Limited Attention and the Demand for Health Insurance*

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Abstract

We analyze how customers with limited attention value and choose among health plans. We show how the model can accommodate four observations regarding plan choice. First, people overweight the premium and thus underappreciate the value of health insurance. Second, insurance companies have a strong incentive to reduce quality and to hide these shortcomings in the fine print while attracting customers with insufficiently lower premiums. Third, customers may choose dominated alternatives. Finally, the willingness-to-pay for insurance is subadditive creating an incentive for providers to unbundle comprehensive plans. We discuss how these effects may result in a fundamental dilemma for policy makers.

JEL Classification: D18, D89, I11, I13

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1 Introduction

Health insurance plans are complex products. They may differ in premiums, which diseases/treatments are covered, co-payment rates, deductibles, coverage of dependents, health incentives, maximum benefits, and many more aspects. Choosing whether to buy, and if so, which plan to buy, is thus seen as a difficult task.\(^1\) Accordingly, there is a strong need for advice on health plan choice and frequent efforts to provide such.\(^2\) Advice on health plan choice and its many dimensions are also a frequent topic in the media.\(^3\)

The topic of complexity of choice has attained increasing attention among economists. Specifically, the introduction of Medicare Part D prescription drug insurance in the United States offers an opportunity to study how consumers choose from a wide array of products differing on several dimensions. The question of whether consumers make optimal choices in that context has been the subject of extensive research.\(^4\) Both theoretical and empirical work has concentrated on the abundance of available options, thus highlighting the cognitive load associated with the number of options available.\(^5\) In consequence, discussion has focused on whether a restricted choice set would make consumers better off. This discussion however neglects a dimension of choice complexity. Choosing the right health plan is difficult not only because there are so many options available, but in particular because these plans differ in so many attributes.\(^6\) It is this aspect of choice complexity and its implications for choice among health plans that is the focus of this work.

We use a model developed in Dahreßmoller and Fels (2012) to depict how consumers with limited attention simplify multi-dimensional choice problems in order to reach a decision. Our results are driven by three basic assumptions, two of which have already been proposed in the literature on focusing and salience. First, we assume attention to be directed towards those aspects of the choice problem that incorporate the largest utility differences (see Köszegi and Szeidl (2013), Bordalo,

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\(^1\)See Loewenstein, Friedman, McGill, Ahmad, Linck, Sinkula, Beshears, Choi, Kolstad, Laibson, Madrian, List, and Volpp (2013) as a recent study that provides strong evidence regarding consumers’ limited understanding of health insurance.

\(^2\)As an example, the U.S. federal government offers information on health plans and advice to understand the different features of health plans on www.HealthCare.gov.

\(^3\)See e.g. http://www.nytimes.com/2010/10/16/health/16patient.html


\(^5\)See e.g. Frank and Lamiraud (2008), Iyengar and Kamenica (2010), and Schram and Sonnemans (2011).

\(^6\)One might argue further that the difficulty of having so many options would not arise if it was not for the possibility to vary health plans on so many dimensions.
Gennaioli, and Shleifer (2012), and Bordalo, Gennaioli, and Shleifer (2013)). Second, we assume a
tendency to completely neglect some aspects of the choice problem in order to simplify the decision
(see Gabaix (2011)). Finally, we argue that there is a strict attention hierarchy, i.e. that no two
aspects of a choice problem can receive the same amount of attention, an assumption we discuss
in more detail later. These three properties of our model allow us to make four propositions on
the demand for health insurance.

We want to propose limited attention as a possible explanation for demand phenomena that
have been observed in the context of health insurance, yet are difficult to reconcile within existing
models. First, we predict people to focus on the premium when deciding whether to purchase
health insurance. The premium incorporates the largest utility difference across options for an
average individual thereby attracting most attention in the insurance problem. This implies
that people underappreciate or even neglect several of the benefits associated with having health
insurance, and, consequently, undervalue health insurance. This is in line with empirical findings
by Abaluck and Gruber (2011) as well as Heiss, Leive, McFadden, and Winter (2012). Also,
it is well in line with the suggestion of Baicker, Congdon, and Mullainathan (2012) that there
might be psychological barriers to take up health insurance. Second, the tendency of customers
to focus on a limited number of diseases covered and to neglect the coverage of others allows
firms to decrease the quality of their health plans unnoticed. We derive conditions under which
customers choose health plans that exclude coverage of certain diseases not because coverage is
deemed undesirable, but because the lack of coverage is ignored due to cognitive limitations. This
topic has been mostly neglected in the health economics literature to date. Yet, media coverage
and an abundance of Internet advice indicate that there is some popular interest in the topic of
insurance providers hiding limited coverage in the fine print of the contract.\footnote{Addressing such
concerns, the Affordable Care Act in the USA mandates insurers to provide a summarized
statement of insurance benefits explicitly prescribing a minimum type size.} In this paper we
argue that it is not insufficient font size but the sheer size of the insurance contracts that results
in customers making less-informed choices. The first and second proposition are both driven by
our assumption of directed attention.\footnote{The other two assumptions are not necessary for the result, yet strengthen it.} In addition to the underappreciation of the benefits of
insurance, we propose that customers may make dominated choices if they happen to neglect
exactly those plan attributes in which the domination occurs. Models that incorporate neglect
such as ours or Gabaix (2011) can explain the observation of dominated choices in the context
of health insurance as documented by Sinaiko and Hirth (2011) that stands in sharp contrast to
any preference-based model of choice. Finally, we show how the undervaluation of comprehensive health plans creates an incentive for an insurance provider to unbundle and offer several more specific insurance plans individually. This is driven by our assumptions of directed attention and of a strict attention hierarchy. Unbundling effects similar to the ones we propose have been reported by Johnson, Hershey, Meszaros, and Kunreuther (1993). We analyze which insurance plans are offered in market equilibrium and conclude the paper by arguing that the effects we describe produce a serious dilemma for policymakers.

It has already been argued by Liebman and Zeckhauser (2008) and Baicker, Congdon, and Mullainathan (2012) that behavioral factors could play a major role in the markets for health care and health insurance. We seek to discuss one such factor, the complexity involved in the insurance purchase decision. Similar to other authors, Liebman and Zeckhauser (2008) stress education and information provision as promising interventions to overcome behavioral biases. We fear that such interventions may be less promising with regard to the bias we discuss here. The complexity problems involved in the insurance decision are a result of the necessity to absorb and process a large amount information. Providing additional information might then turn out to be less helpful or even counterproductive.

Customers' tendency to neglect and the resulting ability of firms to exploit such inattention have already been investigated in industrial organization settings.\footnote{See Gabaix and Laibson (2006), Dahremöller (2013), and Heidhues, Kőszegi, and Murooka (2013), among others.} These works typically assume an ability by firms to shroud some aspects of a product. In our framework, inattention is endogenous to the choice set due to customers' simplification strategy. On the one side this specifies a particular shrouding "technology", one the other side it invokes restrictions as to which aspects can be shrouded and as to how this can be achieved. It has been shown in Dahremöller and Fels (2012) that this may lead to the opposite result of a firm being unable to exploit inattentive customers in a monopoly setting. Interestingly, we see the ability to exploit inattention reemerge when we look at more competitive markets in sections 3 and 6.

We will proceed as follows. Section 2 introduces the problem of whether to purchase health insurance and establishes the undervaluation of insurance if customers’ attention is limited. Section 3 shows the great scope for profitably undercutting any incumbent health plan by reducing quality unnoticed. Section 4 discusses customers’ propensity to make dominated choices. Section 5 summarizes experimental evidence suggesting the profitability of unbundling comprehensive in-
surance plans and indicates how the model of limited attention can accommodate that evidence. Section 6 investigates which health plans are offered in market equilibrium. Section 7 concludes by shortly discussing some implications of these results for policy.

2 The Problem of Buying Insurance

We model the problem of buying health insurance as a problem of choosing between two multi-
dimensional alternatives. Let the insurance contract be described by a premium $P$ and a coverage rate $\alpha \in [0, 1]$, i.e. the share of treatment cost the insurance pays. Each alternative in the choice set is associated with a vector of consequences $((x_1, \pi_1), \ldots, (x_m, \pi_m))$ where $x$ describes the consequence, while $\pi$ describes its probability. For example, buying health insurance incorporates the certain payment of a premium $(-P, 1)$. Second, it comprises consequences contingent on developing a disease. Let $I, |I| = n$ denote the finite set of diseases and assume that the occurrence of different diseases are disjoint events. For expositional purposes, suppose here that there are only two diseases $I = \{1, 2\}$. Buying insurance ensures the reception of treatment if need be. Thus it is associated with the health-related consequences $(-D_i + T_i, \pi_i)$, $i = 1, 2$ where $D_i$ denotes the deterioration of health due to disease $i \in I$, $T_i \leq D_i$ the improvement of health due to medical treatment of disease $i$, and $\pi_i$ the probability of developing disease $i$. Furthermore, dependent on $\alpha$ buying insurance is associated with a monetary consequence of a copayment in case of a disease: $(-(1 - \alpha)c_i, \pi_i)$ where $c_i$ denote the monetary cost of acquiring treatment for disease $i$. In sum, the option insurance can be represented as $^\text{10}

\begin{equation}
\left((-P, 1), \left[(-D_i + T_i, \pi_i), (-(1 - \alpha)c_i, \pi_i)\right]_{i \in I}\right).
\end{equation}

In contrast, the alternative remaining uninsured is represented by a different vector of consequences. Suppose there are two types of diseases. First, there are diseases for which the decision-maker is able to afford treatment even when having no insurance. Denote this set by $F \subseteq I$ and suppose here $F = \{1\}$. Then in case of disease 1, having no insurance is associated with the health consequence $(-D_1 + T_1, \pi_1)$ since we assume the benefits of treatment to outweigh the cost. Second, developing disease 1 is associated with the monetary consequence of having to pay the

$^\text{10}$For the moment, we assume that there are no diseases which are not covered by the insurance and no diseases for which the decision-maker is unable to afford treatment when having health insurance.
full cost of treatment \((-c_1, \pi_1)\). On the other hand, there may be diseases, for which the decision-maker is unable to afford treatment without insurance. Denote this set of diseases by \(\bar{F} = I \setminus F\)\(^{11}\) and suppose here that \(\bar{F} = \{2\}\). For all \(i \in \bar{F}\), remaining uninsured incurs the consequence of a deterioration of health \((-D_i, \pi_i)\). On the other hand, since the decision-maker is unable to afford treatment there is no monetary expenditure associated with receiving treatment, thus there is no monetary consequence.\(^{12}\) Thus the option of remaininsg uninsured is represented by a vector

\[
\left(\left[(-D_i + T_i, \pi_i)\right]_{i \in F}, \left[(-D_i, \pi_i)\right]_{i \in \bar{F}}\right). \tag{2}
\]

The decision-maker is both willing and able to purchase treatment for diseases \(i \in F\). Yet, he is assumed to be willing but unable to do so for diseases \(i \in \bar{F}\).

In order to solve the decision problem, the consequences of the available alternatives have to be ordered into categories, to which we henceforth refer as problem dimensions or aspects. One may think of this categorization process as a way of transforming the choice problem into a list of pros and cons of choosing one alternative over another. To arrive at such a representation, each consequence of an option is ordered into exactly one dimension. Two options each have a consequence in the same dimension if these two consequences are comparable.\(^{13}\) For example, the consequence of a co-payment in case of disease 1 associated with insurance is ordered into the same dimension as the full payment of treatment cost for disease 1 associated with remaining uninsured as they are both payments required to get treatment for disease 1. Similarly, the health consequence \((-D_2, +T_2, \pi_2)\) associated with insuring is categorized into the same dimension as health consequence \((-D_2, \pi_2)\) of a health deterioration associated with remaining uninsured as they both denote health consequences in case of disease 2. An option cannot have two consequences in one dimension. For example, the monetary consequences associated with disease 1 cannot be ordered into the same dimension with the monetary consequence associated with disease 2. Although both denote monetary consequences, they are associated with different events. Finally, there are consequences of one option that the other option lacks, such as the premium payment

\(^{11}\)Formally, if \(B\) is the decision-maker's budget, then \(\bar{F} = \{i \in I : c_i > B\}\).

\(^{12}\)Throughout, we abstract from monetary consequences associated with becoming sick that are unrelated to receiving treatment or insurance.

\(^{13}\)The question of what constitutes a dimension of a choice problem is highly relevant for our later results since it is these dimensions among which attention is allocated. We assume a categorization based on comparability that we deem sensible for the choice problem under investigation. This is also consistent with our assumption discussed later that the difficulty associated with solving multi-dimensional problems is based on the need to make commensurability judgments with regard to different dimensions that are difficult to compare.
associated only with insurance, or the monetary expenses for treating disease 2, also associated only with insurance. This means that the option remaining uninsured lacks a comparable consequence that we represent by associating a consequence (0, π) with that alternative in the respective dimension. The categorization process leads to a choice problem with several dimensions. Denote by \( J \) the set of problem dimensions and note that the categorization described above leads to \( |J| = 2n + 1 \). The relevant aspects of choosing whether to insure comprise the payment of a premium (or the lack of it), as well as the monetary and health consequences associated with each disease \( i \in I \).

The utility difference between two alternatives, here buying insurance versus not buying insurance, is assumed to be the sum of the utility differences in all dimensions of the choice problem. W.l.o.g. we assume the utility of an alternative in a dimension in which the respective alternative has no consequence to be zero.

Further, we assume the utility of a consequence to be linear. The difference \( U \) in utility between buying insurance and remaining uninsured is then

\[
U = v_p [-P - 0] + \sum_{i \in F} \pi_i v_h [(-D_i + T_i) - (-D_i + T_i)] + \sum_{i \in F} v_p \pi_i [(-(1 - \alpha)c_i) - (-c_i)] + \sum_{i \in F} \pi_i v_h [(-D_i + T_i) - (-D_i)] + \sum_{i \in F} \pi_i v_p [(-(1 - \alpha)c_i) - 0] = -v_p P + \sum_{i \in F} \pi_i v_p \alpha c_i + \sum_{i \in F} \pi_i v_h T_i - \sum_{i \in F} v_p (1 - \alpha)c_i \tag{3}
\]

where \( v_p \) denotes the marginal utility of money, \( v_h \) denotes the marginal utility of health. In our simplified setting with only two diseases this gives us

\[
U = -v_p P + \pi_1 v_p \alpha c_1 + \pi_2 v_h T_2 - v_p (1 - \alpha)c_2.
\]

The net utility of buying insurance comprises the disutility of the premium payment, the utility gain from receiving (partial) coverage of affordable treatment cost, the utility gain from receiving (otherwise unaffordable) treatment in case of disease 2, and the disutility from making a copayment in case of disease 2.

The linearity assumptions on both the utility from consequences and the cumulative utility function \( U \) imply risk neutral preferences. Accordingly, if the premium is actuarially fair, i.e.
\[ P = \sum_i \pi_i \alpha c_i, \text{ the value of insurance } U \text{ is given by} \]

\[
U = \sum_{i \in \bar{F}} \pi_i (v_h T_i - v_p c_i) > 0,
\]

or \[ U = \pi_2 (v_h T_2 - v_p c_2) \] in our simplified setting. The utility of insurance is the net value of access to otherwise unaffordable treatment provided by the insurance. Following Nyman (2003) the value of insurance to a risk-neutral customer is created through the access motive: the possibility to acquire treatment for diseases \( i \in \bar{F} \) for which the decision-maker is willing (thus the nonnegativity of the value) but unable to pay without insurance. We abstract from incentives due to risk preferences.\(^\text{14}\)

We assume that the decision-maker has difficulties thinking through each of the \((2n + 1)\) aspects in order to reach a decision. Specifically, incorporating every aspect of the problem into the decision requires judgments concerning the commensurability of different dimensions such as certain monetary consequences, uncertain monetary consequences, or uncertain health consequences. A full consideration of every aspect requires judgments as to how e.g. a disadvantage in the premium dimension compares to an advantage in terms of better health in case of a disease for which treatment is unaffordable. In addition, it requires a judgment as to how one advantage in e.g. a better health in case of one disease, say lung cancer, adds up to an advantage in better health in case of a different disease, say a flu. Appreciating each and every aspect of the problem thus requires a tremendous amount of commensurability judgments that all require cognitive effort. Thus, instead of fully evaluating the utility differences the decision-maker focuses on a subset of the relevant dimensions when making his choice. He thus bases his decision on the difference in decision utility \( \tilde{U} \):

\[
\tilde{U} := -m_p v_p P + \sum_{i \in F} m_{c(i)} \pi_i v_p \alpha c_i + \sum_{i \in F} m_{h(i)} \pi_i v_h T_i - \sum_{i \in \bar{F}} m_{c(i)} \pi_i (1 - \alpha) c_i
\]

where \( m_j \in [0, 1] \) is the attention a dimension \( j \in J \) receives, \( c(i) \) denotes the dimension comprising those consequences that refer to payments in case of disease \( i \), and \( h(i) \) denotes the dimension in which the health consequences of the options in case of disease \( i \) are compared.

\(^{14}\)Our results do not hinge on the functional form of \( U \) since we analyze a biased processing of the inputs of \( U \). With \( U = (1 - \sum_i \pi_i) [u(-P, -0) - u(-0, -0)] + \sum_i \pi_i [u(-P - (1 - \alpha) c_i, -D_i + T_i) - u(-c_i, -D_i + T_i)] + \sum_i \pi_i [u(-P - (1 - \alpha) c_i, -D_i + T_i) - u(-0, -D_i)] \) one may model the familiar expected utility-representation of the problem. Assuming \( u \) to be concave over its first input (the sum of all monetary consequences in a state), one can model risk aversion. As it greatly simplifies exposition we opt for a linear representation.
Limited Attention

We want to shortly discuss the attention allocation that is reflected in the attention parameters $m_{ij}$.\textsuperscript{15} An implicit assumption in models of multi-attribute decision-making is commensurability, i.e. the possibility to measure and compare different concepts by a common standard. A decision-maker has no problem to determine how much a better treatment for disease $i$ is worth compared to a worse (or no) treatment for disease $j$, or whether a better treatment for $i$ is worth $\$x$ to her or not. The attention allocation we assume seeks to depict that the cognitive process of making different consequence dimensions commensurable, that is necessary to attain an overall assessment of desirability of one option over another, is difficult. It is this difficulty that makes complex decisions such as insurance purchase hard. The best way to simplify such decisions is to avoid the task of making dimensions commensurable by ignoring at least some dimensions. This may lead to worse decisions, yet it reduces the cognitive effort.\textsuperscript{16} It remains to ask which dimensions it is sensible to focus on. We assume that the decision-maker focuses on those dimensions in which the utility differences are largest. The decision-maker takes those dimensions into account in which the available alternatives differ the most, and, given these differences, the decision-maker cares most about. The attention allocation thus models neglect as the result of a process of simplification and prioritization. It endogenizes neglect by making assumptions about the characteristics of the dimensions that are ignored, instead of directly assuming ignorance with regard to specific dimensions. Finally, we assume this attention allocation to be “hard-wired”, thereby avoiding questions of strategic ignorance and infinite-regress problems.

We assume a particular framing of the choice problem. In this frame, the premium, the monetary consequences, and the health consequences of each individual disease form a distinct problem dimension. Why do we deviate from the familiar lottery representation, i.e. a problem representation based on states of nature? Our choice is sensible since we argue that the difficulty in complex problems is due to the necessity of making different dimensions commensurable. A frame different from the one we assume, in particular the lottery representation, already prerequisites this act of making different consequences commensurable. For one cannot compare the utility in a particular state (say disease $i$) between two alternatives without assigning a utility for this state to each of the two alternatives. Yet, this assignment already requires to integrate judgments

\textsuperscript{15}A more extensive derivation and discussion can be found in Dahremöller and Fels (2012).

\textsuperscript{16}Note that considering not all of the alternatives, referred to as forming a “consideration set”, will not do the trick, since even as little as only two alternatives may differ on a large number of dimensions.
concerning the relative desirability of different consequences such as a premium payment (or the lack of it), the health consequence, and a copayment (or the lack of one) into an overall assessment of the desirability of a particular alternative given that \( i \) occurs. Assigning the attention weights to different states instead of different consequences would thus assume that it is a comparison across states that is difficult and not the comparison of different consequences. That would contradict our very idea of what makes multi-dimensional problems complex.

We now want to formulate the attention weights \( m_j \) that reflect the above considerations. Let \( \mu_j = \max_{g \in \Gamma} u(g, j) - \min_{g \in \Gamma} u(g, j) \) where \( u(g, j) \) denotes the utility of that consequence of alternative \( g \) which is ordered into dimension \( j \), and \( \Gamma \) denotes the set of all available alternatives \( g \).\(^{17}\) For example, the utility of insuring associated with the health consequence of disease 2 is \( u(\text{insuring}, h(2)) = \pi_2 v_h (-D_2 + T_2) \) while the respective utility for remaining uninsured is given by \( u(\text{uninsured}, h(2)) = \pi_2 v_h (-D_2) \). \( \mu_j \) denotes the maximum utility difference in dimension \( j \) from any binary comparison of alternatives in the choice set. Since in the case we consider here there are only the two options of insuring and remaining uninsured, \( \mu_{h(2)} = \pi_2 v_h T_2 \).

We assume a strict hierarchy \( r : J \to \{1, \ldots, |J|\} \), among the problem dimensions \( j \in J \) to which we henceforth refer as the attention hierarchy. This hierarchy obeys

\[
\mu_j > \mu_{j'} \Rightarrow r(j) < r(j'),
\]

i.e., dimensions with larger utility differences attain a higher attention rank. In case that (6) does not produce a strict order we assume a particular tie-breaking rule.\(^{18}\) Given a dimension’s rank in the hierarchy, the attention \( m_j \) it receives is given by

\[
m_j = \max \left\{ 0, 1 - \frac{\kappa_r(j)}{\mu_j} \right\}
\]

where \( \kappa_r(j) \) may be interpreted as the cognitive cost associated with considering the \( r \)th dimension of the problem. As we seek to model a decision-maker who has difficulties with solving complex

\(^{17}\)Recall that we assume \( u(g, j) = 0 \) for those alternatives \( g \) with no consequence associated with dimension \( j \).

\(^{18}\)If not stated otherwise we assume ties to be broken randomly.
problems we assume

\[(i) \kappa_1 = 0 \]  
\[(ii) \kappa_r < \kappa_{r+1}, \forall r. \]  

(8)  

(9)

This assumption reflects the rising difficulty of considering more and more dimensions of the problem. Eventually, if there are dimensions \(j\), such that \(\mu_j \leq \kappa_r(j)\), then \(m_j = 0\). This means that any differences between the alternatives in these dimensions are completely neglected. The attention allocation thus reflects a need to simplify the complex choice problem in order to reach a decision. This simplification is achieved by ignoring some of the differences between the options. Due to limited attention the decision-maker may not (fully) appreciate differences between the two alternatives.

**Undervaluation of Insurance**

Returning to our problem of insurance purchase we consider the following assumption:

**Assumption 1.**

\[v_p P > \{[\pi_i v_p \alpha c_i]_{i \in F}, [\pi_i v_h T_i]_{i \in \bar{F}}\}.\]  

(10)

The assumption states that (a) the premium exceeds the expected coverage of treatment cost of each individual disease, (b) for the diseases it provides access to treatment the value of the premium exceeds the expected value of this treatment for each individual disease. It turns out that this assumption is sufficient for the value of insurance to be underappreciated.

**Proposition 1. Undervaluation of Insurance**

If Assumption 1 is satisfied, then the decision-maker underappreciates the value of health insurance \((\bar{U} < U)\) that provides close to full coverage\(^{19}\) and may select not to insure despite it being individually optimal.

**Proof.** See Appendix. \(\square\)

\(^{19}\)Precisely, if the premium \(P\) is nondecreasing in the level of coverage \(\alpha\), and the premium for full coverage \(\alpha = 1\) is affordable, then there exists a level of coverage \(0 < \underline{\alpha} < 1\) such that the decision-maker underappreciates the value of insurance for any health plan \((\alpha, P)\) with \(\alpha > \underline{\alpha}\).
We argue that this implies that a majority of people underappreciates the value of health insurance. Consider the setting for which Assumption 1 is satisfied. Part (a) of the assumption is always satisfied if the premium is greater or equal the actuarially fair premium, i.e. if the insurer breaks even. Part (b) is satisfied if insurance covers sufficiently many diseases that are unlikely individually. We regard this assumption to be satisfied in the case of health insurance for the average customer, i.e. an individual with no severe pre-existing condition. This is based on the observation that the distribution of medical expenditures is highly skewed. The most common diseases have rather minor health consequences and available treatments tend to be cheap. These should constitute the diseases in $F$. On the other hand, the largest chunk of medical expenditures is created by rare diseases with highly expensive treatments. These should be the ones we would expect to form the set $\bar{F}$. Hence, we regard it as a valid approximation to assume that the probability to develop any particular disease $i \in \bar{F}$ is small. If (and only if) Assumption 1 is satisfied, the premium dimension receives full attention, $m_p = 1$, while all further dimensions $j \neq p$ are not fully considered, $0 < m_j < 1$, or even neglected, $m_j = 0$. Note that this implies that the cost of insurance (the premium) is fully considered while its benefits are not fully appreciated.\(^{20}\)

Consistent with this, Abaluck and Gruber (2011) find that elders place too much weight on the premium relative to expected out-of-pocket costs when choosing a Medicare Plan D prescription drug plan.\(^{21}\)

The value of insurance $U$ offering (close to) full coverage is not fully appreciated.\(^{22}\) First, people tend to underappreciate all the out-of-pocket cost of attaining treatment that health insurance takes over. Intuitively, as the number of potential diseases is large people are unable to take into account all the expected cost they have to cover privately if they remain uninsured. Second, people tend to underappreciate the access value provided by health insurance. Again, as the number of potential diseases is large, the decision-maker is unable to consider each disease for which he will not be able to afford treatment if remaining uninsured.

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\(^{20}\)The necessary and sufficient condition for full insurance to be underappreciated is $m_p > \bar{m}$, where $\bar{m}$ is the weighted average of the attention parameters associated with the dimensions $j \neq p$.

\(^{21}\)In addition, they find elders not to value variance-reducing aspects of health plans. This last finding is particularly striking as variance reduction is the classic argument for insurance purchase. We conclude that our approach to disregard incentives based on risk aversion can be viewed as a reasonable approximation.

\(^{22}\)We conjecture that underappreciation holds much more generally. For example, if $\alpha$ is close to zero, the set of diseases for which insurance provides access to treatment (call it $A$) is empty, i.e. the health insurance provides no access value, and $U - \bar{U} < 0$. We cannot completely rule out the possibility that $U - \bar{U} \geq 0$ for intermediate $\alpha$ for all possible $(v_p, \alpha c_i) \in F$, $(v_h T_i) \in A$, $(-v_p (1 - \alpha) c_i) \in A$ with $A = \{i \in I : B < c_i \leq (B - P)/(1 - \alpha)\}$. Yet, we conjecture that the underappreciation of coverage and access value usually dominates the underappreciation of copayment.
Next to insufficient income to afford premiums or alternative ways to access medical care (e.g., charity or Medicaid in the U.S.) this underappreciation of the value of health insurance can explain the prevalence of a significant number of voluntarily uninsured where health insurance is not mandatory. Consistent with the model's predictions, Heiss, Leive, McFadden, and Winter (2012) report an undersubscription to the generous Gold plans compared to the Silver plans with less benefits and lower premium. Although being primarily concerned with the sources of advantageous selection, Fang, Keane, and Silverman (2006) find cognitive ability to be positively correlated with insurance purchase. We predict this under the natural assumption that the cognitive cost parameters $\kappa_r$ are negatively correlated with cognitive ability.

Our result of an undervaluation of insurance may be contrasted with evidence suggesting a preference for excessively low or no deductibles. More generally, economists have consistently argued that people tend to overinsure against health risks. First, we want to emphasize that the characterization of a preference for low or no deductible or a strong preference for full insurance as overinsurance is based on the common approach to restrict the value of insurance to the balancing of consumption across states, i.e. its risk-reducing function. If one assumes the value of health insurance to be primarily driven by access motives, as we do here, a preference for a low deductible or even for full insurance cannot be understood as overinsurance. A deductible as high as $1,000 may already restrict access to medical care if a household falls on hard times. Choosing a low deductible or no deductible at all ensures this access. We want to underline that we do not seek to negate the role of risk preferences for the demand of health insurance. Yet, given decades of finding evidence that economists interpret as "overinsurance" we think that we should at least consider the possibility that it is not the customers who consistently buy too much insurance, but it is us economists neglecting an important part of the value of insurance when deriving the optimal amount of insurance.

The underappreciation of the value of insurance is a result of the complexity of the insurance-purchase problem. Such underappreciation does not only make the option of remaining uninsured

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23 See e.g. Sydnor (2010).
24 See e.g. Feldstein (1973) and Feldman and Dowd (1991).
25 A different explanation for a preference for low deductibles would need a modification of the model we apply here. Suppose the explicit mention of a deductible increases the salience of exactly those instances in which the insurance does not pay. Further suppose, that the attention rank of a consequence does not only depend on the utility difference across alternatives but also on the salience of the consequence. In this case, the decision-maker will focus on the events in which a high-deductible insurance does not pay off while neglecting the ones in which it does. A high-deductible insurance may then be regarded as receiving (close to) no insurance yet with the obligation to pay a premium.
more attractive as it actually is, it also makes insurance plans with lower coverage more attractive as they are. This gives rise to a strong potential for undercutting.

3 Profitable Undercutting in an Insurance Market

In this section we want to show that an insurance provider entering the market may profitably attract customers from an incumbent insurance plan by undercutting the premium and lowering coverage. We do not yet consider a full characterization of firm behavior in the insurance market. This will be addressed in a later section. Here we seek to establish that customers with limited attention are attracted towards low-premium, low-quality plans to a suboptimally strong degree and that firms may exploit this attraction. We argue that it is this exploitation of limited attention that underlies the frequently-voiced suspicion that firms “hide” shortcomings of the products in the fine-print of the contracts.

Let us consider more generally the undercutting strategy described above. First, assume that there is an incumbent insurance plan, e.g. a public insurance program. Let it be characterized by some premium $P$ and some degree of coverage of health costs $\alpha \in (0, 1]$. Define $A(\alpha) \subseteq \bar{F}$ as the set of diseases for which an insurance plan with coverage rate $\alpha$ provides access to treatment. To save on notation, let $A = A(\alpha)$ denote the set associated with the incumbent plan. Furthermore, assume that the premium is at least actuarially fair, i.e. $P \geq \sum_{i \in F \cup A} \pi_i c_i$. Now, consider a second insurance plan with $0 < \alpha' < \alpha$ and denote by $A' = A(\alpha') \subseteq A$ the set of diseases for which this second health plan provides access to treatment. Assume that this second plan is priced such that the premium difference reflects the difference in expected cost of coverage, i.e. $P' = P - \sum_{i \in F \cup A'} (\alpha - \alpha') \pi_i c_i - \sum_{i \in A \setminus A'} \pi_i \alpha c_i$. The lower premium $P'$ incorporates the saving of expected coverage cost for all treatments that will be demanded by customers under both plans $i \in F \cup A'$. In addition, there may be additional cost savings as a reduction in coverage may make some treatments unaffordable as copayments $(1 - \alpha)c_i$ increase. For these diseases $i \in A \setminus A'$, the insurance does not have to cover any treatment costs. We now want to investigate the difference in decision utility between health plan 1 and health plan 2. If this difference is negative the second, low-coverage health plan is preferred to the first, high-coverage health plan. The difference in

\footnote{Formally, $A(\alpha) = \{i \in I : B < c_i \leq (B - P)/(1 - \alpha)\}$. We assume throughout that $A$ is nondecreasing in $\alpha$ in the sense that $i \in A(\alpha') \Rightarrow i \in A(\alpha), \forall \alpha' \leq \alpha$. This will hold as long as $(B - P)/(1 - \alpha)$ is nondecreasing in $\alpha$.}
decision utility is given by

\[ \bar{U}_1 - \bar{U}_2 = m_p v_p(P' - P) + \sum_{i \in A \setminus A'} \pi_i \left[ m_{h(i)} v_p T_i - m_{c(i)} v_p (1 - \alpha) c_i \right] \]

\[ + \sum_{i \in F \cup A'} \pi_i m_{c(i)} v_p (\alpha - \alpha') c_i \]

\[ = m_p v_p \left[ \sum_{i \in F \cup A'} \pi_i (\alpha' - \alpha) c_i - \sum_{i \in A \setminus A'} \alpha \pi_i c_i \right] \]

\[ + \sum_{i \in A \setminus A'} \pi_i \left[ m_{h(i)} v_p T_i - m_{c(i)} v_p (1 - \alpha) c_i \right] + \sum_{i \in F \cup A'} \pi_i m_{c(i)} v_p (\alpha - \alpha') c_i \]

\[ = \sum_{i \in F \cup A'} \pi_i v_p \left( m_{c(i)} - m_p \right) (\alpha - \alpha') c_i \]

\[ \text{Attention-weighted net value of higher coverage} \]

\[ + \sum_{i \in A \setminus A'} \pi_i \left[ m_{h(i)} v_p T_i - m_{c(i)} v_p (1 - \alpha) c_i - m_p v_p \alpha c_i \right]. \]  

(11)

Consider the last equality in (11). The first part compares the larger coverage of treatment costs for diseases \( i \in F \cup A' \) under health plan 1 to the premium increase necessary to finance this larger coverage. If these differences between the two plans receive full attention \( m_{c(i)} = m_p = 1 \), they cancel out each other under risk neutrality. If the premium dimension \( p \) receives more attention than the co-payment dimensions \( c(i) \), this first part of (11) is strictly negative. The second part arises if the lower coverage by plan 2 entails a loss in access to treatment. In that case, plan 2 is associated with worse health outcomes in case of sickness as the decision-maker is unable to afford treatment for diseases \( i \in A \setminus A' \) when insured under plan 2: a clear disadvantage of the second plan. Yet, given that there is no treatment, there cannot be any co-payment for these treatments under health plan 2 either: an advantage of plan 2 over plan 1. Finally, as no treatment for diseases \( i \in A \setminus A' \) is sought under plan 2, this allows a premium reduction of the entire expected coverage cost \( \pi_i \alpha c_i \) compared to plan 1: again an advantage of plan 2. Note that, if \( \alpha' \) and \( \alpha \) are such that \( A = A' \), i.e. if the reduction in coverage does not entail a reduction in access, the second part of (11) vanishes since \( A \setminus A' = \emptyset \).

Consider the following assumption reminiscent of Assumption 1:
Assumption 2.

\[ v_p P > \left\{ \left[ \pi_i v_p \alpha_{c_i} \right]_{i \in F}, \left[ \pi_i v_t T_i \right]_{i \in A} \right\}. \tag{12} \]

Assumption 2 states that the disutility from the premium payment for the incumbent plan is larger than each individual expected benefit from having (partial) cost coverage and access to treatment. Now we can state the following proposition regarding the possibility for undercutting.

**Proposition 2. Profitable Undercutting**

Suppose insurance is voluntary and a single incumbent plan with coverage rate \( \alpha \) with \( A \neq \emptyset \) is demanded in the absence of any other plan.

(i) If there exists an \( \alpha' < \alpha \) such that \( A = A' \), and if Assumption 2 holds for the incumbent plan, a strictly more profitable plan with lower coverage can be constructed that customers will mistakenly choose over the incumbent plan.

(ii) If the incumbent plan features a coverage rate \( \alpha \) such that \( A' \subset A \) for all \( \alpha' < \alpha \), and if Assumption 2 holds for the incumbent plan, profitable undercutting is possible if \( m_{h(i)} = 0 \) for the disease(s) \( i \in A \setminus A' \).

**Proof.** See Appendix. \( \square \)

We call customers’ choices described in Proposition 2 mistaken since they would be better off choosing the high-quality incumbent plan instead of the low-quality plan. The reason for the described undercutting strategy to work is the decision-maker’s focus on the premium dimension when making his choice. While the advantage of the new plan over the incumbent plan is concentrated in the premium dimension its disadvantages are distributed across many dimensions. An insurer may thus “hide” the shortcomings of a (qualitatively) disadvantageous insurance plan by reducing coverage rates (or services covered) only slightly for each disease. These service deteriorations in cumulation allow the insurance provider to offer a significant premium reduction. As each single service deterioration is small, customers will not recognize each of them. This allows the firm to retain some of the cost savings from the decrease in quality.

If insurance is voluntary, the attention paid to the health consequences \( h(i) \) of insurance choice is independent of the undercutting plan. Thus, when comparing the two plans a customer may pay attention to health consequences of diseases \( i \in F \cup A' \) in which the two insurance plans do not
differ. At the same time, a customer may neglect health consequences \( h(i), i \in A \setminus A \) of diseases in which the two options do actually differ. If access is lost for one of these diseases under the low-quality plan, it will remain unrecognized by the customer. To give an example: if a customer worries particularly about being insured against costs of treatment of common diseases, such as pneumonia, he will particularly look for these features in an insurance plan. The cheaper plan may then be chosen if it covers these common diseases even if it lacks coverage for treatment of some rare types of cancer, and coverage of cancer would, in isolation, be preferred by the customer. Yet, as the customer is so much preoccupied about receiving coverage for the common diseases he neglects to recognize the limited coverage for rare diseases of the cheaper plan.

Proposition 2 shows that limited attention may result in a quality deterioration in health insurance markets. There is a discussion about whether insurance companies “hide” limited coverage in the fine print. This section suggests that it is not font size that makes insurance contracts hard to evaluate, but the sheer size of the contracts. And it is this degree of complexity that allows firms to hide quality reductions in the “fine print”.

Is such undercutting a real danger? After all, the existing literature predominantly finds considerable reluctance to switch between health plans. The possibility of undercutting might then not be too serious. Yet, given that this very literature usually calls for interventions to reduce switching costs in order to spur efficiency, the danger of inefficient undercutting absent switching costs should at least be considered. Studies that investigate the reasons of those customers who actually do switch health plans find that the premium plays a suboptimally large role. This is striking as there is a considerable number of dimensions in which plans can provide better quality given a premium yet there is only one way to make a health plan cheaper given a level of quality (i.e. coverage). Thus, calls to decrease switching costs based on efficiency arguments should ascertain that health plan choice absent switching cost indeed optimally weighs price differences against quality differences.

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27 This does not mean that attention is “wasted”. The consideration of access is important for the decision-maker to evaluate the desirability of any one of the insurance options against the outside option. If the decision-maker neglected the health consequences of being insured, he would always opt out of insurance as he would disregard all the advantages of being insured.

28 Similarly, people may exhibit a tendency to focus on whether their current medication \((\pi_i = 1)\) is covered when selecting a Medicare Part D plan. This may result in a failure to consider in addition whether a plan covers those medications these people most likely need in the future \((\pi_i < 1)\).

29 See e.g. Heiss, Leive, McFadden, and Winter (2012) and Frank and Lamiraud (2008).

30 See e.g. Abaluck and Gruber (2011) or Heiss, Leive, McFadden, and Winter (2012).

31 Handel (2013) warns against nudging consumers to overcome choice inertia as the improvement in individual choice quality may come at the expense of more severe adverse selection. We complement this by arguing that
Both the result of undervaluation of insurance and of the possibility to undercut are the result of an unequal distribution of advantages and disadvantages of one alternative over another across dimensions. As the benefits of insurance are scattered across dimensions, while costs are concentrated in one dimension, the first tend to be underappreciated. Similarly, the undercutting strategy is successful as it concentrates the advantage over a different insurance plan in one dimension (the premium) while spreading the disadvantages across several dimensions. While this section discusses the suboptimal attraction of customers to plans with lower quality and lower premium, we next want to establish that customers with limited attention may even end up buying plans for which lower quality is not even partially compensated by a premium reduction.

4 Dominated Choices

While most behavioral patterns can be rationalized by some sort of preference, one type of behavior is rather difficult to reconcile with preference-based explanations. If we observe people actively choosing an alternative that fares at most equally well on all dimensions, but is inferior in at least one dimension compared to another available alternative, we remain with two possibilities: the decision-maker does not care at all about the dimension in which the chosen alternative is inferior, or the decision-maker has made a mistake. More precisely, the decision-maker chose a dominated option.

Such dominated choices have been observed in markets for health insurance.\textsuperscript{32} The model of limited attention proposed here can explain such behavior. For this, assume that plans are described by their premium $P$ and, for each disease $i \in I$, by the degree of coverage $\alpha_i \in [0, 1]$ they offer. The choice set $\Gamma$ thus comprises different plans $g$ as elements, where each plan $g$ is described by a premium and a vector of coverage rates: $(P, (\alpha_i)_{i \in I})$. If the decision-maker has the option not to insure this can be represented by a “plan” $g^0 \in \Gamma$ with $P = \alpha_i = 0$, $\forall i \in I$. The following proposition establishes the possibility that a decision-maker may be indifferent between two options, for which one dominates the other.

\textsuperscript{32}See Sinaiko and Hirth (2011).

there might not even be a large benefit of improved individual decision-making to compensate for the exacerbated adverse selection.
**Proposition 3. Indifference despite Dominance.**

Suppose there exists a choice set $\Gamma$ of health plans with at least two distinct elements. If there exists a dimension $j \in \{p, c(i) : i \in F, h(i) : i \in \overline{F}\}$ such that $\mu_j > 0$ yet $m_j = 0$. Then there exists a plan that is dominated by one of the available plans, but the decision-maker will be indifferent between these two plans if the dominated plan is added to the choice set.

**Proof.** See Appendix. □

Let $g^* \in \Gamma$ denote a plan the decision-maker would choose from $\Gamma$. Using the idea of Proposition 3, we can establish the possibility that there exists an option $g'$ that is dominated by $g^*$, yet would be chosen from the set $\Gamma \cup g'$.

**Corollary 1. Choice of a Dominated Alternative.**

Suppose there exists a choice set $\Gamma$ of health plans with at least two distinct elements. If there exists a dimension $j \in \{p, c(i) : i \in F, h(i) : i \in \overline{F}\}$ such that $u(g^*, j) > \min_{g \in \Gamma} u(g, j)$ yet $m_j = 0$. Then there exists a dominated alternative that the decision-maker would choose if it was included in the choice set.

**Proof.** See Appendix. □

As an illustration, suppose only a single plan is offered that fully covers some set $S \subseteq \overline{F}$ with $|S| \geq 2$, i.e. $\alpha_i = 1, \forall i \in S, \alpha_i = 0, \forall i \in I \setminus S$. Further suppose that the premium is actuarially fair, $P = \sum_S \pi_i c_i$ and the decision-maker is willing to purchase that plan $m_p v_p P \leq \sum_{i \in S} m_{h(i)} v_h T_i$ despite that fact that the decision-maker neglects one of the benefits of coverage: $m_{h(i)} = 0$ for some $i \in S$, say $\iota$. Now, imagine a second plan that is identical to the first plan except for the coverage of disease $\iota$ was offered in addition to the first plan, at the same premium $P$. The introduction of this second plan will not change the attention allocation. Further, the new plan will be considered equally good as the first plan. Since the decision-maker would have chosen the first plan absent the second plan he will now choose either the first or the second plan. He may thus end up choosing the second plan despite it being dominated by the first plan for the simple reason that he happens to neglect exactly the dimension in which the domination occurs.

The corollary and the simple example highlight how the model can naturally explain the observation of dominated choices through modeling neglect. A sufficient condition for dominated choices is stated here since it is obvious, and stated here without proof, that a necessary condition
for dominated choices is neglect. For a utility-maximizing decision-maker will only choose a dominated option if he happens to neglect those dimensions that produce the domination. It is important to note the necessity of neglect for the explanation of dominated choices. Other approaches that also feature biases in the weighting process of different problem dimensions such as Kőszegi and Szeidl (2013) or Bordalo, Gennaioli, and Shleifer (2012) are not capable of explaining such behavior. Though parameter values can be found such that decision weights in these models are approximately zero, they can never be exactly zero. Yet, this is necessary to model neglect and dominated choices as one of its behavioral consequence.

Note that the model allows for stronger predictions than stating the mere possibility of dominated choices. The requirement that some benefits of the dominating insurance plan are neglected allows to make further predictions. First, the model predicts at most indifference between a dominating and a dominated alternative. It cannot happen that the decision-maker strictly prefers the dominated over the dominating alternative. This seems plausible: limited attention may attenuate to which extent an advantage is appreciated. It should not lead to an advantage being misperceived as a disadvantage. Second, the model predicts dominated choices never to occur in binary choices. In binary choices, at least one dimension in which the dominated alternative is inferior must be considered. This suffices for a dominated alternative never to be chosen. Finally, if a dominated alternative is chosen, this alternative and the dominating alternative must share advantages over a third alternative that distract attention from the dimensions in which the domination occurs. This again implies that a dominated alternative that is weakly worse than all available alternatives, i.e. an alternative dominated by all other alternatives, will never be chosen. It also means that the shared advantages over the third alternative must be large enough compared to the disadvantage(s) of the dominated alternative, for otherwise the first could not distract from the latter. In this sense, the disadvantages of the dominated alternative that is chosen have to be minor.

5 Specific vs. Comprehensive Insurance: The Benefits of Isolating Risks

It has been observed that people’s willingness-to-pay (WTP) for various specific insurances exceeds their willingness-to-pay for a comprehensive insurance that covers all of the incidences the specific
insurances are addressing. Johnson, Hershey, Mészaros, and Kunreuther (1993) provide several examples of such an unbundling effect.\(^{33}\) They argue that this effect is due to a greater availability of the more specific events compared to the unspecific “any reason”. Our model may complement the availability hypothesis with an explanation based on complexity-reduction.

Suppose that people tend to think of three categories of consequences in which the alternatives differ when considering this decision problem: premium, coverage in case of accident, and coverage in case of disease.\(^{34}\) Denote by \(P\) the premium, \(c_a\) the cost treatment in case of an accident, \(\pi_a\) the probability the DM associates with having an accident, \(c_d\) the cost of treatment in case of a disease, and \(\pi_d\) the probability to be hospitalized for a disease.

First, consider the case of an insurance that only covers one of the incidences (either accident or disease). The decision problem of whether to buy such an insurance comprises two dimensions: the premium dimension and the dimension associated with the payment in case of disease. Each option has an advantage in exactly one dimension. If the decisions are made sequentially without prior anticipation of the second decision\(^{35}\), the decision-maker solves two two-dimensional problems with advantages and disadvantages being condensed in one dimension each. Yet, if the decision-maker has to choose between insuring against any disease or accident, he solves one three-dimensional problem. The advantages of being insured are spread across two dimension: payment in case of an accident and payment in case of a disease. The disadvantage is condensed in only one dimension: the premium. The attention process then favors remaining uninsured. The reason for this effect is that the integration of several incidences into one comprehensive insurance makes the insurance decision more complex. In particular, it adds a benefit dimension while integrating the cost into an already existing dimension (the premium). As a decision-maker cannot fully take into account all dimensions he concentrates on those with the largest utility differences. This tends to be the premium dimension as it integrates the costs of covering several incidences. As a result the benefit dimensions are not fully considered.

\(^{33}\)In a series of experiments they ask their subjects for their willingness-to-pay for health insurance that covers hospitalization either for any disease, for any accident, for any reason, or for any disease or accident. They find that if subjects are asked their WTP for any disease (followed by any accident), or asked their WTP for any accident (followed by any disease), the sum of these two WTP ($89.10 and $69.55 on average) significantly exceeds the WTP expressed for the insurance covering any reason ($41.53 on average) or the insurance covering any disease or accident ($47.12 on average).

\(^{34}\)For simplicity, we assume treatment cost to be affordable for both incidences. The argument can easily be replicated for the cases in which treatment for one or both incidents is unaffordable without insurance.

\(^{35}\)Alternatively, one may assume that the decision-maker narrowly brackets such that he solves the two choice problems in isolation.
This unbundling effect is not only present when the two more specialized insurances incorporate only a single benefit dimension. We can show that any “split” of a comprehensive insurance into an arbitrary number of more specialized insurance plans will result in an increased willingness-to-pay.

**Proposition 4. Unbundling of Insurance Plans**

Let \( S \subseteq I, |S| \geq 2 \) be the set of diseases for which a comprehensive insurance plan offers full coverage of treatment cost. Let \((S_1, ..., S_z)\) be a partition of \( S \) and let \( W(S) \) be the maximum willingness-to-pay for an insurance plan covering the treatment costs for all diseases \( i \in S \). Then \( W(S) < \sum_{i=1}^{z} W(S_i) \).

**Proof.** See Appendix.

Unbundling a comprehensive insurance mitigates the extent of underappreciation of value. This underappreciation of comprehensive insurance might pose a dilemma to insurance providers. On the one hand, there is an incentive to split insurance plans into more specific plans in order to mitigate the underappreciation of the value of insurance. On the other hand, customers may be reluctant to consider a large number of specific plans individually.

### 6 Insurance Provision in Market Equilibrium

We want to investigate which insurance plans are offered in equilibrium in a regulated market. Due to the discontinuities in the attention function \( m_j \), that result in discontinuities in the payoff functions of firms, we cannot be certain that equilibria always exist. We therefore look at a particular setting. Each firm can offer only a single plan. We confine attention to the case in which firms choose the diseases for which they provide coverage. Yet, if they choose to cover a particular disease, they are bound to cover the full treatment cost.\(^{36}\) A firm’s plan choice is then a set \( S \subseteq I \) of diseases covered and a premium \( P \). This simplification allows the convenience to define the benefit \( b_i \) of having insurance for disease \( i \in I \) by

\[
    b_i = \begin{cases} 
        \pi_i v_p c_i & \text{if } i \in F, \\
        \pi_i v_h T_i & \text{if } i \in \bar{F}.
    \end{cases}
\]

\(^{36}\)One could think of this as a regulatory requirement to eliminate the undercutting incentives we discussed in Proposition 2.
Since there are no differences between having or not having insurance in the monetary consequences for diseases \(i \in \bar{F}\) and no differences between having and not having insurance in the health consequences for diseases \(i \in F\), we will write \(m_i\) to denote the attention paid to the benefit of having insurance for disease \(i\), i.e. \(m_i = m_{c(i)}\), \(\forall i \in F\) and \(m_i = m_{h(i)}\), \(\forall i \in \bar{F}\).

We assume that customers are equal with regard to their preferences, their risk, and their cognitive abilities. These customers choose the plan that maximizes their decision utility given the choice set they face. If more than one plan maximizes decision utility, demand is split equally among the maximizing plans unless noted otherwise.

Suppose insurance is voluntary, i.e. there exists the outside option not to insure at all \((S, P) = (\emptyset, 0)\). Consider the following equilibrium candidate. For each subset \(S \subseteq I\) a plan covering this very subset is offered by more than one firm at an actuarially fair premium, i.e. \(P = \sum_{i \in S} \pi_ic_i\). Then, if \(\sum_{i \in I} \pi_ic_i > b_i\ \forall i \in \bar{F}\) is satisfied, this constitutes an equilibrium.

**Proposition 5.** If \(\sum_{i \in I} \pi_ic_i > b_i\ \forall i \in \bar{F}\), then there always exists an asymmetric equilibrium in which each possible plan with an actuarially fair premium \((S, P) : S \subseteq I, P = \sum_{i \in S} \pi_ic_i\) is offered by at least two firms.

**Proof.** See Appendix.

It is interesting to investigate which plans are purchased by customers in the above equilibrium. It turns out that equilibrium insurance, and thus the welfare properties of the equilibrium, strongly depend on the structure of insurance benefits \(b_i\). We will assume that \(b_i \neq b_{i'} \ \forall i, i' \in I : i \neq i'\).

The following proposition characterizes the insurance plan that is purchased in equilibrium.38

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37 We assume throughout the section that the premium payments do not result in an inability to afford treatments that would be affordable without insurance. Formally, with the decision-maker’s budget being \(B\) we assume \(B - P(S) > c_i\), \(\forall F \setminus S\). Since we will consider actuarially fair premia in this section this translates into \(B - \sum_{i \in S} \pi_ic_i > c_i\), \(\forall F \setminus S\). Again, this abstracts from any issues related to the affordability of premia. We note that this is not without loss of generality for a treatment may become unaffordable because insurance for other diseases cuts deep into the decision-maker’s budget. We maintain this assumption in order to focus on the implications of limited attention on equilibrium insurance.

38 We assume that if a customer is indifferent between a plan \((S, \sum_{i \in S} \pi_ic_i)\) and a plan \((S', \sum_{i \in S'} \pi_ic_i)\) with \(S' \subset S\), then the customer purchases the more comprehensive plan covering \(S\).
Proposition 6. In the equilibrium described in Proposition 5 the customers purchase the plan $(S^*, P^*)$ with

$$S^* \{ i \in \bar{F} : b_i - v_p \pi_i c_i \geq \kappa_{r(i)} \}$$

with $r(i) = | \{ i' \in I : b_{i'} > b_i \} | + 1$,

$$P^* = \sum_{i \in S^*} \pi_i c_i$$

Proof. See Appendix. \qed

Note the following properties of insurance purchase in equilibrium. First, in equilibrium no diseases are insured for which customers do not need insurance: $S^* \subseteq \bar{F}$. This is true because $b_i - v_p \pi_i c_i - \kappa_{r(i)} = -\kappa_{r(i)} < 0$ holds for all $i \in F$. However, $S^*$ might be the empty set, i.e. customers may not insure at all in equilibrium. This means it is possible that none of the gains from trade are realized in equilibrium. This happens if there does not exist $i \in \bar{F}$ satisfying the condition for inclusion in $S^*$. Such a situation occurs if the largest insurance benefits are produced by diseases with affordable treatments. In that case, diseases for which insurance is necessary, $i \in \bar{F}$, receive very low attention ranks and therefore very high attention thresholds $\kappa_{r(i)}$ that may preclude them from being appreciated in the decision process.\textsuperscript{39}

The comprehensive plan plays an important role in the equilibrium as it fixes the attention allocation and makes it distraction-proof. This stabilization of attention comes at a cost however. Limited customer attention may be wasted on diseases for which customers do not need (and do not buy) insurance. Formally, there may be diseases $i \in F$ with $m_i > 0$, while we know that $S^* \cap F = \emptyset$. A straightforward question would be whether there always exist equilibria in which the market offers coverage only for diseases $i \in \bar{F}$. Such a setting would be desirable as attention would only be allocated to diseases for which insurance is beneficial. Second, under such an attention allocation the extent of coverage $S^* \subseteq \bar{F}$ that customers eventually choose could be larger since they do not waste attention considering coverage for unnecessary insurance. Unfortunately, this is not the case. It can be shown that in such an environment profitable deviations may occur in which firms distract attention by offering and selling plans that include unnecessary coverage while

\textsuperscript{39}It is interesting to note that the three plans that support this equilibrium are the outside option $(\emptyset, 0)$, the comprehensive plan $(I, \sum_i \pi_i c_i)$, and the chosen plan $(S^*, P^*)$. The former two fix the attention allocation and ensure that attention cannot be distracted. The latter is the one to which customers assign highest decision utility given that attention allocation and it may happen that it coincides with one of the former.
excluding necessary coverage. In that sense, by stabilizing attention the comprehensive option ensures quality in the market. Ironically, it does so by offering the highest extent of unnecessary coverage, i.e. it includes coverage for all \( i \in F \). We want to underline that the comprehensive plan may ensure quality in the market without ever being chosen itself.

Let us consider the welfare properties of the equilibrium. To do so, let us first note that welfare is maximized by any set \( S \in I \) that maximizes \( \sum_{i \in S} (b_i - \pi_i c_i) \). This means that the first-best is characterized by

\[
S^{fb} \supseteq \bar{F}. \tag{13}
\]

That means, customers would purchase insurance for all diseases for which they need insurance, \( i \in \bar{F} \). Comparing this to the insurance plan purchased in the equilibrium with limited attention shows that \( S^* \subseteq \bar{F} \subseteq S^{fb} \). While competition drives premia to actuarially fair levels, customers tend to underinsure under limited attention. In the most extreme case, customers may choose not to insure at all, \( S^* = \emptyset \), thereby foregoing all the benefits from trade prevalent in this market: \( \sum_{F} (b_i - \pi_i c_i) \).

We may wonder whether the equilibrium is at least constrained-efficient in the sense that it maximizes welfare given the cognitive limitations of the market participants. Such a constrained-efficient outcome would result in an insurance of a set \( S \subseteq I \) that maximizes \( \sum_{i \in S} (b_i - \pi_i c_i) \) under the constraint that insurance is purchased voluntarily: \( \tilde{U} \geq 0 \). Unfortunately, the equilibrium set \( S^* \) generally does not coincide with the constrained-efficient set \( S^C \) either.\(^{41}\) One reason for this is that in the competitive equilibrium attention is wasted towards considering diseases \( i \) for which insurance is not necessary. In addition, among the diseases \( i \in \bar{F} \), attention is attracted towards diseases with large benefits \( b_i \). These do not necessarily coincide with the diseases that deliver the largest welfare gains of insurance \( b_i - \pi_i c_i \). Finally, \( S^* \) maximizes decision-utility, while \( S^C \) maximizes experienced utility (while keeping decision utility nonnegative). Thus \( S^C \) may include treatments that result in an increase in experienced utility, yet a decline in decision-utility, as long as this decline does not make the whole insurance purchase undesirable.

\(^{40}\)A proof can be found in the Appendix.

\(^{41}\)To show this consider that \( S^* \) can be empty, while the constrained-efficient set cannot. For any \( i \in \bar{F} \), the insurance plan \((i, \pi_i c_i)\) results in strictly positive decision utility absent any alternative insurance plan (safe the outside option).
7 Conclusion

This paper seeks to illustrate how four phenomena that have been observed in the choice of health insurance may be the result of the complexity inherent in this choice problem. First, we have shown that people with a tendency to simplify complex decisions tend to underappreciate the value of health insurance. Second, this tendency to simplify allows firms to “hide” quality reductions by scattering them across many attributes of the health plan. Third, their propensity to neglect may lead people to make dominated choices. Finally, we have indicated an incentive to unbundle comprehensive health plans in order to mitigate the extent of underappreciation of value.

These results may give rise to a dilemma faced by policy makers who seek to increase insurance coverage. If one acknowledges an underappreciation of value one may support calls for an individual mandate for health insurance incorporating a couple of minimum quality standards. However, to ensure a first-best allocation an individual mandate would have to be coupled with mandated benefits for all diseases for which individuals cannot self-insure. Insurance providers would only be able to compete on the premium dimension. Such a policy has its own drawbacks though. Such a restrictive policy would forgo the benefits of product differentiation for different tastes/risks. In addition, it would create a strong incentive for health providers to lobby for their products to be covered by mandated benefits. Finally, the model of limited attention identifies the underappreciation of the value of such a mandated comprehensive insurance as a particular obstacle. If people underappreciate the benefits while focusing on the cost, such a policy will be highly unpopular.

Hence, acknowledging the existence of the described biases in choice behavior may support calls for policy interventions mandating insurance with extensive benefits. Yet, the very existence of these biases will make such policies quite unpopular. Limited attention as modeled here may thus not only drive a wedge between the need for and the acceptance of policy interventions but even make them reciprocal.

This work is an attempt to model the complexity involved in choosing a health plan that goes beyond modeling the number of choices as the main source of complexity. We argue that a major part of the complexity involved is due to the many aspects this choice problem has. Given that we only consider the large number of diseases a health plan may or may not cover, and
that health plans may vary on many more attributes, we are confident that further research into this aspect of complexity will be instructive. Finally, we think that research on limited attention may add nicely to the well-researched topic of adverse selection in insurance markets. If people underappreciate insurance they may select out of a market to a degree that is suboptimal both from a social and an individual point of view. In addition, selection may occur both due to a heterogeneity in underlying risks and a heterogeneity in cognitive capabilities. We conclude that further research into the issue of complexity in the market for health insurance can take several promising directions.

References


Proof of Proposition 1

If Assumption 1 is satisfied, $\mu_p > \mu_{c(i)}$, $\forall i \in F$ and $\mu_p > \mu_{h(i)}$, $\forall i \in \bar{F}$. Since $v_{hT_i} > v_{pc_i} \geq v_p(1-\alpha)c_i$, $\forall \alpha \in [0,1], \forall i \in \bar{F}$ this also means that $\mu_p > \mu_{c(i)}$, $\forall i \in \bar{F}$. This implies that $r(p) = 1$ and $m_p = 1$. Consider the difference between the difference in experienced utility $U$ and the difference in decision-utility $\bar{U}$ when $m_p = 1$:

$$U - \bar{U} = \sum_{i \in F} \pi_i (1 - m_{c(i)})v_p\alpha c_i + \sum_{i \in F} \pi_i (1 - m_{h(i)})v_{hT_i} - \sum_{i \in F} \pi_i (1 - m_{c(i)})v_p(1-\alpha)c_i. \quad (14)$$

The first and the second term are strictly positive while the third is strictly negative. If $\alpha$ is (close to) one, thus the co-payment rate is zero (small), the third term is dominated. We want to establish this formally.

Since we want to make a statement about a set of contracts differing in their degree of coverage $\alpha$, we need to make some assumptions on how the premium $P$ varies with $\alpha$. Let $P(\alpha)$ denote the premium of a contract offering coverage of $\alpha$. We assume the premium to be weakly increasing in $\alpha$: $P(\alpha) \geq P(\alpha')$, $\forall \alpha > \alpha'$. Second, we assume that $P(1) < B$, i.e. the premium for full coverage is affordable.\footnote{We continue to abstract from the possibility that a premium is not affordable.} Denote by $\bar{c} = \max_{c \in I} c_i$ the cost of the most expensive treatment
and let $\alpha (\bar{F})$ be the largest $\alpha \in [0, 1]$ such that $B - P(\alpha ) = (1 - \alpha )\bar{c}$. It must be true that $B - P(\alpha ) \geq (1 - \alpha )\bar{c}$, $\forall \alpha \in [\alpha (\bar{F}), 1]$, i.e. the decision-maker is able to afford the most expensive treatment, which again implies he is able to afford treatment for all diseases, when buying a contract with coverage $\alpha \geq \alpha (\bar{F})$.

Now, denote by $\bar{\alpha}$ the infimum extent of coverage $\alpha \in [\alpha (\bar{F}), 1]$ such that the following inequality holds for all $i \in \bar{F}$ and all $\alpha \geq \bar{\alpha}$:

$$
\pi_i \left[(1 - m_{h(i)})v_h T_i - (1 - m_{c(i)})v_p (1 - \alpha)c_i \right]
= \min \left\{ \kappa_{\tau h(i)}, \pi_i v_h T_i \right\} - \min \left\{ \kappa_{\tau c(i)}, \pi_i v_p (1 - \alpha)c_i \right\} \geq 0. \tag{15}
$$

This infimum exists\(^{44}\) and is bounded away from 1.\(^{45}\) For any level of coverage $\alpha \in (\bar{\alpha}, 1]$, the second and third part sum to a nonnegative number. Since the first part is strictly positive as we established before, we must have $U - \bar{U} > 0$.

Finally, suppose $\bar{F} \neq \emptyset$ and $U > 0$. It is easy to see that the respective difference in decision utility is negative, $\bar{U} < 0$, if $m_p = 1$ and the cognitive costs $\kappa_r, r > 1$ are sufficiently large.

**Proof of Proposition 2**

We argue that there is scope for profitable undercutting if the difference (11) is strictly negative and $m_p = 1$. For as long as $m_p = 1$, the difference in decision utility $\bar{U}_1 - \bar{U}_2$ is continuous in $P'$. Then there exists a third plan with premium $P''$ such that $P' < P'' < P$ and coverage rate $\alpha'' = \alpha'$ for which $\bar{U}_3 > \bar{U}_1$ must hold. Offering this plan attracts customers and is strictly more profitable than the incumbent plan. At the same time it offers strictly lower experienced utility to customers since $P - P'' < \sum_{i \in F \cup A'} (\alpha - \alpha')\pi_i c_i - \sum_{i \in A \setminus A'} \pi_i \alpha c_i$. In the following, we want to show that under the conditions given in Proposition 2 the difference $\bar{U}_1 - \bar{U}_2$ given by (11) is strictly negative and $m_p = 1$.

Since insurance is voluntary, the customers have the possibility not to insure. Suppose that,

\(^{43}\)We know - by Tarski’s fixed-point theorem - that such an $\alpha$ must exist since $B - P(\alpha)$ is weakly decreasing in $\alpha$, $(1 - \alpha)\bar{c}$ is continuous and strictly decreasing in $\alpha$, and $B - P(1) > (1 - 1)\bar{c} = 0$ while $B - P(0) < (1 - 0)\bar{c}$, since $\bar{c} = c_i$ for some $i \in \bar{F}$. We cannot rule out that there is more than one intersection.

\(^{44}\)The inequalities are satisfied for $\alpha = 1$.

\(^{45}\)The $\kappa_{\tau h(i)}, \pi_i v_h T_i, \kappa_{\tau c(i)}$ are all strictly positive since we have established that the premium is the highest-ranking dimension and all lower-ranking dimensions are associated with a strictly positive threshold $\kappa$. Hence, there must exist an $\alpha < 1$ such that $\pi_i v_p (1 - \alpha)c_i < \min \left\{ \kappa_{\tau h(i)}, \pi_i v_h T_i, \kappa_{\tau c(i)} \right\}$. 

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in addition to this outside option, only a single insurance plan that is priced at (or above) the actuarially fair premium is offered and it is demanded by the customers in absence of a second insurance plan. That is the decision utility of buying this first insurance plan (weakly) exceeds the decision utility of remaining uninsured. Construct a second insurance plan by slightly lowering the coverage rate to \( \alpha' \) and lowering the premium to \( P' = P - \sum_{i \in F \cup A'} (\alpha - \alpha') \pi_i c_i - \sum_{i \in A \setminus A'} \pi_i a c_i \). The difference in decision utility is given by (11). Health plan 2 is preferred to plan 1 (and thus also to the outside option) if this difference is negative. Consider the attention parameters \( m_j \) of this choice problem. The outside option of “no insurance” is an alternative that is “extreme” on many dimensions. It is the best option in the premium dimension, while the worst one is the first insurance plan as it requires the highest premium payment. Thus, \( \mu_p = v_p P \). In the health dimensions for diseases \( i \in F \) all available options feature the same consequences. Hence, these dimensions are neglected. In all health outcome dimensions for which the incumbent plan provides access, \( h(i), i \in A \), the incumbent plan is the best and no insurance is the worst option: \( \mu_{h(i)} = \pi_i v_h T_i \). In the co-payment dimensions for diseases with affordable treatment, \( c(i), i \in F \) the best option is plan 1 (lowest co-payment) while the worst option is no insurance (full payment): \( \mu_{c(i)} = v_p \pi_i (1 - (1 - \alpha)) c_i \). In the co-payment dimensions for diseases \( i \in A' \), the best option is no insurance (no expenditure) and the worst is plan 2 (highest co-payment): \( \mu_{c(i)} = v_p \pi_i (1 - \alpha' - \alpha) c_i \). Finally, in the co-payment dimensions for diseases \( i \in A \setminus A' \), the best option is no insurance (no expenditure) and the worst is plan 1 (highest co-payment): \( \mu_{c(i)} = v_p \pi_i (1 - \alpha - \alpha') c_i \). The attention parameters are thus given by

\[
\begin{align*}
m_p & = \max \left\{ 0, 1 - \kappa_r(p)/(v_p (P - 0)) \right\}, \\
m_{h(i)} & = 0, \forall h(i) : i \in F, \\
m_{h(i)} & = \max \left\{ 0, 1 - \kappa_r(h(i))/(\pi_i v_h T_i) \right\}, \forall h(i) : i \in A, \\
m_{c(i)} & = \max \left\{ 0, 1 - \kappa_r(c(i))/(v_p \pi_i (1 - (1 - \alpha)) c_i) \right\}, \forall c(i), i \in F, \\
m_{c(i)} & = \max \left\{ 0, 1 - \kappa_r(c(i))/(v_p \pi_i (1 - \alpha' - \alpha)) c_i \right\}, \forall c(i), i \in A', \\
m_{c(i)} & = \max \left\{ 0, 1 - \kappa_r(c(i))/(v_p \pi_i (1 - \alpha - \alpha')) c_i \right\}, \forall c(i), i \in A \setminus A'.
\end{align*}
\]

Now suppose that \( \alpha \) and \( \alpha' < \alpha \) are such that \( A = A' \). Then the second term in (11) vanishes. A sufficient condition for (11) to be negative is then \( m_p = 1 \). If assumption 2 is satisfied, then \( \mu_p > \mu_j, \forall j \neq p \). This again implies that \( 1 = m_p > m_{c(i)}; \forall i \in F \cup A' \). As a result, the decision
utility of the low-quality plan 2 will exceed the decision utility of the high-quality plan 1, although the high-quality plan offers higher experienced utility.

Now consider the case when any reduction in coverage entails a loss in access $A' \subset A$, $\forall \alpha' < \alpha$. That is, we assume the incumbent policy offers some coverage $\alpha$ such that $A(\alpha') \subset A(\alpha)$, $\forall \alpha' < \alpha$. In this case, profitable undercutting cannot always work out. Since we assume that the first health plan is demanded in the absence of health plan 2, we know that $m_{h(i)} > 0$ for some $i \in A$. Thus, even if we maintain the assumption that $v_pP > \max_{i \in A} \pi_i v_hT_i$ such that the premium dimension receives full attention, we know that the access value of at least some diseases must be sufficiently large that they make insurance desirable, even when underappreciated. Thus there must exist some $i \in A$ for which the removal of access is noticed and sufficiently undesirable to make undercutting infeasible. However, it is not guaranteed that these are exactly the ones that $A'$ lacks. There can be diseases $i \in A$ for which undercutting an incumbent policy with coverage $\alpha$ is feasible, in particular if the number of diseases covered $|F \cup A|$ is large. Note that since an outside option is available the decision-maker may consider health dimensions $h(i) : i \in A'$ in which the two insurance plans do not differ while paying less or no attention to dimensions in which there are differences between the plans $h(i) : i \in A \setminus A'$. If he happens to neglect exactly the health dimension $h(i) : i \in A \setminus A'$ then the loss in access due to the slight reduction of coverage remains unrecognized. Thus, if $m_{h(i)} = 0$ for $i \in A \setminus A'$ and if assumption 2 is satisfied for plan 1 and thus $m_p = 1$, then $\tilde{U}_1 - \tilde{U}_2$ is negative and, hence, profitable undercutting is feasible.

**Proof of Proposition 3**

Denote by $\psi$ a dimension $j \in \{p, c(i) : i \in F, h(i) : i \in \bar{F}\}$ for which $\mu_j > 0$, yet $m_j = 0$. If $\psi \neq p$, denote by $i$ the disease $i \in I$ of which $\psi$ is either a monetary or health consequence. Denote by $\bar{g} \in \operatorname{argmax}_{g \in \Gamma} u(g, \psi)$ one of the available alternatives with maximal utility in dimension $\psi$. Denote by $g \in \operatorname{argmin}_{g \in \Gamma} u(g, \psi)$ one of the alternatives with minimal utility in dimension $i$. Construct a plan $g'$ such that $u(g', \psi) = u(g, \psi)$ and $u(g', j) = u(g, j)$, $\forall j \in B \setminus \psi$. More precisely, if $\psi = p$, set the price of $g'$ equal to the price of the most expensive plan available, $\bar{g}$, and set the levels of coverage $\alpha'_i$ equal to the levels of coverage $\alpha_i$ of the cheapest plan available, $\bar{g}$. Alternatively, if $\psi \neq p$ construct $g'$ by equating the level of coverage for disease $i$ to the lowest level of coverage for $i$ available (under $\bar{g}$) while equating the price $P'$, and the levels of coverage $\alpha'_i, i \in I \setminus \psi$ to the levels provided by the plan $\bar{g}$ that offers highest coverage of $\psi$. It is easy to see
that extending $\Gamma$ by $g'$ does not change the attention allocation since the range of utility $\mu_j$ in each dimension remains unchanged. It follows that dimension $\psi$ remains neglected if $g'$ is included in the choice set. $g'$ is constructed to be equal to $\bar{g}$ in all dimensions but $\psi$, in which it is inferior, hence $\bar{g}$ dominates $g'$. But since $\psi$ is neglected by the decision-maker, he is indifferent between these two alternatives.

**Proof of Corollary 1**

The stated condition requires that there exists a dimension $j \in \{ p, c(i) : i \in F, h(i) : i \in \bar{F} \}$, call it $\psi$, in which an alternative $g^*$ that would be chosen from $\Gamma$ holds an advantage over some other available alternative, yet this advantage is neglected. In this case the dominated alternative $g'$ is constructed as in the proof of Proposition 3 by replacing $\bar{g}$ with $g^*$. The newly constructed alternative $g'$ will be dominated by $g^*$, yet the decision-maker will be indifferent between $g^*$ and $g'$. Since $g^*$ is maximizing decision-utility among all alternatives from the choice set $\Gamma$, and, since the attention allocation remains unchanged, also from the choice set $\Gamma \cup g'$, it follows that $g'$ must also maximize decision-utility among all alternatives from $\Gamma \cup g'$. It follows that the decision-maker would be willing to choose $g'$ despite it being dominated.

**Proof of Proposition 4**

We consider insurance plans that fully pay the treatment cost for the diseases they cover. The difference between the decision utility of buying insurance covering the nonempty set of diseases $S$ and the decision utility of not buying insurance is then given by $\bar{U}(S) = \sum_{i \in S} m_{i,S} b_i - m_{p,S} v_p P$. $m_{j,S}$ denotes the attention a dimension $j$ receives when the choice set is given by $\Gamma = \{(S,P),(\emptyset,0)\}$. $b_i$ denotes the benefit of having insurance covering the full treatment cost for disease $i$. That means, $b_i = \pi_i c_p c_i$, $\forall i \in F$ and $b_i = \pi_i v_H T_i$, $\forall i \in F$.\(^46\)

Let $W(S) = \max \left\{ P : \bar{U}(S) \geq 0 \right\}$ be the maximum willingness-to-pay for an insurance that fully covers treatment costs of diseases $i \in S$. We make the following technical assumption. If $\mu_p = \mu_j, j \neq p$, then $r(p) > r(j)$. That is, if the premium dimension ties with another dimension, this other dimension gains higher rank in the attention hierarchy. This assumption ensures that the maximum premium $P : \bar{U} \geq 0$ always exists.

\(^{46}\)As the two options only differ in either the health consequence or the monetary consequence in case of a disease, we refrain from differentiating between subscripts $c(i)$ and $h(i)$ for the attention parameters $m_{j,i}$. 

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We now establish that $W(S) = \max \{ \max_{i \in S} b_i/v_p, \sum_{i \in S} \bar{m}_{i,S}b_i/v_p \}$ where $\bar{m}_{j,S}$ is the attention parameter of dimension $j$ if the attention rank rank of the premium is bound to be $r(p) = 1$, while the remaining ranks are determined as usual according to $\mu_j > \mu_{j'} \Rightarrow r(j) < r(j')$.

It is easy to see that $W(S) \geq \max_{i \in S} b_i/v_p$. Suppose not and consider $P < \max_{i \in S} b_i/v_p$ and let $j$ be disease $i \in S$ with maximum expected benefit $b_i$. Then $\mu_P \leq \mu_j$ and thus $m_{p,S} < m_{j,S}$. This suffices to let $\tilde{U}(S) > 0$. As this holds true for all levels of $P \leq \max_{i \in S} b_i/v_p$, the premium could be increased up to the amount $\max_{i \in S} b_i/v_p$ with $\tilde{U}$ remaining strictly positive. Now, if $W(S) > \max_{i \in S} b_i/v_p$ then the premium must rank first in the attention hierarchy as $\mu_p = v_p P > \max_{i \in S} b_i = \max_{i \in S} \mu_i$ and thereby $m_{S,p} = 1$. Then, from $\tilde{U} = 0$ one can easily verify that $W(S) = \frac{1}{v_p} \sum_{i \in S} \bar{m}_{i,S}b_i$ must be true since $m_{j,S} = \bar{m}_{j,S}$.

Next, we show that $W(C) < W(A) + W(B)$ for any disjoint, nonempty sets of diseases $A, B$ and $C = A \cup B$.

First, suppose that $W(C) = \max_{i \in C} b_i/v_p$. Then $W(C) < \max_{i \in A} b_i/v_p + \max_{i \in B} b_i/v_p \leq W(A) + W(B)$.

Second, suppose that $W(C) = \frac{1}{v_p} \sum_{i \in C} \bar{m}_{i,C}b_i$. Then

$$W(C) < \frac{1}{v_p} \sum_{i \in A} \bar{m}_{i,A}b_i + \sum_{i \in B} \bar{m}_{i,B}b_i \leq W(A) + W(B). \tag{16}$$

The second inequality holds by definition of $W(\cdot)$. The first strict inequality is due to the fact that adding further benefit dimensions to the choice problem can never increase the attention rank of (and thus the attention attributed towards) the previous benefit dimensions. Moreover, when “merging” two insurance plans into one comprehensive plan, some of the benefit dimensions must lose rank as the attention hierarchy is strict. In contrast, as the willingness-to-pay for the comprehensive insurance will be at least as high as the willingness-to-pay for each of the individual insurances the premium dimension cannot lose rank through the merger.

We now show that at least one benefit dimension receives strictly less attention which implies the first strict inequality in (16). First, suppose $W(A) = \frac{1}{v_p} \sum_{i \in A} \bar{m}_{i,A}b_i$ and $W(B) = \frac{1}{v_p} \sum_{i \in B} \bar{m}_{i,B}b_i$, i.e. that the premium dimension ranks first for both insurance plans before the merger. Consider for each of the two plans that are merged the benefit dimension $i$ that ranks highest in the attention hierarchy. For both of these dimensions, call them $a$ and $b$, it must be
that \( m_{a,A} > 0 \) and \( m_{b,B} > 0 \). Otherwise, e.g. if \( m_{a,A} = 0 \), then \( \frac{1}{v_p} \sum_{i \in A} \bar{m}_{i,A}b_i = 0 \neq W(A) \). One of the dimensions must lose rank through the merger since it cannot be that both maintain the rank two as the attention hierarchy is strict. From the definition of the attention parameters \( m_j \) it is easy to see that: If (and only if) a dimension receives attention, i.e. \( m_j > 0 \), then a loss in rank implies a loss in attention \((m_j)\). Therefore, as both highest-ranking benefit dimensions were considered before the merger and one of them loses rank, say \( a \), it must be that this dimension receives strictly less attention, so that \( m_{a,C} < m_{a,A} \). As all benefit dimensions receive weakly less attention and there is at least one dimension that receives strictly less attention, it must be that \( W(C) < 1 \sum_{i \in A} \bar{m}_{i,A}b_i + \sum_{i \in B} \bar{m}_{i,B}b_i \).

Consider, on the other hand, the cases in which \( W(A) = \max_{i \in A} b_i/v_p \), or \( W(B) = \max_{i \in B} b_i/v_p \), or both. W.l.o.g. suppose \( W(A) = \max_{i \in A} b_i/v_p = b_a v_p \), where we again call \( a \) the \( b \)-maximal disease in set \( A \). Since we consider the case in which \( W(C) = \frac{1}{v_p} \sum_{i \in C} m_{i,C}b_i \), we know that dimension \( a \) ranks first in the attention hierarchy before the merger, while the premium ranks first after the merger. Thus, dimension \( a \) must have lost rank through the merger, and since \( m_{a,A} > 0 \), we know that this loss in rank was accompanied by a loss in attention \( m_a \). Again, since all benefit dimensions receive weakly less attention and there is at least one that receives strictly less attention, we can conclude that \( W(C) < 1 \sum_{i \in A} \bar{m}_{i,A}b_i + \sum_{i \in B} \bar{m}_{i,B}b_i \).

As we have shown that \( W(C) < W(A) + W(B) \) for arbitrary non-empty, disjoint sets \( A, B \) and \( C = A \cup B \), the proposition follows.

**Proof of Proposition 5**

In the proposed equilibrium candidate, each firm earns zero profit. Also, the maximum premium charged by any firm in the market is \( \sum_{i \in I} \pi_i c_i \), the premium charged for the comprehensive insurance \( S = I \), while the minimum premium payment is realized in the outside option of no insurance. If \( \sum_{i \in I} \pi_i c_i > b_i \forall i \in \bar{F} \) then \( \mu_p > \mu_i \forall i \in \bar{F} \). Since \( \sum_{i \in I} \pi_i c_i > b_i = \pi_i c_i \forall i \in F \) always holds, we conclude that \( r(p) = 1 \) and \( m_p = 1 \). Hence, customers always recognize premium differences. In this case, no firm can profitably deviate. To show this, we first want to establish that no deviation can change the attention allocation \( m_j, j \in I \cup p \) prevailing in the equilibrium candidate. For the benefit dimensions \( j \in I \), we have \( \mu_i = b_i - 0 = b_i \) since there are firms that offer plans including insurance against \( i \), thus offering \( b_i \), and there are options, specifically the outside option, that do not include this benefit. No deviation by a single firm could change \( \mu_i \).
since there is neither a way to offer lower utility in dimension $i$ than zero nor a way to offer higher utility than $b_i$ in dimension $i$. Now, consider the premium dimension $p$. The maximum utility in this dimension is zero given by the outside option. The lowest utility is set by the comprehensive plan that covers all diseases. It is thus possible to further increase $\mu_p$ if the deviant plan would include a premium payment larger than $\sum_i \pi_i c_i$. However, since the premium dimension already ranks first in the attention hierarchy in the equilibrium candidate, $r(p) = 1$, and thereby $m_p = 1$, such a deviation could not further increase the attention allocated to the premium dimension. We conclude that the attention allocation induced in the equilibrium candidate cannot be changed by any deviant plan. We now want to argue that no deviant plan could earn a strictly positive profit. Suppose the contrary, i.e. the exists a plan $(\bar{S}, \bar{P})$ $\bar{S} \subseteq I$ that is not in the set of plans offered in our equilibrium candidate to which one of the firms could deviate and earn a strictly positive profit. Then $\bar{P} > \sum_{i \in \bar{S}} \pi_i c_i$ must hold for this plan. However, in the equilibrium there exists a firm offering the plan $(\bar{S}, \sum_{i \in \bar{S}} \pi_i c_i)$, i.e. a firm offering the same insurance benefits at an actuarially fair premium. Since premium differences are recognized because $m_p = 1$, no customer would choose the deviant plan. The deviant firm would thus make zero profits, a contradiction.

**Proof of Proposition 6**

In the equilibrium of Proposition 5, the attention hierarchy is given by

$$r(p) = 1,$$

$$r(i) = | \{ i' \in I : b_{i'} > b_i \} | + 1,$$

since $\mu_i = b_i \ \forall i \in I$. This means that the diseases with the highest insurance benefits receive more attention. This implies $m_i = \max \left\{ 0, 1 - \frac{\kappa_r(i)}{b_i} \right\}, \ \forall i \in I$. Customers will purchase the plan with the highest decision utility given this attention allocation.\footnote{We will consider the outside option of no insurance as the “plan” $(0, 0)$.}

We want to establish that the plan maximizing decision utility cannot include any insurance of diseases $i \in I$ with $b_i - v_p \pi_i c_i < \kappa_r(i)$. Suppose otherwise and $\exists i \in S^* : b_i - v_p \pi_i c_i < \kappa_r(i)$. Then consider the plan $S', P'$ with $S' = S^* \backslash i$ and $P' = \sum_{i \in S'} \pi_i c_i$. The difference in decision-utility
between the two plans is given by

\[ \tilde{U}(S^*) - \tilde{U}(S') = m_i b_i - m_p v_p \pi_i c_i = \max \{ b_i - \kappa_{r(i)}, 0 \} - v_p \pi_i c_i < 0. \]

The plan \((S', P')\) would thus give higher decision utility to the consumer, a contradiction to \((S^*, P^*)\) maximizing decision utility.

Now, suppose in contrast to the claim that \(\exists i \in I \setminus S^* : b_i - v_p \pi_i c_i \geq \kappa_{r(i)}\). Construct the plan \((S', P')\) with \(S' = S^* \cup i\). The difference in decision utility between the two plans is given by

\[ \tilde{U}(S^*) - \tilde{U}(S') = m_p v_p \pi_i c_i - m_i b_i = v_p \pi_i c_i - (b_i - \kappa_{r(i)}) \leq 0, \]

where the second equality holds since \(b_i - v_p \pi_i c_i \geq \kappa_{r(i)} \Rightarrow b_i > \kappa_{r(i)}\). Hence, customers would choose \((S', P')\) over \((S^*, P^*)\). Again, we have a contradiction.

**Proof of Claim:** If only plans covering \(i \in \bar{F}\) are offered in the market, profitable deviations may occur.

Suppose there are only plans available that cover diseases \(i \in \bar{F}\); the most comprehensive being \((\bar{F}, \sum_{i \in \bar{F}} \pi_i c_i)\). Further suppose that \(\sum_{i \in \bar{F}} \pi_i c_i > b_i, \forall i \in \bar{F}\), such that the premium dimension ranks first again: \(r(p) = 1\). The attention hierarchy amongst dimensions on which the available options differ will be given by

\[ r(p) = 1, \]

\[ r(i) = | \{ i' \in \bar{F} : b_{i'} > b_i \} | + 1 \tag{18} \]

Let \((S^*, P^*)\) denote the plan customers would choose from the available set. Denote by \(\iota = \min_{i \in S^*} b_i\) the disease with the lowest insurance benefit covered under this plan. Assume that \(b_\iota < \kappa_{r(\iota) + 1}\), i.e. this benefit would we neglected at the next lower attention rank. Now, suppose there exists a disease \(i \in F\) such that \(\sum_{i \in F} \pi_i c_i > b_i > b_j, \forall j \in \bar{F}\). Construct an additional plan that includes coverage of \(i\) yet excludes coverage of \(\iota\) and suppose it is priced actuarially fair. The difference in decision utility between this new plan and the plan \((S^*, P^*)\) is given by

\[ m_i^D b_i - m_i^D b_\iota - m_p^D v_p (\pi_i c_i - \pi_\iota c_\iota), \]
where \( m_j^D, j = p, i, \iota \) denotes the attention paid to dimension \( j \) after the inclusion of the newly constructed plan into the choice set. Note first that since \( b_i > b_j, \forall i \in \tilde{F} \) it must be true that \( m_i^D = 1 - (\kappa_2/b_i) \). Second, \( m_i^D = 0 \). After the inclusion of the new plan there is now an additional dimension, \( i \), that incorporates a larger utility difference. Hence, dimension \( \iota \) loses a rank in the hierarchy and is now neglected. Finally, since \( m_p = 1 \) before, we now must have \( m_p^D \leq 1 \). Thus,

\[
m_i^D b_i - m_i^D b_i - m_p^D v_p (\pi_i c_i - \pi_i c_i) \geq b_i - \kappa_2 - v_p (\pi_i c_i - \pi_i c_i) \tag{19}
\]

\[
= v_p \pi_i c_i - \kappa_2 - v_p (\pi_i c_i - \pi_i c_i) \tag{20}
\]

\[
= v_p \pi_i c_i - \kappa_2. \tag{21}
\]

Therefore, if \( v_p \pi_i c_i > \kappa_2 \), the customers strictly prefer the new plan to \((S^*, P^*)\). This would allow a small increase in the premium of the new plan without breaking the strict preference. Hence, the newly constructed plan could attract the whole market while making a positive profit.