic profit on the consumers who have invalid insurance for which their coverage is actually void and whom have no loss.

Proposition 2: If courts of law strictly enforce insurance contracts, and consumers do not know their risk type and/or do not understand utmost good faith (consumers therefore under-estimate their risk) insurers will not underwrite even if the cost of underwriting is zero.

Proof: If the consumer under-estimates his risk and has a loss, the insurer will discover the consumer's risk type and the contract of insurance will be void. If the consumer under-estimates his risk and has no loss, then the insurer will not pay anything and will actually have never had any risk on his books whatsoever, even though this is not known. Therefore, the insurer will earn economic profit on every consumer who under-estimates his risk and does not have a loss, If J consumers underestimate their expected loss to be $p_j{}' < p_j$, then the insurer will earn economic profit equal to $\sum_{j=1}^{J}(1-p_i)p_j{}'$. If the insurer engages in underwriting at the contract outset and discovers any individual consumer has under-estimated his loss, he will lose the expected economic profit that he could have earned on that consumer, equal to $(1-p_i)p_j'$. This is true when the underwriting costs are zero and so is true, by trivial extension, to any case where underwriting costs are positive.□

Proposition 3: It is straightforward that for any normally behaved social welfare function SW, the situation described in Proposition 2 will decrease social welfare.

Proof: Define SW to be additive of the individual $i \in I$ consumers' utility functions such that we have the following equation:

$$SW = \sum_{i=1}^{I} \hat{V}_i(p_i, W_{1i}, W_{2i}) \tag{3}$$

From the equilibrium vector of insurance contracts, $\boldsymbol{\alpha}$, purchased by the $i \in I$ consumers, the first-best outcome arrived at in the basic model (above) will be such that $W_{1i} = W_{2i} \; \forall i$. Let SW' be this first-best outcome where all consumers know their risk-type, understand utmost good faith, and are fully insured at actuarially fair prices (no underwriting/transaction costs incurred).

If J of the I consumers under-estimate their risk-type, then they will only attain their reservation utility, defined as $\bar{U}_j$, the utility they receive from not having insurance coverage which is

strictly lower than it is for the case where they do have insurance coverage. Therefore, social welfare will be equal to $SW'' = \sum_{j=1}^{J} \bar{U}_j + \sum_{i=1}^{(I-J)} \hat{V}_i(p_i, \alpha)$, where α is the equilibrium vector of insurance contracts purchased. If we make the unrealistic assumption that one dollar of economic profit is equal to one unit of utility for consumers, then we can see that the value of SW'' does not alter even though we have excluded economic profits and, rather, included the supposed utility gained from the reservation level of utility. Given that this assumption is unrealistic, the social welfare effects are even more severe.[1] □

Proposition 4: An ex-ante expectation that courts of law will not strictly enforce contracts of insurance when the consumer's stated probability of loss does not equal the actual probability of loss (when the consumer has withheld material information) will create an incentive for profit-maximizing insurers to perform underwriting.

Proof: If the probability of accurately discovering a consumer's risk type increases with the amount of money spent on underwriting, then the level of underwriting will be a positively related function of the ex-ante probability that a court of law will rule equitably in favor of the consumer if the consumer under-estimates his probability of loss. If a court is nearly always equitable towards the consumer if the consumer's stated risk type is lower than his actual risk type and there is a loss, then insurers will spend a sufficiently high level of money to reveal consumer's risk types. If the court is only equitable towards consumers some of the time, then insurers will spend a less, yet still positive, amount of money on underwriting, such that they maximize their expected profits. □

Therefore, if consumers do not know their risk type and/or do not understand utmost good faith, it is possible that the equitable legal judgment of insurance contracts can increase social welfare through the increase in the number of consumers with valid insurance coverage, at the expense of decreasing social welfare through the extra cost of underwriting (if underwriting is costly).

Conclusion
This short paper has presented a new theory of underwriting. If consumers do not know their risk type and/or do not understand the concept of utmost good faith as it applies to their contracts of insurance, then the ex-ante expectation (by insurers) that courts will rule in-favor of consumers even though consumers have under-estimated their risk type (an equitable judgment for the consumer), can create an incentive whereby insurers underwrite as part of their profit maximization objective. Without such ex-ante expectation that courts will rule equitably, if courts rule mercilessly and strictly upon the contract of insurance, insurers have no incentive to

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[1] More work can be done here. The question is the following: how should a consumer who believes he has insurance coverage, but doesn't, be regarded in a social welfare function when he does not have a loss and, therefore, does never realize that he never had coverage? Furthermore, how should economic profit from such void insurance coverage be included in the social welfare function and in the insurer's profit function? In the insurer's profit function, when the insurer does not realize which consumers are informed and which are not, and if the insurer does not know the distribution of risk-types (the overall riskiness of those consumers in the market), then how would the insurer treat such profits? Wouldn't the insurer treat those profits as an indicator that prices can be lowered for each risk type? And in so doing, how would this affect long-term equilibrium prices, coverage level, adverse selection, and the dynamic flow of information?

underwrite and this brief paper has shown that this can possibly reduce social welfare if consumers do not know their risk type and/or do not understand utmost good faith in insurance contracts.

Future revisions of this paper need to be more sophisticated and must address the following concerns: (1) there should be an actual ex-ante probability of equitable judgment in favor of the consumer, the amount of underwriting conducted should be a function of this ex-ante probability; (2) underwriting should be costly and the amount of information revealed should be an increasing function of the money spent on underwriting, the marginal information received from increased expenditure on underwriting should be decreasing; (3) underwriting/verification of risk-type strategies should be incorporated whereby insurers can underwrite ex-ante or ex-post a loss; (4) the modeling, in the social welfare function, of consumers who believe they are insured but aren't and yet never realize this because they don't have a loss, should be investigated; (5) the modeling, in the insurer's profit function, of economic profit earned on consumers who pay insurance premiums but aren't insured, and don't have losses, should be investigated. Insurers may potentially treat this economic profit as a signal that they can charge less money for each unit of risk, this could potentially create an insurance cycle. It should be investigated whether this hypothesis, with some Bayesian-updating filter on the part of insurers, could cause an insurance cycle; (6) the assumption that the consumer's true risk-type is revealed in the event of a loss could be relaxed in conjunction with concerns (2) and (3) above.

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