The price increasing effect of insurance

A review of the effects of introducing insurance in a pharmaceutical market on the ability of a manufacturer to increase his price.

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Abstract

This paper examines the effects of introducing an optional insurance into a pharmaceutical market with a monopolistic manufacturer of medication. With the help of a model the changes in the price of medication are identified and evaluated. It is found that under certain conditions the insurance allows the manufacturer to increase his price, since the manufacturer can incorporate the presence of insurance into the determination of the optimal price. Furthermore, it is identified that due to this insurance the price can even be increased beyond the maximum individual liquidity constraints in the population. This model explains why risk neutral individuals strictly prefer insurance, even with an above actuarially fair premium. In a later extension a profit margin for the insurer is added to the model, from which it follows that this does not further increase the price for consumers, but rather takes away some of the manufacturer's profits. This price increase is constrained by the amount of harm the disease does. In an extension it is also shown how adding a competitor constrains this increase in prices further and provides incentives for innovation. The contribution to scientific literature of this paper is the explanation why risk neutral individuals strictly prefer insurance and how insurance can lead to increases of prices.

Table of contents

I. Introduction

The provision and financing of health care costs are heavily debated subjects in most western countries. The United States, for example, has struggled with rising health care costs that have an overall growth rate above the average inflation rate of the economy (Bodenheimer, 2005). There is a lot of discussion on the causes for these rising costs and how to deal with inaccessible health care in society. In the current presidential election of the United States many politicians point to proper insurance as a socially efficient way to pay for medical costs and make medicines and treatments available for everybody[1]. In scientific literature countervailing market power, the balancing of one group's market power by the market power of another, is mentioned as a method for insurance companies to constrain rising medical costs by negotiating large buyer discounts (Mechanic, 1991). However, several papers have contested the notion that countervailing market power always leads to price discounts or mention the presence of supplier competition as a necessary condition (Gans & King, 2002; Snyder, 1996, 1998). In an empirical study with data from the pharmaceutical industry Ellison and Snyder (2010) showed that within this market supplier competition is indeed a necessary condition for large buyer discounts to emerge. As a result, this raises questions about the effects of a health care insurance on prices within the pharmaceutical industry, since within this market supplier competition is often absent due to many patent enforced monopolies. This paper focusses on the effect of introducing an insurance into a pharmaceutical market. It presents a model that identifies and explains how the presence of an optional insurance in the market enables a monopolistic manufacturer of a medicine to inflate his prices. The implications of this model explain why risk neutral individuals would prefer insurance even with an above actuarially fair premium and why insurance can lead to a strong increase in the price of medication.

In current scientific literature, related to insurance, several studies have focussed on insurance as a way of reducing risk. Through risk-pooling individuals can limit out of pocket money and the risk of high unexpected payments (Zeckhauser, 1970). For example Friedman (1974) showed that on average individuals display a high degree of risk aversion regarding

[1] https://www.nytimes.com/2019/06/23/us/politics/2020-democrats-medicare-for-all-public-option.html

medical expenses, but this risk aversion decreases as income increases. A similar conclusion follows from Manning and Marquis (1996) who also find that most families exhibit risk aversion with regards to medical expenses and often prefer an insurance with an above actuarially fair premium. Both papers use an empirical analysis based on expected utility theory to study the choices made with regards to medical insurance and explain that the choices made are in line with what would be expected from risk averse individuals. Earlier literature mostly focusses on that risk averse individuals choose insurance and study the degree of risk averse behaviour that is displayed. This paper takes a different approach and provides an explanation why risk neutral individuals in some cases also strictly prefer insurance, even when this is against an above actuarially fair premium. Therefore, the focus is more on why risk neutral and risk averse individuals prefer insurance instead of the degree of displayed risk averse behaviour.

Furthermore, there is a lot of scientific literature that focusses on whether the presence of insurance increases or decreases total health care costs and whether this is beneficial to society. A report about the costs to society when a large part of the population lacks health insurance identifies this presence of many uninsured individuals as a cause for high and rising costs to the American society (Institute of Medicine (IOM), 2003). These costs to society follow mainly from lost health and longevity, financial risks, lost workforce productivity, and financial instability of institutions and health care providers in neighbourhoods with relatively high rates of uninsured individuals. So most of these costs to society are caused by lack of access to proper health care, not increased use of insurance.

In contrast to this there are also cost increasing effects of insurance itself that are identified in current literature. One of the limitations of insurance is discussed by Arrow (1963, 1968) and Pauly (1968) who explain how insurance can enable moral hazard among the insured. Coverage for some or all medical related costs reduces or completely removes the incentive for individuals to limit medical expenses. For an insured individual it becomes convenient to, for example, visit a general practitioner more often, consume more expensive medical treatments, or simply be more careless with one's health. A study about the trade-off between the benefits of risk pooling and this increase in moral hazard showed that the net effect is zero for a co-insurance plan of 45%, meaning that at this level of co-insurance the loss of increased moral hazard equals the gain from risk-pooling (Manning & Marquis, 1996). They also show that at a lower level of co-insurance the increased costs of moral hazard outweigh the gains of risk-pooling leading to a net welfare loss.

Another cost increasing aspect of insurance comes from the fact that it is impossible to operate an insurance firm without incurring administrative costs. To be more precise, a paper by Jiwani et al. (2014) showed that of all spending on clinical care and administration in the U.S. health care system 18 percent is allocated to billing and insurance-related costs. So, although billing costs are inherent to health care systems and will also be incurred without insurance, a big part of all health care costs comes from billing, administrative, and monitoring expenses related to insurance companies.

Both the problem of moral hazard and administrative expenses can increase total health care costs for society. However, these explanations for the possible cost increasing effects of insurance mainly focus on the demand side of the market, meaning the costs incurred due to the interaction between the consumers and the insurance company. This paper introduces a different explanation for the possible costs increasing effects of insurance by focussing on the reaction of a manufacturer of medicines on the presence of an insurance in the market. Instead of focussing on inefficiencies it explains how the presence of an optional insurance in a market enables a monopolistic manufacturer of a medicine to directly increase its prices beyond an individual's liquidity constraint.

The structure of this paper starts by introducing the model and analysing its outcomes. Then, three extensions will be added to the model to evaluate how the optimal price responds under changing assumptions, after which the implications of the paper will be discussed. Finally, the conclusion will provide a final summary of the analysis, some remarks on the limitations of the paper, and several suggestions for future research.

II. Model

Consider a population wherein every individual has a completely uncorrelated chance of either falling ill to a disease or remaining healthy. For this disease exists a treatment medicine which is supplied by one manufacturer, so he is a monopolist in this market. Furthermore, I consider the case where the manufacturer is only concerned with maximizing his own profits, π_m. The profit function of this manufacturer is denoted by:

(1) $$\pi_m = Q(P) * (P - c) - F$$

Here *P* denotes the price of the medicine, *Q(P)* the quantity sold as a function of *P*, *c* the marginal costs incurred per unit of medicine, and *F* the fixed costs. In the first stage of the analysis I assume marginal costs to be zero, but this assumption will be revisited in a later extension. Next to that I assume that there is perfect information in this market.

If the disease remains untreated by this medicine, it causes damage *D* to the individual that suffers from the illness. Furthermore, let the probability of falling ill to this disease be represented by *q*, with range $0 < q < 1$, and the mass of the population by *N*. Each individual within the population has a liquidity constraint and all constraints are uniformly distributed over the interval [0, 1]. Let x_i be the liquidity constraint, where x_i defines the liquidity of an arbitrary individual *i*.

To look at the effect of an optional insurance in the market I introduce an option for the individuals in the population to buy insurance. The insurance charges premium *z* to all individuals that choose to insure themselves and it covers all costs of the medicine when someone falls ill to the disease, so the insurance will pay the costs of the medicine *P* to the manufacturer. I also assume that the insurer charges a price equal to expected costs per individual, so without a profit margin. In a later extension I will add a profit margin, *y*, to the price of the insurer.

In the third and last extension I will add a competitor to the model. Although the original manufacturer is still a monopolist of his own medicine, this competitor offers an alternative treatment that is less expensive but has a lower quality level. Let α denote this quality difference between the two different medicines. Furthermore, let P_2 be the price of the alternative medication offered by the competitor. For clarity, the original manufacturer will be referred to as manufacturer 1 and the competitor will be referred to as manufacturer 2.

III. Analysis

The above described model allows to evaluate the effect of an optional insurance on the price of a medicine. First, I look at the situation in the market without the presence of an optional insurance.

III.A Optimal price without insurance

The damage of the illness *D* is exogenous, and the price *P* is endogenous, as the price is set by the manufacturer. Since the manufacturer focusses on maximizing his own profits it follows that he will set a price $0 < P < D$. The intuition behind this is that the manufacturer will strictly prefer to sell his medicine, since there are no marginal costs, and there will be no demand for the medicine if $P > D$. From this it follows that those who get sick, which is proportion *q* of the population, wish to buy the medicine for price *P*. However, every individual has a liquidity constraint which means that only those individuals who have a liquidity constraint that exceeds the price of the medicine can afford to buy it. So, an arbitrary individual *i* who suffers from the illness will buy the medicine if $x_i - P \geq 0$. As the liquidity constraints are uniformly distributed from 0 to 1 the proportion of the population that can afford the medicine is $1 - P$.

With this information it is now possible to derive the price that the manufacturer sets for the medicine. For this I insert the defined variables into the standard profit function of the manufacturer (1) which results in the following profit function:

(2) $$\pi_m = qN(1 - P) * P - F$$

Here $qN(1 - P)$ is the proportion of the population that suffers from the disease and can afford the medicine. Optimizing this function with the first derivative to *P* gives:

(3) $$\frac{d\pi_m}{dP} = qN(1 - 2P) = 0$$

(4) $$P = \frac{1}{2}$$

So, without insurance in the market the optimal price to set for the manufacturer, when maximizing profits, is $P = \frac{1}{2}$. And his profit will be:

(5) $$\pi_m = qN\left(1 - \frac{1}{2}\right) * \frac{1}{2} - F = \frac{qN}{4} - F$$

III.B Optimal price with insurance

As mentioned in the model section, insurance is added to the market to evaluate the effect this insurance has on the price level of the manufacturer. Following from the assumption that the insurance charges endogenous premium *z* equal to expected costs per individual I obtain that *z* is:

(6) $$z = EC_i = q * P + (1 - q) * 0 = q * P$$

Demand for this insurance will exist as long as the price of premium *z* is less than the expected harm of the disease, so $qP < qD$. From this it follows that the manufacturer will still prefer to set the price of the medicine lower than the damage of the disease, so $P < D$.

The introduction of the insurance also changes who can afford access to medication as individuals now only need to be able to afford the price of the insurance resulting in an adjusted constraint of $x_i - qP \geq 0$. However, as stated in the model section there is perfect information in the market, so the manufacturer knows that there is an insurance and that the premium *z* is dependent on the price of his medicine *P*. The manufacturer can take this into account with his own determination of the optimal price *P* when maximizing profits. This results in the following new profit function:

(7) $$\pi_m = qN(1 - qP) * P - F$$

Optimizing this function with respect to *P* gives:

(8) $$\frac{d\pi_m}{dP} = qN(1 - 2qP) = 0$$

(9) $$P = \frac{1}{2q}$$

In this scenario the optimal price to set for the manufacturer is $P = \frac{1}{2q}$. And his new profit function will be:

(10) $$\pi_m = qN\left(1 - \frac{1}{2q}\right) * \frac{1}{2q} - F = \frac{N}{4q} - F$$

From this optimisation it follows that for every $q < 1$ the optimal price will be $P > \frac{1}{2}$. The difference between the first and second scenario is that without insurance the optimal price to set for the manufacturer is $P = \frac{1}{2}$ and with insurance this changes to $P = \frac{1}{2q}$. This shows that the presence of the insurance in this market increases the price of the medicine, and this price is negatively correlated with the probability of getting sick. If *q* decreases *P* increases and vice versa. From this new optimal price of *P* it follows that the insurance allows the manufacturer to inflate his prices beyond the maximum liquidity constraints of the individuals in the market, in particular I obtain that for all $q < \frac{1}{2}$ the optimal price will be $P > 1$. Without insurance the manufacturer would never choose a price $P > 1$ because no individual would be able to afford the medicine resulting in zero demand. However, with the insurance an individual only pays $z = qP$ which is only a proportion of the total price of the medicine. Everybody is paying for the medication that is only used by the proportion of the population that gets sick. The manufacturer can anticipate this effect when insurance is present in the market and raise the price accordingly. The manufacturer knows that charging a higher *P* will increase the premium of the insurance and decrease the amount of individuals that can afford this premium. The optimal level of this interaction is at the point where individuals pay $z = \frac{1}{2}$, which follows from combining (6) and (9):

(11) $$z = EC_i = q * P = q * \frac{1}{2q} = \frac{1}{2}$$

So, the insurance enables the manufacturer to increase his profits by raising the price of the premium to $z = \frac{1}{2}$, which is done by raising his own price *P* to a level beyond the individual liquidity constraints in the population. This ability to increase *P* is limited though by the level of *D*, because as mentioned individuals in the population will only buy the insurance if it costs less than the expected harm of the disease.

The presence of an optional insurance and the increase in the price of the medicine has two interesting consequences. Firstly, next to the risk averse individuals a part of the risk neutral individuals in the population will strictly prefer to buy the insurance, in particular those who cannot afford the medicine. These individuals have to choose between the costs of insurance or the expected damage of falling ill, since buying the medicine is not an option. As long as the costs of the insurance is less than the expected damage of the disease they will strictly prefer insurance over no insurance. The increase in the price of the medicine can even have the effect that all risk averse and risk neutral individuals will strictly prefer insurance. When price *P* increases to the point where it exceeds the maximum liquidity constraint the medicine becomes unaffordable for all individuals in the population. In this case, all individuals must choose between the price of the insurance or the expected harm of the disease resulting in that all risk neutral and risk averse will prefer to buy the insurance. Whether risk seeking individuals in the population prefer insurance depends on their degree of risk seeking behaviour.

Secondly, total health care costs increase drastically due to the introduction of the insurance. The increase in the price of the medicine increases total health care costs of the population. As seen in (11) the price of the premium will end up at $z = \frac{1}{2}$ as long as *D* is high enough. The optimal price of the insurance becomes just as expensive as the medicine was before the introduction of optional insurance. However, as *P* has increased less people can pay for the medicine and will have to buy the insurance. This results in increased profits for the manufacturer and higher costs for the population as a whole, so the manufacturer seizes the benefits for consumers as his profits. Furthermore, compared to the situation without insurance there is also no benefit for those who were previously unable to afford medicine as the insurance takes the same price, and is therefore also too expensive for them.

IV. Model extensions

The previously described model has a very specific set of assumptions such as no marginal costs or profit margin for the insurer. In this section several extensions to the model and their implications will be discussed. First, I will investigate the changes to the pricing structure when the manufacturer incurs marginal costs for the production of the medicine. Secondly, I introduce a profit margin for the insurer into the model to look at how this affects the optimal price of the medicine. And lastly, I will focus on how the model changes if the manufacturer has a competitor in the market that offers an alternative medicine of lesser quality.

IV.A Adding marginal costs of the manufacturer

As mentioned in the model section marginal costs is denoted by c. For this section I assume that that the manufacturer does incur constant marginal costs to produce the medicine, so $c > 0$. This changes the profit function of the manufacturer (7) to:

(12) $$\pi_m = qN(1 - qP) * (P - c) - F$$

Differentiating this function to find the optimal price for the manufacturer gives:

(13) $$\frac{d\pi_m}{dP} = qN(1 - 2qP + qc) = 0$$

(14) $$P = \frac{1+qc}{2q} = \frac{1}{2q} + \frac{c}{2}$$

From this it follows that, as the formula shows, the price of the medicine only increases by half of the marginal costs. This change in the optimal price will also affect the premium of the insurance. The premium now changes to:

(15) $$z = EC_i = q * P = q * \frac{1+qc}{2q} = \frac{1+qc}{2}$$

So, when adding marginal costs to the equation we can see that the price of the medicine increases by $\frac{c}{2}$ and the price of the premium of the insurance by $\frac{qc}{2}$. The importance of this finding is that marginal costs do not change the situation much, they are simply split between the manufacturer and the consumer. This shows that it is reasonable to assume marginal costs to be zero in the analysis, as it does not affect the price increasing effect of the insurance.

IV.B Adding a profit margin of the insurance company

Now I look at the second addition to the model, a profit margin for the insurance company. A more realistic assumption for this market is that the insurer also has the intent of making a profit, in his case from the sale of the insurance. Adding a profit margin for the insurer changes the price structure for the premium *z* charged by the insurer. So, in this section it is no longer assumed that *y* is zero. This changes the cost structure of *z* (6) to:

(16) $$z = EC_i + profit\ margin = qP(1+y)$$

Since perfect information is still present in the market the manufacturer is aware of this profit margin in the price charged by the insurer, and can account for this in determining his optimal price *P*. As *y* would increase the price of the insurance it affects who can afford the insurance in the population. With the added profit margin the proportion of the population that can afford to buy the insurance comes down to $1 - qP(1+y)$. Inserting this into the profit function of the manufacturer, and optimizing for *P* by differentiation, yields a new optimal price of:

(17) $$\pi_m = qN(1 - qP(1+y)) * (P) - F$$

(18) $$\frac{d\pi_m}{dP} = qN(1 - 2qP(1+y)) = 0$$

(19) $$P = \frac{1}{2q} * \frac{1}{1+y} = \frac{1}{2q(1+y)}$$

The optimal price for the manufacturer is inversely related with the profit margin of the insurer. If *y* increases the price *P* decreases. To see if this also affects the final price charged to the consumers in the form of the premium *z* I insert the new formula for *P* into the price structure of *z* (16):

(20) $$z = qP(1+y) = q * \frac{1}{2q(1+y)} * (1+y) = \frac{q(1+y)}{2q(1+y)} = \frac{1}{2}$$

Although one would expect a double marginalization problem to occur in this case, this is not reflected in the price. The price of the insurance does not change after including a profit margin for the insurer. However, an explanation for this is that I assume the profit margin to be a fixed percentage added to the actuarially fair premium. Because the manufacturer knows the profit margin beforehand he can set his price accordingly so that no double marginalization problem occurs, which is beneficial for his own profits. Under these conditions the optimal price of the premium remains at $z = \frac{1}{2}$, while the optimal price of *P* decreases. The profits generated in the market are now shared between the manufacturer and the insurer, as *y* and *P* are inversely related. Although the insurer takes over some of the profits of the manufacturer this does not counteract the increased prices resulting from the introduction of the insurance, the price of the medicine is still much higher than before the presence of an optional insurance. The introduction of a constant profit margin for the insurer therefore has a negative effect on the manufacturer, as his overall profits decrease, but no negative effect for the consumers, since the price of *z* stays the same.

It is also possible to combine this extension with the previous extension in the original model. Combining both the marginal costs for the manufacturer and profit margin of the insurer provides a clearer image of the price breakdown for both *P* and *z*:

(21) $$\pi_m = qN\big(1 - qP(1+y)\big) * (P - c) - F$$

(22) $$\frac{d\pi_m}{dP} = qN\big(1 - 2qP(1+y) + qc(1+y)\big) = 0$$

(23) $$P = \frac{1}{2q} * \frac{1}{1+y} * \big(1 + qc(1+y)\big) = \frac{1}{2q(1+y)} + \frac{c}{2}$$

(24) $$z = qP(1+y) = q * \left(\frac{1}{2q(1+y)} + \frac{c}{2}\right) * (1+y) = \frac{1+qc(1+y)}{2}$$

In conclusion, the optimal price *P* of the manufacturer is decreasing in *q* and *y*, and increasing in *c*. The premium of the insurance is increasing in all *q*, *c,* and *y*.

IV.C Introducing a competitor

In this section I will introduce the competitor, as defined in the model section, to the market to evaluate how this affects the prices set by manufacturer 1. As stated manufacturer 2 sells a medicine for the same disease but has a lower quality. This quality difference between the two medicines, denoted as α, can be seen as the discomfort still experienced when using the medicine of lesser quality. The costs incurred when buying the alternative medicine are therefore P_2 and α. As long as $P_2 < D - \alpha$ individuals in the population will strictly prefer to buy the alternative medicine over being sick. In this scenario I assume that the individuals can buy insurance for either one of the medicines under the same assumptions as before. So, if an individual chooses insurance for the medicine from manufacturer 1, they pay $z = EC_i = q * P$. And if they choose insurance for the alternative medicine from manufacturer 2 they pay $z_2 = EC_i = q * P_2$.

Individuals in the population will prefer the better medicine if $P - P_2 < \alpha$, so when the difference in price between de medicines is less than the difference in quality. The proportion of the population that buys a medicine in general is $1 - P_2$ and the proportion that buys the better medicine is $1 - P$, as long as $P - P_2 < \alpha$ holds. Manufacturer 1 will always set a price P where this constraint holds, as otherwise there will be zero demand for his medicine. The profit function of manufacturer 1 (7) does not change:

(25) $$\pi_{m1} = qN(1 - qP) * P - F$$

Manufacturer 2 will have a different profit function. He will sell his medicine to the part of the population that can afford the insurance of his cheaper medicine, but is not able to afford the better medicine from manufacturer 1. His profit function will be:

(26) $$\pi_{m2} = qN\big((1 - qP_2) - (1 - qP)\big) * P_2 - F$$

The optimal price of P_2 to set for manufacturer 2 will be:

(27) $$\frac{d\pi_{m2}}{dP_2} = qN\big((1 - 2qP_2) - (1 - qP)\big) = 0$$

(28) $$P_2 = \frac{P}{2}$$

It follows that the optimal price for manufacturer 2, when maximizing his profits, is half of the price set by manufacturer 1. This provides an interesting implication for the ability of manufacturer 1 to increase the price of P. Without competition his binding constraint is $P < D$. But now with competition another constraint is added, namely $P - \frac{P}{2} < \alpha$ which can also be written as $\alpha > \frac{P}{2}$. If the quality of the medicine from manufacturer 1 is not at least $\frac{P}{2}$ better than the medicine from manufacturer 2 the individuals in the population will prefer the alternative medicine. Adding a competitor with an alternative medicine to the market therefore constraints the ability of manufacturer 1 to increase his price. How much this constrains the price increase in *P* depends on the quality difference between both medicines.

From the above results another very interesting implication follows. If *P* increases the difference between *P* and P_2 increases, allowing both manufacturers to capture more profits. Both manufacturers want to increase the quality difference to the point where manufacturer 1 can charge his optimal price *P*, so that the insurance premium for his medicine is $z = \frac{1}{2}$. This incentive for manufacturer 1 is clear, as optimizing his profit function ends up at this price. However, manufacturer 2 also has the same incentive because he can sell his medicine for a higher price to a bigger share of the population, when manufacturer 1 increases his price. As long as the insurance premium for the alternative medicine is $z_2 < \frac{1}{2}$ manufacturer 2 can increase his profits when *P* increases. On one hand this provides manufacturer 1 with incentives for innovation, if he can increase the quality of his product he increases α and can then increase his profits accordingly. However, on the other hand this also provides manufacturer 2 with an incentive to enter the market with a purposely worse medicine. Decreasing the quality of the alternative medicine also leads to an increase in α and therefore an increase of his profits.

V. Discussion

The analysis of the model and the extensions showed interesting results about the price increasing effect of insurance. Within the model an introduction of an insurance can allow a monopolistic manufacturer of a medicine to directly increase the price of medication. Here the consequences of this effect will be discussed.

V.A Implications of findings within scientific literature

As mentioned in the introduction Zeckhauser (1970) described in his paper that the main purpose of insurance is to reduce the risk of high unexpected payments. However, the model in this paper showed how it is possible that this benefit of insurance can be completely or partially eradicated by profit maximizing behaviour of the manufacturer. Without insurance in the market, the costs of falling ill were $P = \frac{1}{2}$, and after the introduction of the insurance the premium for this insurance was $z = \frac{1}{2}$. From this it follows that the benefit of insurance, reducing the costs of high unexpected payments, can be partially or completely counteracted by profit maximizing behaviour of a manufacturer. Furthermore, Manning and Marquis (1996) found that most families often choose health insurance as they exhibit risk aversion with regards to medical expenses. This paper also showed that it is in the best interest of risk averse individuals to choose insurance, but it adds that risk neutral individuals also often prefer health insurance. A part of the population is not able to afford the medication without insurance, so when these individuals have to choose between the price of the insurance or the expected harm of the disease they often prefer the insurance even though they are inherently risk neutral. Part of this finding could explain why Friedman (1974) found that risk aversion among individuals is decreasing as their income increases. If the liquidity constraint of individuals increases enough to be able to afford the medication without insurance, they might start displaying risk neutral or risk seeking behaviour by not buying insurance.

Scientific literature by Arrow (1963, 1968) and Pauly (1968) showed how insurance can increase prices through moral hazard, insured people often overconsume medical services since they do not incur the full costs of the treatments. Jiwani et al. (2014) added that monitoring costs and billing related expenses of insurance further increase total health care costs of society. This paper adds another explanation to how insurance can lead to higher health care expenses of society, the actual increase in the prices of medication. Through anticipation of the manufacturer he is able to shift the benefits from insurance to his own gain, in this way redistributing the consumer surplus to his personal producer surplus.

The last extension showed the changes to the model when a competitor is introduced to the market. Under the assumptions of the model this introduction leads to an extra constraint on the price increase of the manufacturer. Following from this extra constraint, the manufacturer of the better medicine has an incentive to increase the quality of his product as this can increase the maximum amount of profits he can obtain. The manufacturer of the medicine with lesser quality has an incentive to actually decrease the quality of his medicine, as his profits would also increase as a result. However, these conclusions do not take into account the findings of Ellison and Snyder (2010) who showed that supplier competition can lead to discounts for large buyers within the pharmaceutical industry. The used model in this paper does not incorporate this contribution, so the predicted results could turn out different if this is included.

V.B Welfare effects

The implications of this paper also provide interesting discussion points regarding the welfare effects of insurance. Within this model the social benefit of more accessible health care is eradicated by the price increase of the manufacturer. The market ends up in a situation where half of the population has no access to treatments as they can neither afford the insurance nor the medicine. Although these effects are probably less severe in real markets, it still holds that the manufacturer has a possibility to increase his prices. Even if only part of the benefits are seized by the manufacturer, this will still result in that a part of the population has no access to medication because the insurance will be to expensive. This could be problematic for the population in question as a lack of proper insurance coverage can contribute to increasing inequality in society (Townsend, 1995). This in turn raises questions whether government intervention is desirable or not. If governments fixate the prices of medication, the medication becomes more available to society. Based on the findings of the Institute of Medicine (2003), which show that uninsured individuals are the cause of high and rising costs to society, more accessible insurance can have positive consequences. Whether the positive effects of more accessible health care outweigh the deadweight loss of government intervention will probably differ per market. It is however highly advisable to investigate this, as identifying whether government intervention is desirable can have important policy implications.

During this paper the constraint that $P < D$ was used. Although risk averse individuals would maybe still prefer insurance for *P* when $P > D$ many individuals would no longer be interested in the medicine. However, if the above mentioned costs to society of uninsured individuals are incorporated into the analysis it could still be beneficial to society if the individual buys the medicine when $P > D$. This follows from that costs to society are not only individual costs *D*, but also the added costs as mentioned above. How the market would respond if $P > D$ occurs is hard to predict, but I would expect that government intervention is needed to stimulate individuals to consume the medicine, since on an individual level they have no incentive for consumption. It can be very interesting to study the model under the condition that $P > D$ as this can have important implications for the overall welfare effects of insurance.

VI. Conclusion

In the previous section the findings of this paper were discussed and evaluated in context to earlier scientific literature. This section will discuss the further findings of the model, its limitations, and suggestions for further research. In the extension marginal costs and a profit margin for the insurer were added to the defined model. This showed that marginal costs are split between the manufacturer and consumer, which increases the price a bit but has no further influence on the price increasing effect. Adding the profit margin for the insurer showed that this did not increase the price of the premium, which could mean that the manufacturer already captures the maximum achievable amount of profits in the market as a monopolist. So as soon as the insurer starts to charge a profit margin as well, they share the profits of the manufacturer. However, there are certain limitations to this finding. Stating that the manufacturer adjusts his price after observing the profit margin charged by the insurer assumes that the insurer sets his profit margin first. It could very well be that the insurer waits to observe the price of the manufacturer before determining his own profit margin. Furthermore, the profit margin of the insurer is assumed to be a constant margin on top of the actuarially fair premium. In real markets it is not unlikely that insurance companies have a more complex profit structure, making it impossible for the manufacturer two completely account for this influence on the price. Although the implication that a part of the manufacturer's profits are transferred to the insurer is still valid, it is questionable that completely no double marginalization problem will occur in real markets.

The last extension displays how adding a manufacturer of an alternative medicine to the market changes the ability for the first manufacturer to increase his price. It shows that the extent to which the manufacturer can increase his prices is dependent on the quality difference between both medicines. However, the extension assumed that this quality difference is perfectly observable and can be represented by one variable that is constant for everybody. In reality most consumers in a population cannot accurately value the difference in quality between different types of medication, due to over- or undervaluation of either medicine. It could also be that the negative effects of using the medicine of lesser quality are valued differently among individuals. For example, being sick for 5 weeks can be very problematic for one individual while not so much of a problem for another. As shown in the extension, the difference in the prices of both medications are constrained by the difference in α. If this difference becomes less accurately observable it could constrain the prices even more, because the quality difference would be undervalued. If the manufacturers can cause the quality difference to be overvalued, this will reduce the price constraint. So, next to the incentive to increase the actual quality difference the manufacturers also have an incentive to increase the perceived quality difference between the medicines.

Another limitation of the model is that it assumes perfect information in the market. Because of this perfect information the model clearly displays how insurance leads to increases in price, however in reality perfect information almost never exists. Without perfect information the variables in the model would be less accurately known, for example the harm of the disease, the profit margin of the insurer, and the quality difference between types of medication would all be less observable for the manufacturer. I would expect this to reduce the severity of the results as the manufacturer now has to work with estimates. However, to know the exact consequences of imperfect information further research is needed on this topic and how the model behaves under imperfect information.

Next to that, this paper focusses on a market with an insurance that covers only one disease. In reality insurances cover many diseases and treatments under one premium, so the situation would not be so abstract. It could very well be that the identified effects of introducing an optional insurance are not so severe or less observable. Researching whether and how the identified price increasing effect can be observed in more broader insurance markets can be a valuable addition to scientific literature as well.

VII. References

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