

Arentz, Christine; Rehm, Rebekka

Working Paper

Behavior-based tariffs in health insurance: Compatibility with the German system

Otto-Wolff-Discussion Paper, No. 04/2016

Provided in Cooperation with:

Otto-Wolff-Institut für Wirtschaftsordnung (owiwo), Köln

Suggested Citation: Arentz, Christine; Rehm, Rebekka (2016) : Behavior-based tariffs in health insurance: Compatibility with the German system, Otto-Wolff-Discussion Paper, No. 04/2016, Otto-Wolff-Institut für Wirtschaftsordnung (owiwo), Köln

This Version is available at:

<https://hdl.handle.net/10419/201594>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

Direktor: Prof. Achim Wambach, Ph. D.

Geschäftsführer: Dr. Steffen J. Roth

Behavior-based Tariffs in Health Insurance – Compatibility with the German System

Christine Arentz and Rebekka Rehm

Otto-Wolff-Discussion Paper 04/2016 – October 2016

Inhaltsverzeichnis

1. Introduction.....	1
2. The Use of Wearables in Health Insurance	2
3. Behavior-based Bonus Programs in the German Public Health Insurance System.....	5
3.1 Relevant Characteristics of the German Public Health Insurance Systems	5
3.2 Analysis.....	6
4. Behavior-based Insurance Tariffs in the German Private Health Insurance System.....	10
4.1 Relevant Characteristics of the German Private Health Insurance Systems.....	10
4.2 Analysis.....	11
5. Conclusion	12
6. References.....	14

Contact details

Christine Arentz

Email: christine.arentz@wiso.uni-koeln.de

Phone : +49 221 470 5351

Rebekka Rehm (Corresponding author)

Email: rebekka.rehm@wiso.uni-koeln.de

Phone: +49 221 470 5349

Address

Institute for Economic Policy
at the University of Cologne
Pohligstr. 1 – 50969 Köln

1. Introduction

In the following, we will analyze the consequences of an implementation of behavior-based tariffs/bonus programs in private and public health insurance in Germany. Programs rewarding a particular behavior have been used in health insurance for years. However, the respective debate has recently been revived as insurers started using so called wearables to monitor the behavior of their insured more accurately. Especially in the United States, insurers have been granting rewards for those achieving certain wellness and fitness goals while documenting it with wearables.¹ In Germany, only public insurers have recently begun rewarding the use of wearables in bonus programs,² whereas private health insurers have not yet introduced tariffs that use wearables to monitor their insured's behavior. Only in life insurance, there has been recently a launch of a tariff where the data collected by wearables potentially leads to premium reductions.³

The introduction of tariffs that rely on wearables can be understood as part of the digitization process that affects many aspects of health care supply, mainly due to simplified communication and data exchange. Technical progress allows health care providers to exchange information more efficiently and thus to avoid redundancy in services and medical errors (Agarwa et al. 2010, p. 796).⁴ Not only the exchange between health care providers becomes easier, but the interaction between insurers and insured can benefit from digital opportunities as well. Insurance companies might be able to simplify administrative processes and to assist their insured with choosing the right treatment more easily.⁵ Besides its potential to improve the process of health care supply the data collected provides great opportunities for the understanding of diseases itself (Raghupathi, Raghupathi 2014) and also for new forms of underwriting and pricing of health insurance (Swedloff 2014).

Especially the possibility of adjusting health insurance premiums according to an individual's behavior, measured by technical devices, has been subject of some debate (see for example Mc Fall 2015). There are different ethical concerns regarding those tariffs⁶ but also questions of the economic consequences for the respective health care systems if these are used for underwriting.

¹ See for example the introduction of the program offered by the United Health Group: <http://www.unitedhealthgroup.com/Newsroom/Articles/Feed/UnitedHealthcare/2016/0301QualcommUnitedHealthcareMotion.aspx?r=1> (checked on October 11th 2016).

² See for example the website of the program offered by AOK Nordost: <https://www.fitmit-aok.de/> (checked on October 11th 2016).

³ See the website of the program offered by Generali: <https://www.generali-vitalityerleben.de/> (checked on October 11th 2016).

⁴ Because this potential has remained largely unexploited in Germany, a so-called e-health law was passed in 2015, which obliges health care providers to acquire the respective infrastructure.

⁵ The use of online services in insurances has often been criticized for being used as a risk selection instrument (see chapter 3.2.1).

⁶ For a comprehensive overview, see for instance Have 2013.

In the following, we are going to concentrate on these economic effects of behavior-based tariffs.⁷ First, we will analyze potential motives for the introduction of such tariffs that are rather independent of the institutional context (chapter 2). However, as our further analysis will show, economic effects of behavior-based tariffs actually do depend on the respective institutional setting. That is why we will briefly describe important characteristics of the statutory and the private insurance system (chapter 3.1 and 4.1). We will then analyze how the availability of individual, real-time health data will influence the functionality of each system as a whole and display the economic consequences for insured individuals in each case (3.2 and 4.2).

2. The Use of Wearables in Health Insurance

So-called wearables are devices that track different health related information such as pulse, temperature, activity, sleep stages or blood glucose and more (Steinhubl et al. 2015, p. 2). Wearables exist in different forms, such as watches, wristbands or headbands. Even specific clothes or implants can monitor vital signals (Chan et al. 2012, pp. 141–142). The health related information gathered by wearables can be processed into an overall account of a person's fitness level with the help of smartphones or computers. Besides tracking someone's fitness level, wearables can also be used for medical purposes, such as managing chronic health conditions (Chiauzzi et al. 2015, Chan et al. 2012).

The information gathered by wearables appears to be interesting for several kinds of insurers. It is relevant for insurances regarding life, pension, long-term care and of course health. The following analysis aims at displaying the economic consequences of the use of wearables in health insurance. That is, broadly speaking, health insurers differentiating premiums according to the data collected by wearables.

Tariffs using wearables can be introduced out of different motives. One of their main functions seems to be reducing asymmetric information between insurers and insured individuals. They might thus be able to contribute to tackling the moral hazard problem⁸: once individuals are insured, the cost of risky behavior is reduced for them. Due to the asymmetry of information, insurers are not able to price this risky behavior accurately. Individuals are thus likely to respond to the price distortion induced by an insurance in two ways: Taking more risks such as eating unhealthily or smoking and thereby increasing the probability of an insured event (ex-ante moral hazard) and/or using more covered services after the insured event has occurred (ex-post moral hazard) (Breyer et al. 2013, p. 248). Both forms of moral hazard can drive costs in insurance systems.

⁷ It is beyond question that the ethical concerns should be taken into account when assessing the consequences of behavior-based tariffs. It is however beyond the scope of this paper to discuss those issues in depth.

⁸ Arrow 1963 was the first to acknowledge the moral hazard problem in health insurance.

Via wearables insurers can, at least theoretically, monitor the behavior of their insured, price them accordingly and thus reduce ex-ante moral hazard. In general, avoiding moral hazard is favorable. Reducing the cost of opportunistic behavior leaves more resources for the treatment of diseases that are not under individual control and/or premium reductions for the insurance collective.

However, the relevance of ex-ante moral hazard is subject to controversial discussion in the literature (see for example Zweifel, Manning 2000, pp. 415–418 or Kenkel 2000, pp. 1685–1687). One might question whether it is actually plausible to assume that individuals will endanger their health just because they bought an insurance contract. Empirically, ex-ante moral hazard appears rather difficult to document. There are several studies trying to assess its relevance coming to different conclusions.⁹

Alternatively, an unhealthy lifestyle could be the result of unhealthy habits that are not causally linked to closing an insurance contract. That is, a person could eat unhealthily and smoke before closing an insurance contract and continue doing so afterwards. In this case, there would not be any inefficiency stemming from moral hazard but from not adjusting premiums to his or her condition when closing the contract. If premiums are not adjusted to behavior, the individual might exert negative external effects on the other insured in the pool by needing more funds from the insurance collective due to the unhealthy lifestyle. The use of wearables could allow determining more precisely those kinds of habits that are likely to increase risk and to identify those individuals who carry out a specific behavior.

However, it is questionable whether behavior-adjusted premiums are socially desirable¹⁰. In practice, social health insurance systems rely on broader concepts of solidarity. There is an ongoing debate whether differentiations with regard to behavior endanger solidarity or on the contrary, reinforce the willingness to pay for an (public) insurance system (Have 2013, pp. 49–50). Indeed, opinion polls provide evidence that many people would not mind higher premiums for those who smoke or are overweight.¹¹

Behavior-based tariffs could furthermore be introduced out of paternalistic reasons. That is, members of the government might believe that people carry out an unhealthy behavior against their own will. In that sense, incentivizing individuals to behave differently can be understood as helping them to act in their best interest. There has been an extensive discussion about whether paternalistic motives can legitimize public action. From an economic perspective, the major weak point of any paternalistic concept is the impossibility of

⁹ For an overview, see for example Stanciole 2008.

¹⁰ From an economic perspective, it is difficult to judge whether something is desirable if not all individuals concordantly approve it. For the understanding of the impossibility of obtaining a social welfare function Arrow 1950 has been decisively responsible.

¹¹ For the results of an opinion poll conducted by Statistics Netherlands, see <https://www.cbs.nl/en-gb/news/2011/39/majority-think-people-with-unhealthy-lifestyle-should-pay-more-for-health-insurance> (checked on October 11th 2016).

identifying the individuals' true preferences, thereby being likely to cause preference violation costs.¹²

So far, we have assumed that by using wearables and behavior-based tariffs insurers can motivate a specific behavior, which will help to reduce costs. There are a few important remarks to make about this assumption:

Firstly, the effect of rewards and penalties can be generally questioned: A hypothesis intensively discussed in psychological, legal, pedagogical and economic literature is that extrinsic incentives decrease intrinsic motivation. Deci 1971 and Lepper et al. 1973 were the first to provide evidence that the implementation of rewards negatively affects intrinsic motivation. This effect occurs when individuals' engagement in an activity for its own sake reduces when external incentives are implemented. If those findings were applicable to health insurance, individuals' intrinsic motivation to work out or eat healthily would decline as rewards are implemented.

However, even if that were the case, it would not mean that rewards would overall inversely affect behavior. Instead, sufficiently high rewards will outweigh the negative effect on intrinsic motivation (Gneezy, Rustichini 2000). Nevertheless, this effect should be kept in mind, as it is likely to mitigate the influence of incentives.

Secondly, there are technical limitations restricting the potential of rewarding a specific lifestyle in health insurance. It is not always trivial to verify how an individual actually behaved. In one German sickness fund, bonus program participants have to send pictures of the gym as evidence that they have been exercising for instance.¹³ It seems that this way the insured could easily simulate a workout. Consequently, insurers are likely to reward individuals who have not actually adjusted their behavior.

However, it seems that those limitations are set by the technical devices people usually possess today, rather than by actual technical possibilities. Moreover, technologies are likely to evolve and can thus be expected to offer further opportunities for insurers in the future. The data transmitted by implants appears to be less easy to manipulate for instance.

Thirdly, it is difficult to identify those behavioral patterns that actually positively affect health care expenditure. That is mainly because correlations do not necessarily imply causal relationships. For instance, there might be characteristics, such as being young, which are more likely to apply to those who regularly work out as well as to those who cause little cost. A correlation between working out and causing little costs would thus not automatically imply that working out decreases costs. The effect of certain behavioral changes might consequently be difficult to determine.

¹² For a critical discussion of paternalistic concepts, see for instance Mitchell 2005 or Kirchgässner 2015.

¹³ See the website of the bonus program offered by AOK Nordost: <https://www.fitmit-aok.de/> (checked on October 11th 2016).

Fourthly, even a certain behavior that positively causally affects one's health and thus decreases short-term health care expenditure might not reduce one's lifetime health care expenditure. If individuals live shorter, they are less likely to develop severe diseases that adjusting one's behavior cannot help to avoid. The cost of treating these diseases in later stages of life might exceed the cost of treating those diseases correlated to an unhealthy lifestyle. Empirically, this has been shown for smoking (Barendregt et al. 1997) and overweight (van Baal et al. 2008) for instance. In that case, the insurance system as a whole would "profit" from unhealthy habits because they would lead to less costs for the system in the long run. Therefore, if the motive of introducing behavioral tariffs is to reduce overall costs, this might be the wrong means to achieve this goal.

For the single insurer, however, it is crucial to differentiate between periodical health costs and long-term overall health costs. Since in many systems, insureds can switch insurers, it is more important for them to keep periodical costs down, which can be assumed to be higher for people with unhealthy habits (Buchanan 2011, p. 19). Whether this actually constitutes an incentive for insurers to attract those who cause low periodical costs, that is, to perform risk selection, depends on the way health care expenditure is financed. We will thus return to this aspect in the next chapters.

The characteristics of health insurance systems are likely to determine the consequences of an implementation of behavior-based contracts. In the next two chapters, we are going to analyze those consequences for the German health insurance system. Since the system is divided, we will be looking at the public (chapter 3) and the private system (chapter 4).

3. Behavior-based Bonus Programs in the German Public Health Insurance System

Since last year, wearables have been used in the German statutory health insurance system. Sickness funds have been rewarding their use in bonus programs.¹⁴ After briefly outlining the basic institutional setting (chapter 3.1), we will analyze the effects of such programs in the statutory system (chapter 3.2).

3.1 Relevant Characteristics of the German Public Health Insurance Systems

The German statutory insurance system is mandatory for all citizens with an income from dependent employment below a certain threshold (in 2016, the annual income threshold for compulsory insurance was 56.250 €). Citizens whose income exceeds this threshold, public officials and citizens who work freelance can choose to enroll in the private health insurance system.

Citizens enroll in sickness funds, which are public-law corporations. The insured are free to choose and switch their sickness fund. Contributions to the statutory insurance are based on

¹⁴ See for example the website of the program offered by AOK Nordost: <https://www.fitmit-aok.de/> (checked on October 11th 2016).

dependent income and pensions. The uniform contribution rate amounts to 14.6 percent paid to the so-called Health Fund. Additional to those contributions, the Health Fund is financed by tax subsidies.

Sickness funds that cannot cover their expenses with the payouts they receive from the Health Fund have to charge their insureds with supplementary contributions, which are also wage-dependent. As of today, the average supplementary contribution is 1.1 percent (Bundesministerium für Gesundheit 2016). The employee alone pays supplementary contributions whereas the general contribution rate is divided equally between the employer and the employee.¹⁵

To avoid risk selection incentives due to wage-dependent contributions, there is a risk-adjustment scheme (Morbi-RAS) in place. This scheme is morbidity oriented: the payouts for insureds are the sum of lump-sum payments and risk-oriented surcharges/deductions dependent on age, gender, disabilities and 80 different diseases. The risk-adjustment scheme does not equalize actual costs but bases its payouts on average costs to induce incentives for economic efficiency (Bundesversicherungsamt 2008).

However, the actual risk-adjustment scheme does not fully eliminate incentives for risk-selection. Evidence shows that the scheme still overcompensates the costs associated with low risks while some groups of high risks cause costs that exceed the payout sickness funds receive for them (Bundesversicherungsamt 2014). Thus, from the funds' point of view, there exist "good" and "bad" risk types. Risk selection is therefore still a problem in the German statutory health insurance system. In the following chapter, we will analyze how the introduction of behavior-based bonus programs interacts with this problem.

Since 2004, sickness funds have been allowed to use bonus programs that reward a particular behavior. Those programs were introduced as a means of inducing competition (Bundesministerium für Gesundheit 2015) and have been subject to debate ever since (see for example Schulze Ehring, Weber 2007 or Weber 2007). Since the introduction of wearables, the debate has attracted further attention as wearables give sickness funds better means to monitor actual behavior.

In the following, we are going to analyze the consequences of behavior-based bonus programs for the system while paying attention to the possibilities and limitations of wearables.

3.2 Analysis

In the analysis, we will assume that programs that reward a healthy lifestyle mainly attract those risks that are likely to imply a surplus for sickness funds. As mentioned above, this tends to be the case for low risks. As we have suggested in chapter 2, being a low risk and behaving a certain way can be correlated in different ways. Repeating the example used previously: For one thing, there might be a causal relationship between working out and causing little costs.

¹⁵ Which party actually bears the burden depends on the elasticity of supply and demand on the labor market.

Besides, it is also possible that other variables are responsible for the correlation, such as being young. With regard to the use of wearables, earning a sufficiently high income might be another relevant factor that determines the affordability of a respective device and can be assumed to be correlated with one's health status.¹⁶ In terms of risk selection, those kinds of correlations could be just as interesting for sickness funds.

Under those assumptions, introducing behavior-based programs that reward healthy behavior might induce a differentiation of contributions with respect to risk. It is not clear whether a differentiation of that kind is desired. The statutory system has been relying on community-rated contributions since its introduction in 1883 (Mülheims et al. 2015, pp. 6–10). In the following, we will analyze the effects of rewarding healthy behavior on the rest of the statutory health insurance system to be able to assess whether respective programs actually endanger solidarity.

Whether the implementation of behavior-based bonus programs has negative consequences for the rest of the insurance collective or not, depends on whether they at least break even or do not pay for themselves. We will thus distinguish between those two cases in the following. For each case, we will furthermore differentiate between a situation in which sickness funds can successfully select risks by offering the program and one in which they cannot:

First case: Bonus programs at least break even

In the first case, behavior-based bonus programs pay for themselves because they lead to behavioral changes that reduce health costs to an amount at least equal to the contribution reduction. That is:

$$\begin{array}{c} \textit{Cost reduction due to behavioral changes} \\ \geq \\ \textit{Sum of bonuses granted} \end{array}$$

If so, health care expenditure will actually decrease (or stay the same). As long as individuals choose bonus programs voluntarily, they constitute an efficiency gain in this case. Due to the surplus generated with the program, sickness funds offering it can reduce supplementary contributions and thus become more attractive for insured from other funds. This induces a desirable dynamic as it incentivizes other sickness funds to implement innovative programs as well. Consequently, the whole system is likely to become more efficient.

Moreover, Sickness funds offering this program might profit from risk selection if a disproportionately high number of low risks join the fund. However, in this case sickness funds

¹⁶ This correlation can be twofold: On the one hand, income might positively influence health and on the other hand, health might positively influence income. For a discussion of both effects and an assessment of their empirical relevance in Germany, see for instance (Brennecke 1998).

do not rely on risk selection when offering the program. If all kinds of risk would join a certain fund evenly, offering this program would still be economically rational for this fund.¹⁷

Second case: Bonus programs do not break even

In the second case, bonus programs do not break even.¹⁸ That is:

$$\begin{array}{c} \textit{Cost reduction due to behavioral changes} \\ < \\ \textit{Sum of bonuses granted} \end{array}$$

There are several possible reasons for a bonus program that rewards a certain behavior not breaking even: Firstly, rewards might be granted, even though the program did not lead to any behavioral changes. This could for instance be because someone had been equally working out before joining the program already. Rewards might also be granted without a change in behavior if sickness funds cannot monitor behavior reliably. They might then unintentionally reward those who did not change their behavior, but pretended to do so. Moreover, behavioral change might actually take place but not reduce costs (sufficiently). This might be for instance because insured engage in activities that are likely to cause injuries.

Without risk selection, sickness funds would not be interested in offering this program. If all kinds of risks were going to join it evenly, the fund would not be able to maintain the program. If, however, a sickness fund can successfully select risks by offering the program, doing so could be worthwhile from its perspective. That would be the case, if the sickness fund could profit more from the insured that can be attracted with the program being good risks with respect to the Morbi-RAs than it loses from the bonus program not breaking even. That is:

$$\begin{array}{c} \textit{Sum of bonuses granted} - \textit{Cost reduction due to behavioral changes} \\ < \\ \textit{Surplus from Morbi-RAs due to better risk structure} \end{array}$$

Even though sickness funds offering the program might be profiting from it, overall expenditure of the system nevertheless increases in this case. Such a program does not constitute an efficiency gain but a waste of resources. That is because it could only be profitable because of the benefits from risk selection induced by the institutional setting.

The implementation of bonus programs in the statutory system thus firstly depends on the expectations of sickness funds regarding costs saved by behavioral changes as compared to bonuses granted and secondly on their expectations about whether they can successfully select risks by implementing it.

¹⁷ Of course, if high risks overproportionally joined a fund, this could have overall negative economic consequences for the fund. But there is no rationale why only high risks should be attracted to the sickness fund in question.

¹⁸ Insurers are supposed to avoid offering bonus programs that do not break even. However, this can be assumed to be hardly avoidable because sickness funds only have to account for their programs every three years (§ 65a Abs. 4 SGB V).

The following table shows the four situations analyzed above:

	Sickness funds can successfully select risks	Sickness funds cannot successfully select risks
Bonus programs at least break even	Sickness funds offer program → Program constitutes an efficiency gain	Sickness funds offer program → Program constitutes an efficiency gain
Bonus programs do not break even	Sickness funds offer program → Program constitutes an efficiency loss	Sickness funds do not offer program

The arguments outlined so far refer to ex-ante risk selection. Behavior-based bonus programs might also increase ex-post risk selection possibilities. While ex-ante risk selection refers to sickness funds trying to attract certain risks, ex-post risk selection refers to them trying to get rid of certain risks who have been insured with them.¹⁹ As outlined above, the fact that behavior-based bonus programs are meant to attract low risks does not necessarily mean that they will harm high risks. However, sickness funds can use them to identify high risks in order to then take measures against them. Firstly, they might be able to gain information about one's risk status from observing one's decision to switch or not to switch into such a program. Secondly, they will be able to collect information about one's health status once the insured did choose a bonus program. Although, as argued above, it appears plausible that low risks are more likely to do so, some of the individuals participating in the program might still thereby reveal that they are actually high risks. They might have nevertheless chosen to participate, especially if the rewarding bonus is sufficiently high. Further reasons for high risks joining the program could be that they do not have sufficient information about their health status themselves or that they cannot foresee the consequences of the sickness fund performing risk selection.

With regard to preventive care, the effects of high risks revealing as such are twofold. On the one hand, sickness funds need to know about potential risk factors of their insured in order to be able to offer preventive measures. Thus, it could be beneficial for insured to reveal certain risks that they have. On the other hand, sickness funds can only be assumed to want to finance costly preventive measures if they can expect to profit from doing so. That is, they must believe that preventive care will lead to a situation where payouts from the risk-adjustment scheme exceed the expenditure of the insured including the cost of preventive care. Since there is the risk that preventive care does not pay off, the incentives for implementing prevention programs are reduced by the Morbi-RAS (Binder 2015, pp. 266–268).

¹⁹ For an overview of different effects of risk selection, see for example van de Ven et al. 2000, p. 319.

Summarizing, it can be stated that whether behavioral-based bonus programs interfere with the principle of solidarity in the German statutory insurance depends on whether those programs at least break even. This applies to all bonus programs, not only those relying on the data collected by wearables. Programs based on wearables, however, seem to be particularly suitable for risk selection, as they appear likely to attract mainly those insured that sickness funds are interested in, the young, wealthy and therefore healthy individuals.

4. Behavior-based Insurance Tariffs in the German Private Health Insurance System

In the private health insurance system, behavior-based tariffs using wearables have not been introduced yet. However, one private insurer introduced a program bounded to buying a disability or term life insurance contract with the data collected by wearables potentially leading to premium reductions.²⁰ In the following, we will briefly outline the basic institutional setting of the German private health insurance system (chapter 3.1). Afterwards, we will analyze the effects of tariffs using wearables on the system (chapter 3.2).

4.1 Relevant Characteristics of the German Private Health Insurance Systems

The private health insurance system comprises both full and supplementary insurance contracts. Only people earning above a certain annual income threshold (see 3.1), freelance workers and public employees can choose full insurance. Supplementary insurance is open to all citizens. Funding of private insurance is different from the statutory health insurance in two aspects: first, premiums are risk-based, dependent on age and risk-profiles. Second, private insurance is a funded insurance system in contrast to the statutory pay-as-you-go system. For younger cohorts, premiums exceed the average costs of the cohort. Private insurers invest premium excesses on the capital market, thereby creating so called ageing provisions. Insurers use these ageing provisions to smooth premiums over the life cycle: when costs exceed premium income for older cohorts, ageing provisions are used to reduce the premium burden for this cohort.

When switching insurers, ageing provisions are only partly transferred to the new insurer.²¹ For external switches, insurers transfer average ageing provisions limited to the basic coverage level, irrespective of the actual tariff the individual was insured in. That is why competition for existing customers is very limited between private insurers. Due to the limited amount in ageing provisions, individuals usually have to pay a higher premium to the new insurer, since they have to offset the loss in ageing provisions. What is more, when the individual's risk-profile has deteriorated in the meantime, premium surcharges have to be paid due to the higher expected costs. That is why insured are often locked-in with their

²⁰ See the website of the program offered by Generali: <https://www.generali-vitalityerleben.de> (checked on October 11th 2016).

²¹ For those who have been insured with the same insurer since before 2009, no ageing provisions are transferred.

original insurer. Especially high risks cannot switch without economic consequences, whereas low risks could still profit from lower premiums with the new insurer. That is, a new insurer would offer premium reductions for low risks and premium surcharges for high risks. Therefore, the incomplete transfer of ageing provisions is likely to lead to a separation of low and high risks. In practice, there have not been many external switches since the introduction of the transfer option in 2009.²²

When switching tariffs within the present insurers, average ageing provisions are transferred with regard to the actual coverage level. Provisions are thus too low for above-average risks and too high for below-average risks. Thus again, switches are only profitable for low risks. This leads to a separation of risks within those insured with the same insurer.

Private insurers are – as of today – only allowed to risk-rate premiums when closing a contract. Once a contract is closed, the insurer can neither terminate the contract nor adjust premiums due to changes in individual risk profiles after closing the contract. That is, tariffs that change premiums according to behavior, in extreme day-to-day premium changes, are not possible in the German private insurance market.

Private insurers can, however, offer tariffs with premium paybacks for individuals who do not have any insurance claims within a given period for example. Insurers are obligated to calculate those tariffs so that they pay for themselves meaning that they are not allowed to cross-subsidize them. Private insurers are much more likely to adhere to that rule than stated for the statutory system because the calculation regulation of the private system is rather strict and premium increases have to be authorized (Verband der privaten Krankenversicherung 2016, p. 11). As long as the net premium payments of those receiving a payback remain the same, other insured in the same tariff are not harmed. If insurers miscalculate premium paybacks, they will have to raise overall pool premiums, both for high and low risk customers.

With regard to the present regulation, wearables could only be used as a means to control the efforts of the insured and to reward behavior that saves costs by granting premium paybacks. In order to do so, insurer would have to offer new tariffs including this option. In the following, we will briefly outline the consequences of this use of wearables in the German private health insurance system.

4.2 Analysis

As mentioned above, insurers could offer a new tariff and reward a certain behavior of those entering it by granting premium paybacks. Insurers have an incentive to do so, mainly to attract new customers by attractive premiums.

²² In the last years, for instance, there were 1000 (2014) and 900 (2015) switches per year. This accounts to about 0.02 percent of about 4.6 million insured per year (figures are taken from Verband der privaten Krankenversicherung 2015, pp. 10–14).

Once an insurer is offering a new tariff of this kind, already insured low risks are likely to choose the new tariff as well. Insurers cannot prevent them from switching because they are obligated to open new tariffs for all of their insured (§ 204 Abs. 1 VVG).²³ This leads to a separation of risks within the insurance. The internal separation puts a disadvantage to high risks because the former collective suffers from low risks taking average ageing provisions with them. In other words, they take higher ageing provisions with them than they were expected to need. Consequently, premiums have to increase as low risks leave the pool. For the same reason, high risks are not likely to switch to the new tariff or any other tariff themselves: As explained above, they are locked-in due to the negative economic consequences of a tariff switch, be it internal or external to a new insurer.

It should be noted that insurers' incentive to offer new tariffs which harm some of their insured is not unlimited. If insurers excessively took advantage of locked-in individuals, they would at some point damage their reputation. This again would hamper attracting new customers and thereby be counterproductive.

The problem described has been inherent to the system before the existence of wearables. As long as ageing provisions are only partly transferred when individuals switch insurers, competition between insurers will be very limited and practically non-existent when it comes to high risks. The use of wearables compounds this problem because it gives insurers additional means to open new tariffs when trying to attract new customers. Those might be particularly prone to be attracted by wearables, as those first switching to the private health insurance system can be assumed to be rather young and earning well.

The problem described could be largely prevented by transferring individual ageing provisions. If insurers were to transfer ageing provisions equal to one's expected costs, switching would be possible for all kinds of risk types without negative economic consequences. This system and its practical feasibility have been broadly discussed in the literature (see for example Eekhoff et al. 2008 or Arentz 2016).

5. Conclusion

The use of digital data in health care has been subject to intense debate. Technological innovations are likely to offer a wide range of new possibilities. They have to be evaluated carefully to identify their costs and benefits.

When it comes to the use of wearables and behavior-based tariffs/bonus programs in health insurance, there could be several reasons for their implementation, in particular the aim to reduce moral hazard, the intention to internalize external effects and paternalistic motives.

However, health insurance systems are highly regulated with the regulation appearing to reflect social values. In the analysis, we did not try to question those. Instead we analyzed

²³ If the new tariff covers more services, the insurer can attach conditions to the switch (§ 204 Abs. 1 VVG).

whether, given the current regulation in Germany, behavior-based tariffs appear desirable from an economic perspective.

Regarding the German statutory insurance system, whether behavioral-based bonus programs interfere with the concept of solidarity depends on whether those programs at least break even. If they did not, their implementation would only be profitable due to risk selection incentives and would thus constitute an inefficiency.

In the German private health insurance system, the introduction of tariffs granting premium paybacks for those causing relatively little costs would lead to a separation of risks within insurance companies. This would harm high risks because they are locked in with the former collective that would suffer from the transfer of average ageing provisions. As outlined above, this problem will be inherent to the system as long as individual ageing provisions are not fully transferred.

For a full assessment of the use of wearables in health insurance, ethical aspects would have to be taken into consideration as well. As mentioned in the analysis, one central question is whether the members of society would prefer those with unhealthy habits to pay more for health insurance. It seems that when considering this question, one would quickly face questions of responsibility: What if someone was raised by their parents to eat unhealthily? What if someone grew up at a time when the dangers of smoking were not well known? Those questions do not appear trivial to answer. The same applies to questions of information self-determination such as: Can the use of the data collected by insurers be sufficiently stipulated? Is there a danger of insured receiving information about their health status that they would not want to have? Moreover, the use of wearables in health insurance raises questions of justice with regard to individual income such as: What if certain individuals do not have the means to pay for healthy food or a gym membership nor for wearables? This list is clearly incomplete and shall only suggest that there are many different kinds of questions to consider.

It can be expected that the debate about the use of wearables in health insurance will intensify as the technology of those devices further evolves. Given the current regulation, we cannot recommend the use of wearables in the German health insurance system, except in specific circumstances. If their use is nevertheless desired, institutional adjustments might be necessary.

6. References

- Agarwa, Ritul; Gao, Guodong; Catherine DesRoches; Ashish K. Jha (2010): The Digital Transformation of Healthcare: Current Status and the Road Ahead. In *Information Systems Research* 21 (4), pp. 796–809.
- AOK Nordost (2016): FitMit AOK. Available online at <https://www.fitmit-aok.de>, checked on 14/10/2016.
- Arentz, Christine (2016): Bürgerprivatversicherung: Weiterentwicklung und Wege zu ihrer Implementierung im deutschen Gesundheitssystem. Cologne, Germany: Institut für Wirtschaftspolitik (Untersuchungen zur Wirtschaftspolitik, 140).
- Arrow, Kenneth J. (1950): A Difficulty in the Concept of Social Welfare. In *Journal of Political Economy* 58 (4), pp. 328–346.
- Arrow, Kenneth J. (1963): Uncertainty and the Welfare economics of Medical Care. In *The American economic review* 53 (5), pp. 941–973.
- Barendregt, Jan J.; Bonneux, Luc; van der Maas, Paul J. (1997): The Health Care Costs of Smoking. In *New England Journal of Medicine* 337 (15), pp. 1052–1057.
- Binder, Andreas (2015): Die Wirkung des morbiditätsorientierten Risikostrukturausgleichs auf innovative Versorgungsformen im deutschen Gesundheitswesen. Wiesbaden, Germany: Springer Gabler.
- Brennecke, Ralph (1998): Einkommen und Gesundheit - Längsschnittanalysen mit dem Sozio-ökonomischen Panel (SOEP). In *Empirische Forschung und wirtschaftspolitische Beratung: Festschrift für Hans-Jürgen Krupp zum 65. Geburtstag*. Frankfurt am Main u.a., Germany: Campus-Verlag, pp. 226–240.
- Breyer, Friedrich; Zweifel, Peter; Kifmann, Mathias (2013): Gesundheitsökonomik. 6th ed. Berlin, Germany: Springer.
- Buchanan, David R. (2011): Should People with Unhealthy Lifestyles Pay Higher Health Insurance Premiums? In *The Journal of Primary Prevention* 32 (1), pp. 17–21.
- Bundesministerium für Gesundheit (2015): Wahltarife. Available online at <http://www.bmg.bund.de/glossarbegriffe/glossar-v-y/wahltarife.html>, updated on 17/06/2015, checked on 13/10/2016.
- Bundesministerium für Gesundheit (2016): Durchschnittlicher GKV-Zusatzbeitragssatz für 2016 bei 1,1 Prozent. Available online at <http://www.bmg.bund.de/ministerium/meldungen/2015/gkv-zusatzbeitrag.html>, updated on 1/07/2016, checked on 13/10/2016.
- Bundesversicherungsamt (2008): So funktioniert der neue Risikostrukturausgleich im Gesundheitsfonds. Available online at http://www.bundesversicherungsamt.de/fileadmin/redaktion/Risikostrukturausgleich/Wie_funktioniert_Morbi_RSA.pdf, updated on 16/09/2008, checked on 13/10/2016.
- Bundesversicherungsamt (2014): Ergebnisse des Jahresausgleichs. Available online at http://www.bundesversicherungsamt.de/fileadmin/redaktion/Risikostrukturausgleich/Info-Dateien%20und%20Auswertungen/Auswertung_JA2014.pdf, checked on 13/10/2016.

- Chan, Marie; Estève, Daniel; Fourniols, Jean-Yves; Escriba, Christophe; Campo, Eric (2012): Smart Wearable Systems: Current Status and Future Challenges. In *Artificial Intelligence in Medicine* 56 (3), pp. 137–156.
- Chiauzzi, Emil; Rodarte, Carlos; DasMahapatra, Pronabesh (2015): Patient-Centered Activity Monitoring in the Self-Management of Chronic Health Conditions. In *BMC Medicine* 13 (1), pp. 1–6.
- Deci, Edward L. (1971): Effects of Externally Mediated Rewards on Intrinsic Motivation. In *Journal of Personality and Social Psychology* 18 (1), pp. 105–115.
- Eekhoff, Johann; Bünagel, Vera; Kochskämper, Susanna; Menzel, Kai (2008): Bürgerprivatversicherung. Ein neuer Weg im Gesundheitswesen. Tübingen, Germany: Mohr Siebeck.
- Generali Versicherung AG (2016): Generali Vitaly. Available at <https://www.generali-vitalityerleben.de/>, checked on 14/10/2016.
- Gneezy, Uri; Rustichini, Aldo (2000): Pay Enough or Don't Pay at All. In *Quarterly Journal of Economics* 115 (3), pp. 791–810.
- Have, Marieke ten (2013): Lifestyle Differentiation in Health Insurance. A Survey of the Ethical Arguments. The Hague, Netherlands: Netherlands Centre for Ethics and Health (Monitoring Report on Ethics and Health, 2013/1).
- Kenkel, Donald S. (2000): Prevention. In Anthony J. Culyer, Joseph P. Newhouse (Eds.): *Handbook of Health Economics* (Volume 1, Part B). Amsterdam, Netherlands: Elsevier, pp. 1675–1720.
- Kirchgässner, Gebhard (2015): Soft paternalism, merit goods, and normative individualism. In *European Journal of Law and Economics*, pp. 1–28.
- Lepper, Mark R.; Greene, David; Nisbett, Richard E. (1973): Undermining Children's Intrinsic Interest with Extrinsic Reward: A Test of the "Overjustification" Hypothesis. In *Journal of Personality and Social Psychology* 28 (1), pp. 129–137.
- Mc Fall, Liz (2015): Is Digital Disruption the End of Health Insurance? Some Thoughts on the Devising of Risk. In *economic sociology_the european electronic newsletter* 17 (1), pp. 32–44.
- Mitchell, Gregory (2005): Libertarian paternalism is an oxymoron. In *Northwestern University Law Review* 99 (3), pp. 1245–1277.
- Mülheims, Laurenz; Hummel, Karin; Peters-Lange, Susanne; Toepler, Edwin; Schuhmann, Iris (2015): *Handbuch Sozialversicherungswissenschaft*. Wiesbaden, Germany: Springer.
- Raghupathi, Wullianallur; Raghupathi, Viju (2014): Big data analytics in healthcare: promise and potential. In *Health Information Science and Systems* 2 (3).
- Schulze Ehring, Frank; Weber, Christian (2007): Wahltarife in der GKV. Nutzen oder Schaden für die Versichertengemeinschaft? In *WIP-Diskussionspapier* 7 (4).
- Stanciole, Anderson E. (2008): Health Insurance and Lifestyle Choices: Identifying Ex Ante Moral Hazard in the US Market. In *Geneva Pap Risk Insur Issues Pract* 33 (4), pp. 627–644.

Statistics Netherlands (2011): Majority think people with unhealthy lifestyle should pay more for health insurance. Available online at <https://www.cbs.nl/en-gb/news/2011/39/majority-think-people-with-unhealthy-lifestyle-should-pay-more-for-health-insurance>, updated on 27/09/2011, checked on 14/10/2016.

Steinhubl, S. R.; Muse, E. D.; Topol, E. J. (2015): The Emerging Field of Mobile Health. In *Science Translational Medicine* 7 (283), pp. 1–6.

Swedloff, Rick (2014): Risk Classification's Big Data (R)evolution. In *Connecticut Insurance Law Journal* 21, pp. 339–374.

United Health Group (2016): UnitedHealthcare and Qualcomm Collaborate to Launch New Wellness Program That Links Financial Incentives with the Use of Wearable Devices.

Available online at:

<http://www.unitedhealthgroup.com/Newsroom/Articles/Feed/UnitedHealthcare/2016/0301QualcommUnitedHealthcareMotion.aspx?r=1>, updated on 01/03/2016, checked on 14/10/2016.

van Baal, Pieter H. M.; Polder, Johan J.; Wit, G. Ardine de; Hoogenveen, Rudolf T.; Feenstra, Talitha L.; Boshuizen, Hendriek C. et al. (2008): Lifetime Medical Costs of Obesity: Prevention No Cure for Increasing Health Expenditure. In *PLoS Medicine* 5 (2), pp. 242–249.

van de Ven, Wynand P. M. M.; van Vliet, René C. J. A.; Schut, Frederik T.; van Barneveld, Erik M. (2000): Access to Coverage for High-Risks in a Competitive Individual Health Insurance Market: via Premium Rate Restrictions or Risk-Adjusted Premium Subsidies? In *Journal of Health Economics* 19 (3), pp. 311–339.

Verband der privaten Krankenversicherung (2015): Rechenschaftsbericht der Privaten Krankenversicherung. Available online at

<https://www.pkv.de/rechenschaftsbericht-2015.pdb.pdf>, updated on 06/2016, checked on 14/10/2016.

Verband der privaten Krankenversicherung (2016): Die Beitragskalkulation in der Privaten Krankenversicherung. Available online at

<https://www.pkv.de/service/broschueren/.../beitragskalkulation-in-der-pkv.pdb.pdf>, updated on 04/2016, checked on 13/10/2016.

Weber, Guido W. (2007): Kundenbindung durch Wahltarife. In *Gesundheits- und Sozialpolitik* 61 (7-8), pp. 54–63.

Zweifel, Peter; Manning, Willard G. (2000): Moral Hazard and Consumer Incentives in Health Care. In Anthony J. Culyer, Joseph P. Newhouse (Eds.): *Handbook of Health Economics* (Volume 1, Part A). Amsterdam, Netherlands: Elsevier, pp. 409–459.