

Focus on the Actuarially Fair Premium

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Handout of Sample Problems

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In-class Exercises on Selection, Actuarially Fair Premiums and Risk Adjustment

Actuarially Fair Premium (AFP):

Suppose that the population of some place is 95% low risk and 5% high risk. Low-risk people have expected medical expenditures of \$500 and high-risk people have expected medical expenditures of \$30,000.

- What is the AFP for an insurance plan with only low-risk people?
- What is the AFP for an insurance plan with only high-risk people?
- What is the AFP for an insurance plan covering the entire population?
- What is the AFP for an insurance plan covering a representative sample of the entire population?
- What is the AFP for a plan with disproportionately greater share of high-risk people, specifically 50% high risk?

Risk Adjustment: With the same population and ignoring administrative costs (loading)...

- What do plans have to receive (in *total* from agency plus policy buyer...) in order for the plans to be willing to provide a sell a policy for a high-risk person?
- What do plans have to receive in order for them to be willing to sell to low-risk people but not try cherry-pick the low-risk people?
- Imagine you want to implement a risk adjustment scheme with these characteristics:
 - Everyone pays the same premium out-of-pocket, regardless of their risk
 - Plans have no incentives to lemon-dump or cherry-pick
 - The scheme is budget-neutral, requiring no outside subsidies

How would you implement this scheme? What would you charge people for plans?

What would you pay plans for the different risk categories? What rules would you need?

Assignment or exam question for AFPs, selection, risk-adjustment

Suppose AIDS patients are 5% of Xanadu's population and have expected medical care costs of \$100,000/year. The remaining 95% of the population has expected medical care costs of \$1000/year. *Per capita* income in Xanadu is \$50,000/year.

(a) Suppose that insurers can identify AIDS patients and exclude them from particular policies.

- What kind of policies will exist in the market?
- What will be the actuarially fair premiums (AFPs) for those plans?
- How will the AFP and loading costs affect the actual premiums?

(b) The government of Xanadu decides to help AIDS patients with the creation of an insurance purchasing alliance that is guaranteed to be available to everyone, irrespective of health status.

- If it is not mandatory to join the purchasing alliance, who will join? Explain.
- What will be the resulting actuarially fair premium for the alliance plan?

(c) If it is mandatory to join in the alliance and therefore the entire population joins (i.e., pools together), what is the actuarially fair premium that each citizen should pay to the alliance?

(d) In order for the alliance to get insurers to accept AIDS patients, payments to insurers must be risk-adjusted.

- Explain the general meaning of risk adjustment.
- Describe *one* way risk adjustment could work in this (simplified) situation.
- How much would the alliance need to pay insurers to cover AIDS patients?
- How much should the alliance pay insurers to cover other citizens?

In-class Exercises: Actuarially Fair Premium & Different Treatment Choices

Teaching note: Nowadays, I would give (a)-(d) on one day after teaching about AFPs with differing disease probabilities and about value of insurance, and then give (e)-(f) on another day after starting to teach moral hazard/cost-containment using AFPs and treatment choices.

This is a model like the one we did in class with similar assumption: Initially (*ex ante*) everyone has the same risks. There are only three periods: uncertainty, plan purchase decisions and consumption of non-health stuff; uncertainty resolved; enjoying resulting health.

<i>Health State</i>	<i>Probability</i>	<i>Health Care Costs to Treat</i>
Kidney disease	1%	\$250,000
Heart attack	4%	\$100,000
Good health	95%	\$1000

- (a) Assume, for now, that health insurance fully covers treatment for all conditions and that there is only one possible course of treatment for each condition. What is the AFP?

- (b) Before you know your ultimate health status, what is the incremental expected cost of buying an insurance policy relative to not buying a policy? What real-world opportunity cost does that represent?

- (c) Suppose that your lifetime wealth is \$150k. What will you do if you get kidney disease? In words, what is the incremental expected benefit of having an insurance policy?

- (d) Suppose your lifetime wealth is \$300k. What will you do if you get kidney disease? In words, what is the incremental expected benefit of having an insurance policy?

Now, suppose that these are different possible treatment options. Everything else is the same.

Assume that there are two possible treatment choices for those who get kidney disease:

Treatment for kidney disease	Cost ¹	Quality of Life (1-10 scale), where 1 as bad as death and 10 perfect health
Dialysis	\$50,000	2
Transplant	\$250,000	9

(e) For someone who already has kidney disease (*ex post*), what are the incremental costs and incremental benefits of transplant relative to dialysis? What would you want if you had kidney disease?

(f) In expectation (*ex ante*), from the perspective of someone who does not know whether or not they will get kidney disease, consider a policy that covers transplant or dialysis to one that covers only dialysis.

- What is the incremental expected cost (incremental increase in AFP) of an insurance policy that covers transplant relative to an insurance policy that covers only dialysis?
- What is the real world opportunity cost of purchasing a policy that covers transplant relative to one that covers only dialysis?
- What are the incremental expected benefits of an insurance policy that covers transplant relative to an insurance policy that covers only dialysis? Give these in *both* in everyday words *and* numbers using quality of life.
- What would you personally choose?

¹This is a misleading (well, wrong!) caricature of reality. In general, dialysis costs *more* in expectation and in total than transplant, as well as having a much worse quality of life. It is the shortage of kidney donors that is the reasons transplants are limited.