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# Risk Classification: The American Academy of Actuaries Monograph

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# A Public Policy Monograph on Risk Classification

Section I: Financial or Personal Security Systems

Section II: Expected Cost

Section III: Risk Classification

Section IV: Considerations in Designing a Risk Classification System



- The Monograph was developed by the Academy's Risk Classification Work Group at the request of the Academy's Risk Management and Financial Reporting Council
- Its purpose is to provide background and information to the public on risk classification and the design and management of risk classification systems
- The Monograph also provides a systematic development of these concepts for actuaries and other professionals in a form applicable to all areas of practice
- It is **not** a standard or practice and is not binding upon any actuary
- It is intended to be objective without proposing any social or political points of view by describing those features that are necessary for the success of any financial or personal security system
- The Monograph is also available on the Academy website:  
[http://www.actuary.org/pdf/finreport/RCWG\\_RiskMonograph\\_Nov2011.pdf](http://www.actuary.org/pdf/finreport/RCWG_RiskMonograph_Nov2011.pdf)



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# Careful definition of terms is an important aspect of the Monograph

- A peril is a cause of possible injury or loss at times in the future.
- A risk is a situation, created by a peril, that gives rise to a defined set of potential outcomes and the probability of occurrence associated with each outcome.
  - Can be monetary or non-monetary
  - The possible outcomes for a monetary risk are the amounts that must be paid at each future time



## Definition of terms (cont'd)

- Example: the risks associated with the possibility of a house fire
  - The non-monetary risks include the risk of physical damage to the structure and the risk of inconvenience and emotional upset
  - The monetary risks include the risk of incurring expense to repair the structure
  - The list of possible outcomes for the risk of physical damage to the structure can be infinitely long



## Definition of terms (cont'd)

- A risk subject is a person or thing, or a collection of persons or things, associated with a risk
  - The unmodified word “risk” is often used for both risks and their risk subjects—these terms are carefully distinguished in the Monograph
  - Numerous risks could be associated with the same risk subject
  - For example, a person could be, simultaneously, the risk subject for life insurance risk, for workers’ compensation risk, and for non-monetary risks such as the risk of personal unhappiness



## Definition of terms (cont'd)

- The severity of a particular outcome of a monetary risk is the monetary loss associated with the outcome.
  - If the monetary loss consists of a series of payments, the severity is the current monetary value of the payments at the time the event occurs.





# People often seek to mitigate risk

- Mitigation of the adverse consequences of an uncertain event often is provided by families, friends, privately funded charities, or government assistance, among others
- Mitigation also is provided by governmental or private insurance programs or prepaid service plans



# Transfer of risk

- Some mitigation options provide a degree of advance risk transfer—a specific commitment by one party to mitigate the impact of certain risks that face another party—other options do not involve such commitment
- While both approaches can mitigate the adverse consequences of uncertain events, programs such as insurance and pensions that are based on advance risk transfer also can mitigate the uncertainty the individual faces before any loss has occurred and thus may provide an enhanced sense of security



## Transfer of risk; coverage

- A private or government-sponsored arrangement that is intended to offer a means to mitigate the impact of unfavorable outcomes on some or all of the members of an at-risk group through advance risk transfer is called a financial or personal security system (security system).
  - A group of individuals or entities facing possible unfavorable outcomes arising from one or more specified uncertain events is called an at-risk group
  - A security system covers or provides coverage for those who participate in the system, the participants



## Transfer of risk; coverage (cont'd)

- A coverage provider is an entity associated with a security system that agrees to take actions that mitigate the unfavorable outcomes of specified risks through advance risk transfer in return for payments or other consideration
  - Examples are insurance companies, pension plans and pre-paid health plans
  - The coverage provider is the entity that bears the risk—for example, under cost-plus insurance, the plan sponsor is the coverage provider, not the insurer that administers the claim payments



# Terms of coverage; covered risk

- For a specific coverage offered by a coverage provider, the terms of coverage is a description of the rights and responsibilities of the coverage provider and of the participants to whom it provides coverage
  - A covered risk associated with a security system is a risk for which the possible outcomes are the mitigating actions that would be undertaken by a coverage provider upon the occurrence of one or more of the system's covered events



# Compulsory and voluntary systems

- Compulsory systems provide coverage for a specified group and all members of the group are required to participate
- In a voluntary system, an individual has the right to choose whether or not to participate
- Both government-sponsored and private security systems can be either compulsory or voluntary



# Individual Choice in a Financial or Personal Security System

- Voluntary Systems—choices and options
  - Participation—Continuity is an issue
  - Benefit levels—How much and when triggered
  - Riders or other bells and whistles—How do cost and access/quality vary?
- Compulsory systems—mandated coverage
  - Does the system allow any choice—and is the tax or penalty used to enforce a mandate actually strong enough?
  - Participant options are desirable but expensive—must balance of risk and reward



# Compulsory systems with elements of choice

- In compulsory systems with elements of choice individuals are required to participate, but are allowed to make certain choices about coverage or coverage providers
  - Allowing participant choice can introduce adverse selection into a compulsory system





# The role of competition

- Fully competitive system: A financial or personal security system with multiple coverage providers that are free to offer terms of coverage, including prices, of their own choosing; potential participants are free to choose among these providers
- Single-provider system: A financial or personal security system with only one coverage provider



# The Role Of Competition (cont'd)

- Advantage of fully competitive systems:
  - Rates tend to be lower and options are frequently more varied and available
- Advantage of systems that are not fully competitive:
  - May be better able to provide coverages that require subsidies (if, for example, coverage is not affordable for participants with certain risks), where the cost of subsidies cannot be allocated equitably among coverage providers or participants
- Advantage of single-provider compulsory systems:
  - May have administrative cost advantages and advantages related to participation/selection



## The Role Of Competition (cont'd)

- In comparing the advantages and disadvantages of competitive and single-provider systems, consider not only the stated goals of the systems, but also the incentives and constraints that each system establishes for coverage providers, participants and other interested parties.



# Characteristics of successful financial or personal security systems

- The goal of a financial or personal security system is to provide a means by which the impact of unfavorable outcomes of uncertain events can be mitigated through advance risk transfer
- By what criteria may the success of a financial or personal security system be judged?



# Characteristics of successful financial or personal security systems (cont'd)

- Three criteria necessary (but not necessarily sufficient) for success:
  - Coverage is **widely available** to those in the at-risk group who desire it
  - The terms of coverage, taken as a whole, are **sufficiently acceptable** to those eligible to be participants
  - The system will have access to **sufficient resources to fulfill its promises**



# Some critical issues related to the success criteria

#1 Wide availability of coverage:

- How does this differ, if at all, by level of risk?

#2 Sufficiently acceptable terms of coverage:

- What do participants with different levels of risk think of the coverage terms, including price?

#3 Sufficient resources to fulfill promises:

- Does the system treat future generations equitably?



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# The importance of expected cost

- Expected cost:
  - Each outcome of a covered risk has an expected cost equal to the current monetary value of the outcome times its risk probability (the probability that an outcome occurs at a particular time and is of a particular severity)
  - The expected cost of providing coverage for a covered risk is the sum of the products of current monetary value of each outcome and the outcome's risk probability
  - In most cases, both severities and risk probabilities must be estimated





# The importance of expected cost (cont'd)

- Example: Disability income policy
  - Outcomes are possible streams of benefit payments that will be paid if disability occurs
  - For each possible outcome (stream of payments), there is a risk probability
  - The severity of each outcome is the current monetary value that the coverage provider places on the stream of benefit payments
  - The expected cost is obtained by (1) multiplying the severities by the risk probabilities and (2) summing



# Expected-cost-related pricing

- Price for coverage: amount paid by or on behalf of a participant in order to receive coverage for a risk
  - May be set by market forces or regulated
- If prices reflect expected costs, they are expected-cost-related



# Expected cost and the price for coverage

- “Assessment societies” did not base price of coverage on expected cost
  - Paid benefits upon deaths of members by assessing all members an equal amount
  - The expected cost of coverage for each member was dependent on his or her age and health status
  - The assessment (the “price of coverage”) was not
  - Assessment societies eventually failed
- Life insurance companies based price on expected cost
  - Many US life insurers have existed for over 150 years



# Expected cost and the success of security systems

- Success Criterion #1: Coverage is **widely available** to those in the at-risk group who desire it
  - Competitive systems: if prices are expected-cost-related, all risks are desirable to coverage providers
  - Single-provider systems: if prices are expected-cost-related, estimates of the level of contributions needed to provide the coverage will tend to be more accurate, allowing for increased participation without fear of deficits



## Expected cost and the success of security systems (cont'd)

- Success Criterion #2: The terms of coverage, taken as a whole, are **sufficiently acceptable** to those eligible to be participants
  - If the security system's prices are reasonably proportional to expected costs of coverage, the system has achieved individual equity
  - If the system charges some more and some less than expected cost, it uses internal subsidies—often not well-received
  - Resources in addition to payments by participants are external subsidies—may be proportional to expected costs or not



# Expected cost and the success of security systems (cont'd)

- Success Criterion #2 (cont'd):
  - Considerations of social adequacy—the desire to make coverage available to all or most of an at-risk group at prices that are deemed affordable—may be in conflict with individual equity
  - Even if such considerations are deemed critical and result in prices that depart from individual equity, acceptance of the system can be enhanced by demonstrating that the departures are not arbitrary
    - For example, U.S. Social Security benefits



# Expected cost and the success of security systems (cont'd)

- Success Criterion #3: The security system has access to **sufficient resources to fulfill its promises**
  - If prices do not reflect expected costs, the security system may be subject to adverse selection—an action taken by a participant that is based on information unavailable or not used by the coverage provider and that is perceived to confer an economic benefit to the participant
  - Adverse selection can arise from:
    - intentional withholding of information by (prospective) participants
    - inability or unwillingness of provider to use information
    - prices that appear too low or too high to participants or potential participants—*if* they have a choice



# Expected cost and the success of Security Systems (cont'd)

- Success Criterion #3 (cont'd):
  - Adverse selection can lead to a price spiral: a repetitive process that occurs in voluntary security systems and compulsory security systems with elements of choice when an upward adjustment of prices intended to remedy a shortfall in resources leads to an exodus of risks having expected costs lower than the price, and thus to a continuing shortfall





# Expected cost and the success of Security Systems (cont'd)

- Increased understanding of the expected costs of coverage helps a financial or personal security system satisfy the three criteria necessary (but not necessarily sufficient) for success
- The implications of not satisfying the three criteria differs by situation, but can include:
  - Inability to deliver on promises; lack of sustainability
  - Coverage providers deciding not to participate
  - Shunning of high cost participants or markets
  - Contribution spirals
  - Underinsurance



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# The need for risk classification

- The expected cost of coverage needs to be estimated—to do this the current monetary value of the various possible outcomes and their corresponding risk probabilities are needed
  - Statistical methods are generally used and produce better results when observations are made from a large group of participants
  - Need to group risks to better utilize statistical methods



# Risk classification is a process by which such grouping is accomplished

- A risk class is a set of covered risks grouped together by a coverage provider based on its knowledge or belief that some or all of the risk probabilities of the possible outcomes associated with each risk in the class are substantially similar
- The specification of a set of risk classes, together with a procedure to assign each covered risk to one of the risk classes, is called a risk classification system



# Risk classification is a process by which such grouping is accomplished (cont'd)

- As long as the risk probabilities remain stable over a given time frame, historical data may provide a basis from which a reasonable estimate of the risk probabilities for the risks in the risk class can be derived



# Risk characteristics

- Risk classification typically involves the identification of certain characteristics of the risk subjects associated with the risk
- For many risks one can observe qualities, often quantitative, that provide **useful information** about the likelihood of various outcomes associated with the risk—these are risk characteristics



## Risk characteristics (cont'd)

- For a given risk, there is often more than one risk characteristic that provides such useful information
  - For the risk faced by the sponsor of a pension plan, for example, the risk characteristics of a given retiree might include the age, gender and health of the recipient
  - For auto insurance, relevant risk characteristics may include the driving experience and driving record of the principal driver and the geographic location of the driver's principal residence



## Risk characteristics (cont'd)

- The ways risk characteristics are used in a risk classification system vary
  - A value often is determined for each risk characteristic and the set of these values determines the risk class to which the risk is assigned
  - Determining a value for some risk characteristics such as age or gender is straightforward and objective, while in other cases such as certain medical conditions, judgment is required





# Number of Risk Classes, Adverse Selection and Individual Equity

- Risk classes: In the process of designing a risk classification system, the selection of the number of risk classes to use is pivotal
  - Choosing a small number of large risk classes or a large number of small risk classes
- Credibility: Fewer classes means more data per class
- Homogeneity: More classes means greater similarity of risks within risk classes, allowing prices to better reflect individual equity. Fewer classes can mean more internal subsidies; could lead to adverse selection



# Risk classification and the success criteria

## Success Criterion #1: Wide availability of coverage

- In competitive systems, if providers are free to set up their own risk classification systems, the differences of judgment will lead to a spectrum of prices for each risk
- In a single-payer system, an effective risk classification system can result in increased accuracy of cost estimates, giving a clearer picture of the coverages that can be offered and how external subsidies can best be employed to increase availability and affordability—thus can be useful, even if prices do not reflect risk classification



# Risk classification and the success criteria (cont'd)

## Success Criterion #2: Broad acceptability

- Risk classification can be used to demonstrate that the system exhibits individual equity, or to show that departures to achieve social adequacy are not arbitrary
- In competitive systems, risk classification can bring prices closer to expected cost by reducing uncertainty for coverage providers—thus providing more coverage for less aggregate cost
  - Example: preferred term life insurance rates in the U.S.



# Risk classification and the success criteria (cont'd)

## Success Criterion #3: Sufficient resources to fulfill promises

- An effective risk classification system can be used to set expected-cost-related prices and thus control the adverse selection that occurs when high-cost risks and low-cost risks pay the same price
- Even if prices are not expected-cost-related, an effective risk classification system facilitates more accurate estimation of resource needs



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# Establishment of Risk Classes

Identification of risk characteristics, considering:

- Objective determinability
- Controllability
- Avoidance of overly large discontinuities
- Correlation and causality
- Absence of ambiguity
- Homogeneity and credibility
- Expense and practicality



# Social, legal, and regulatory considerations

## Philosophical concerns

- Is correlation enough to establish a risk characteristic?
  - What is “causality”?
- Is it ever acceptable to “classify” people?
- What social constraints to classification exist in a given society?
  - Do these constraints differ due to cultural differences?



# Social, legal, and regulatory considerations

Practical concerns: what can be done:

- If predictive capability is perceived to be insufficient?
  - For example, travel to regions newly engulfed in war
- To address privacy concerns?





# Social, legal, and regulatory considerations (cont'd)

## Risk adjustment

- What is it?
  - An example is retrospective rating
- Can it solve the problem of unaffordability of coverage for some risks?
- What are its limitations?
- What about hybrid systems?



# Social, legal, and regulatory considerations (cont'd)

## Legal and regulatory constraints on risk classification

- What are the implications of constraints?
- If a constraint is imposed either by the coverage provider itself or by law or regulation, what can be done to avoid unacceptable or undesirable consequences?
  - Examples:
    - Restriction on use of pre-existing conditions in determining eligibility for or price of health care coverage
    - use of gender with respect to life insurance and annuities



# Discussion and Questions

