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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 tend to overweight the premium and thus underappreciate the value of health insurance. Second, insurance companies may 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

Keywords: Limited Attention, Salience, Focus, Health Insurance, Insurance Demand

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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. Accordingly, there is a strong need for advice on health plan choice and frequent efforts to provide such.¹ Advice on health plan choice and its many dimensions are also a frequent topic in the media.²

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.³ 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.⁴ In consequence, discussion has focused on whether a restricted choice set would make consumers better off. This discussion 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.⁵ It is this aspect of choice complexity and its implications for choice among health plans which is the focus of this paper.

This work highlights the difficulty associated with evaluating the desirability of a health plan given that each alternative may differ on several dimensions, in particular the numerous diseases for which treatment/medication may or may not be covered. It uses a model developed in Dahremöller and Fels (2012) to depict how consumers with limited attention choose among multi-dimensional options, by focusing on a limited number of the attributes which are relevant for choice.

The paper seeks to carve out four possible implications of such limited attention of customers.

¹As 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.

²See e.g. <http://www.nytimes.com/2010/10/16/health/16patient.html>

³See Cubanski and Neuman (2007) and Neuman and Cubanski (2009) for reports on the program. See e.g. Heiss, McFadden, and Winter (2006) and Heiss, McFadden, and Winter (2010) for a discussion of optimal choice among Medicare Part D plans. Kling, Mullainathan, Shafir, Vermeulen, and Wrobel (2012) report evidence for a “comparison friction” in the choice of Medicare Part D plans.

⁴See e.g. Frank and Lamiraud (2008), Iyengar and Kamenica (2010), and Schram and Sonnemans (2011).

⁵One 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.

First, people tend to focus on the premium when deciding whether to purchase health insurance. This implies that they 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). Second, the tendency of customers to focus on a limited number of diseases covered allows firms to decrease the quality of their health plans unnoticed. Customers may then choose health plans which exclude coverage for certain conditions 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 might be some popular interest in the topic of insurance providers hiding limited coverage in the fine print.⁶ Third, customers may make dominated choices if they happen to neglect exactly those plan attributes in which the domination occurs. This can explain the observation of dominated choices in the context of health insurance as documented by Sinaiko and Hirth (2011). Finally, the undervaluation of comprehensive health plans creates an incentive for an insurance provider to unbundle and offer several more specific insurance plans individually. Such an unbundling effect has been reported in experiments 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 three effects we describe produce a serious dilemma for policymakers.

It has already been argued by Liebman and Zeckhauser (2008) that behavioral factors could play a major role in the markets for health care and health insurance. This paper seeks 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. Close to our approach that assumes a necessity to focus on a subset of the available information is Kőszegi and Szeidl (2013). We are confident that some of our results can be replicated within the framework of Kőszegi and Szeidl (2013). This assures us that these predictions are not just an artifact of the

⁶Accordingly, policy makers have attempted to regulate information provision by insurance providers. See e.g. <http://www.healthcare.gov/news/factsheets/2011/08/labels08172011a.html>.

model we employ here, but are robust to the choice of different models of limited attention. Distinct elements of our approach are the modeling of neglect and the assumption of a strict attention hierarchy.⁷ In particular, taking into account neglect enables us to accommodate evidence of dominated choices. Bordalo (2011) and Bordalo, Gennaioli, and Shleifer (2012) model salience as a function of perceptual biases. We share the assumption of the weighting of a problem’s dimensions being driven by an ordering of dimensions with respect to utility differences although we differ on the motivation of this assumption. In addition to our approach, they discuss the conflicting influence of such an ordering and diminishing sensitivity in perception on the weighting process. Similar to Kőszegi and Szeidl (2013) their model neither features a strict salience order among the dimensions nor does it feature neglect. As discussed before, this makes their model incapable of explaining dominated choices. Customers’ tendency to neglect and the resulting ability of firms to exploit such inattention have already been investigated in industrial organization settings (see most prominently Gabaix and Laibson (2006)). In our framework, inattention is endogenous. It has been shown that this endogeneity may lead to the opposite result of a firm being unable to exploit inattentive customers in a monopoly setting (Dahremöller and Fels (2012)). Interestingly, we will 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 insurance 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 the implications of these results for policy.

⁷We deem both elements to be important in the modeling of complexity problems as discussed in Dahremöller and Fels (2012). Specifically, the assumption of a strict attention hierarchy ensures that more complex problems are more difficult to solve, thereby leading to a larger tendency for decision errors. In Kőszegi and Szeidl (2013)’s approach one can find arbitrarily complex problems which the decision-maker may solve without problem.

2 The Problem of Buying Insurance

We model the problem of buying health insurance as a problem of choosing between two multi-dimensional alternatives. Buying insurance is associated with a vector of consequences $((x_1, \pi_1), \dots, (x_m, \pi_m))$ where x describes the consequence, while π describes its probability. For example, buying health insurance incorporates the (certain) payment of a premium $(-P, 1)$. Second, it comprises consequences contingent on contracting a disease. Let $I, |I| = n$ denote the finite set of diseases and assume that the occurrence of different diseases are disjoint events. Buying insurance ensures the reception of treatment if need be. Furthermore, it is associated with a certain amount of co-payment for each treatment. Thus, the option *insurance* can be represented as

$$((-P, 1), [(-D_i + T_i, \pi_i), (-(1 - \alpha)c_i, \pi_i)]_{i \in I}) \quad (1)$$

where P denotes the premium, D_i the deterioration of health due to disease $i = 1, \dots, n$, $T_i \leq D_i$ the improvement of health due to medical treatment of disease i , π_i the probability of contracting disease i , c_i the (monetary) cost of treatment for disease i , and $\alpha \in (0, 1]$ $(1 - \alpha)$ the coverage rate (co-payment rate) of the insurance.⁸

In contrast, the alternative *remaining uninsured* is represented by a different vector of consequences. First, a disease may be associated with treatment costs c_i for those diseases for which treatment is affordable even without insurance. Denote this set of diseases by $F \subseteq I$. For all $i \in F$, remaining uninsured is associated with (a) the monetary cost and (b) the health benefits of treatment. Second, there may be diseases for which the monetary cost of treatment exceed the decision-maker's budget. Denote this set of diseases by $\bar{F} = I \setminus F$.⁹ For all $i \in \bar{F}$, remaining uninsured incurs the consequence of a deterioration of health. Thus the option of *remaining uninsured* is represented by a vector

$$[(-D_i + T_i, \pi_i), (-c_i, \pi_i)]_{i \in F}, [(-D_i, \pi_i)]_{i \in \bar{F}}. \quad (2)$$

The decision-maker is both willing and able to purchase treatment for diseases $i \in F$. Yet, he is

⁸For the moment, we assume that there are no diseases which are not covered and no diseases for which the decision-maker is unable to afford treatment when having health insurance.

⁹Formally, if B is the decision-maker's budget, then $\bar{F} = \{i \in I : c_i > B\}$.

assumed to be willing but unable to do so for diseases $i \in \bar{F}$.

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. The dimensions of the choice problem are derived by assigning each consequence of an option into exactly one dimension. Two options each have a consequence in the same dimension if these two consequences are *comparable*. For example, the consequence co-payment in case of disease $i \in F$ associated with insurance is ordered into the same dimension as the full payment of treatment cost for this disease i associated with remaining uninsured as they are both considered payments required to get treatment for disease i . Similarly, the health consequence $(-D_i, +T_i, \pi_i), i \in \bar{F}$ associated with insuring is categorized into the same dimension as health consequence $(-D_i, \pi_i), i \in \bar{F}$ of a health deterioration associated with remaining uninsured. There are yet consequences of an option which the other option lacks, such as the premium payment associated only with insurance, or monetary expenses for treatment for a disease $i \in \bar{F}$, also associated only with insurance. W.l.o.g. we normalize the utility of an alternative in a dimension it does not feature to zero. 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.

We assume the utility of a consequence to be linear. The difference U in utility between buying insurance and remaining uninsured is then

$$\begin{aligned}
U &= v_p [-P - 0] + \sum_{i \in F} \pi_i v_h [(-D_i + T_i) - (-D_i + T_i)] + \sum_{i \in F} v_p \pi_i [(-(1 - \alpha)c_i) - (-c_i)] \quad (3) \\
&+ \sum_{i \in \bar{F}} \pi_i v_h [(-D_i + T_i) - (-D_i)] + \sum_{i \in \bar{F}} \pi_i v_p [(-(1 - \alpha)c_i) - 0] \\
&= -v_p P + \sum_{i \in F} \pi_i v_p \alpha c_i + \sum_{i \in \bar{F}} \pi_i [v_h T_i - v_p (1 - \alpha)c_i]
\end{aligned}$$

v_p denotes the marginal utility of money, v_h denotes the marginal utility of health. The net utility of buying insurance comprises the disutility of the premium payment, the utility gain from receiving (partial) coverage of treatment cost, the utility gain from receiving treatment in case of disease $i \in \bar{F}$, and the disutility from making a co-payment in case of disease $i \in \bar{F}$.

Note that this choice problem has $2n + 1$ dimensions, one dimension associated with the health consequences of each disease, one dimension for the monetary consequences of each disease, and one dimension for the premium. 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. $P = \sum_i \pi_i \alpha c_i$, the value of insurance U is given by

$$U = \sum_{i \in \bar{F}} \pi_i (v_h T_i - v_p c_i) > 0, \quad (4)$$

which is the net value of access to otherwise unaffordable treatment provided by the insurance. 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 thus follow Nyman (2003) in identifying the access motive as the primary incentive to buy health insurance. We abstract from incentives due to risk preferences.¹⁰

Suppose the decision-maker has difficulties solving the $(2n + 1)$ -dimensional problem. Specifically, this problem requires judgments concerning the commensurability of different dimensions such as certain monetary consequences, uncertain monetary consequences, or uncertain health consequences. Instead of fully evaluating the utility differences the decision-maker may focus on a subset of the relevant dimensions when making his choice. He thus bases his decision on the difference in decision utility \tilde{U} :

$$\tilde{U} := -m_p v_p P + \sum_{i \in F} m_{c(i)} \pi_i v_p \alpha c_i + \sum_{i \in \bar{F}} m_{h(i)} \pi_i v_h T_i - \sum_{i \in \bar{F}} m_{c(i)} \pi_i (1 - \alpha) c_i \quad (5)$$

where $m_j \in [0, 1]$ is the attention a dimension j receives, $c(i)$ denotes the dimension comprising those consequences which 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.

2.1 Limited Attention

We want to shortly discuss the attention allocation that is reflected in the attention parameters m_j .¹¹ An implicit assumption in models of multi-attribute decision-making is commensurability,

¹⁰Our results do not hinge on the functional form of U since we analyze a biased processing of the inputs of U . With $U = (1 - \sum_i \pi_i) [u(-P, -0) - u(-0, -0)] + \sum_{i \in F} \pi_i [u(-P - (1 - \alpha)c_i, -D_i + T_i) - u(-c_i, -D_i + T_i)] + \sum_{i \in \bar{F}} \pi_i [u(-P - (1 - \alpha)c_i, -D_i + T_i) - u(-0, -D_i)]$ 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 risk neutral representation.

¹¹A more extensive derivation and discussion can be found in Dahremöller and Fels (2012).

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 it 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, which 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.¹² 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.

The reader has noticed that we assume a particular framing of the choice problem. This frame assumes the premium, the monetary consequences, and the health consequences of each individual disease to form a distinct problem dimension. Why do we deviate from the familiar lottery representation, i.e. a problem representation based on states of nature? We want to remind the reader of our argument 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) across two alternatives without assigning a utility to each state for each alternative. Yet, this assignment already requires to integrate judgments 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

¹²Note 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.

assume that it is a comparison across states which 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 which reflect 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 Γ denotes the set of all available alternatives g .¹³ Then μ_j denotes the maximum utility difference in dimension j from any binary comparison of alternatives in the choice set. As we only consider two alternatives in this section, μ_j is the utility difference between the options of buying insurance and not buying insurance in dimension j .

We assume a strict hierarchy $r : J \rightarrow \{1, \dots, |J|\}$, where J denotes the set of dimensions, between the dimensions to which we henceforth refer as the *attention hierarchy*. This hierarchy obeys

$$\mu_j > \mu_{j'} \Rightarrow r(j) < r(j'), \quad (6)$$

i.e., dimensions with larger utility differences attain a higher attention rank. In case that (6) does not produce a strict order we assume tie-breaking rules.¹⁴ Given a dimension's rank in the hierarchy, the attention m_j it receives is given by

$$m_j = \max \left\{ 0, 1 - \frac{\kappa_{r(j)}}{\mu_j} \right\} \quad (7)$$

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 problems we assume

$$(i) \kappa_1 = 0 \quad (8)$$

$$(ii) \kappa_r < \kappa_{r+1}, \forall r. \quad (9)$$

This assumption reflects the rising difficulty of considering more and more dimensions of the

¹³Recall that we assume $u(g, j) = 0$ for those alternatives g with no consequence associated with dimension j .

¹⁴For example, if two dimensions tie such that $\mu_j = \mu_{j'}$, one may assume this tie to be broken according to the probability of the consequences ordered into dimensions j, j' .

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.

2.2 Undervaluation of Insurance

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

Assumption 1.

$$v_p P > \{[\pi_i v_p \alpha c_i]_{i \in F}, [\pi_i v_h T_i]_{i \in \bar{F}}\}. \quad (10)$$

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 ($\tilde{U} < U$) that provides close to full coverage ($\alpha \cong 1$) and may select not to insure despite it being individually optimal.

Proof. See Appendix. □

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 trivially satisfied if the premium is greater or equal the actuarially fair premium. Part (b) is satisfied if insurance covers sufficiently many diseases which *individually* are unlikely. We regard this assumption to be satisfied in the case of health insurance for the average individual, i.e. the individual with no pre-existing condition. If (and only if) this assumption 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.¹⁵ 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.¹⁶

The value of insurance U offering (close to) full coverage is not fully appreciated.¹⁷ 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 integrate the access value of each individual disease into his evaluation of the insurance option.

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 κ_r are negatively correlated with cognitive ability.

Finally, one may oppose the result of an undervaluation of insurance with evidence concerning a preference for excessively low or no deductibles. First, we want to emphasize that the characterization of a preference for low or no deductible as overinsurance is based on the common approach to restrict the value of insurance to the balancing of consumption across states, i.e. its

¹⁵The 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 $j \neq p$. This condition is satisfied whenever the premium must be cost covering and the set I of diseases covered is sufficiently large.

¹⁶In 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.

¹⁷We conjecture that underappreciation holds much more generally. For example, if α 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 $U - \tilde{U} < 0$. We cannot completely rule out the possibility that $U - \tilde{U} \geq 0$ for intermediate α for all possible $(v_p \alpha c_i)_{i \in F}, (v_h T_i)_{i \in A}, (-v_p(1 - \alpha)c_i)_{i \in A}$ with $A = \{i \in I : B < c_i \leq B/(1 - \alpha)\}$. Yet, we conjecture that the underappreciation of coverage and access value usually dominates the underappreciation of copayment.

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 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 ensures this access.¹⁸

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 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 $\alpha \in (0, 1]$. Denote by $A \subseteq \bar{F}$ the set of diseases for which the insurance with coverage rate α provides access to treatment and assume that α is large enough that A is nonempty.¹⁹ Furthermore, assume that the premium is at least actuarially fair, i.e. $P \geq \sum_{i \in F \cup A} \pi_i \alpha c_i$. Now, consider a second insurance plan with $0 < \alpha' < \alpha$ and denote by $A' \subseteq A$ the set of diseases for which this second health plan provides access to

¹⁸A different explanation 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.

¹⁹That is, if the decision-makers budget is B , A comprises all diseases i for which treatment cost satisfy: $B < c_i \leq B/(1 - \alpha)$.

treatment. Assume that this second plan is priced such that the premium difference reflects the difference in expected cost of coverage, i.e. $P' = P - \sum_{i \in F \cup A'} (\alpha - \alpha') \pi_i c_i - \sum_{i \in A \setminus A'} \pi_i \alpha c_i$. 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 decision utility is given by

$$\begin{aligned}
\tilde{U}_1 - \tilde{U}_2 &= m_p v_p (P' - P) + \sum_{i \in A \setminus A'} \pi_i [m_{h(i)} v_h T_i - m_{c(i)} v_p (1 - \alpha) c_i] \\
&\quad + \sum_{j \in F \cup A'} \pi_j m_{c(j)} v_p (\alpha - \alpha') c_j \\
&= m_p v_p \left[\sum_{j \in F \cup A'} \pi_j (\alpha' - \alpha) c_j - \sum_{i \in A \setminus A'} \alpha \pi_i c_i \right] \\
&\quad + \sum_{i \in A \setminus A'} \pi_i [m_{h(i)} v_h T_i - m_{c(i)} v_p (1 - \alpha) c_i] + \sum_{j \in F \cup A'} \pi_j m_{c(j)} v_p (\alpha - \alpha') c_j \\
&= \underbrace{\sum_{j \in F \cup A'} \pi_j v_p (m_{c(j)} - m_p) (\alpha - \alpha') c_j}_{\text{Higher coverage}} \\
&\quad + \underbrace{\sum_{i \in A \setminus A'} \pi_i [m_{h(i)} v_h T_i - m_{c(i)} v_p (1 - \alpha) c_i - m_p v_p \alpha c_i]}_{\text{Higher access}}. \tag{11}
\end{aligned}$$

Consider the last line of equation (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 received full attention $m_{c(j)} = m_p = 1$, they would cancel out each other. If the premium dimension p receives more attention than the co-payment dimensions $c(j)$, 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 will be 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 will be no treatment, there will not be any co-payment for these treatments under health plan 2 either. Though one may regard this advantage of plan 2 to be small compared to the disadvantage of not receiving treatment, it is still an advantage. 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

again that, if α' and α 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 $A \setminus A' = \emptyset$.

We distinguish between the two scenarios of voluntary insurance and individual mandate since the option of not buying insurance is extreme. It is extreme in the sense that it is the best alternative in the premium dimension and the worst alternative in the copayment dimensions for diseases $i \in F$ and in the health dimensions for diseases $i \in A$. Thus, this outside option changes the attention parameters m_j . The following proposition states the conditions under which profitable undercutting is feasible.

Proposition 2. *Profitable Undercutting*

- (i) *Suppose insurance is mandatory and there is an insurance market in which a single plan with coverage rate $\alpha \in (0, 1]$ is already offered at a cost-covering premium. If there exists an $\alpha' < \alpha$ such that $A = A'$, there always exists a strictly more profitable plan with lower coverage and lower premium which customers will choose over the initially offered plan. If $A' \subset A$ for all $\alpha' < \alpha$, a more profitable plan with lower coverage and lower premium exists if the probability π_i of the disease(s) $i \in A \setminus A'$ is sufficiently small.*
- (ii) *Suppose insurance is voluntary and the incumbent plan with coverage rate α with $A \neq \emptyset$ is demanded in the absence of any other plan. If there exists an $\alpha' < \alpha$ such that $A = A'$, a strictly more profitable plan with lower coverage can be constructed if Assumption 1 holds for the incumbent plan. If the incumbent plan features a coverage rate α such that $A' \subset A$ for all $\alpha' < \alpha$, profitable undercutting is possible if $m_{h(i)} = 0$ for the disease(s) $i \in A \setminus A'$.*

Proof. See Appendix. □

The reason for the described undercutting strategy to work is that the benefit of the new plan is concentrated in one dimension (the premium) while the 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, attention of customers are distracted by the comparatively large savings in premium payments. This distraction and the resulting inattention to reduced quality allow the firm to retain some of the cost savings from the decrease in quality.

The different conditions in proposition 2 describe the circumstances under which premium

differences are most salient, $m_p = 1$, and quality differences tend to be underappreciated or neglected. If there are no difference in health consequences between the health plans, $A' = A$, undercutting is particularly easy. All that is required is that premium differences are recognized. It is less easy to undercut if a coverage reduction implies a loss of access $A' \subset A$. Whether and to what extent a customer recognizes this loss in access can vary strongly between the two regimes. If insurance is mandatory, a loss in access can only be “hidden” if the access value lost is small (e.g. because π_i is small) relative to the premium reduction. The latter is large if the cumulative cost savings due to a coverage reduction are large, e.g. because the plan still covers many diseases ($|F \cup A'|$ is large). In contrast, 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 options do not differ.²⁰ 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, 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, she 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 she neglects to recognize the limited coverage for rare diseases of the cheaper plan.²¹

Proposition 2 seeks to show that limited attention may result in a quality deterioration in health insurance markets. Absent of switching costs, a qualitative race to the bottom may arise in markets for complex insurance products. Thus, a regime of mandatory health insurance may be insufficient for the provision of health insurance if not coupled with minimum quality standards or mandated benefits. There is a discussion about whether insurance companies “hide” limited coverage in the fine print. This section seeks to highlight how the model can accommodate the

²⁰This 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 no insurance-option. If the decision-maker neglected the health consequences of being insured, she would always opt out of insurance as she would disregard all the advantages of being insured.

²¹Similarly, 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 ($\pi_i < 1$).

intuition 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.²² 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.²³ This is striking as there are considerably more ways to provide better quality given a premium than there are ways 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.

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

²²See e.g. Heiss, Leive, McFadden, and Winter (2012) and Frank and Lamiraud (2008).

²³See e.g. Abaluck and Gruber (2011) or Heiss, Leive, McFadden, and Winter (2012).

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.²⁴ The model of limited attention proposed here can explain such behavior. For this, assume that plans may be 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 Γ 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.

Proposition 3. *Indifference despite Dominance.*

Suppose there exists a choice set Γ of health plans with at least two distinct elements. If there exists a dimension $j \in \{p, c(i) : i \in F, h(i) : i \in \bar{F}\}$ such that $\mu_j > 0$ yet $m_j = 0$. Then there exists a plan which is dominated by one of the available plans, but the decision-maker will be indifferent between these two plan 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 Γ . 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 Γ of health plans with at least two distinct elements. If there exists a dimension $j \in \{p, c(i) : i \in F, h(i) : i \in \bar{F}\}$ such that $u(g^, j) > \min_{g \in \Gamma} u(g, j)$ yet $m_j = 0$. Then there exists a dominated alternative which 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 which fully covers some set $S \subset \bar{F}$ 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,

²⁴See Sinaiko and Hirth (2011).

$P = \sum_S \pi_i c_i$ 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 ι . Now, imagine a second plan that is identical to the first plan except for the coverage of disease ι was offered in addition to the first plan, at the same premium P as the first plan. 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 which produces the dominance.

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 which 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 which 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, Meszaros, and Kunreuther (1993) provide several examples of such an unbundling effect.²⁵ 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.²⁶ Denote by P the premium, c_a the cost treatment in case of an accident, π_a the probability the DM associates with having an accident, c_d the cost of treatment in case of a disease, and π_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, the decision-maker solves two two-dimensional problems with advantages and disadvantages being condensed

²⁵In 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).

²⁶For 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.

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 composite insurance makes the insurance contract 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 is likely to be the premium dimension as it integrates the costs of covering several incidences. As a result the benefit dimensions are not fully considered.

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 I , $|I| \geq 2$ be the set of diseases for which a comprehensive insurance plan offers full coverage of treatment cost. Let (I_1, \dots, I_z) be a partition of I 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 $W(I) < \sum_{l=1}^z W(I_l)$.

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 , which result in discontinuities in the payoff functions of firms, we cannot be certain that equilibria always exist. We will, therefore,

consider under which conditions equilibria (in pure strategies) exist. Further, we will investigate the optimality of these equilibria.

We will look at a particular setting. Each firm can offer only a single plan. We will 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.²⁷ A firm's plan choice is then a set $S \subseteq I$ of diseases covered and a premium P .

Consider a situation in which demand is homogenous and perfectly elastic. That is, 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.

Again, we distinguish between the two regimes of individual mandate and voluntary insurance.

6.1 Individual Mandate

We want to see which health plans are offered in a symmetric pure-strategy equilibrium, and under which conditions such an equilibrium exists in the first place. An individual mandate requires each customer to purchase a health plan. Accordingly, such a policy might be considered an interesting candidate to tackle the underappreciation of insurance as described in Proposition 1.

Proposition 5. *Suppose customers are bound to choose a health plan, i.e. there is an individual mandate. If there exists an equilibrium in pure strategies in which all firms offer the plan (S^*, P^*) , then*

1. *the equilibrium set $S^* \supseteq \bar{F}$.*
2. *the equilibrium price $P^* = \sum_{i \in S^*} \pi_i c_i$.*
3. *the equilibrium set S^* comprises at most one $i \in F$.*

Proof. See Appendix. □

²⁷One could think of this as a regulatory requirement to eliminate the undercutting incentives we discussed in Proposition 2.

Proposition (5) shows that if there exists an equilibrium in pure strategies when customers have to buy insurance, this equilibrium is first-best. It is first-best since the equilibrium set S^* must contain all diseases for which customers are unable to self-insure, i.e. all $i \in \bar{F}$. In addition to that, the equilibrium plan comes at the lowest possible price, i.e. the actuarially fair premium.

Unfortunately, the supply of plan $(\bar{F}, \sum_{i \in \bar{F}} \pi_i c_i)$ may not be an equilibrium either. The reason is the underappreciation of the value of insurance as shown in Proposition 1. For $(\bar{F}, \sum_{i \in \bar{F}} \pi_i c_i)$ to be an equilibrium there must not exist any plan $(S', P') \in 2^I \times \mathbb{R}$, $(S', P') \neq (\bar{F}, \sum_{i \in \bar{F}} \pi_i c_i)$ with $P' = \sum_{i \in S'} \pi_i c_i$ such that

$$\sum_{i \in \bar{F} \setminus S'} m_i b_i - \sum_{i \in S' \setminus \bar{F}} m_i b_i - m_p v_p \left[\sum_{i \in \bar{F} \setminus S'} \pi_i c_i - \sum_{i \in S' \setminus \bar{F}} \pi_i c_i \right] < 0$$

with b_i being the benefit of coverage for disease i , i.e. $b_i = \pi_i v_H T_i$, $i \in \bar{F}$ and $b_i = \pi_i v_p c_i$, $i \in F$. Now suppose there exists a set $S' \subset \bar{F}$: $\sum_{i \in \bar{F} \setminus S'} v_p \pi_i c_i > b_i$, $\forall i \in \bar{F} \setminus S'$. This amounts to applying Proposition 1 to the subset $\bar{F} \setminus S'$ instead of I . The value of full insurance against $\bar{F} \setminus S'$ is underappreciated. If cognitive costs are sufficiently high, the customer will prefer the deviant plan, i.e. remaining uninsured against diseases $\bar{F} \setminus S'$. If the set \bar{F} is sufficiently large we may not hope for such a subset S' not to exist.

In sum, if underappreciation of full insurance is not severe, an individual mandate coupled with an obligation of full coverage will result in an equilibrium with a first-best allocation despite cognitive limitations. If the set of diseases for which customers cannot self-insure is too large, underappreciation of full insurance of such diseases is too severe such that offering such a plan can be sustained in equilibrium.

6.2 Voluntary Insurance

Customers have an additional option in the voluntary insurance regime: the option not to insure at all $(\emptyset, 0)$. This is important as this outside option offers the highest utility in the premium dimension, yet the lowest utility in all benefit dimensions. The existence of an outside option thus strongly influences which dimensions of the choice problem are taken into account. In addition, an equilibrium plan must now fare at least as good as the outside option (participation constraint), while a successful deviation must be better than the incumbent plan and the outside option given

the attention allocation resulting from this triple choice set.

Let us define $E = \{(\emptyset, 0), (S, P)\}$ to be the choice set of the customers if only plan (S, P) is offered, and $D = E \cup (S', P')$ be the choice set E ammended by an additional plan (S', P') . We will introduce a second subscript to the attention parameter. Now, $m_{j,\Gamma}$ denotes the attention dimension j receives when customers have to make a choice from the set Γ .

There exists a symmetric pure-strategy equilibrium under voluntary insurance if and only if there exists a plan (S, P) which

1. is voluntarily chosen if there is no other plan available: $\tilde{U}(S, P|E) = \sum_{i \in S} m_{i,E} b_i - m_{p,E} P \geq 0$, and

2. there is no profitable deviation, i.e. $\nexists (S', P') \in 2^I \times \mathbb{R}, (S', P') \neq (S, P)$ such that

$$(a) \quad \tilde{U}(S', P'|D) = \sum_{i \in S'} m_{i,D} b_i - m_{p,D} P' \geq 0 \text{ and}$$

$$(b) \quad \tilde{U}(S', P'|D) = \sum_{i \in S'} m_{i,D} b_i - m_{p,D} P' \geq \tilde{U}(S, P|D) = \sum_{i \in S} m_{i,D} b_i - m_{p,D} P.$$

We have argued that, if there exists a pure strategy equilibrium when insurance is mandatory, the equilibrium set S^* must contain all diseases in \bar{F} . This is no longer true under voluntary insurance.

Proposition 6. (*Trivial Insurance*) Suppose that $\arg\max_{i \in I} b_i \in F$. Then if $\kappa_2 > b_j, \forall j \in I \setminus \{i\}$ there exists a pure strategy equilibrium in which only the plan $(i, \pi_i c_i)$ is offered.

Proof. We will assume throughout that if $\mu_i = \mu_p$, then $r(i) < r(p)$, i.e. ties between a benefit and the premium dimension are always broken in favor of the benefit dimension. This implies $\tilde{U}(i, \pi_i c_i|E) > 0$. The plan is purchased by customers if no other plan is available.

Suppose any plan (S', P') with $P' > 0$ is offered in addition. Since $b_i > b_j, \forall j \in S'$ we know that $r(j) \geq 2, \forall j \in S'$. This again implies that $m_{j,D} = 0, \forall j \in S'$ since $b_j < \kappa_{r(j)}$. None of the benefits of the deviant plan are considered by the customers. This means that the deviant firm can earn at most zero profits. It is obvious that no deviation to a plan (i, P') with $P' \neq \pi_i c_i$ can be profitable. Undercutting the price yields strictly negative profits. Asking a higher price results in no sales. As the two options only differ in the premium, this difference is fully recognized by the customers who opt for the cheaper plan. We conclude that no profitable deviation exists. \square

The possibility that such an equilibrium exists is rather undesirable. It shows that none of the gains from trade which exist in the insurance market may be realized in equilibrium.

The proof of the last proposition reveals the conditions under which the provision of an insurance plan (S, P) with $S \cap \bar{F} \neq \emptyset$ can be an equilibrium. Suppose that for all $i, j \in \bar{F}$ it holds that $b_i > b_j \Rightarrow b_i - v_p \pi_i c_i > b_j - v_p \pi_j c_j$. If this holds true, one can construct the set S in the following way. First, order the set \bar{F} according to b_i . Include in S the first, i.e. the b_i -maximal, element of \bar{F} . Include the second element if $m_{i,E} b_i - m_{p,E} \pi_i c_i \geq 0$ where (S, P) in E refers to S after the inclusion and $P = \sum_{i \in S} \pi_i c_i$. Continue until either $S = \bar{F}$ or $m_{i,E} b_i - m_{p,E} \pi_i c_i < 0$ for all $i \in \bar{F} \setminus S$.

Proposition 7. *Suppose S is constructed as above and the assumption $b_i > b_j \Rightarrow b_i - \pi_i c_i > b_j - \pi_j c_j$ holds. Further suppose that $\sum_{i \in S} v_p \pi_i c_i > b_i > b_j, \forall i \in S, j \in \bar{F}$. Then there exists a symmetric equilibrium in pure strategies in which (S, P) with $P = \sum_{i \in S} \pi_i c_i$ is offered.*

Proof. See Appendix. □

We shall provide some intuition for why there does not exist a profitable deviation under above assumptions. The main reason for why there does not exist any deviation is that $b_i < b_j, \forall i \in S, j \in \bar{F} \setminus S$. This implies that any benefit provided by a deviation plan that is not already provided by the incumbent plan receives less attention as any of the benefits of the incumbent plan. Thus, the benefits of any deviation plan are more underappreciated than the benefits of the incumbent plan. Since the incumbent plan includes coverage of those diseases from which the customer benefits most (in expectation), no deviation plan can distract attention from these benefits.

How efficient is this equilibrium? If \bar{F} is small and/or cognitive costs κ are sufficiently low, the equilibrium set may include all diseases in \bar{F} . Then the equilibrium plan is $(\bar{F}, \sum_{i \in \bar{F}} \pi_i c_i)$ and the equilibrium is first-best. If \bar{F} is large, or cognitive costs are sufficiently large, the equilibrium set S is only a subset of \bar{F} . In contrast to the individual-mandate regime, an equilibrium in pure strategies may still exist under such conditions. Could one call such an equilibrium constrained-efficient, in the sense that the equilibrium plan maximizes experienced utility subject to decision utility being nonnegative?²⁸ Unfortunately, the answer is no. It is easy to see why. The set S is expanded until including any further element $i \in \bar{F} \setminus S$ would result in a decline in decision utility.

²⁸Such a plan could be called the best plan that customers with the given cognitive limitations are still willing to purchase.

Yet for the set S to be the constrained-efficient, it should include all additional elements of $\bar{F} \setminus S$ of which the inclusion does not result in negative decision utility being ascribed to the entire plan. Unless no such elements exist, the market equilibrium will not be constrained-efficient.

We note that the existence of a pure-strategy equilibrium is given for weaker conditions in the voluntary-insurance regime. On the other hand, trivial insurance can be an equilibrium if insurance is voluntary, an outcome which is impossible if insurance is mandatory. Such an equilibrium is undesirable as none of the benefits from trade prevalent in the market are realized in this equilibrium. We conclude that equilibrium existence in this market is not necessarily given when no better plan exists, but when attention cannot be distracted by a plan that appears better in comparison.

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 may show an underappreciation of the value of health insurance. Second, this tendency to simplify may give rise to strong incentives for 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 fundamental 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. However, given an individual mandate, insurance providers may have strong incentives to decrease quality in less salient dimensions, such as coverage for rare but costly diseases. To oppose such attempts one may call for regulations that eliminate such incentives. We have shown that adding an obligation to provide full payment for any disease the insurance contract covers may not ensure the market to provide the first-best allocation. A further avenue that could be considered are mandated benefits, i.e. the obligation for each health plan to cover particular diseases. However, with a significant number of mandated benefits, each insurance plan is a comprehensive plan increasing the extent of underappreciation of

value. A policy of mandated benefits without an individual mandate may thus lead to insufficient insurance purchase. We conclude that 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.

In sum, acknowledging the existence of the described biases in choice behavior may support calls for policy interventions such as an individual mandate or mandated benefits. Yet, the very existence of these biases may 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 attributes 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.

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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 $v_h T_i > v_p c_i$, $\forall i \in \bar{F}$ 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 experienced-utility difference U and the decision-utility difference \tilde{U} when $m_p = 1$, i.e. the premium dimension receives full attention.

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

The first and the second term are strictly positive while the third is strictly negative. If α is (close to) one, thus the co-payment rate is zero (small), the third term is dominated.

Finally, suppose $\bar{F} \neq \emptyset$ and $U > 0$. It is easy to see that the respective difference in decision utility is negative, $\tilde{U} < 0$, 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 $\tilde{U}_1 - \tilde{U}_2$ 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 $\tilde{U}_3 > \tilde{U}_1$ must hold. Offering this plan attracts customers and is strictly more profitable than the incumbent plan. In the following, we thus concentrate on the conditions under which the difference (11) is strictly negative and $m_p = 1$.

Scenario 1: Mandatory Insurance

Consider the scenario in which insurance is mandatory and assume that only the two insurance plans are available to the customer. Then the first (second) plan fares worst (best) from the perspective of the customer in the premium dimension as the first (second) one has the highest

(lowest) available premium. In contrast, the first plan fares best and the second plan fares worst in those dimensions $j = c(i)$ associated with the monetary costs the customer faces in case of a disease. The attention parameters of the dimensions of the problem are then given by

$$\begin{aligned}
m_p &= \max \left\{ 0, 1 - \frac{\kappa_r(p)}{v_p(P - P')} \right\} \\
m_{c(i)} &= \max \left\{ 0, 1 - \frac{\kappa_r(c(i))}{v_p(\alpha - \alpha')\pi_i c_i} \right\}, \quad \forall i \in F \cup A', \\
m_{c(i)} &= \max \left\{ 0, 1 - \frac{\kappa_r(c(i))}{v_p(1 - \alpha)\pi_i c_i} \right\}, \quad \forall i \in A \setminus A', \\
m_{h(i)} &= \max \left\{ 0, 1 - \frac{\kappa_r(h(i))}{\pi_i v_h T_i} \right\}, \quad \forall i \in A \setminus A', \\
m_{h(i)} &= 0, \quad \forall i \in F \cup A'.
\end{aligned}$$

First, assume that there exists an $\alpha' < \alpha$ such that $A = A'$. In this case, the second health plan offers lower coverage, yet it does not restrict access to treatment more than health plan 1 does. Then, the premium dimension must have the highest attention rank as the difference between the two premiums comprises the sum of all differences in expected coverage cost and thereby exceeds the expected difference in out-of-pocket payment for each individual disease, i.e. $\mu_p = v_p \sum_{i \in F \cup A'} \pi_i (\alpha - \alpha') c_i > v_p \pi_i (\alpha - \alpha') c_i = \mu_{c(i)}, \quad \forall i \in F \cup A'$. As a result $1 = m_p > m_{c(i)}, \quad \forall i \in F \cup A'$. As the premium difference is fully recognized while the differences in out-of-pocket payments are not (maybe even neglected for some diseases) the second policy is strictly preferred to the first one.

Remember that we assumed that $A = A'$ for some $\alpha' < \alpha$. This assumption does not hold for some $\alpha \in (0, 1]$, in particular those that are just sufficient to provide access to some treatment. Any lowering of coverage below these coverage rates denies access to the treatment of at least one disease. Assume that there are $n - m$ diseases for which the customer is unable to afford treatment without health insurance. W.l.o.g. assume the diseases to be strictly ordered according to their treatment costs, i.e. $c_1 < \dots < c_m < c_{m+1} < \dots < c_n$. For $i \geq m + 1$, define $\alpha(i) = \min \{ \alpha : i \in A \}$ to be the minimum coverage rate such that treatment for diseases $j \leq i$ is affordable with an insurance covering at least $\alpha(i)$. We have shown above, that if $\alpha \neq \alpha(i), \forall i = m + 1 \dots n$, there is a way to profitably undercut. It is easy to show that such undercutting is more difficult, yet maybe not impossible if $\alpha = \alpha(i)$ for some $i = m + 1, \dots, n$. Assume the incumbent health plan offers some coverage $\alpha(i)$. For any $\alpha' < \alpha(i)$ we know that $A' \subset A$ as A' lacks at least

element i . Let the difference in premiums $P - P'$, again, be the difference in expected coverage cost. The difference in decision utility between plan 1 and 2 is given by (11). The same logic as before applies. Since the premium difference comprises all coverage reductions it is larger than the increase in co-payment for each individual disease. Hence $\mu_p > \mu_{c(i)}$, $\forall i \in F \cup A'$ which again implies $m_p \geq m_{c(i)}$, $\forall i \in F \cup A'$ with strict inequality if $m_p > 0$. This again means that the first term in 11 is nonpositive, and strictly negative for $m_p > 0$. However, because $v_h T_i > v_p c_i$ we also know that $m_{h(i)} \geq m_{c(i)}$, $\forall i \in A \setminus A'$ with strict inequality if $m_{h(i)} > 0$. This means that the second term may be positive for $m_{h(i)} > 0$. In this case, it is not straightforward whether the difference in (11) is positive or negative. If T_i , the access value of the treatment excluded from coverage, is very large the second term may be sufficiently positive. In this case, the restriction of access by the low-coverage health plan draws attention and makes the undercutting health plan unattractive. On the other hand, if π_i is very low, i.e. the disease to which access is denied is quite unlikely, or if the number of diseases $|F \cup A'|$ still covered by the new plan is very high such that a small coverage reduction for each of these diseases allows a large premium reduction, there can be an $\alpha' : \alpha(i-1) < \alpha' < \alpha(i)$ such that the premium reduction is large enough to attract most attention $m_p = 1$, distracting from the reduction of access value. Then, profitable undercutting may again be feasible, particularly if the loss of access remains unrecognized, $m_{h(i)} = 0$. Thus, if π_i for $i : \alpha = \alpha(i)$ is sufficiently small, there exist $\alpha' < \alpha$ such that (11) is strictly negative and $m_p = 1$.

Scenario 2: Voluntary Insurance We now want to investigate the scope of such undercutting strategies if insurance is voluntary, i.e. the customers have the possibility not to insure. Suppose there exists an insurance plan which is priced at (or above) the actuarially fair premium and 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. Again, construct a second insurance plan like above by slightly lowering the coverage rate. The difference in decision utility is, again, given by (11). Health plan 2 is preferred to plan 1 (and thus also to the outside option) if this difference is negative. The only difference to the mandatory-insurance scenario are the attention parameters. With “no insurance” being an available alternative, there is an alternative which is “extreme” on many dimensions. The best option in the premium dimension is now the option of no insurance, the worst option in the premium dimension is the first insurance plan. In the health dimensions for diseases $i \in F$ all options feature the same consequences. Thus, these dimensions are neglected. In the health outcome dimensions

for which both insurance plans provide access, $h(i), i \in A'$, the two insurance plans are the best and no insurance is the worst option. 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). Finally, in the co-payment dimensions for diseases with treatments which are unaffordable without insurance, $i \in A'$, the best option is no insurance (no expenditure) and the worst is plan 2 (highest co-payment). The salience parameters are thus given by

$$\begin{aligned}
m_p &= \max \{0, 1 - \kappa_{r(p)} / (v_p(P - 0))\}, \\
m_{h(i)} &= 0, \forall h(i) : i \in F, \\
m_{h(i)} &= \max \{0, 1 - \kappa_{r(h(i))} / (\pi_i v_h T_i)\}, \forall h(i) : i \in A, \\
m_{c(i)} &= \max \{0, 1 - \kappa_{r(c(i))} / (v_p \pi_i (1 - (1 - \alpha)c_i))\}, \forall c(i), i \in F, \\
m_{c(i)} &= \max \{0, 1 - \kappa_{r(c(i))} / (v_p \pi_i (1 - \alpha' - 0)c_i))\}, \forall c(i), i \in A', \\
m_{c(i)} &= \max \{0, 1 - \kappa_{r(c(i))} / (v_p \pi_i (1 - \alpha - 0)c_i))\}, \forall c(i), i \in A \setminus A'.
\end{aligned}$$

Again, suppose α and $\alpha' < \alpha$ are such that $A = A'$. Then the second term in (11) vanishes. A sufficient condition for (11) to be negative is again that $m_p = 1$. It requires that $\mu_p > \mu_{c(i)}, \forall i \in F \cup A'$. This condition is trivially satisfied for all $i \in F$, since for these $\mu_{c(i)} = v_p \pi_i \alpha c_i < v_p \sum_{i \in F \cup A} \alpha c_i \leq v_p P = \mu_p$. However, it is not clear whether $\mu_p > \mu_{c(i)} = v_p \pi_i (1 - \alpha') c_i, \forall i \in A'$. And even if this is the case, it is not guaranteed that $m_p > 0$ as well. Thus, we need an additional assumption for undercutting to be feasible. If $v_p P > \max_{i \in A} \{\pi_i v_h T_i\}$, i.e. assumption 1 is satisfied for plan 1, then $\mu_p > \mu_{h(i)} > \mu_{c(i)}, \forall i \in A$.²⁹ This again implies that the premium dimension ranks first in the attention order, which means that $1 = m_p > m_{c(i)} \forall i \in F \cup A'$, so that (11) is negative.

Again, we want to 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 $\alpha(i)$ for some $i \in \bar{F}$. Note a crucial difference to the setting with mandatory insurance. With the exception of $m_{c(i)}, i \in A'$ all salience parameters, in particular m_p and $m_{h(i)}, i \in A$, are independent of the second health plan. Also, since we assumed in the beginning that the first health plan is demanded in the absence of health plan 2, we know that $m_{h(i)} > 0$ for some $i \in A$. Also, even if we maintain the assumption that $v_p P > \max_{i \in A} \pi_i v_h T_i$ such that the premium dimension receives full attention,

²⁹The second inequality is a direct result of our assumption that $v_h T_i > v_p c_i \forall i \in \bar{F}$.

we know that the access value of at least some diseases must be sufficiently large that, even when underappreciated, make insurance desirable altogether. Thus there must exist some $i \in A$ for which the removal of access is sufficiently undesirable to make undercutting unfeasible. Yet, it is not guaranteed that these are the ones which A' lacks. There may be some diseases $i \in A$ for which undercutting an incumbent policy with coverage $\alpha(i)$ is feasible, in particular if the number of diseases covered $|F \cup A|$ is large. If an outside option is available the decision-maker may consider health dimensions $h(j) : j \in A'$ on which the two insurances do not differ. If he happens to neglect exactly the health dimension $h(i) : i \in A \setminus A'$ then the loss in access due to the reduction of coverage slightly below $\alpha(i)$ remains unrecognized. Thus, if $m_{h(i)} = 0$ for $i \in A \setminus A'$ and if assumption 1 is satisfied for plan 1 and thus $m_p = 1$, profitable undercutting is feasible.

Proof of Proposition 3

Denote by ψ a/the 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 ι the disease $i \in I$ of which ψ 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 ψ . Denote by $\underline{g} \in \operatorname{argmin}_{g \in \Gamma} u(g, \psi)$ one of the alternatives with minimal utility in dimension ι . Construct a plan g' such that $u(g', \psi) = u(\underline{g}, \psi)$ and $u(g', j) = u(\bar{g}, j)$, $\forall j \in B \setminus \psi$. More precisely, if $\psi = p$, set the price of g' equal to the price of the most expensive plan available, \underline{g} , and set the levels of coverage α'_i equal to the levels of coverage α_i of the cheapest plan available, \bar{g} . Alternatively, if $\psi \neq p$ construct g' by equating the level of coverage for disease ι to the lowest level of coverage for ι available (under \underline{g}) while equating the price P' , and the levels of coverage $\alpha'_i, i \in I \setminus \iota$ to the levels provided by the plan \bar{g} that offers highest coverage of ι . It is easy to see that extending Γ by g' does not change the attention allocation since the range of utility μ_j in each dimension remains unchanged. It follows that dimension ψ remains neglected if g' is included in the choice set. g' is constructed to be equal to \bar{g} in all dimensions but ψ , in which it is inferior, hence \bar{g} dominates g' . But since ψ 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 ψ , in which an alternative g^* that would be chosen from Γ 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 Γ , and, because 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 which fully pay the treatment cost for those diseases which 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 $\tilde{U}(S) = \sum_{i \in S} m_{i,S} b_i - m_{p,S} v_p P$. $m_{j,S}$ 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 $b_i = \pi_i v_H T_i$, $\forall i \in \bar{F}$.³⁰ Let $W(S) = \max \left\{ P : \tilde{U}(S) \geq 0 \right\}$ 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 $P : \tilde{U} \geq 0$ always exists.

We now establish that $W(S) = \max \left\{ \max_{i \in S} b_i / v_p, \sum_{i \in S} \bar{m}_{i,S} b_i / v_p \right\}$ where $\bar{m}_{j,S}$ is the attention parameter of dimension j if the attention 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

³⁰ 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 .

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

$$W(C) < \frac{1}{v_p} \sum_{i \in A} \bar{m}_{i,A} b_i + \sum_{i \in B} \bar{m}_{i,B} b_i \leq W(A) + W(B). \quad (12)$$

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 (12). 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 which are merged the *benefit* dimension i which ranks highest in the attention hierarchy. For both of these dimensions, call them a and b , it must be that $\bar{m}_{a,A} > 0$ and $\bar{m}_{b,B} > 0$. Otherwise, e.g. if $\bar{m}_{a,A} = 0$, 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 $W(C) < \frac{1}{v_p} \sum_{i \in A} \bar{m}_{i,A} b_i + \sum_{i \in B} \bar{m}_{i,B} b_i$.

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_i -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 which receives strictly less attention, we can conclude that $W(C) < \frac{1}{v_p} \sum_{i \in A} \bar{m}_{i,A} b_i + \sum_{i \in B} \bar{m}_{i,B} b_i$.

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

Part 1. Suppose all firms offer the plan (S, P) with $P \geq \sum_{i \in S} \pi_i c_i$. Suppose there exists an $i \in \bar{F} : i \notin S^*$. Consider the following deviation by one firm: $S' = S \cup \{i\}$, $P' = P + \pi_i c_i$. The choice set of the customers includes only these two plans as they have no outside option, i.e. $\Gamma = \{(S, P), (S', P')\}$. The difference in decision utility is then given by $m_i \pi_i v_h T_i - m_p \pi_i v_p c_i$ which is strictly positive since $\mu_i = \pi_i v_h T_i > \mu_p = \pi_i v_p c_i$ and therefore $m_i > m_p$.³¹ Thus the deviating firm can capture the whole market. If $P > \sum_{i \in S} \pi_i c_i$ this suffices to make the deviation profitable. If $P = \sum_{i \in S} \pi_i c_i$, the deviation to (S', P') would allow to capture the market, yet it would result in zero profits. Note, however, that the difference in decision utility remains positive if the deviating firm charges a price $P'' = P + \pi_i c_i + \epsilon$ for some small $\epsilon > 0$. Thus the deviating firm can capture the market and secure a strictly positive profit by deviating to (S', P'') . Since offering (S, P) results in zero profits, (S', P'') constitutes a profitable deviation.

Part 2. Suppose all firms offer the plan (S, P) with $P \neq \sum_{i \in S} \pi_i c_i$. If $P < \sum_{i \in S} \pi_i c_i$, all firms make negative profits. Deviating to (S, P') with $P' = \sum_{i \in S} \pi_i c_i$ increases the profit of the deviating firm. If $P > \sum_{i \in S} \pi_i c_i$, there exist deviations to (S, P') with $P > P' > \sum_{i \in S} \pi_i c_i$ which

³¹Since we restrict firms either to fully cover or not to cover a disease, any two options can differ in at most one dimension per disease. We therefore omit the distinction between $h(i)$ and $c(i)$ and write m_i as the attention given to the dimension that comprises the consequences which are conditional on having disease i . Further, since the choice set is given by $\Gamma = \{(S, P), (S', P')\}$ throughout this proof we will omit the second subscript which identifies the choice set.

are strictly profitable. Any deviation to a premium P' with $P > P' > \sum_{i \in S} \pi_i c_i$ captures the whole market. Since the two plans only differ in the premium, the premium difference is recognized by the customers and they choose the cheaper plan, which is the plan of the deviating firm. Since $P' > \sum_{i \in S} \pi_i c_i$ the deviating firm makes positive profit. If P' is sufficiently close to P , this profit from deviation is higher than the profit from the shared market when offering (S, P) .

Part 3. Suppose all firms offer the plan (S, P) with $P \geq \sum_{i \in S} \pi_i c_i$ and there exist at least two diseases $i, j \in F$ which are covered: $i, j \in S$. Now consider the deviation (S', P') with $S' = S \setminus \{i, j\}$ and $P' \geq P - \pi_i c_i - \pi_j c_j$. The two options available to the customers differ in three dimensions: the monetary consequences of disease i , those of disease j , and the premium. The difference in decision utility between the first plan and the deviating plan is then given by $m_i v_p \pi_i c_i + m_j v_p \pi_j c_j - m_p v_p (\pi_i c_i + \pi_j c_j)$. The difference across options is largest in the premium dimension, hence $m_p = 1 > m_k, k = i, j$. Thus, the deviating plan is preferred by the customers. The deviating firm reaps the same profit per customer as when offering the plan (S, P) , yet it captures the whole market. Again, if $P = \sum_{i \in S} \pi_i c_i$ the deviation to (S', P') would result in zero profits. Then there exists a deviation to $P'' > P'$ such that $\mu_p > \mu_k, k = i, j$ still holds and the deviating plan, which now reaps strictly positive profits, is still preferred by the customers.

Proof of Proposition 7

We will show that there do not exist deviation plans which - fairly priced- would be strictly preferred to the plan (S, P) described above. This again implies that such plans would neither be preferred at a higher price (which would be necessary for a positive profit), and could not be profitable at a lower price.

Consider as deviation plan (S', P') any set $S' \subseteq \bar{F}, S' \neq S$ with $P = \sum_{i \in S'} \pi_i c_i$. The difference in decision utility between the incumbent and the deviation plan is given by

$$\sum_{i \in S \setminus S'} [m_{i,D} b_i - m_{p,D} v_p \pi_i c_i] - \sum_{i \in S' \setminus S} [m_{i,D} b_i - m_{p,D} v_p \pi_i c_i]$$

We know that $\mu_p = v_p \cdot \max \{ \sum_{i \in S} \pi_i c_i, \sum_{i \in S'} \pi_i c_i \} > \mu_i = b_i > \mu_j = b_j, \forall i \in S \setminus S', j \in S' \setminus S$. This implies that $m_{p,D} = m_{p,E} = 1$ and $m_{i,D} = m_{i,E}, \forall i \in S$. This again implies that the left sum is nonnegative by the construction of S . Also, by the construction of S the right sum must

be strictly negative, for if there existed an element $i \in S' \setminus S$ for which $m_{i,D}b_i > 1 \cdot \pi_i c_i$, then $m_{i,E}b_i > m_{p,E}\pi_i c_i$ where $E = \{(\emptyset, 0), (S \cup i, \sum_{j \in S \cup \{i\}} \pi_j c_j)\}$ must hold for this element as well.

Suppose $S' \cap F \neq \emptyset$. The difference in decision utility between the incumbent and the deviation plan is given by

$$\sum_{i \in S' \setminus S'} [m_{i,D}b_i - m_{p,D}v_p \pi_i c_i] - \sum_{i \in S' \setminus (F \cup S)} [m_{i,D}b_i - m_{p,D}v_p \pi_i c_i] - \sum_{i \in S \cap F} [m_{i,D}b_i - m_{p,D}v_p \pi_i c_i].$$

Since $\mu_p = v_p \cdot \max \{ \sum_{i \in S} \pi_i c_i, \sum_{i \in S'} \pi_i c_i \} > b_i > b_j > b_k, \forall i \in S \setminus S', j \in S' \setminus F \cup S, k \in F$, we know that $m_{p,E} = m_{p,D} = 1$ and $m_{i,E} = m_{i,D}, \forall i \in S' \setminus S'$. Hence the first sum is positive by the construction of S . Similarly, $m_{i,E} = m_{i,D}, \forall i \in S' \setminus (F \cup S)$, so the second sum must be negative by the construction of S . Finally, since $\mu_i = b_i < \mu_p$ and $b_i = \pi_i c_i$ for all $i \in S' \cap F$ we know that the last sum is negative. We conclude the the utility difference is negative, so customers will prefer the incumbent plan.

Finally, since $m_{p,E} = 1$ and $P = \sum_{i \in S} \pi_i c_i$ there exists neither an incentive to decrease or increase the premium given coverage for S is offered. We conclude that there exists no profitable deviation.