

Utility Function's Influence on Insurance Policy Customer Choices

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Abstract:

This research examines into the influence of utility functions on consumer decisions regarding insurance plans, emphasizing the importance of expected utility theory in making choices amidst uncertainty. Originated by Daniel Bernoulli, this concept plays a crucial role in contemporary economics by guiding individuals towards options that maximize their anticipated satisfaction. Through an examination of deductible options—percentage and straight—this study demonstrates how these decisions impact both the profitability of insurers and the behavior of customers. Utilizing a literature review methodology, the research scrutinizes previous studies to clarify the relationship between utility theory and insurance choices. The results highlight that utility functions offer a numerical structure for assessing personal preferences and tolerance for risk, assisting in the creation of policies that harmonize customer requirements with insurer goals. This holistic approach to comprehending insurance decisions underscores the pivotal function of utility theory in economic evaluations, providing valuable insights into the financial security and welfare of individuals in an unpredictable environment.

Keywords: Utility Function, Insurance Policy Customer, Customer Choices

1. Introduction

In economics, the concept of utility refers to the satisfaction a user derives from using a good or service. It also relates to an arbitrary preference index used in analyzing economic choices. The satisfaction a user gets from using a good or service is referred to as utility. Utility can also relate to an arbitrary preference index that is employed in the analysis of economic choices. Daniel Bernoulli developed the expected utility theory in 1738, which is utilized in decision and game theories as well as modern economics. When

presented with a choice, the option that offers the most expected utility is the preferred one. Making decisions is a matter of personal preference, and when faced with ambiguity, a decision maker will attempt to maximize his utility. Utility functions assign numerical satisfaction units, or "utils," to one or multiple outcomes quantified in monetary wealth units, or "w." Since terminal wealth is frequently the most significant result, utility is frequently defined as a function of terminal wealth (Harel et al., 2018).

Utils = u (w)

Utility has also been defined as an individual's subjective psychological feeling and assessment. It is the distinct inclination, sentiment or trade-off reaction of decision-makers toward the projected gains and projected losses of particular risk events. In risk management decisions, it may represent the decision-makers' particular risk events (Shi & Wang, 2019). The utility value has a range of 0 to 1, and for multiple possible outcomes of a decision problem, if the decision maker believes they are equivalent, then they are all assigned the same utility value. Utility theory integrates utility considerations with expected returns to enable investors to make decisions that are consistent with their risk tolerance and general well-being (Omar, 2023).

In practical terms, people's decisions and choices are the focus of utility function. Along with assessments of worth, value, goodness, and other related concepts, it also deals with people's preferences (Fishburn, 2010).

Customer Choices

In any economy, people live in a state of uncertainty all the time, but they nevertheless make decisions that affect their health, relationships with others, the environment, and the economy. The significance of the expected utility theory is demonstrated by having to choose between two possibilities that may be equally plausible. Given that human decision-making has played a major part in human evolution, decision-making is an indispensable function of consumer life. Humans possess an unmatched ability to live in a variety of surroundings, so understanding how people make decisions and how various circumstances influence them is essential.

People's lives are majorly impacted by the decisions they make, from small daily choices to significant life decisions. As people make judgments based on the subjective relevance of the options' expected values, their choices may be influenced by biases hence the utility theory is an essential component of decision-making. Individuals' lives are closely linked to a variety of decision-making processes, from straightforward to intricate

(Liu, 2023). Understanding decision-making processes allows people to see the factors influencing their choices and adapt accordingly. Decision-making is fundamental to the existence of humans and fully connects humans to one another.

2. Methodology

This study uses a literature review research method. It focusses on a number of past studies done by various researchers explaining different aspects and applications of the Utility function and theory. Their findings are analyzed to provide an informed conclusion. This study further provides an understanding of customer behavior while deciding between buying a deductible-only policy and a comprehensive insurance policy. We try to determine how the utility function affects the wealth of consumers when they select one alternative over the other.

3. Literature Review

Omar, (2023) conducted a study on the application of utility theory to investment decisions made in Kenya. According to his findings, by taking utility factors into account in addition to expected profits, the Utility theory enables investors to make decisions that are in line with their risk tolerance and general well-being. It recognizes the different risk preferences of individuals and makes it easier to quantify and compare utility across investment possibilities. By giving outcomes utility values, utility functions help make decisions easier to make and mathematically express preferences. However, even if utility theory provides insightful information, other aspects including individual circumstances, financial goals, time horizons, and market conditions must be taken into account while implementing it.

In a study of the foundations of expected utility theory and its application to insurance purchases, Chukwudum (2016) revealed that setting the insurance product's price at the actuarially fair premium rate will result in losses for the insurer while maintaining the customer's level of wealth across all states, encouraging him to choose full insurance coverage. Since the equation is unbalanced, the insurer must raise the premium that the customer pays in order to turn a profit. However, the increase cannot equal or exceed the maximum premium that the customer is willing to pay. We have somewhat of a balance inside this area where the insurer won't lose money and the customer can't get complete insurance. Findings suggest that if the consumer's projected utility goes above

this point, it will become more difficult for him to buy the product. As a result, there is less demand for the product, which adversely affects the insurance provider.

In a study on the utility theory approach to insurance pricing, [Gharakhani et al., \(2016\)](#) observed that paying an insured for a loss experienced is the primary duty of insurance companies. Agreements regarding the amount of reimbursement are made between the policyholder and the insurance company at the time an insurance policy is issued. In the event that the specific protected risk occurs, the insured may receive full coverage in exchange for a higher premium. In some situations, the insured might receive a premium discount in exchange for keeping a portion of the loss, referred to as a franchise or deductible. A deductible provision, found in the majority of insurance plans, states that the insurer will only pay a loss after deducting the insured's portion. This approach could be attractive to the insured as well as the insurer. Because an insurance company's administrative costs, particularly when settling claims, are typically expensive and the majority of claims are insignificant, the insurer may choose to exclude the majority of its claims from the settlement process, saving a substantial amount of labor by implementing the deductible. Thus, an insurance company's overall cost of doing business is decreased.

The insured will attempt to prevent the loss since they are aware that they will be responsible for paying their portion of the loss in the event of a loss, which is another benefit for the insurer. Deductible use can reduce the likelihood of moral hazard and have an impact on the frequency and degree of losses. On the other hand, low risk insureds may purchase insurance to control their risks as well as financial constraints. By retaining a portion of their losses, they may be able to lower their insurance premium costs. Consequently, if the cost is greater than the actuarially fair cost, the utility theory suggests that many insureds would not need to insure tiny risk of the deductible and will thus be more likely to get insurance with a deductible.

As explained by [Gharakhani et al. \(2016\)](#), in insurance, there are two primary types of deductibles: percentage deductibles and straight deductibles. A percentage deductible is calculated as a proportion of the total loss amount. For instance, with a 10% deductible, the insured is responsible for paying 10% of the total damage, while the insurer covers the remaining 90%. This type of deductible is often used in various business lines, substantial individual risks, and health insurance policies. On the other hand, a straight deductible is a fixed dollar amount, denoted as D , that the insured must pay before the insurer contributes to the loss. If the loss is less than D , the insurance does not pay anything. If the loss exceeds D , the insurer covers the amount beyond D . This type of deductible is commonly applied to property insurance, especially in policies with lower insured sums, to discourage small claims.

Illustration of the Utility function

Assume the customer making the decision is risk-averse and has access to **A+L's** starting wealth. If the consumer chooses to purchase insurance, they will be responsible for paying a premium of **P**, while the potential loss is represented as **L** with a known probability of **n**. The insured's preferences about the use of insurance in various scenarios and contexts can be illustrated using the Utility function. The expected utility theory, often known as the theory of preferences under uncertainty, holds that the demand for insurance remains the solution to maximizing a utility function.

In case of the theory of insurance demand, the consumer is modelled as having a **von Neumann-Morgenstern utility function $u(w)$** , (Rees & Wambach, 2008).

A consumer of an insurance policy may, under normal circumstances, be in one of two states of nature: either **No loss state** or **Single loss** event state with amount **L**, depending on the degree of loss incurred.

In the event that the insured chooses not to get insurance, his ultimate worth in these two scenarios will be as follows:

$$W = A \quad n \text{ (probability of loss)}$$

$$W = A + L \quad 1 - n \text{ (probability of no loss state)}$$

The Expected utility will be expressed as:

Event	Resulting Wealth	Utility	Probability	Expected utility
Loss	A	$U(A)$	n	$nU(A)$
No loss	L+A	$U(L+A)$	1-n	$(1-n) U(A+L)$

The following formula yields the expected value of the insured's wealth and utility:

$$U'(W) = nU(A) + (1-n) U(A+L)$$

The insured's ultimate wealth in the event of a loss and in the absence of a loss if he purchases full insurance coverage and is charged **P** as premium will be as follows.

$$W = A + L - P - L + L \quad n$$

$$W = A + L - P \quad 1 - n,$$

The expected utility function is;

$$U(W) = nU(A + L - P) + (1 - n) U(A + L - P), = U(A + L - P)$$

$$P = A + L - (A^n * (A + L)^{1 - n})$$

Buying insurance with b % of deductible in exchange for α % premium discount.

In this instance, the insured receives insurance coverage and agrees to keep a portion of the loss, denoted by a, in the event of a loss. The ultimate wealth can be determined using the formula below.

$$W = A + (1-b) L - (1-a) P \quad n$$

$$W = A + L - (1-a) P \quad 1-n$$

Where there is a relationship between the percentage of premium discount a and the amount or percentage of deductible b, we also look for the maximum loss the insured is willing to accept in order to retain a portion of the loss b in exchange for a certain percentage of premium discount a in his or her premium. This is the minimal amount of discount that must be paid to the insured in order for them to maintain the same degree of pleasure when purchasing insurance with a deductible. The anticipated benefit for the insured in this instance of purchasing insurance is displayed as follows:

$$U''(W) = nU(A + (1-b) L - (1-a) P) + (1-n) U(A + L - (1-a) P)$$

Buying insurance with D dollars' deductible for α % discount in premium.

Here, the insured consents that in the event that the loss is less than D, he will not file a claim with the insurance company and will bear the cost of covering the loss; in the event that the loss exceeds D, the insurance company will reimburse the full amount of the loss less D. We now look at the percentage (a%) of the premium discount that the insured agrees to pay the first D dollars of loss. His riches in this instance is equivalent to:

$$W = A + L - D - (1-a) P \quad n$$

$$W = A + L - (1-a) P \quad 1-n$$

The expected utility function in this case is;

$$U'''(W) = nU(A + L - D - (1-a) P)$$

4. Discussion and Conclusion

The fundamental concept that guides decision-making in the face of uncertainty is the expected utility theory. It considers an individual's perspective, which is a crucial consideration when determining whether or not to consume a product or service. A person with no tolerance for risk won't perceive the need for insurance. Hedging one's risk is essential for someone who is risk averse. When it comes to advising the insurer on how much to charge for the insurance product, the expected utility theory plays a vital role. It's crucial to note that the insured's expected utility in any insurance scenario shouldn't be

lower than it would be in the absence of insurance. Depending on the type of coverage selected, the insured should be able to get sufficient compensation in the event of a loss. The findings indicate that each decision made has a distinct predicted utility. Given that every option has a range of possible outcomes, a consumer seeking to achieve a particular level of ultimate wealth in the event of a risk must choose a particular decision. This explains the concept of the utility function. Economic theories that explain prices, individual behavior, and other pertinent economic phenomena continue to be based on the idea of utility (Moscati,2021).

Utility functions of insurance choices reveal how individuals make decisions under uncertainty. Expected utility theory by Daniel Bernoulli guides consumers towards satisfying choices. It shows individuals how to balance benefits and losses when making insurance decisions. Utility functions help translate preferences into quantifiable units for decision-making. They assist in navigating the complexities of insurance for consumers and insurers. Insurers use utility theory for setting premiums, while customers use it to choose suitable policies. Different deductibles influence customer decisions and insurer costs. Understanding deductibles helps in policy design to attract risk-averse customers and manage costs. It shapes insurance policies and affects the willingness to claim losses. Utility theory aids in understanding insurance choices by integrating psychological, risk, and economic factors. It is a tool for informed decisions by consumers and insurers. It remains essential in economic analysis for financial stability and well-being.

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