Seminar Paper

Moral Hazard In Health Insurance

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1 Introduction

The following paper is based on the book Moral Hazard In Health Insurance, Amy Finkelstein. A footnote is set if other sources have been used. The paper is about Moral Hazard in Health Insurance in the US health care system. The different types of moral hazard are described and the existence of moral hazard is questioned in the second section. In the third section an experiment for proving moral hazard and the impact on medical care will be presented. The second mentionable experiment which proves moral hazard and again the effects on the health market will be introduced in the forth section. An understanding of health insurance policies, forward looking behavior and how alternative health insurance policies affect health care spending will be given in the fifth section. The sixth section will be about the medical care market and the comparison with competitive models under certainty and uncertainty.
2 Is demand for medical care really price-sensitive?

What is the meaning of moral hazard in health insurance? Kenneth J. Arrow defined it as medical insurance increasing the demand for medical care. There are 2 different types of moral hazard. The first is known as ex ante moral hazard. The idea of ex ante moral hazard is if you get health insurance, you will live less healthier, because your bills will be paid by the insurance. Therefore, for example, you will eat unhealthier, drink more alcohol, smoke more or exercise less.

The second type of moral hazard is called ex post moral hazard. For this, we forget about the changing behavior when you get health insurance. We just take health insurance as given. The idea is, that if you have health insurance you will consume more of it because the price of medical care is lower. In essence this is about a demand curve and the price sensitivity of demand for medical care. Moral hazard and health insurance have come to mean price sensitivity of demand for medical care, rather than the impact of health insurance on investment in one’s health. Therefore the focus will be set on the price sensitivity of demand. The first question is whether the demand for medical care is really price sensitive. So if, for example, the cost of medical care is lowered, will people consume more of it? But what if we take a different point of view. What if medical care is determined not by price but by needs.

“The moral hazard argument make sense... only if we consume health care in the same way we consume other consumer goods, and to economists like John Nyman this assumption is plainly absurd. We go to the doctor grudgingly, only because we’re sick. Do people really like to got to the doctor? Do they check into the hospital instead of playing golf?!”

Now the question is, if we give people health insurance do they consume more health care? For proving this, people without health insurance will not be simply compared with people with health insurance. It is obvious that people with health insurance consume more medical care than people without health insurance. Additionally, data would show, that health insurance kills people, because people with health insurance have a higher mortality rate than people without. The ideal solution to prove moral hazard would be randomly chosen people who will be assigned to different insurances. Then the selection problem does not exist.

In the United States two mentionable experiments were conducted. One is the RAND Health Insurance Experiment from the 1970s and the other is the Oregon Medicaid Experiment in 2008 from Amy Finkelstein and Kate Baicker.

3 The Oregon Medicaid Experiment

Medicaid is a health insurance for the indigent. In Oregon, the state has an expansion program to cover people who are financially but not categorically eligible for Medicaid. These are low income people, who have less than $10,000 annual income. These people are uninsured, but they are not eligible for Medicaid because they are on welfare. Oregon had money to cover thousand of these uninsured low-income adults. They had to think

\[1^{“The Moral-Hazard Myth”, Malcolm Gladwell} \]
about who will get insured and who will not. A first-come-first-serve system was ineligible because it seemed to be not fair for those who were not socially good connected. So they ran a lottery. The state sponsored a big public campaign and asked interested people to sign up for the lottery. About ninety thousand people signed up, of which thirty thousand were eligible. These are the results from the first 16 months of this experiment.

3.1 Emergency Department Visits

First of all we take a look at the emergency department records from Portland-area hospitals. It was proved that Medicaid increased the emergency department use. The “Control Mean” are the people, who did not win in the lottery. They have about a 7 percent admission rate over a 16-month period. The “Control Mean plus Medicaid Effect” are the winners of the lottery. One can see, that it is about 2 percent points, or 30 percent, higher. Additionally, visits during standard hours (weekdays) and outside standard hours (evenings and weekends) were increased by Medicaid over 40 percent. The Emergency Department visits can be classified in “non-emergent”, “primary care treatable”, “emergent, preventable” and “emergent, non preventable”. Statistically significant increases were observed in all classes, except in “emergent, non preventable”. Further, Medicaid increased outpatient emergency department visits (visits that did not result in a hospital admission), but they did not found an increase of visits that did result in a hospital admission.\(^2\)

![Figure 1: Emergency Department Visits](http://www.nber.org/oregon/3.results.html)

3.2 Outpatient Care

They observed that the number of office visits increased by 2.7 visits compared to the prior year, or about 50 per cent relative to the control group with an average of 5.5 office visits per year. The total number of used prescription drugs increased by 0.35, relative to a control group average of 2.3. Respondents also noticed an increase in different types of preventive care. For example, the cholesterol monitoring was about 50 percent

\(^2\)http://www.nber.org/oregon/3.results.html
higher than before and the amount of mammograms doubled. Medicaid also increased the probability of being diagnosed with diabetes and in consequence of that the use of diabetes medication and the rate of diagnoses of depression. The amount of hospital admissions not originating in the emergency department was 30 percent higher after Medicaid.  

\[\text{Figure 2: Outpatient Care}\]

### 3.3 Financial Hardship

Medicaid reduced the probability of having to borrow money for medical care about 50 percent, almost eliminated the chance of being financially ruined as a result of out-of-pocket payments and decreased the probability of having an unpaid bill sent to the collecting agency by 25 percent. Medicaid had no statistically significant effect on labor market outcomes, such as employment status or earnings.  

\[\text{Figure 3: Financial Hardship}\]

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\[3\text{http://www.nber.org/oregon/3.results.html}\]

\[4\text{http://www.nber.org/oregon/3.results.html}\]
They did not find any evidence for ex ante moral hazard. For example, there was no change in smoking behavior. Reasons for that could be, that when someone has health insurance, the person is less concerned about their health is not operative, or it might be operative but counterbalanced by the fact that if the person goes to the doctor more often, the doctor will always warn about their smoking behavior, for example.

4 The Rand Health Insurance Experiment

The Rand Health Insurance Experiment was about people getting insured but with different cost-sharing plans. Compared to the Oregon Health Insurance Experiment where the impact of public insurance on people’s medical care spendings was monitored, in the RAND Health Insurance Experiment everybody received a private insurance, but every insurance was different in the amount of deductibles. The most comprehensive coverage was called the free-care plan. The consumers did not have to pay anything out-of-pocket with this plan. All other plans had different cost-sharings where people had to pay a certain amount out-of-pocket, depending on what one was assigned. So there were consumers with 5 percent, 25 percent, 50 percent or even 95 percent out-of-pocket payments. All of these plans had low out-of-pocket maximums, or stop losses, so consumers with high cost-sharing plans just had to pay a certain amount of money. So, for example, someone with a 95 percent plan did not have to pay more than $1000, when the out-of-pocket maximum was set at $1000. When the maximum was reached the insurance covered everything. The question was now, is the medical care spending lower when consumer cost-sharing was higher, or if the consumers have to pay a higher share of the cost out-of-pocket, they spend less. Let’s have a look on the results of the experiment:

- Participants with free care had one to two more visits to the doctor annually and 20 percent more hospitalizations than those with a cost-sharing plan.

- Participants in cost sharing plans spent less on health care. This savings came from using fewer services rather than finding lower prices. Those with 25 per cent co-insurance spent 20 per cent less than participants with free care, and those with 95 per cent co-insurance spent about 30 per cent less.

- The reduced use of medical care was a result from participants deciding not to consume medical care. Once patients were in the system, the cost-sharing plans did not really affect the intensity or cost of an episode of care.

4.1 Effects on Appropriateness of Care and on Quality of Care

The appropriateness of the services reduced by cost-sharing and the quality of care received by consumers was also observed. Did cost-sharing deter people from using appropriate health care more or less than from ineffective care? To prove this, specific conditions were grouped into seven categories depending to the degree to which outpatient care and therapies were known to be effective. The categories were ranged from highly effective care to rarely effective care. Cost-sharing reduced the use of both cares. For hospitalization and prescription drugs use, cost-sharing reduced both equally. Additionally the quality of care was measured. Two remarkable findings emerged: First,
cost-sharing did not affect the quality of care. The only difference that appeared was the process criteria dealing with the need for an office visit: 59 percent for those with free care plan and 52 percent for those with cost-sharing plan. Second, the quality criteria was in general quite low: criteria for quality were met only 62 percent of the time. 

4.2 Effects on Health

However, reduced services for cost-sharing patients did not have any adverse impact on their health. Just a few exceptions were found:

- Free care improved the control of hypertension. The poorest patients with free care plan had a greater reduction in blood pressure than those with a cost-sharing plan. Also, the mortality rate because of hypertension was 10 percent lower in the group with free care plan.
- Free care improved vision for the poorest patients.
- The rate of receiving needed dental care increased too.
- Serious symptoms were less prevalent for poorer people on the free plan.

5 How will alternative health insurance policies affect health care spending?

Now that we have the evidence of moral hazard, the next question is: What are the policy implications of moral hazard in health insurance? So it should be thought about the impact of high-deductible health insurance plans on spending. High deductible insurance plans were encouraged by the Health Savings Accounts Act of 2003, which encouraged people through tax subsidies to buy very high-deductible plans. Within the deductible, a participant pays 100 percent out-of-pocket. If you get now over the deductible limit the insurance will pay the rest of your bill. The basic idea was to get people in high-deductible plans to reduce the level and growth of healthcare spending, but to make sure at the same time that people would not get financially ruined. There are three questions that come up when we talk about how a high-deductible plan is going to affect health care spending:

1. Which price matters to consumers? Is it the deductible that they face at the start of the year or their premonitions that by the end of the year they may have spent past the deductible? Which are they going to respond to in their spending behavior?

2. Who is going to select the high-deductible plans, and how is that going to affect the impact of these plans on spending?

3. Why would health insurance affect spending growth?

[https://www.rand.org/pubs/research_briefs/RB9174.html]
[https://www.rand.org/pubs/research_briefs/RB9174.html]
5.1 What price matters to consumers?

First of all, let’s have a look, how deductible plans look like. We do not find a linear relationship between out-of-pocket spendings and total spendings. It’s more like it is shown in the figure. First of all you have your out-of-pocket, you pay 100 percent, so the total spending is one to one with the out of pocket spending. Then you reach the out-of-pocket maximum. Now the co-insurance starts. Let’s start with a 25 percent co-insurance. The out-of-pocket spending is now rising one-forth for every dollar that is spent. Then you hit the stop, medical care is now free. So at every beginning of the year these deductible plans a reset. The question is now how do people think. Do they think that they will bear the full price of going to the doctor or do they think that they will past the deductible through the year anyway because they will go to the doctor more times? Which price do they respond to? People will reduce their spending more if they have to pay 100 percent out-of-pocket than if they forecast a lower effective marginal price at the end of the year.

Imagine someone with a $3000 deductible, but with a chronical illness that costs him or her more than $10000 a year. So if this person is going to the doctor because of a headache at the beginning of the year, he or she should think, that he or she would past the deductible anyway over the year and face now a marginal price much lower, instead of thinking that he or she has to bear the full out-of-pocket cost with the current visit. The question is, do people really think like that? How important is forward looking behavior in moral hazard? Let’s think of an example. The deductible plans always rests on the 1st of January, indepent when the employee is hired. Now there are two different employees, one is hired in March and the other one is hired in October. They have the same deductible and the same spot price of medical care, but they face different end-of-the year prices, because those hired in March have the nearly the whole year and so a higher chance to past the deductible. Studies showed that employees hired earlier in the year, who face the same spot price but a lower expected end-of-the year price than employees hired later in the year, use more medical care. So forward-looking behavior does exist, but how important is it? It was shown that people are not fully forward-looking, they respond to spot and future prices. It is estimated that the spending reduction of moving
from a no-deductible to a high-deductible plan is about 25 to 50 per cent lower, as it would be if people were fully myopic.

5.1.1 A simple Model

Consider a model of a risk-neutral forward-looking individual who faces uncertain medical expenditure, and is covered by a contract of (discrete) length $T$ and deductible $D$. That is, the individual pays all his expenditures out of pocket up to the deductible level $D$, but any additional expenditure is fully covered by the insurance provider. The individuals utility is linear and additive in health and residual income, and we assume that medical events that are not treated are cumulative and additively separable in their effect on health. Medical events are given by a pair $(\theta, \omega)$, where $\theta > 0$ denotes the total expenditure (paid by either the individual or his insurance provider) required to treat the event, and $\omega > 0$ denotes the health consequences of the event if left untreated. We assume that individuals need to make a discrete choice whether to fully treat an event or not. Events cannot be partially treated. We also assume that treated events are fully cured, and do not carry any other health consequences. Thus, conditional on an event $(\theta, \omega)$, the individuals flow utility is given by

$$u(\theta, \omega, d) = \begin{cases} -\min\{\theta, d\} & \text{if treated} \\ -\omega & \text{if not treated} \end{cases}$$

where $\min\{\theta, d\}$ is the out-of-pocket cost associated with expenditure level, which is a function of $d$, the amount left to satisfy the deductible. Medical shocks arrive with a per-period probability $\lambda$, and when they arrive they are drawn independently from a distribution $G(\theta, \omega)$. Given this setting, the only choice individuals make is whether to treat or not treat each realized medical event. Optimal behavior can be characterized by a simple finite horizon dynamic problem. The two state variables are the time left until the end of the coverage period which we denote by $t$, and the amount left until the entire deductible is spent which we denote by $d$. The value function $v(d, t)$ represents the present discounted value of expected utility along the optimal treatment path. Specifically, the value function is given by the solution to the following Bellman equation:

$$v(d, t) = (1-\lambda)\delta v(d, t-1) + \lambda \max \left\{ \begin{array}{ll} -\min\{\theta, d\} + \delta v(max\{d - \theta, 0\}, t - 1), \\
-\omega + \delta v(d, t - 1) \end{array} \right\} dG(\theta, \omega),$$

with terminal conditions of $v(d, 0) = 0$ for all $d$. If a medical event arrives, the individual treats the event if the value from treating, $-\min\{\theta, d\} + \delta v(max\{d - \theta, 0\}, t - 1)$, exceeds the value obtained from not treating, $-\omega + \delta (d, t - 1)$. The model implies simple and intuitive comparative statics: the treatment of a medical event is more likely when the time left on the contract, $t$, is higher and the amount left until the deductible is spent, $d$, is lower. This setting nests a range of possible behaviors. For example, "fully" myopic individuals ($\delta = 0$) would not treat any shock as long as the immediate negative health consequences of the untreated shock, $\omega$, are less than the immediate out-of-pocket expenditure costs associated with treating that shock, $\min\{\theta, d\}$. Thus, if $\theta > d$, fully myopic individuals ($\delta = 0$) $\omega > \theta$. By contrast, "fully" forward looking individuals ($\delta \approx 1$) will not treat shocks if the adverse health consequences, $\omega$, are less than the expected
end-of-year cost of treating this illness, which is given by \( fp \cdot \theta \), where \( fp \) (for "future price") denotes the expected end-of-year price of medical care, which is the relevant price for a "fully" forward looking individual in deciding whether to consume care today. Thus, if \( \theta > d \), fully forward looking individuals will not treat if \( \omega > fp \cdot \theta \). That is, while fully myopic individuals consider the current, "spot", or nominal price of care (which in our example is equal to one), fully forward looking individuals only care about the future price.

We solve the model for a simple case, where we assume that \( \lambda = 0,2 \) and that medical events are drawn uniformly from a two-point support of \((\theta = 50, \omega = 50)\) and \((\theta = 50, \omega = 45)\). We use two different deductible levels (of 600 and 800) and up to 52 periods (weeks) of coverage. The figures below present some of the models implications for the case of \( \delta = 1 \). It uses metrics that are analogous to the empirical objects we later use in the empirical exercise. Figure 1 presents the expected end-of-year price of the individual as we change the deductible level and the coverage horizon. The expected end-of-year price in this example is \( 1 - Pr(hit) \), where \( Pr(hit) \) is the fraction of individuals who hit the deductible by the end of the year.

Individuals are more likely to hit the deductible as they have more time to do so or as the deductible level is lower. This ex-ante probability of hitting the deductible determines the individuals expectations about his end-of-year price. This future price in turn affects a forward looking individuals willingness to treat medical events. Figure 2 presents the (cumulative) expected spending over the initial three months (12 weeks). Given the specific choice of parameter values, expected spending over the initial 12 periods is at least 60 (due to the per-period 0.1 probability of a medical event \((\theta = 50, \omega = 50)\) that would always be treated) and at most 120 (if all medical events are treated).

The expected end-of-the year price is increasing as the coverage horizon declines (Figure 1) for a given deductible. Therefore the expected initial spending also declines as the coverage horizon declines (Figure 2) for a forward looking individual. Forward looking individuals expect to eventually hit the deductible and treat therefore all events, if the coverage horizon is long enough and the deductible level low enough. So the expected spending is 120. If the horizon gets shorter, there is a greater possibility that the deductible will not be hit by the end of the year. The end-of-year price could be 1 (rather than zero). Therefore forward looking individuals will not treat the less severe medical events of \((\theta = 50, \omega = 45)\).

Further, we can see in Figure 2 a great variation between a fully forward looking individual initial medical utilization (in the first 12 weeks) and the coverage horizon despite a spot price which is always one. In comparison, a fully myopic individual \((\delta = 0)\) who only responds to the spot price has expected 12-week spending of 60, regardless of the coverage horizon \( t \) as you can see in Figure 2. Likewise, the expected three-month spending of individuals in a no-deductible plan does not vary with the coverage horizon, regardless of their, since the expected end-of-year price does not vary with the coverage horizon.\(^7\)

\(^7\) [http://www.nber.org/programs/ag/rrc/NB12-15%20Aron-Dine,%20Einv,%20Finkelstein,%20Cullen %20FINAL.pdf, p.5 et seq]
Figure 5: Model illustration, Figure 1

Figure 6: Model illustration, Figure 2
5.2 Who selects high-deductible plans?

To answer this question, it must be differentiated between more or less price sensitive people. This leads to the selection on moral hazard. Let’s take a look on a model in which three different reasons why people demand health insurance exists.

1. The first is the traditional adverse selection, in which people have private information about their risk types.

2. The second is selection on moral hazard. These people are more price sensitive. They probably would think if the price is cheaper they are more likely to demand more health insurance.

3. The third are risk averse people. The more risk averse people are the more health insurance they will demand.

A briefly analogy to differentiate between traditional adverse selection and selection on moral hazard: Think for a moment of the concept of all-you-can-eat restaurants. The idea of traditional adverse selection is that people with big appetites are more likely to go to all-you-can-eat restaurants. Selection on moral hazard means now if you have just an average appetite you will go to the all-you-can-eat restaurant anyway because you know when the food is free on the margin you are going to eat a lot more than you would do in an à la carte restaurant.

An evidence for selection on moral hazard was found by using data from Alcoa that included employee health insurance options, choices, and medical claims. The particular sign was that individuals who consumed more medical care when it was subsidized more, are more likely to choose more coverage. So not only do sicker people seek more medical coverage, but also people who are more price sensitive of demand seek more coverage. So moral hazard is quite important for the prediction on spending behavior. For example, trying to predict the spending reduction of a family with a $3000 deductible plan. A decrease of about $350 in spending per employee of changing from the current plan to a high-deductible plan, with the traditional approach and the assume that people who are buying those plans are random with respect to their moral hazard type and the average moral hazard estimate, was predicted.

However, low moral hazard types are people who select a high-deductible plan with less coverage. So if the low moral hazard people move to a high-deductible plan the spending reduction will be much lower. The reason for this is that those who choose the high-deductible plans are less responsive than average to consumer cost-sharing. Depending on how the plan has been priced, the spending decrease can be lower by a factor of two or three. This will have very important implications for how introducing a plan when people are given a choice, is going to reduce health spending.

5.3 Spending Growth

The spread of health insurance may have played a much larger role in the growth of health spending than the Rand Experiment would suggest. The introduction of Medicare is a good example for this. Medicare provided health insurance to all Americans aged 65 and older. Prior Medicare about three-quarters of the elderly were uninsured. Therefore,
Medicare provided health insurance to about 7.5 percent of the U.S. population where there was none before. To estimate the impact of Medicare the rates of health insurance dependent on different regions of the country must be distinguished. In New England, for example, 50 percent were newly covered because of Medicare. In the East-South-Central of the United States Medicare increased the fraction with insurance by about 90 percent. Huge spending effects were the result. 5 years after the introduction, it was estimated that the hospital spending was about 40 percent higher than before. That’s over 6 times larger than what the estimates from the Rand Health Insurance Experiment would have predicted. But what is the difference? One difference is that the RAND is a real randomized experiment. The analysis of the introduction of Medicare 1st capturing general equilibrium effects that the RAND Health Insurance Experiment cannot. In RAND, the sample is six thousand people across the United States, so we are getting the effect of someone newly insured on his or her health care use, holding constant the health care environment: the doctors and hospitals are not doing anything different because of this few people who got newly insured. But when 7.5 percent of the U.S. population gets a health insurance it is increasing the demand of health care. In fact, there was also an evidence that Medicare encouraged the adoption of new medical technologies. There is a widespread relation between growth in health care spending and technological change in medicine. When large-scale insurance changes lead to an increase in demand, hospitals have a bigger incentive to adopt new medical technologies. People will use this technologies because they don’t have to pay out-of-pocket. They would not have used it as much when they had to pay for them. Not just the adoption of new technologies was affected but also the development of those technologies, in the first instance. This was the result of the work that Finkelstein (2004) and that Daron Acemoglu and Josh Linn (2004) have done. They proved pharmaceutical innovation. When one increase the size of the market for a special drug, one see new clinical trials and new drug approvals increasing. So if the price is lowered the demand will increase and this involve the adoption and the development of new technologies.

6 Uncertainty and the welfare economics of medical care

This section will list some specific differences of medical care market compared to the norms of welfare economics.

6.1 A survey of the special characteristics of the medical care market

Some specific characteristics of the medical care market which distinguish it from the usual economic market are:

- **The nature of demand**
  That the demand of medical care is not steady in origin is the most distinguishing characteristic. It is irregular and unpredictable, not as such things as clothing and food are. In addition, the demand for medical services is associated, with a
considerable probability, with an assault on personal integrity. There is some risk of death and a chance for loss and reduction of earning ability. Food, for example, is also a necessity, but a deprivation of food can be avoided by sufficient income. That can not be said about illness. Illness is therefore not just a risk but a costly risk in itself, independent from the cost of medical care.

- **Expected behavior of the physician**
  There is a difference between sellers of medical care and business men in general. The element of trust is very important when we are talking about medical care. The behavior of the physician is supposed to be lead by concern for the costumer’s welfare which would not be expected of a salesman. Some examples for the difference between the expected behavior of a physician and other types of business men. Advertising and overt price are nearly eliminated among physicians. Advice given by physicians as to further treatment by himself or others is supposed to be completely divorced from self-interest. It is claimed that treatment is dictated by the objective needs of the case and not limited by financial considerations. . . .

- **Product uncertainty**
  Uncertainty is probably more intense in the health market. Recovery from disease is as unpredictable as is its incidence. In addition there exists an uncertainty due to non-experience. Further, the amount of uncertainty, measured in terms of utility variability, is certainly much less in cases for, say, houses or automobiles than in medical care in severe cases even though these are also expenditures sufficiently infrequent so that there may be considerable residual uncertainty.

- **Supply conditions**
  Entry to the profession is restricted by licensing. Licensing, restricts supply and therefore increases the cost of medical care. In addition, the cost of medical education today is high and is borne only to a minor extent by the student.

- **Pricing Practices**
  There are unusual pricing practises in medical professions. Additionally to the extensive price discrimination by income, a strong insistence on fee for services against alternatives are well known. Another problem is the implicit and explicit price-fixing. Price competition is frowned on. Arrangements are not uncommon in service industries, and they have not been subjected to antitrust action.

### 6.2 Comparison with the competitive model under Certainty

#### 6.2.1 Non-marketable Commodities

A good example for non-market interactions is the diffusion of communicable diseases. Further, there is a special interdependence, namely the concern for others. This concern is found in donations to hospitals and to medical education. The desire to help others sometimes seems to be stronger than improving other aspects of their welfare. In interdependencies caused by concern for the welfare of others always exists a theoretical case for collective action if each participant derives satisfaction from the contribution of all.
6.2.2 Increasing Returns

The problems related with increasing returns in allocation of resources in the medical field should be regarded, especially in areas of low density or low income. But increasing returns are not a big problem in large cities in the United States and improved transporta-tion to some extent reduces their importance elsewhere.

6.2.3 Entry

Another important aspect are entry restrictions. To help to evaluate these different issues must be considered:

- In general, quality would be lowered by additional entrants. The addition to the supply of medical care, properly adjusted for quality, is less than purely quantitative calculations would show.

- In addition to the remove of numerical entry restrictions it would be necessary to remove the subsidy in medical education to get genuinely competitive conditions.

- The result of making tuition carry the full cost of education will be to create too few entrants, rather than too many. In view of the imperfections of the capital markets, loans for this purpose to those who do not have the cash are difficult to obtain.

The exclusion of many imperfect substitute for physicians is another aspect of entry which makes the contrast with competitive behavior even sharper. All others are excluded by the licensing laws from engaging in any one of the activities as medical practice. The result of this exclusion is that the costly physicians time is needed for something that could be performed by others who are less trained and therefore less expensive.

6.2.4 Pricing

The price discrimination is a problem in many aspects. First, it is not compatible with the competitive model and second, the preservation of it corresponds to a collective monopoly. Therefore, price discrimination is a source of non optimality. Hypothetically, everyone would be better off if the price would be equal for all. This can simplified by just considering two income levels, rich and poor and if the elasticity of demand by either one is zero. Then the initial situation would be optimal because a reallocation of medical service would take place. The only effect would be the redistribution of income between the medical profession and the group with the zero elasticity of demand. The gain would be smaller with lower elasticity of demand. To give an example, imagine the price of medical care to the rich is double that to the poor. The medical expenditures by the rich are 20 per cent of those by the poor, and the elasticity of demand for both classes is 0.5. Then the social net gain due to the elimination of discrimination would be slightly over 1 percent of previous medical expenditures.
6.3 Comparisons with the competitive model under uncertainty

In this section the different operations of the actual medical care market and of an ideal system will be compared. Now, in the ideal medical care market insurance policies against all conceivable risks are available. There are two main risks in the medical care market. The first of getting ill and the second of total or incomplete or delayed recovery. The cost of medical care do not consist only of loss due to illness but also of discomfort and loss of productive time during illness and in more serious cases, death or deprivation of normal functions. The nonexistence of suitable insurance for the risk of both losses implies a loss of welfare.

6.3.1 The theory of ideal insurance

Each individual acts so as to maximize the expected value of a utility function conduces as basis. If we think of utility as attached to income, then the costs of medical care act as a random deduction from this income, and it is the expected value of the utility of income after medical costs that will be concerned with in this section. (Income is the ability to spend money on other objects which give satisfaction. Illness should not be considered as source of satisfaction. The illness should enter into the utility function as a separate variable.) The most manageable theory to explain behavior under uncertainty is the expected utility hypothesis, due to Daniel Bernoulli. In addition, individuals are assumed as risk averts. In utility terms, this means that they have a diminishing marginal utility of income. The only problem is the possibility of gambling. This is the result of risk aversion, because if a choice is given between a probability distribution of income, with the mean $m$, and the certainty of the income $m$, risk averse people will always prefer the last.

Suppose, there will be offered an insurance against medical cost on an actuarially fair basis. The company will charge a premium $m$ if the costs of medical care are a random variable with mean $m$. Will this be a social gain? Yes, if the company does not suffer a loss. The risk of a loss will get the smaller the more individuals will get an insurance, because the medical risks on different individuals are basically independent. In the limit, the welfare loss would vanish and there would be a net social gain. The problem is that pooling the risks does not go to the limit. There is only a finite number of risks and there may be some interdependence among the risks due to epidemics, for example. Then a premium slightly above the actuarial level would be sufficient to offset the welfare loss. People would still have a preference for an unfair actuarially policy, but not too unfair, over assuming the risks themselves. The administrative costs and irregular payments are another reason for insurance companies to put up the price.

To take a simply case, assume the insurance company will charge a fixed-percentage on the insurance policy above the actuarial value for its premium. From the point of view of a insurance taker the most preferred policy is then a overage with a deductible. If the company differentiate between several risks it is loading an extra percentage depending on the risk. Some element of co-insurance will be then involved in the Pareto optimal policy. The coverage for the costs over the minimum limit will be some fraction less than 100 per cent.\(^8\)

\(^8\)The prove is in section 7
This is also interesting if you have a look on the hypothetical concept of insurance against failure to recover from illness. To take a simply case, the cost of failure to recover is regarded purley as a money cost and the expected value of medical care is greater than is costs. Briefly, the resources devoted to medical help is less than the expected money value dependent to recovery because of medical care. The recovery is uncertain. A risk-averter without insurance would prefer not to take a chance on getting bankrupted by medical costs. A suitable insurance would then mean that he doesn’t pay anything if he doesn’t benefit. A social net gain would follow because the expected value is greater than the cost.

6.3.2 Problems of Insurance

- **Moral Hazard.** An optimal insurance market would exists if in the event of insurance in which insurance is taken would be out of the control of the insured person. But this separation can never be perfectly achieved. For example, the outbreak of a fire can never be controlled by the insured person, but the probability for the outbreak can be influenced by carefulness. The same thing counts for health insurance. The case of illness can not be controlled but the recover can be by the right choice of the doctor and the willingness to use medical services. For the physician it is convenient to prescribe more expensive medication, private nurses, more frequent treatments and other marginal variation of care.

- **Alternative methods of insurance payment.** There exist three different methods of coverage of the costs of medical care: prepayment, indemnities according to a fixed schedule, and insurance against costs. In prepayment insurance is paid directly in medical services. For the other two forms you pay cash. In the first you pay a schedule that is fixed in advance. In the second one, the insured person pay all the costs whatever they may be to provisions like deductible and coinsurance.
  
  In a perfect health market these three payments would be equivalent. The indemnities stipulated would be equal the market price of the services, so that value of the insured would be the same if he were to be paid the fixed sum or the market price or were given the services free. Third-party control over payments. The physician has the greatest control over moral hazard, as described in the first point. The strongest incentive to keep medical costs to a minimum is found in prepayment plans, where the insurance and the medical services are supplied by the same group. In the Blue Cross group, for example, a conflict developed between the insurance and the medical suppliers. Another aspect, why a third-party control is needed, is that insurance removes the incentive on the part of individuals, patients, and physicians to shop around for better prices for medical care.

- **Administrative costs.** One of the most important costs of operating an insurance company are commissions and selling costs. There is a great differential among several types of insurance and also a striking differential between individual and group policies. This then provides a very strong argument for widespread plans.

- **Predictability and insurance.** The greater the uncertainty in the risk being insured against the more valuable is insurance. This is often used as argument
to put greater emphasis on hospitalization and surgery. This was questioned by O.W. Anderson, who asserted that the out-of-hospital expenses were equally as unpredictable as in-hospital costs. It was shown that the variability is much lower for ordinary medical expenses compared to the average cost. For example, for the city of Birmingham, the mean expenditure on surgery was $7, as opposed to $20 for other medical expenses, but for those who paid for surgery the average bill was $99, as against $36 for those with some ordinary medical cost.

• **Pooling of unequal risks.** Theoretically, insurance needs for its full social benefit the greatest as possible differentiation between the various risks. Those who have a higher incidence of illness should pay higher premiums. In real life, there is more equalization than discrimination. This constitutes a redistribution of income from those with a low propensity to illness to those with a high propensity. The equalization would not make sense if the market was genuinely competitive. Under this circumstances, insurance plans could appear which charged higher premiums to less preferred risks.

• **Gaps and Coverage.** Certain groups, such as the unemployed, the institutionalized and the aged, are completely uncovered. Of total expenditures, between one-fifth and one-fourth are insured.

### 6.3.3 Uncertainty of effects of treatment

There are two different “uncertainties” in health care for a person already suffering from illness. One is the uncertainty of the effectiveness of the treatment and the the other is based on the different medical knowledge.

**Ideal Insurance.** This will necessarily involve insurance against a failure to benefit from medical care, whether through recovery, relief of pain, or arrest of further deterioration. One solution approach would be that the doctor is paid dependent of the degree of benefit. This would transfer the risk from the patient to the doctor.

In a market with ideal insurance, the illness of the patient will always be treated if the expected utility, taking account of the probability, exceeds the expected medical cost. This would lead to an economic optimum. If we think of failure to recovery mainly in terms of lost working time, then this policy would maximize economic welfare as ordinarily measured.

**The concept of trust and delegation.** Under ideal insurance, the patient would have no concerns about the medical knowledge asymmetry between him and the doctor, because he only pays the results. In the absence of ideal insurance, the patient want have a guarantee that the physician is doing the best he can do for the patient. The relationship of trust and confidence has to be set up. Since the patient does not know as much as the physician, he can’t completely enforce standards of care.

One consequence of this trust relationship is that the doctor can not act as if he is maximizing his income. The result of this special relationship is a discussion about ethical behavior and profit-making in hospitals.

The second problem with information inequality is that the patient must devolve much of his freedom of choice to the physician, because the patient does not have the knowledge to make the correct decisions respectively to his health. So the general problem here is
that there are information barriers and the non existence of a market in which the risk involved can be insured.

7 Optimal Insurance Policies

Propostion 1 If an insurance company is willing to offer any insurance policy against loss desired by the buyer at a premium which depnds only on the policy’s actuarial value, then the policy chosen by a risk-averting buyer will take the form of 100 per cent coverage above a deductible minimum.

Proof 1 Let W be the initial wealth of the individual, X his loss, a random variable I(X) the amount of insurance paid if loss X occurs, P the premium, and Y(X) the wealth of the individual after paying the premium, incurring the loss, and receiving the insurance benefit.

\[ Y(X) = W - P - X + I(X) \]  

The individual values alternative policies by the expected utility of his final wealth position \(Y(X)\). Let \(U(y)\) be the utility of wealth \(y\), then his aim is to maximize,

\[ E[U[Y(X)]] \]  

where the symbol E denotes mathematical expectation.

An insurance payment is necessarily nonnegative, so the insurance policy must satisfy the condition,

\[ I(X) \geq 0 \text{ for all } X. \]  

If a policy is optimal, it must in particular be better in the sense of the criterion (2), than any other policy with the same actuarial expectation, \(E[I(X)]\). Consider a policy that pays some positive amount of insurance at one level of loss, say \(X_1\), but which permits the final wealth at some other loss level, say \(X_2\), to be lower than that corresponding to \(X_1\). Then it is intuitively obvious that a risk-averter would prefer an alternative policy with the same actuarial value which would offer slightly less protection for losses in the neighborhood of \(X_1\) and lightly higher protection for those in the neighborhood of \(X_2\), since risk aversion implies that the marginal utility of \(Y(X)\) is greater when \(Y(X)\) is smaller: hence, the original policy cannot be optimal.

To prove this formally, let \(I_1(X)\) be the original policy, with \(I_1(x) > 0\) and \(Y_1(X_1) > Y_2(X_2)\), where \(Y_1(X)\) is defined in terms of \(I_1(X)\) by (I). Choose \(\delta\) sufficiently small so that,

\[ I_1(X) > 0 \text{ for } X_1 \leq X \leq X_1 + \delta, \]  

\[ Y_1(X') < Y_1(X) \text{ for } X_2 X' \leq X_2 + \delta, \ X_1 \leq X \leq X_1 + \delta \]  

This choice of \(\delta\) is possible if the function \(I_1(X), Y_1(X)\) are continuous; this can be proved to be true for the optimal policy, and therefore we need only consider this case.
Let \( \pi_1 \) be the probability that the loss, \( X \), lies in the interval \([X_1, X_1 + \delta]\) and \( \pi_2 \) be the probability that \( X \) lies in the interval \([X_2, X_2 + \delta]\). From (4) and (5) we can choose \( \epsilon > 0 \) and sufficiently small so that,

\[
I_1(x) - \pi_2\epsilon \geq 0 \text{ for } X_1 \leq X \leq X_1 + \delta, 
\]

and

\[
Y_1(X') + \pi_1\epsilon > Y_1(X) - \pi_2\epsilon 
\]

for \( X_2 \leq X' \leq X_2 + \delta, X_1 \leq X \leq X_1 + \delta. \)

Now define a new insurance policy, \( I_2(X) \), which is the same as \( I_1(X) \) except that it is smaller by \( \pi_2\epsilon \) in the interval from \( X_1 \) to \( X_1 + \delta \) and larger by \( \pi_1\epsilon \) in the interval from \( X_2 \) to \( X_2 + \delta \). From (6), \( I_2 \geq 0 \) everywhere, so that (3) is satisfied. We will show that \( E[I_1(X)] = E[I_2(X)] \) and that \( I_2(X) \) yields the higher expected utility, so that \( I_1(X) \) is not optimal.

Note that \( I_2(X) - I_1(x) \) equals \(-\pi_2\epsilon\) for \( X_1 \leq X \leq X_1 + \delta \), \( \pi_1\epsilon \) for \( X_2 \leq X \leq X_2 + \delta \), and 0 elsewhere. Let \( \phi(X) \) be the density of the random variable \( X \). Then

\[
E[I_2(X) - I_1(X)] = \int_{X_1}^{X_1 + \delta} [I_2(x) - I_1(x)]\phi(X)dx + \int_{X_2}^{X_2 + \delta} [I_2(x) - I_1(x)]\phi(X)dx
\]

\[
= (-\pi_2\epsilon) \int_{X_1}^{X_1 + \delta} \phi(X)dx + (\pi_1\epsilon) \int_{X_2}^{X_2 + \delta} \phi(X)dx
\]

\[
= -(\pi_2\epsilon)\pi_1 + (\pi_1\epsilon)\pi_2 = 0,
\]

so that the two policies have the same actuarial value and, by assumption, the same premium. Define \( Y_2(X) \) in terms of \( I_2(X) \) by (1). Then \( Y_2(X) - Y_1(X) = I_2(X) - I_1(X) \).

From (7),

\[
Y_1(X') < Y_2(X') < Y_2(X) < Y_1(X) 
\]

for \( X_2 \leq X' \leq X_2 + \delta, X_1 \leq X \leq X_1 + \delta \).

Since \( Y_1(X) - Y_2(X) = 0 \) outside the intervals \([X_1, X_1 + \delta], [X_2, X_2 + \delta]\), we can write,

\[
E[U[Y_2(X)] - U[Y_1(X)]] = 
\]

\[
\int_{X_1}^{X_1 + \delta} [U[Y_2(X)] - U[Y_1(X)]]\phi(X)dx + \int_{X_2}^{X_2 + \delta} [U[Y_2(X)] - U[Y_1(X)]]\phi(X)dx. 
\]

By the Mean Value Theorem, for any given value of \( X \),

\[
U[Y_2(X)] - U[Y_1(X)] = U'(Y(X))[Y_2(X) - Y_1(X)] = U'(Y(X))[I_2(X) - I_1(X)], 
\]

where \( Y(X) \) lies between \( Y_1(X) \) and \( Y_2(X) \). From (8),

\[
Y(X') < Y(X) \text{ for } X_2 \leq X' \leq X_2 + \delta, X_1 \leq X \leq X_1 + \delta,
\]

\[
\text{20}
\]
and, since $U'(y)$ is a diminishing function of $y$ for a risk-averter,

$$U''[Y(X')] > U''[Y(X)]$$

or, equivalently, for some number $u$,

$$U'[Y(X')] > u \text{ for } X_2 \leq X' \leq X_2 + \delta,$$

$$U'[Y(X)] < u \text{ for } X_1 \leq X \leq X_1 + \delta.$$  \hspace{1cm} (11)

Now substitute (10) into (9),

$$E[U[Y_2(X)] - U[Y_1(X)]] = -\pi_2 \epsilon \int_{X_1}^{X_1+\delta} U'[Y(X)] \phi(X) dX + \pi_1 \epsilon \int_{X_2}^{X_2+\delta} U'[Y(X)] \phi(X) dX.$$  

From (11), it follows that,

$$E[U[Y_2(X)] - U[Y_1(X)]] > -\pi_2 \epsilon u \pi_1 + \pi_1 \epsilon u \pi_2 = 0,$$

so that the second policy is preferred.

It has thus been shown that a policy can not be optimal if, for some $X_1$ and $X_2$, $I(X_1) > 0$, $Y(X_1) > Y(X_2)$. This may be put in a different form: Let $Y_{\text{min}}$ be the minimum value taken on by $Y(X)$ under the optimal policy; then we must have $I(X) = 0$ if $Y(X) > Y_{\text{min}}$. In other words, a minimum final wealth level is set; if the loss would not bring wealth below this level, no benefit is paid, but if it would, then the benefit is sufficient to bring up the final wealth position to the stipulated minimum. This is, of course, precisely a description of 100 per cent coverage for loss above a deductible.

**Proposition 2** If the insured and the insurer are both risk-aversers and there are no costst other than coverage of losses, then any nontrivial Pareto-optimal policy, $I(X)$, as a function of the loss, $X$; must have the property, $0 < dI/dX < 1$. That is, any increment in loss will be partly but no wholly compensated by the insurance company; this type of provision is known as coinsurance. We give here a somewhat simpler proof.

**Proof 2** Let $U(y)$ be the utility function of the insured, $V(z)$ that of the insurer. Let $W_0$ and $W_1$ be the initial wealths of the two, respectively. In this case, we let $I(X)$ be the insurance benefits less the premium; for the present purpose, this is the only significant magnitude (since the premium is independent of $X$, this definition does not change the value of $dI/dX$). The final wealth positions of the insured and insurer are:

$$Y(X) = W_0 - X + I(X),$$

$$Z(X) = W_1 - I(X),$$ \hspace{1cm} (12)
respectively. Any given insurance policy then defines expected utilities, \( u = E[U[Y(X)]] \) and \( v = E[U[Z(X)]] \), for the insured and insurer, respectively. If we plot all points \((u, v)\) obtained by considering all possible insurance policies, the resulting expected-utility-possibility set has a boundary that is convex to the northeast. To see this, let \( I_1(X) \) and \( I_2(X) \) be any two policies, and let \((u_1, v_1)\) and \((u_2, v_2)\) be the corresponding points in the two-dimensional expected-utility-possibility set. Let a third insurance policy, \( I(X) \), be defined as the average of the two given ones,

\[
I(X) = \frac{1}{2}I_1(X) + \frac{1}{2}I_2(X)
\]

for each \( X \). Then, if \( Y(X), Y_1(X) \) and \( Y_2(X) \) are the final wealth positions of the insured, and \( Z(X), Z_1(X) \) and \( Z_2(X) \) those of the insurer for each of the three policies, \( I(X), I_1(X) \) and \( I_2(X) \), respectively,

\[
Y(X) = \frac{1}{2}Y_1(X) + \frac{1}{2}Y_2(X),
\]

\[
Z(X) = \frac{1}{2}Z_1(X) + \frac{1}{2}Z_2(X),
\]

and, because both parties have diminishing marginal utility,

\[
U[Y(X)] \geq \frac{1}{2}U[Y_1(X)] + \frac{1}{2}U[Y_2(X)],
\]

\[
V[Z(X)] \geq \frac{1}{2}V[Z_1(X)] + \frac{1}{2}V[Z_2(X)].
\]

Since these statements hold for all \( X \), they also hold when experience are taken. Hence, there is a point \((u, v)\) in the expected-utility-possibility set for which \( u \geq \frac{1}{2}u_1 + \frac{1}{2}u_2 \), \( v \geq \frac{1}{2}v_1 + \frac{1}{2}v_2 \). Since this statement holds for every pair of points \((u_1, v_1)\) and \((u_2, v_2)\) in the expected-utility-possibility set, and in particular for pairs of points on the northeast boundary, it follows that the boundary must be convex to the northeast.

From this, in turn, it follows that any given Pareto-optimal point can be obtained by maximizing a linear function, \( \alpha u + \beta v \), with suitably chosen \( \alpha \) and \( \beta \) nonnegative and at least one positive, over the expected-utility-possibility set. In other words, a Pareto-optimal insurance policy, \( I(X) \), is one which maximizes,

\[
\alpha E[U[Y(X)]] + \beta E[V[Z(X)]] = E[\alpha U[Y(X)] + \beta V[Z(X)]],
\]

for some \( \alpha \geq 0, \beta \geq 0, \alpha > 0 \) or \( \beta > 0 \). To maximize this expectation, it is obviously sufficient to maximize:

\[
\alpha U[Y(X)] + \beta V[Z(X)],
\]

with respect to \( I(X) \), for each \( X \). Since, for given \( X \), it follows from (12) that,

\[
dY(X)/dI(X) = 1, \ dZ(X)/dI(X) = -1
\]

it follows by differentiation of (13) that \( I(X) \) is the solution of the equation,

\[
\alpha U'[Y(X)] - \beta V'[Z(X)] = 0.
\]
The cases $\alpha = 0$ or $\beta = 0$ lead to obvious trivialities (one party simply hands over all his wealth to the other), so we assume $\alpha > 0$, $\beta > 0$. Now differentiate (13) with respect to $X$ and use the relations, derived from (12),

$$dY/dX = (dI/dX) - 1, \quad dZ/dX = -(dI/dX).$$

$$\alpha U''[Y(X)] [(dI/dX) - 1] + \beta V''[Z(X)] (dI/dX) = 0,$$

or

$$dI/dX = \alpha U''[Y(X)] / [\alpha U''[Y(X)] + \beta V''[Z(X)].$$

Since $U''[Y(X)] < 0, V''[Z(X)] < 0$ by the hypothesis that both parties are risk-aversers, Proposition 2 follows.
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