Determinants of the Value of Health in Germany
Behavioural Aspects

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Introduction

Increasing health expenditure and the efficient allocation of resources in the field of healthcare are subject to continuous discussion worldwide (OECD, 2019b; World Health Organization (WHO), 2019). Focussing on Germany, this dissertation contributes to the debate by analysing the effect of behavioural aspects on the decision-making in healthcare. The objective is to determine factors influencing the perception of the value of health in Germany. The dissertation at hand comprises three articles.

The first study analyses factors potentially affecting the outcome of the German pharmaceutical price negotiations since the introduction of the Act on the Reform of the Market for Medicinal Products (AMNOG) in 2011 (see Federal Ministry of Health, 2016 for further information on the AMNOG regulation). A total of 187 pharmaceuticals that completed the AMNOG process from 2011 to 2017 are analysed. In line with previous studies (see Lauenroth & Stargardt, 2017; Radic, Haugk, & Radic, 2018; Theidel & von der Schulenburg, 2016), only a small effect of the (additional) benefit of the pharmaceutical on the price negotiation is found. However, the results of the study show that the price freely set by the manufacturer before the negotiation (*launch price*) has a major impact on the negotiated price. On average, the negotiated price is 80.3% (median 83.3%) of the launch price. Moreover, renegotiating has a positive effect on the outcome, while a decision made by the arbitration board decreases the premium.

Results of the first study suggest that factors besides the actual benefit of the pharmaceutical affect its evaluation. Decisions regarding the value of pharmaceuticals (pharmaceutical prices) in Germany are made by official institutions on behalf of the population. These decisions on behalf of the institutions are, in turn, made by individuals acting as representatives. The aim of the second study is, therefore, to shed some light on the factors influencing the preferences of individuals.

A survey on German subjects was conducted with a total of 1,199 people participating. Queried subjects were asked to state their willingness to pay for a new

pharmaceutical. Data indicates that the participant's perception of the pharmaceutical's benefit strongly affects their willingness to pay. However, besides the benefit, characteristics of the participants seem xto influence the willingness to pay as well. Results show a higher payment if the queried subjects are (a) covered by private insurance, (b) state a higher willingness to consume, (c) have more conservative values, and (d) express social security to be less important. Furthermore, providing information on the price of the pharmaceutical to some of the participants (2/3 of the cases) leads to a higher amount of money these participants are willing to pay. Results of this survey are in line with the first study. The perception of the value of a pharmaceutical seems to be influenced by factors beyond its actual benefit.

While the first two studies focus on pharmaceuticals, a third study was conducted to determine whether the evaluation of health, in general, is affected by factors besides the actual benefit of the intervention. Focussing on Germany, this study contributes by providing a survey of the determinants of willingness to pay for healthcare in the literature. Results show socio-economic and health characteristics of the participants to affect the willingness to pay (e.g. income, health state). Moreover, stated preferences are found to depend on the survey methodology, such as the survey form and the elicitation method. The reviewed studies contain three overarching topics: disease treatment, prevention and health insurance. Interestingly, in the literature examined, certain effects are found for two of the three topics in several studies each. It is only for a specific topic that the relationship between willingness to pay and the respective determinant cannot be proven (e.g. health status and willingness to pay for prevention). Furthermore, it is noticeable that some determinants are not even examined for certain topics (e.g. risk perception and willingness to pay for health insurance).

Results of this dissertation indicate that the perception of the value of health in Germany is affected by determinants besides the (perceived) benefit of the intervention. On an institutional level, the first study finds the launch price to influence the value assessment. In the second study, individual characteristics like conservative values are found to affect preferences in willingness to pay studies for pharmaceuticals. Results of the literature review also confirm these effects for the general area of health. Furthermore, in addition to the study participants' socio-economic and health characteristics, the influence of the study methodology on the surveyed preferences also becomes clear in the third study.

Chapter 1

Pharmaceutical Prices: The Impact of the Launch Price – An Analysis of German AMNOG Early Benefit Assessment Data*

1.1 Introduction

Average health spending of the OECD countries corresponds to 8.31% (median: 8.28%) of the country's gross domestic product; and 16.75% (median: 14.67%) of this derives from pharmaceuticals (OECD, 2019a, 2019c). Moreover, since effective drugs are in high demand, national healthcare systems often struggle with the question of appropriate pricing. On the one hand, there is a social desire for low pharmaceutical expenses. On the other hand, high prices (i.e. high prospective gains) which are anyway in the interest of the firms also provide incentives to invest in research and development which is socially desired. As a consequence pharmaceutical prices are a notoriously contentious topic (Steele, 1962, 1964; Scherer, 2004; Stiglitz & Jayadev, 2010; Parker-Lue, Santoro, & Koski, 2015; Frakt, 2019) and have become a major topic in the political discussion worldwide, causing the World Health Organization to call for more transparency regarding medicine prices (t' Hoen, 2019).

This paper contributes to the discussion by analysing the pricing process for new pharmaceuticals in Germany, a reference market for the European Union (Vogler & Martikainen, 2015). The focus on Germany is made not only because of its wider

*This chapter is based on Böhler, Lamping, and Wichardt (2019).

relevance. Also a new procedure to determine pharmaceutical prices – the Act on the Reform of the Market for Medicinal Products (AMNOG) – was introduced in 2011 with the intent to tie prices closer to benefits. In order to achieve this, price negotiations are now based on an early benefit assessment of the respective drug's additional benefit compared to the appropriate comparative therapy (comparator).[1] According to the new procedure, manufacturers are allowed to freely price their new product during the first year after its release. The negotiated price, then, applies for any future years (Federal Ministry of Health, 2016).

The procedure, however, keeps being criticised for still granting only minor or no influence to fundamentals, most of all the drug's additional benefit (Aerztezeitung, 2014). In fact, previous studies (i.e. Lauenroth & Stargardt, 2017 and Theidel & von der Schulenburg, 2016) come to the conclusion that the additional benefit and other factors such as therapeutic area, orphan drug status, and appropriate comparative therapy alone do not fully explain the negotiated reimbursement price. With the present study, we extend earlier works in two ways. First of all, we use a broader and more current dataset. Moreover, we provide an analysis of the relation between the price freely set by the manufacturer and the price negotiated between the manufacturer and the Statutory Health Insurance Funds. The results indeed suggest that caution regarding the effectiveness of the new negotiation process in terms of reaching a closer tie between prices and actual benefits is warranted.

1.2 Methods

Sample Selection

From January 1st 2011 to December 31st 2017, the Federal Joint Committee (Federal Joint Committee, 2019b) conducted 327 early benefit assessments (EBAs), which are the basis of our dataset. 309 of these 327 EBAs completed the assessment by the Federal Joint Committee and were, hence, eligible for our study. Of these 309 EBAs, a total of 122 EBAs had to be excluded for various technical reasons. The final sample therefore contains 187 EBAs. Figure 1 illustrates the selection process.

[1] Negotiating parties are the pharmaceutical manufacturer and the National Association of Statutory Health Insurance Funds (Henke, 2014).

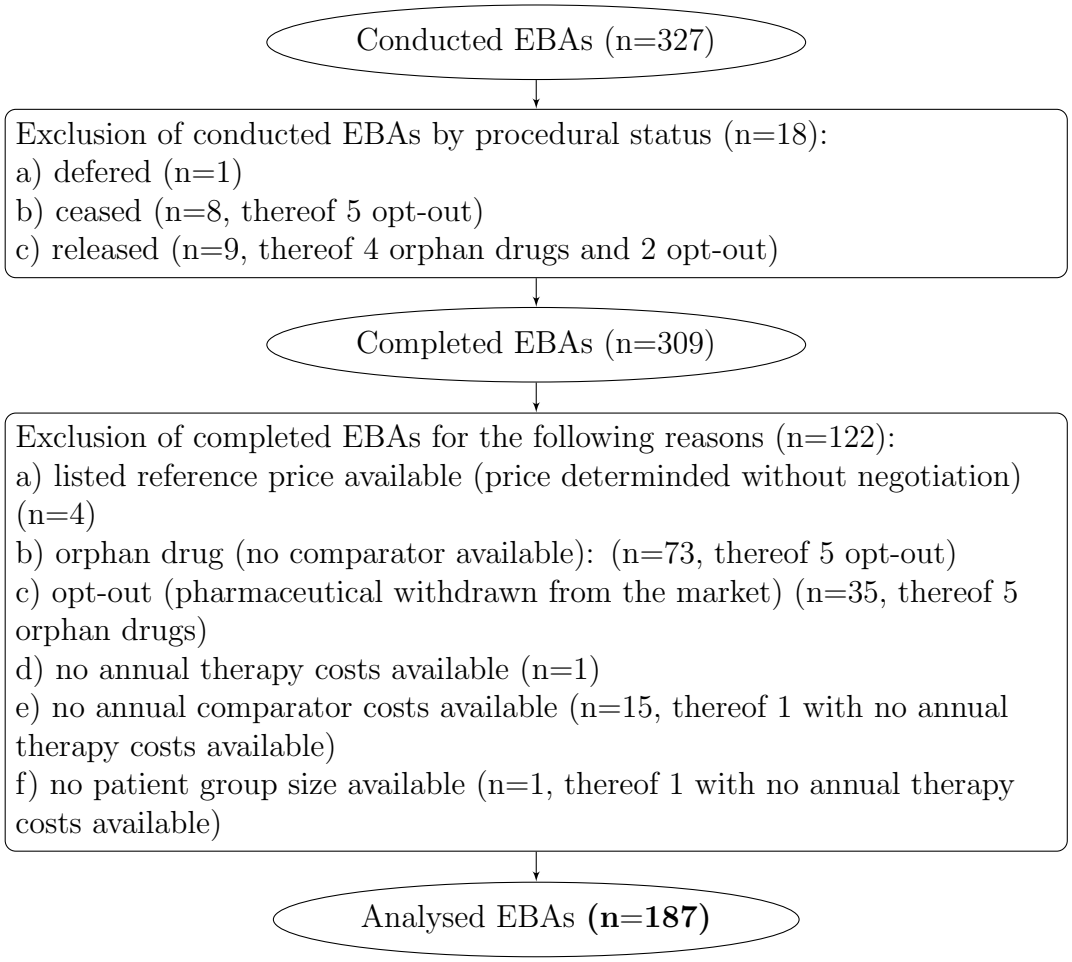

Figure 1: Sample selection: Exclusion criteria and number of excluded EBAs in rectangle boxes. Number of remaining EBAs in round ellipses boxes.

Data Gathering

Data regarding the early benefit assessment were extracted from the publicly available website of the Federal Joint Committee (Federal Joint Committee, 2019b). These data contain extent and certainty of the additional benefit as assessed by the manufacturer, the Institute for Quality and Efficiency in Health Care (IQWiG) and the Federal Joint Committee, as well as the annual costs of therapy per patient, the patient group size, and the appropriate comparator. Moreover, pharmaceutical prices before and after the negotiation were extracted from the official German price database Lauer-Taxe (Lauer-Taxe, 2019). Publicly available information on financial data was gathered from the ifo Business Climate Index (ifo Institute, 2019) and finanzen.net (Finanzen.net GmbH, 2019).[2]

Variables

Dependent Variable: For our analysis, we use the negotiated premium on the comparator price as a target variable. This is defined as the relation between the new pharmaceutical's annual cost of therapy per patient and the respective comparator's annual cost of therapy per patient. For both costs, we use the values defined by the Federal Joint Committee. This approach is consistent with the intentions of AMNOG, creating a reimbursement price, which represents the additional benefit assessed over the appropriate comparator (Federal Joint Committee, 2019a). The method was already used by Lauenroth and Stargardt (2017).

$$\text{negotiated premium} = \frac{\text{pharmaceutical's annual costs per patient after the negotiation}}{\text{comparator's annual costs per patient}} \tag{1}$$

Independent Variables: The dataset includes a total of 18 explanatory variables. A summary of these can be found in Table 1.

Similarly to the *negotiated* premium, we use the ratio of the pharmaceutical's annual costs per patient before the negotiation to the comparator's annual costs per patient, henceforth referred to as *launch* premium.

$$\text{launch premium} = \frac{\text{pharmaceutical's annual costs per patient before the negotiation}}{\text{comparator's annual costs per patient}} \tag{2}$$

[2]In organising the data, we greatly benefitted from Blankart and Stargardt (2017) who kindly provided a reference data set.

Independent Variable	Inclusion Citeria
launch	Ratio of the pharmaceutical's annual costs per patient before the negotiation to the comparator's annual costs per patient.
cost	Annual therapy costs per patient for the new pharmaceutical defined by the Federal Joint Committee.
comparator cost	Annual therapy costs per patient for the respective appropriate comparative therapy (comparator) defined by the Federal Joint Committee.
extent additional benefit	The extent of the additional benefit compared to the appropriate comparative therapy (comparator) defined by the Federal Joint Committee.
certainty additional benefit	The certainty of the additional benefit compared to the appropriate comparative therapy (comparator) defined by the Federal Joint Committee.
extent*certainty (interaction)	The product of the extent and certainty of the additional benefit defined by the Federal Joint Committee.
renegotiation	Binary variable indicating whether a manufacturer chose to apply for a reassessment (e.g. due to an extension to a new indication). Reassessment causes a renegotiation (Federal Joint Committee, 2019a).
arbitration	Binary variable indicating whether the pricing decisions were made by an arbitration board. The independent arbitration board takes over if both parties cannot agree on a price during the negotiation (Ludwig & Dintsios, 2016). The dataset contains 47 EBAs with decisions made by the arbitration board.
population size	Total target population size of the new pharmaceutical. The sum of the average sizes of the respective patient groups defined by the Federal Joint Committee.
headquarter	The location of the headquarter of the manufacturer's parent company.[3]
experience process experience negotiation company size	The number of conducted AMNOG processes and AMNOG negotiations, and the size of the manufacturer (measured by its total assets (Moeller, Schlingemann, & Stulz, 2004)).[4]
limitation	Binary variable indicating whether an EBA has a time limitation which causes further assessment in the near future (Federal Ministry of Justice and Consumer Protection, 2010). This holds for 31 EBAs.
previous opt-outs	The number of previous withdrawals from the German market (also called opt-out) (Social Security Code V (SGB V), 2012) made by a manufacturer.
ifo business climate index	The annual ifo business climate index (ifo Institute, 2019) as a proxy for the general economic situation during the negotiation.
hearing participants	The number of participants in the hearing (vfa. Die forschenden Pharma-Unternehmen, 2018) as a proxy for the perceived importance of respective pharmaceutical.
discrepancy assessed benefit	The effect of the discrepancy between the manufacturer's and the Federal Joint Committee's assessed extent of the additional benefit on the negotiation.

[3] See French and Poterba (1991) for the influence of home bias and Chang (2006) for cultural differences in negotiation techniques.

[4] See Thompson (1990) for the influence of experience on the negotiation performance.

Table 1: Summary of independent variables potentially influencing the AMNOG price negotiation.

Data Organisation

For each pharmaceutical one specific price is negotiated. However, for the benefit assessment, the patient population of a certain pharmaceutical is divided into different patient groups. This leads to divergent assessed additional benefits, annual costs of therapy (also for comparator) and patient group sizes, within one pharmaceutical.

For the analysis, we weigh the annual costs of therapy per patient of each patient group with the ratio between its population size and the sum of the population size of all patient groups of the respective EBA. We use annual costs of treatment per patient, and patient group size defined by the Federal Joint Committee.

$$\text{cost} = \sum_{i=1}^{n} \frac{\text{population size}_i}{\sum_{j=1}^{n} \text{population size}_j} \cdot \text{cost}_i \tag{3}$$

Similarly, we calculate the extent of the additional benefit and the certainty of the additional benefit for each EBA using the additional benefit assessed by the Federal Joint Committee. The necessary transformation of the ordinal benefit assessments to cardinal ones is conducted using the following point scale in Table 2. See Hammerschmidt (2017) for a similar approach.

$$\text{extent additional benefit} = \sum_{i=1}^{n} \frac{\text{population size}_i}{\sum_{j=1}^{n} \text{population size}_j} \cdot \text{extent additional benefit}_i \tag{4}$$

$$\text{certainty additional benefit} = \sum_{i=1}^{n} \frac{\text{population size}_i}{\sum_{j=1}^{n} \text{population size}_j} \cdot \text{certainty additional benefit}_i \tag{5}$$

For the purpose of the analysis an ordinary least squares regression was conducted. Because of the distribution of the following variables: negotiated *premium*, *launch* premium, *costs of the pharmaceutical*, *costs of the comparator*, and *population size*, we use the logarithm of these five variables. All other variables are kept at their initial state. Several sensitivity analyses were conducted to control for our premises (see Appendix A.1). The core results remain the same for all models. All analyses were conducted using Stata 15.1.

Extent Benefit	Point Scale	Certainty Benefit	Point Scale
major	6	proof	4
considerable	5	indication	3
non quantifiable	4	hint	2
minor	3	n/a	1
no added benefit	2		
lesser benefit	1		

Table 2: Transformation of ordinal additional benefit into a cardinal point scale.

1.3 Results

The following section is divided into three parts. The results of the (1) descriptive analysis, (2) regression analysis, and (3) an analysis of the assessment differences between the Federal Joint Committee, IQWiG, and the manufacturer.

Descriptive Analysis

The 187 EBAs used in our study were submitted by 53 manufacturers (average: 3.53, median: 1; min: 1, max: 19), with more than half of the manufacturers (N = 28) having submitted only one EBA. Moreover, the predominant group of EBAs are pharmaceuticals for oncological diseases (N = 68). In fact, the top three therapeutic areas (oncological diseases N = 68; infectious diseases N = 29; metabolic diseases N = 22) make up for 64% of the EBAs.

Furthermore, our data reveal a difference between the manufacturers' stated expectation about the assessment, and the assessments made by IQWiG and the Federal Joint Committee. In particular, IQWiG and the Federal Joint Committee assess the additional benefit lower. A summary of the extent of the additional benefit by assessor can be found in Table 4; see Fischer and Stargardt (2014) for a more detailed discussion of the topic.

Regarding the actual pricing, we find that the average premium on the comparator's cost before the negotiation (*launch*) is 526.4%. During the negotiations, this gets reduced to approximately 80.3% of the initial premium (average final *premium*: 422.7%). These values are strongly influenced by some outliers, though. The median *launch* price premium is 195.2% and the median final *premium* after the negotiations is 151.8%.

Regression Analysis

A linear regression was conducted to analyse the effect of various determinants on the German pharmaceutical price negotiation. The results are summarised in Table 3.

Model 1 (M1), is based on all independent variables except for the *launch* premium; a full analysis is reported in Model 2 (M2). Model 3 (M3) reports results from a regression including only cost variables; Model 4 (M4) in turn focusses on the sole influence of the *launch* premium. Finally, Model 5 (M5) analyses the effect of the additional benefit - and only that - on the negotiated *premium*. The main results of our analysis – excluding variables with a statistically insignificant effect – are presented as Model 6 (M6) in the sequel.

premium	M1 17 iv	M2 18 iv	M3 costs	M4 launch	M5 benefit	M6 final
launch		0.977***		0.973***		0.960***
cost	0.977***	(omitted)	0.983***			
comparator cost	-0.971***	0.006	-0.970***			
extent additional benefit	0.170*	0.170*			0.549	0.172*
certainty additional benefit	0.141	0.141			0.296	0.151
extent*certainty (interaction)	-0.056	-0.056			-0.089	-0.058
renegotiation	0.221***	0.221***				0.224***
arbitration	-0.086	-0.086				-0.120**
population size	-0.004	-0.004				
headquarter	0.012	0.012				
experience process	0.028	0.028				
experience negotiation	-0.025	-0.025				
company size	0.000	0.000				
limitation	-0.009	-0.009				
previous opt-outs	-0.064	-0.064				
ifo business climate index	0.006	0.006				
hearing participants	0.003	0.003				
discrepancy assessed benefit	0.006	0.006				
constant	-1.518	-1.518	-0.351***	-0.226***	-0.840	-0.690***
N	177	177	187	187	187	187
R-sqr	0.955	0.955	0.936	0.935	0.131	0.948

Table 3: Regression results of M1-M6; Factors influencing the negotiated premium; M1 and M2 controlled for therapeutic area; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Launch Premium

A first analysis shows that the negotiated *premium* is strongly correlated with the annual costs of the new pharmaceutical (+0.977; p < 0.001) and the annual costs of the comparator (-0.971; p < 0.001); (see M1, Table 3). However, including the *launch* premium leaves the effect of both, the costs of the new pharmaceutical, and the comparator insignificant. Thus, the *launch* premium itself seems to have a strong

effect on the negotiated *premium* (see M2, Table 3).

Comparing the effect of *cost of the pharmaceutical* and *comparator cost* on the negotiated *premium* (see M3, Table 3) with the sole effect of the *launch* premium on the negotiated *premium* (see M4, Table 3), both regression models come to very similar results. The correlation between the *launch* premium and the negotiated *premium* can be seen in Figure 2.

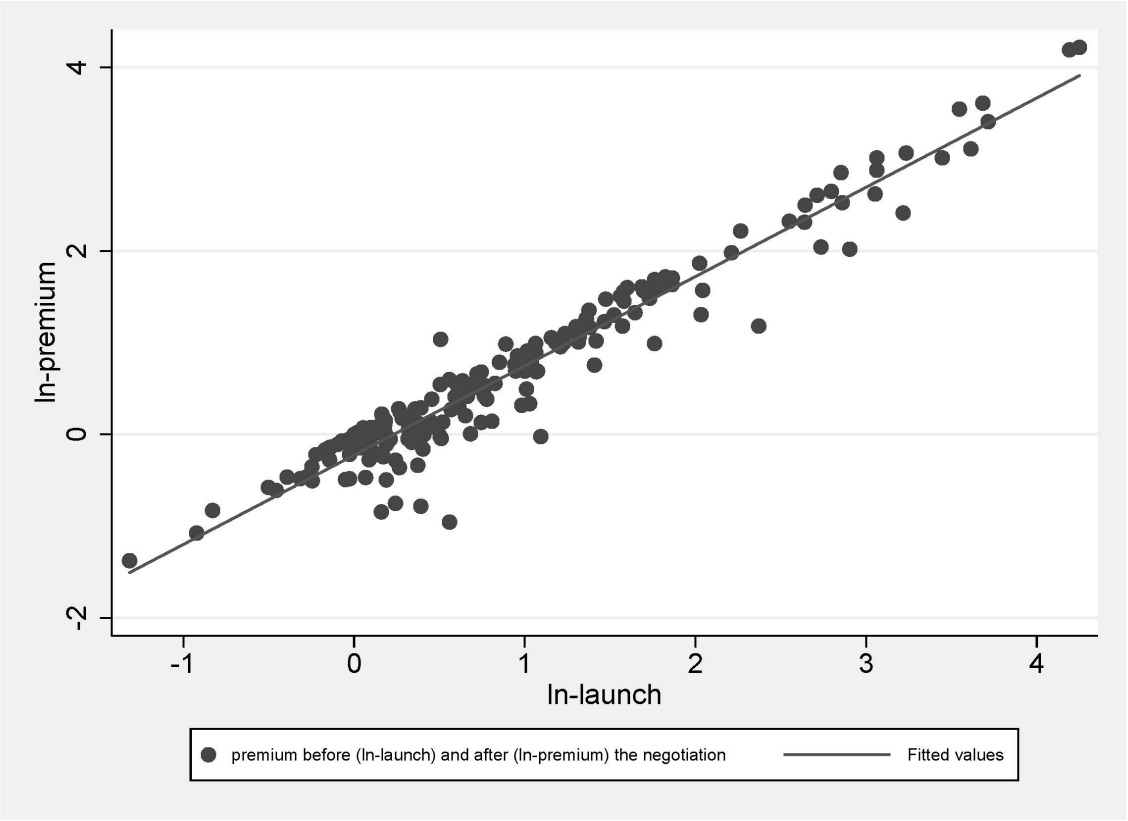

Figure 2: Log OLS of the premium before and after the negotiation.

Note in particular that the goodness of fit for Model 4 (M4, Table 3) is 93.5%, suggesting that the *launch* price explains a large share of the eventual *premium*.

Result 1 *The launch premium has a strong correlation with the eventually negotiated premium (M4; $p < 0.001$).*

Additional Benefit

By contrast, Model 5 (M5, Table 3), which only considers the additional benefit of the new pharmaceutical, has only a goodness of fit of 13.1% with no statistically significant impact of the variables. Once we take the pharmaceutical costs and comparator costs

(or *launch* premium) as well as all other variables into account, the extent of the additional benefit becomes statistically significant (+0.170; $p < 0.05$; see M1 or M2, Table 3).

Result 2 *The extent of the additional benefit of the new pharmaceutical shows only a small correlation with the negotiated premium which also shows a lower degree of statistical significance (M5, $p >= 0.05$; M6, $p < 0.05$).*

Renegotiation
For some pharmaceuticals (N = 69) renegotiation took place, e.g. due to an extension to a new indication. In Model 6 (M6, Table 3), we find a positive effect of this renegotiation on the premium.[5]

Result 3 *Renegotiation (e.g. due to adding a new indication) correlates positively with the negotiated premium (M6, $p < 0.001$).*

Decision by Arbitration Board
Including the *launch* premium, the *additional benefit* and a binary defining whether it is a *renegotiation*, results suggest a lower negotiated *premium* (-0.120; $p < 0.01$) if the decision is made by an arbitration board (see M6, Table 3). However, the effect of a decision by the arbitration board is not significant in the full model (M1 or M2, see Table 3).

Result 4 *If the pricing decision is made by an arbitration board, the effect on the negotiated premium is negative (M6, $p < 0.01$).*

Assessment Differences
Finally, we want to emphasise that the data show a tangible discrepancy between the three different assessments of the additional benefit (Federal Joint Committee, IQWiG, manufacturer; see Table 4). In fact, a two-sided paired t-test, and a Wilcoxon matched-pairs signed-ranks test (Wilcoxon, 1946) show that manufacturers systematically provide more favourable assessments of their products than the Federal Joint Committee ($p < 0.001$).

However, to our surprise we find that the assessment of the Federal Joint Committee actually shows the highest explanatory power regarding *launch* prices (OLS

[5] An additional confirming analysis, taking into account only the first assessment of each pharmaceutical (N = 118) and thus excluding 69 renegotiated EBAs, shows the same results (see Appendix A.2).

Extent Additional Benefit	Manufacturer	IQWiG	Federal Joint Committee
lesser benefit	0	1	0
no added benefit	12	110	96
minor	21	38	44
non quantifiable	44	20	30
considerable	56	11	11
major	48	1	0
total	181	181	181

Table 4: Comparison of the assessed extent of the additional benefit by the manufacturer, IQWiG and the Federal Joint Committee. Number of assessments with a certain extent of the additional benefit, by organisation.

regression: manufacturer: 0.254, $p < 0.001$, R-sqr=9.6%; Federal Joint Committee: 0.383, $p < 0.001$, R-sqr=13.8%).[6]

This is at least puzzling, as the assessment of the Federal Joint Committee is made only after the *launch* price is set using data provided by the manufacturer. Assuming that the Federal Joint Committee does not use the pharmaceutical's *launch* price itself for the evaluation of the drug's benefit, results suggest that manufacturers at least partly decouple prices from data and make strategic pricing decisions. While in itself is not surprising the decoupling of information (about the benefit) and the price setting contradicts the general idea of the AMNOG procedure, which aims to tie benefits and prices more closely. Moreover, our previous results show that the *launch* premium affects the eventually *negotiated* premium. Manufacturers decoupling benefit and price and setting prices strategically suggests that there is further room for social welfare improvement in the procedure.

Result 5 *Manufacturers assess their pharmaceutical more positively than IQWiG and the Federal Joint Committee. Moreover, the assessment by the Federal Joint Committee shows a stronger correlation with the launch price than the manufacturer's own assessment.*

[6]We find no statistically significant difference – using a generalised Hausman specification test (Hausman & Taylor, 1981) (prob > chi2 = 0.0582) – regarding the effect of the benefit assessments by the manufacturer and the Federal Joint Committee on the *launch* premium.

1.4 Concluding Remarks

In this paper, we have presented the results from an analysis of the pricing process of 187 innovative pharmaceuticals in Germany which were introduced between 2011 and 2017. While the data confirm a small but tangible dependence of eventual price *premiums* on the actual additional benefit of the respective pharmaceutical, they also provide support for the claim that eventual prices are only weakly tied to fundamentals (i.e. actual additional benefit of the drug). Instead, the *launch* price set freely by the manufacturer in the first year has a far stronger impact on the negotiated *premium* in our data set, both in terms of parameter size and level of statistical significance. While we can of course only speculate about reasons, a likely explanation seems to be that manufacturers simply exploit anchoring effects when setting prices for the first year (cf. Ariely, Loewenstein, & Prelec, 2003; Galinsky & Mussweiler, 2001; Mussweiler, Strack, & Pfeiffer, 2000; Tversky & Kahneman, 1974).

Moreover, a comparison of the additional benefit assessments by the manufacturers, IQWiG and the Federal Joint Committee suggests that manufacturers provide assessments with a systematically higher additional benefit of their pharmaceuticals. Further analysis leads to the result that the official assessment by the Federal Joint Committee has the highest explanatory power regarding *launch* prices freely set by the manufacturers in the first year.

While in itself not entirely surprising, this result, to us, still seems relevant from a policy perspective. If firms use overly positive reports on their pharmaceuticals to set their *launch* prices and if these are what effectively determines later prices, further regulation or at least a less lenient bargaining strategy of official institutions might be justified or even called for.

Chapter 2

Determinants of Willingness to Co-Pay for Pharmaceuticals – An Empirical Study on German Subjects*

2.1 Introduction

Pharmaceutical prices in Germany are negotiated between the drug's manufacturer and political institutions on behalf of the population.[1] These decisions on behalf of political institutions and manufacturers are, in turn, made by individuals. Therefore the individual situation of the decision-maker might influence the decision making for others (Ifcher & Zarghamee, 2020).

Asking participants for their willingness to pay is one method to elicit preferences which has become popular in health economics (Ryan et al., 2001; Smith, 2000).

Previous studies (see Ryen & Svensson, 2015 for a review of the empirical literature on willingness to pay for a quality adjusted life year) analyse participants' willingness to pay for certain treatments. However, they mostly focus on the influence of the treatment's benefit and control for socio-economic effects (e.g. income). The aim of this study is to find out whether individual characteristics (e.g. values, opinions) affect the evaluation of pharmaceuticals. We conducted a survey asking for people's

*This chapter is based on Lamping, Boehler, and Wichardt (2020).

[1]The Act on the Reform of the Market for Medicinal Products (AMNOG) was introduced in 2011 in order to tie pharmaceutical prices closer to their benefit (see Henke, 2014 for further information).

willingness to pay for pharmaceuticals and determinants potentially influencing their decision.

In line with previous studies analysing the factors that potentially influence the pharmaceutical price negotiation in Germany (see Böhler et al., 2019; Lauenroth & Stargardt, 2017; Radic et al., 2018; Theidel & von der Schulenburg, 2016, for more details), results of our statistical analysis indeed suggest that the evaluation of pharmaceuticals by the population is determined by various factors besides the perceived benefit. Participants' health insurance (statutory vs private), willingness to consume, values, need for social security, and information on pharmaceutical prices affect their willingness to pay.

Therefore, if pharmaceutical prices should be based exclusively on their benefit (efficacy), controlling for the decision-makers' characteristics should be discussed. However, further research is necessary regarding the influence of individual factors on the pricing process. Furthermore, our results raise the question of whether the evaluation of pharmaceuticals should depend on the people's preferences. This could be done by taking not only the pharmaceutical's benefit but also the characteristics of the pharmaceutical's target population into account when defining prices on behalf of them.

The remainder of this paper is structured as follows: In section 2.2, we describe our experimental design. Analyses and results are provided in Section 2.3. Section 3.3 concludes with some general comments.

2.2 Survey Design

The aim of this study is to elicit the determinants affecting people's evaluation of pharmaceuticals. Therefore, a willingness to pay survey was conducted at three different universities.[2] The survey took part from September to October 2019. Data was gathered using a paper-back questionnaire at the beginning of a lecture. Each session started with a short introduction after which the questionnaires were handed out to the students, willing to participate. Responding to our items took about 10 minutes of subjects' time in total. Data from 1,199 university students is eligible for analysis.

The questionnaire consists of two parts and can be found in the appendix (Appendix A.3). The first part accounts for the participant's socio-economic and health

[2]We conducted the study at TH Koeln University of Applied Sciences, OWL University of Applied Sciences and Arts, and Hamm-Lippstadt University of Applied Sciences.

status[3] as well as their satisfaction, priorities, and opinions. In the second part, a fictitious person having a certain disease is presented, and the efficacy of two (current and new) pharmaceuticals approved for the respective disease is compared. Afterwards, participants are asked to express their perception of the advantage of the new pharmaceutical in comparison to the current one, henceforth *added benefit*. Following the question regarding the perceived added benefit, queried subjects are asked whether they would recommend the new pharmaceutical.

(i) If the participant does not recommend the pharmaceutical, the questionnaire ends.

(ii) If the participant does recommend the pharmaceutical, information regarding the price of the current and the new pharmaceutical is given (2/3 of the cases receive information on the price). Eventually, participants are asked to state their willingness to pay for the new pharmaceutical.

Effectively we ask for the *willingness to co-pay* as the German healthcare system employs statutory health insurance funds financed by the solidarity community (Federal Ministry of Health, 2015).[4] For the ease of exposition, we refer to it as *willingness to pay*.

Our experimental design consists of twelve treatments. The treatments differ in the following ways: Four different indications (psoriasis, lung cancer, heart failure, and COPD) are used. Within these four scenarios, there are three different variations regarding the stated price of the current and the new pharmaceutical (no price stated, real price stated, and fictitious price stated).

The fictitious price for the new pharmaceutical is the same for all four indications. It is the average of the real prices of all four new pharmaceuticals. The same applies to the fictitious price of the current pharmaceutical.

This leads to a total of twelve different treatments, i.e. four diseases multiplied by three prices each.

Using different indications allows us to analyse framing effects (Tversky & Kahneman, 1981). The different price information is used to analyse two effects. The anchor effect (a higher stated price might cause a higher willingness to pay) (Kahneman, 1992) and the effect of cost awareness as people with a statutory health insurance

[3]We use the EQ-5D to measure the participants' generic health status (EuroQol Research Foundation, 2019a).

[4]Health insurance funds reimburse pharmaceutical expenses, and patients only co-pay a maximum of €10 per pharmaceutical (Federal Ministry of Health, 2017). If a manufacturer decides to price its pharmaceutical above the negotiated price, patients have to pay the difference, and therefore co-payment might exceed €10 (DeutschesApothekenPortal (DAP), 2019).

(90% of the population, Federal Ministry of Health, 2020) might not have information on pharmaceutical prices but only know the relatively small co-payments (Breyer, Zweifel, & Kifmann, 2003). The described effect of the drug for COPD occurs after only 24 weeks, while the effect of the drug for heart failure is reported over a period of two years. These different time periods allow us to test whether a present bias affects the decision of the queried subjects (O'Donoghue & Rabin, 1999). See Table 5 for an overview of the twelve treatments. Each participant received only one treatment. The questionnaires were randomly sorted before the lecture and then distributed in the lecture hall.

treatment	indication	price information	price new pharmaceutical	price current pharmaceutical
treatment 1	psoriasis	no price information	n/a	n/a
treatment 2	psoriasis	real price	€1,416.62	€206.61
treatment 3	psoriasis	fictitious price	€2,613.93	€1,310.40
treatment 4	lung cancer	no price information	n/a	n/a
treatment 5	lung cancer	real price	€8,841.93	€4,983.85
treatment 6	lung cancer	fictitious price	€2,613.93	€1,310.40
treatment 7	heart failure	no price information	n/a	n/a
treatment 8	heart failure	real price	€165.14	€24.62
treatment 9	heart failure	fictitious price	€2,613.93	€1,310.40
treatment 10	copd	no price information	n/a	n/a
treatment 11	copd	real price	€32.03	€26.52
treatment 12	copd	fictitious price	€2,613.93	€1,310.40

Table 5: Overview of the twelve treatments. Four indications with three different kinds of price information. The fictitious price of the new/current pharmaceutical is the average of the real price of the new/current pharmaceutical price.

2.3 Analyses and Results

Summary Statistics

Our dataset contains responses of 1,199 participants. The participants' mean age is 22.7 years (SD of age = 4.2). Women represent 42.4% of the participants. The majority (93.9%) of the participants are single (not married, divorced, or widowed) and currently in a bachelor's degree programme (91.2%). The stated average money available after rent is €393.0 (SD of income = 217.9).

Average willingness to pay for the twelve treatments is €139 (median: €31) per

month.[5] Table 6 gives an overview of the average and median willingness to pay per treatment and indication.

treatment	indication	price information	willingness to pay	conditional willingness to pay
treatment 1	psoriasis	no price information	€68; €31	€77; €31
treatment 2	psoriasis	real price	€159; €76	€181; €76
treatment 3	psoriasis	fictitious price	€145; €76	€158; €76
treatment 1-3	psoriasis	n/a	€124; €76	€139; €76
treatment 4	lung cancer	no price information	€118; €31	€183; €31
treatment 5	lung cancer	real price	€151; €31	€215; €31
treatment 6	lung cancer	fictitious price	€201; €31	€334; €31
treatment 4-6	lung cancer	n/a	€157; €31	€243; €31
treatment 7	heart failure	no price information	€141; €31	€179; €31
treatment 8	heart failure	real price	€110; €31	€142; €31
treatment 9	heart failure	fictitious price	€246; €126	€306; €126
treatment 7-9	heart failure	n/a	€167; €31	€212; €31
treatment 10	copd	no price information	€81; €31	€105; €31
treatment 11	copd	real price	€80; €10	€108; €10
treatment 12	copd	fictitious price	€154; €76	€207; €76
treatment 10-12	copd	n/a	€106; €31	€141; €31
treatment 1-12	n/a	n/a	€139; €31	€180; €76

Table 6: Willingness to pay in Euro (average; median) per treatment and indication. Willingness to pay: Willingness to pay is assumed to be zero for participants not recommending the new pharmaceutical. Conditional Willingness to Pay: Analysing only data of participants who recommend the new pharmaceutical.

Regression Analyses

Linear regression is conducted to analyse effects on the willingness to pay (M1 and M2, Table 7) and the perceived added benefit (M4, Table 7). The questionnaire contains Likert-scale items. Therefore, we additionally perform an ordered probit regression to account for the ordinal type of the dependent variable (willingness to pay and added benefit) (Daykin & Moffatt, 2002). First, we still treat the independent variables as interval scaled (willingness to pay: M5; added benefit: M7). Then, we conduct an ordered probit regression using dichotomous explanatory variables to account for the ordinal type of these variables (willingness to pay: M6; added benefit: M8). Results do not change in effect direction (see Appendix B.1.1 and B.1.2). We use logistic

[5]The participants were able to choose from predefined payments. These payment options were presented in form of €50 ranges, e.g. €51 to €100. We use the mean value between the lower and the upper bound. Sensitivity analyses show no difference in results when using the lower or upper bound.

regression to analyse, which factors influence the decision of recommending the new pharmaceutical (M3, Table 7). All analyses are conducted using Stata 15.1.

As only those participants who decide to recommend the new pharmaceutical can state their willingness to pay, we assume the *willingness to pay* to be zero for participants who do not recommend the new pharmaceutical (M1, Table 7). In a second model (M2, Table 7) we only consider participants who recommend the new pharmaceutical and therefore state a willingness to pay – henceforth *conditional willingness to pay*. A two-step Heckman correction, to control for the caused truncation does not change results (Heckman, 1976, 1979), (see Appendix B.2).

Based on a factor analysis, certain variables are grouped into the following categories for regression analyses:

(1) *Conservative*: Higher priorities regarding being able to afford things, being successful, owning a house, having a happy marriage/relationship, and having children.
(2) *Consume*: Willingness to spend on a car, a smartphone, and shoes.
(3) *Social security*: Importance of the social security system in Germany and whether it should be decreased or expanded.
(4) *System confidence*: Perceived circumstances and medical care in Germany.

Willingness to Pay

A regression analysis regarding the queried subjects' willingness to pay leads to the following results (see also Model M1, Table 7).

Result 1 *The willingness to pay is affected by the following six factors.*

The willingness to pay correlates positively with:

(a) The perceived added benefit of the new pharmaceutical in comparison to the current standard therapy (b=+20.028, p<0.001).

(b) Being more conservative (b=+5.020, p<0.01).

(c) The willingness to spend on consumer products (b=+7.705, p<0.01).

(d) Information about pharmaceutical prices (no price information: b=-83.966, p<0.001; real price: b=-55.749, p<0.01; fictitious price: reference).

The willingness to pay correlates negatively with:

(e) Being insured by statutory health insurance (not privately insured) (b=-68.499, p<0.01).

(f) The stated importance of the German social security system (b=-14.957, p<0.05).

Higher willingness to pay at higher incomes tells us relatively little about participants' needs (See Liebe, Preisendörfer, & Meyerhoff, 2011 presenting results that income does not affect the general willingness to pay, but the amount of money people are willing to pay.) In contrast, our results suggest that the respective participants have a particular preference for the pharmaceutical in question. For instance, a comparison of the willingness to pay for the different pharmaceuticals reveals a substantially higher perceived need for the provision of a drug to treat lung cancer.

Information on the pharmaceutical prices (real or fictitious prices) correlates positively with the willingness to pay. However, we find no general increase in willingness to pay with an increase in the stated price. The fictitious price is higher than the real price for all indications but "lung cancer". However, for the indication "lung cancer" the treatment 6 (fictitious price) and for the indication "psoriasis" the treatment 2 (real price) yield the highest willingness to pay. Stating higher prices for the indications "heart failure" and "COPD" leads to a higher willingness to pay of the participants.

Note that the higher willingness to pay of participants with private health insurance is to be taken with a grain of salt as in the German healthcare system in principle only people with statutory health insurance need to co-pay for pharmaceuticals (Busse, Blümel, Knieps, & Bärnighausen, 2017; Wissen-PKV.de, 2020). Therefore, it is unclear whether these participants thought that they should co-pay themselves or state a monetary value which the statutory health insured population would pay.

Considering only those questionnaires with a recommendation (N=870), the average *conditional willingness to pay* for the twelve treatments is €161 (median: €51) per month. Regression analysis results (M2, Table 7) match those of the previous regression analysis (M1, Table 7) except for two differences. The perceived added benefit of the new pharmaceutical has no statistically significant influence on the level of willingness to pay for participants who already recommend the new pharmaceutical (b=+2.101, p>=0.05). Also, women's willingness to pay is lower (b=-39.171, p<0.05). For results regarding the *conditional willingness to pay*, see Model 2 (M2), Table 7.

	(M1) willingness to pay b/se	(M2) conditional willingness to pay b/se	(M3) recommendation or/se	(M4) added benefit b/se
lung cancer	reference	reference	reference	reference
psoriasis	-76.487***	-116.385***	1.771*	1.879***
	(21.11)	(25.36)	(0.45)	(0.16)
heart failure	-2.989	-42.599	1.692*	0.506**
	(20.09)	(25.11)	(0.37)	(0.16)
copd	-61.424**	-114.722***	1.581*	0.219
	(20.23)	(25.82)	(0.34)	(0.16)
fictitious price	reference	reference		
no price information	-83.966***	-114.035***		
	(17.28)	(20.94)		
real price	-55.749**	-76.267***		
	(17.30)	(20.91)		
added benefit	20.028***	2.101	1.798***	
	(3.67)	(5.12)	(0.08)	
statutory health insurance	-68.499**	-73.590**		
	(23.08)	(27.37)		
conservative	5.020**	6.999***		
	(1.70)	(2.02)		
consume	7.705**	11.358**		
	(2.93)	(3.54)		
social security	-14.957*	-15.962*		0.230***
	(6.28)	(7.88)		(0.05)
system confidence	6.884	6.263		0.114***
	(4.22)	(5.29)		(0.03)
female	-25.844	-39.171*		-0.262*
	(14.84)	(17.94)		(0.12)
constant	-16.153	137.651	0.069***	3.987***
	(64.95)	(82.24)	(0.02)	(0.38)
N	1032	802	1123	1127

M1, M2 and M4: Linear Regression; M3: Logistic Regression; or: Odds Ratio (Exponentiated coefficients)
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 7: Regression analysis. Factors influencing willingness to pay, recommendation and perceived added benefit. M1: Willingness to pay is assumed to be zero for participants not recommending the new pharmaceutical. M2: Analysing only data of participants who recommend the new pharmaceutical. M3: Recommendation of the new pharmaceutical. M4: Perceived added benefit of the new pharmaceutical in comparison to the current standard therapy.

Recommendation and Perceived Benefit

Recommendation: Only participants recommending the new pharmaceutical were allowed to state their willingness to pay. A total of N=870 participants recommended the new pharmaceutical while N=262 did not. This questionnaire design was chosen to simulate the hurdle created by the introduction of the Act on the Reform of the Market for Medicinal Products (AMNOG) in 2011. Since then, the manufacturer needs to provide evidence that its new pharmaceutical has an added benefit compared to the respective current therapy in order to negotiate a premium on the price of the current standard therapy (Social Security Code V (SGB V), 2020).

Analysing the queried subjects' decisions to recommend the new pharmaceutical leads to the following results, which can be found in Model 3 (M3), Table 7.

Result 2 *The odds that a participant recommends the new pharmaceutical are affected by the following two factors:*

(a) The higher the perceived added benefit of the new pharmaceutical in comparison to the current standard therapy, the higher the odds of a recommendation of the new pharmaceutical (or=+1.798, p<0.001).

(b) The indication "lung cancer" has a negative impact on the odds of a recommendation of the new pharmaceutical (psoriasis: or=+1.771, p<0.05; heart failure: or=+1.692, p<0.05; COPD: or=+1.581, p<0.05; lung cancer: reference).

Perceived Benefit: Results of our analysis (Model 1, Table 7) show that the decision to recommend the new pharmaceutical strongly depends on the perceived added benefit. An analysis of the factors influencing the perception of the benefit can be found in Model 4 (M4), Table 7.

Result 3 *The perceived added benefit of the new pharmaceutical in comparison to the current standard therapy correlates positively with:*

(a) the stated importance of the German social security system (b=+0.230, p<0.001) and

(b) the perceived confidence in the German system (b=+0.114, p<0.001).

Summarising, we observe a positive correlation between confidence in the German (healthcare) system and its social security and the perceived added benefit of the new pharmaceutical. The perceived benefit, in turn, has a significant impact on the willingness to recommend a new drug. The amount of the additional payment depends

essentially on the perceived benefit, the type of insurance (statutory or private), the willingness to consume, values (conservative or not), attitudes towards social security, and the prices stated for the pharmaceuticals.

2.4 Concluding Remarks

In this paper, we have presented the results from an analysis of survey data regarding the determinants of willingness to pay for pharmaceuticals in Germany.

Study subjects' median willingness to pay is €31 (and using the lower bound €11), which is slightly above the legally defined co-pay maximum of €10 (Federal Ministry of Health, 2017).[6] While in itself not entirely surprising, the results regarding the determinants affecting the willingness to pay, to us, seem relevant from a policy perspective.

People seem to evaluate a pharmaceutical by its perceived benefit. However, we find the participants' preferences to be strongly affected by their individual characteristics. Moreover, subjects who received information on the pharmaceutical prices (2/3 of the cases) were willing to pay a higher amount. A natural guess to us seems to be that this former result is caused by the missing information on pharmaceutical prices at least by people with a statutory health insurance who are only aware of the relatively small amount of co-payment (Breyer et al., 2003). However, we find no relationship between the height of the stated price and the willingness to pay.[7]

The results emphasise that people's perception of a pharmaceutical's value is not only defined by its medical benefit. In the context of the pharmaceutical price negotiations, one should be aware that individuals negotiate on behalf of institutions. As a result, biases might be present, especially as the decision-makers themselves or relatives could be affected by the disease for which the pharmaceutical is provided. From a political perspective, this raises the question of who should be deciding on pharmaceutical prices (e.g. decision-makers with statutory health insurance, conservatives). From a different perspective, it might be an option to consider taking not only the pharmaceutical's benefit (efficacy) but also the characteristics of the pharmaceutical's target population into account when defining prices on behalf of them.

[6] If a manufacturer decides to price its pharmaceutical above the negotiated price, patients have to pay the difference and therefore co-payment might exceed €10 (DeutschesApothekenPortal (DAP), 2019).

[7] Besides the anchor effect, we tested for framing effects and present bias (Tversky & Kahneman, 1981; O'Donoghue & Rabin, 1999). However, we find no statistically significant effects.

However, further research is necessary regarding these two issues.

Chapter 3

Determinants of Willingness to Pay for Health in Germany – A Literature Review*

3.1 Introduction

Healthcare expenditure of the OECD countries is increasing and subject to discussions regarding an efficient allocation of resources (OECD, 2019b; World Health Organization (WHO), 2019). For the allocation, it is interesting to find out about society's preferences regarding health.

These preferences, however, are not apparent and to some extent ambiguous (see, for example, Croson and Gneezy (2009) for gender differences in preferences and Kahneman and Tversky (1982) for results that show individuals' decision making to be not objective, however, following certain patterns).

Ryan et al. (2001) present different quantitative and qualitative methods to reveal preferences. Among others, the willingness to pay (WTP), which is based in welfare economics (Pauly, 1995; Samuelson, 1938, 1948).[1] Over time, willingness to pay has become an established method to elicit public preferences in the area of healthcare as well (O'Brien & Gafni, 1996; Klose, 1999; Smith, 2000).

Nevertheless, the results of willingness to pay studies need to be viewed with caution. Studies differ regarding their selection from the variety of methods to measure

*This chapter is based on Lamping (2021).

[1]Gafni (1998) differentiate between the use of willingness to pay as a measure for individual preferences and as the public's total willingness to pay for treatment. The latter is used in cost-benefit-analyses.

willingness to pay (Breidert, Hahsler, & Reutterer, 2006; Diener, O'Brien, & Gafni, 1998). These differences in methodology, however, are found to influence the stated willingness to pay (c.f. Nimdet, Chaiyakunapruk, Vichansavakul, & Ngorsuraches, 2015 and Ryen & Svensson, 2015, presenting literature reviews on willingness to pay for a quality adjusted life year). Using the results of willingness to pay studies for healthcare decision-making becomes, therefore, difficult when the stated preferences are already affected by the studies' settings.

Besides methodological approaches, further factors might influence the stated willingness to pay as well. Lamping et al. (2020) find queried subjects' willingness to pay for pharmaceuticals to depend on their characteristics (e.g. conservative values, stated importance of the social security system). Note that decisions regarding pharmaceutical prices are made by institutions on behalf of the public (Federal Ministry of Health, 2016). In turn, these institutions are represented by individuals whose evaluations of pharmaceuticals might be affected by their characteristics as well.

The number of papers that condense the findings on the various factors of willingness to pay for healthcare is small and focused on very specific topics. Nosratnejad, Rashidian, and Dror (2016) (low and middle income countries) and Noor Aizuddin and Aljunid (2017) conducted literature reviews and present factors of willingness to pay for health insurance. Noor Aizuddin, Sulong, and Aljunid (2012) review the existing literature for determinants of willingness to pay for health in general. This study, however, is only available in the form of an abstract. These studies find the willingness to pay to be affected by the following factors: income, education, age, household size and place of residence.

With this work, I want to contribute by presenting factors potentially influencing people's (stated) preferences for healthcare in general. This is done by conducting a literature review.[2] Hereby, I focus on Germany, which is no exception regarding the health expenditure increase (Federal Statistical Office (Destatis), 2020), and where the evaluation of health enjoys great attention (Henke, 2004; Bundesvernband Deutscher Internisten, 2008; Balzter, 2018). Moreover, Germany is of particular interest because of its health insurance system based on solidarity (Federal Ministry of Health, 2015). A majority (89%) of the German population (Federal Ministry of Health & Association of Private Health Insurance, 2019) does not bear individual treatment costs directly but indirectly via income-based contributions to a public health insurance system

[2]Information regarding the literature search strategy (C.1), the PICO(S) framework, the inclusion and exclusion criteria (C.2) and the sample selection process (C.3) as well as a list of the reviewed studies (C.4) can be found in the Appendix.

(Blümel & Busse, 2019). This makes it difficult to elicit the public's preferences regarding healthcare expenditure (cf. Hanley, Ryan, & Wright, 2003).

The reviewed studies in this work contain two categories of determinants: characteristics of the survey participants and methodological approaches in the survey. The characteristics can be further divided into health and socio-economic characteristics. Furthermore, three overarching topics of the reviewed studies are identified: disease treatment, prevention and health insurance.

The relationship between health status and willingness to pay is analysed for all three of these topics. The healthier the queried subjects, the lower their willingness to pay for disease treatment and health insurance. No correlation is found for the topic of prevention. In line with basic economic theory (c.f. Carson, Flores, & Meade, 2001 for use and existence value), the studies find patients suffering from a particular disease to have higher preferences for treatment, preferably financed via solidarity health insurance. Also, participants who perceive their risk of a health state decrease to be higher, and those who had past exposure to a disease are willing to pay a higher amount for preventing this respective event. Surprisingly, the effect of risk perception and past exposure on health insurance preferences has not yet been examined. Lastly, and opposing to economic theory, the health economic literature finds lower preferences for community funded health insurance among participants conducting harming habits such as smoking.

Regarding socio-economic characteristics, a positive correlation is found between income, education and employment, and willingness to pay. Moreover, opting out of statutory health insurance (having private health insurance) positively affects the willingness to pay. Regarding gender and age, mixed results are found. However, one essential common feature is that the effects of these factors lose statistical significance when controlling for income (gender pay gap) and health (decreasing with age). Willingness to pay seems to be independent of marital status and the number of children. Interestingly, there is still a difference found between participants living in East and West Germany.

Besides the participants' characteristics, the health economic literature finds the survey methodology to influence the willingness to pay as well. Results show the willingness to pay to depend on the form of questioning (questionnaire vs interview), the order of questions and the elicitation method (payment cards vs discrete choice). Furthermore, questioning participants regarding their general willingness to pay negatively influences the amount they are willing to pay. A similar effect occurs when

the amount "€0" is given a prominent position among the willingness to pay choices. On the other hand, emphasising that the participants work on a fictitious scenario increases the willingness to pay.

The remainder of this paper is structured as follows: potential factors of willingness to pay and their effect on the willingness to pay in the literature are presented in section 3.2. Section 3.3 concludes with some general comments.

3.2 Determinants

The purpose of this literature review is to illustrate how individuals' evaluation of health-related topics is affected by factors beyond the benefit of a certain intervention. These factors can be divided into two distinct categories: characteristics of the study participants and methodological approaches in the surveys. In addition, I distinguish in the following between health and socio-economic characteristics. The reviewed studies contain three overarching health-related topics: disease treatment, prevention and health insurance.

3.2.1 Health characteristics

The analysed studies find the queried subjects' health status to affect their willingness to pay. Moreover, the studies present results that show the willingness to pay to depend on the participants' perceived personal risk and their past exposure to a disease. Studies surveying patients and non-patients (healthy subjects, physicians) find their willingness to pay to differ.

Health status. Studies of all three health-related topics (disease treatment, prevention and health insurance) cover the effect of the participants' health status on the willingness to pay. However, an effect is only found for studies analysing the willingness to pay for disease treatment and health insurance. The willingness to pay for prevention seems to be uncorrelated with the health status (Himmler, van Exel, Perry-Duxbury, & Brouwer, 2020 [prevention of infectious diseases]; Mayer et al., 2019 [genetic testing for prostate cancer]; Sikorski et al., 2012 [obsesity prevention]; Siol, Lange, Prenzler, Neubauer, & Frank, 2017 [oncological genetic testing]).

Regarding disease treatment, results generally show participants with a worse health state to have a higher willingness to pay. However, the results differ in that (a) within certain studies, one health measure finds an effect while another does

not (e.g. Schmitt, Meurer, Klon, & Frick, 2008 [treatment of psoriasis and atopic eczema]) and (b) the same health state measure used in different studies has only a correlation with the willingness to pay in some of them (e.g. Beikert, Langenbruch, Radtke, & Augustin, 2013 [treatment of rosacea] vs. Augustin et al., 2018 [melanoma treatment]).

Skin diseases are common, and one of the leading causes of disease burden (Seth, Cheldize, Brown, & Freeman, 2017). While their impact on the quality of life of those affected is high (e.g. stigmatisation; Audureau, Davis, Besson, Saba, & Ladner, 2019), the diseases are largely non-fatal (Seidler, Bayoumi, Goldstein, Cruz, & Chen, 2012). Willingness to pay studies represent an opportunity to quantify the burden of disease due to skin conditions and are also very prominent in the reviewed health economics literature.

Schiffner et al. (2003) assess the use of willingness to pay and time trade-off (TTO) as measures for psoriasis patients' quality of life (for further information on time-trade-off, see Dolan, Gudex, Kind, & Williams, 1996). They analyse the changes in these measures over time and compare them with the participants' health status. They use the Psoriasis Disability Index (PDI) and the Psoriasis Area and Severity Index (PASI) as health state measures and find a statistically significant correlation between the health status and the willingness to pay.[3] With an increasing health status, queried subjects' willingness to pay decreases. Similar results are found by Beikert et al. (2013) [assessing the burden of disease for patients with rosacea], Radtke, Schäfer, Gajur, Langenbruch, and Augustin (2009) [evaluating the disease burden of vitiligo patients] and Schmitt et al. (2008) [assessing health utilities of patients suffering from psoriasis and atopic eczema, and the general population], all using the Dermatology Life Quality Index (DLQI). Beikert et al. (2014) [assessing patients' burden of disease due to atopic dermatitis] also using the DLQI, find only a marginal correlation. Yet, (Beikert et al., 2013, 2014) find a correlation between the health state measured using the EuroQol instrument, EQ-5D VAS, and the willingness to pay (for further information on the EQ-5D, see EuroQol Research Foundation, 2019b). This result is also found by Radtke et al. (2009) [vitiligo patients]. In contrast, Schmitt et al. (2008) [psoriasis and atopic eczema patients and general population] present results that show only a weak relationship between different measures of utility (TTO, VAS, WTP) and conclude that they are not interchangeable. Moreover, Schmitt et al.

[3]Schiffner et al. (2003) find a correlation between the changes in PDI, PASI, TTO and the willingness to pay from pre to post treatment. In the six months follow-up survey, they find this correlation only for PDI, TTO and willingness to pay.

(2008) find no correlation between two further measures of the health status and the participants' willingness to pay. These measures are the Eczema Area and Severity Index (EASI) and the Psoriasis Area and Severity Index (PASI).

In line with the missing correlation between the health status (measured using the EASI and PASI) and the willingness to pay, disease duration, global disease severity, symptoms and whether the participants are in current treatment seem to have no effect in the study by Schmitt et al. (2008) [psoriasis and atopic eczema patients and general population]. In contrast, this relationship between the disease duration and the willingness to pay is found by Beikert et al. (2013) [rosacea patients] and Radtke et al. (2009) [vitiligo patients]. However, the results of the two studies are contradictory. While Beikert et al. (2013) find participants' willingness to pay to decrease with the duration of symptoms, Radtke et al. (2009) find a higher willingness to pay with an increase of time with the disease. These contradictory effects might be due to two opposing effects. Longer duration of the disease decreases the quality of life and therefore increases willingness to pay. On the other hand, individuals' ability to adapt might cause a decrease in willingness to pay with longer duration of the disease (Oswald & Powdthavee, 2008).

Besides general health measures, studies find involvement of specific body areas to increase willingness to pay (Beikert et al., 2013, 2014: facial involvement; Schmitt et al., 2008: involvement of genital region).

Adjacent to the area of skin conditions, Augustin et al. (2018) study preferences for the treatment of melanoma, comparing the willingness to pay of patients and physicians (the patients' treating derma-oncologists). Their aim ist to assess the burden (a.o. psychological) of the disease. Regarding the relationship between the patients' health state and their willingness to pay, Augustin et al. (2018) find mixed results. While they find a higher score (worse health) on the anxiety scale (HADS-A), assessed by the patients, to affect the willingness to pay positively, they find no effect for the depression scale (HADS-D).[4] Furthermore, they find no correlation between the EQ-5D VAS and the willingness to pay of patients and physicians.

The relationship between health status and willingness to pay is also studied for the treatment of other diseases such as the treatment of menopause symptoms (Rasch, Hodek, Runge, & Greiner, 2009) [measure: Menopause Rating Scale (MRS)] and depression (König, Bernert, & Angermeyer, 2005) [measures: EuroQoL instruments, time-trade-off, SF-12 questionnaire] with results showing an increase in willingness to

[4]Hospital Anxiety and Depression Scale (HADS). See also (Sondermann, 2019) for a study on the negative effect of depression on the response to psoriasis treatment.

pay with a decrease in health.

Regarding the preferences for health insurance, a similar effect of higher willingness to pay by participants with a worse health state is found (Bock et al., 2017[5] [effect of longitudinal changes in several factors on the willingness to pay for health insurance] and Leukert-Becker & Zweifel, 2014 [preferences for obtaining the status quo regarding health insurance services]). Individuals with a relatively lower health state seem to especially prefer healthcare provision through publicly financed statutory health insurance funds (Pfarr & Schmid, 2016 [empirical experiment to test the assumption by Gouveia (1997) that preferences for the extent of statutory health insurance is affected by a health-income ratio]).

A major difference between the studies presented so far is the degree to which the study participants are affected. For example, several studies find an effect of the health measure EQ-5D VAS on *patients'* willingness to pay (Beikert et al., 2013, 2014; Radtke et al., 2009). However, when surveying patients and non-patients, no effect or only a marginal one is found (Augustin et al., 2018; Schmitt et al., 2008). Explicitly differentiating between patients and healthy subjects, a correlation between health status (EQ-5D VAS) and willingness to pay is only found for patients (König et al., 2005).

Being a patient. In line with basic economic theory of use value (Carson et al., 2001), several studies find that being a patient, instead of a healthy subject or the treating physician, affects the willingness to pay positively. This effect is found for the treatment of i) different diseases (Augustin et al., 2018 [comparing the preferences of melanoma patients and their treating physicians]; Krammer & Heinzerling, 2014 [analysing the preferences of patients, physicians and healthy controls for melanoma treatment]; Günther et al., 2007 [assessing the burden of depressive disorders using the stated preferences of participants with and without depression]; Rasch et al., 2009 [analysing factors influencing preferences of menopause-aged women for treatment]) and ii) health prevention (Kesztyüs et al., 2014; Lauer et al., 2020 [parents' willingness to pay for the prevention of childhood overweight]). One exception is found by Braun et al. (2000) who find a lower willingness to pay for treatment in participants suffering from erectile dysfunction compared to healthy subjects. This result, however, is not necessarily contradictory. Depending on the form of financing, queried subjects' preferences might change. Affected patients were found to prefer financing

[5]Bock et al. (2017) find only a correlation between the health status and the willingness to pay for patients with private health insurance.

in the form of a (solidarity) contribution to health insurance, whereas non-patients favour direct copayments (Sennhauser & Zweifel, 2009) [preferences of patients and healthy subjects regarding the coverage of a diabetes pharmaceutical by the health insurance].

Perceived risk and past exposure. In general, willingness to pay is expected to depend on the perceived personal exposure (McDaniels, Kamlet, & Fischer, 1992).[6] Focussing on the preferences for health in Germany, an effect of the perceived risk and the past exposure on the willingness to pay is only found for the topic of prevention. For example, the willingness to pay for predictive oncological genetic testing is found to positively correlate with the participants' assessment of their personal risk of getting the disease (Siol et al., 2017). Moreover, having a family member with lethal prostate cancer caused participants to state a higher preference for genetic testing of the respective disease (Mayer et al., 2019). Note that participants of this study by Mayer et al. (2019) are men who have undergone radical prostate surgery. Within this group of highly affected participants, exposure of a family member even further increases the willingness to pay for prevention.

No relationship is found when analysing the willingness to pay for disease treatment (Augustin et al., 2018 [melanoma treatment]). Moreover, despite "risk [being] the fundamental element of insurance" (Ewald, 1991, p. 199), there is no study that examines the perceived risk as a potential determinant of health insurance preferences in the German context. Here, in particular, one would expect risk perceptions to affect the preferences. Whether these preferences are aligned with economic theory is part of another discussion (c.f. Slovic, Fischhoff, & Lichtenstein, 1982 who find individuals to insure against relatively high-probability, low-loss events instead of low-probability high-loss events.). For a thorough discussion of the topic "risk perception" including the assessment of risk perceptions, see Slovic (2000).

International studies have found another link between past exposure, perceived risk and willingness to pay, the comorbidity effect. A history of a certain disease and the associated higher subjective perception of risk increase the preferences for treatment of the corresponding disease. In contrast, interest in treatment decreases if someone has been affected by other diseases in the past and perceives their risk to be relatively higher (DeShazo & Cameron, 2005). A similar effect is found by Eeckhoudt

[6] This applies in particular for well defined risks. If uncertainty regarding the probability of risks becomes bigger, the willingness to pay is affected by the dread and severity of the hazard (McDaniels et al., 1992).

and Hammitt (2001). They argue that a so called 'why bother effect' explains the decrease in demand for the treatment of a certain disease in the presence of another disease.

Harming habits. So far, this study found individuals with a worse health state to show a higher willingness to pay for treatment. This seems to be especially true for those being net beneficiaries of treatments financed via public health insurance (Pfarr & Schmid, 2016) [health-income ratio as predictor of preferences for public health insurance]. Generally, in Germany, healthcare costs are covered by statutory health insurance, which is financed by income based contributions independent from the individual health state (Federal Ministry of Health, 2015). Therefore, one would expect that people who engage in health-damaging habits like smoking show a higher preference for health insurance financing. The opposite result is found, however. When confronted with a fictitious scenario without health insurance, smokers stated a lower willingness to pay for health insurance with the same standards as their current one (Bock et al., 2017).

3.2.2 Socio-economic characteristics

In this section, I present results from health economic literature regarding the relationship between socio-economic characteristics and the willingness to pay for health-related topics in Germany. Income, education, employment, type of health insurance coverage, age, gender and region of residence are found to affect willingness to pay in these studies.

Income, education and employment. The upper boundary of individuals' willingness to pay is generally defined by their disposable income. Therefore, income is expected to correlate positively with the willingness to pay (Carson et al., 2001). Nevertheless, Flores and Carson (1997) argue that while a person with a higher income might buy a higher quantity of a product, the person might not necessarily be willing to pay a higher amount for the same product than others. For a detailed discussion regarding the relationship between income and willingness to pay, see Flores and Carson (1997); Hanemann (1991); Horowitz and McConnell (2003); Sugden (2001).

Health economic literature regularly includes income as an explanatory variable in their willingness to pay analyses. The reviewed studies in this work present results that show a positive correlation between income and the willingness to pay for disease treatment, prevention and health insurance in Germany (e.g. Augustin et al.,

2018 [melanoma treatment]; Schmitt et al., 2008 [treatment of skin conditions]; Mayer et al., 2019 [genetic testing for prostate cancer]; Kesztyüs et al., 2014 and Lauer et al., 2020 [prevention of childhood overweight and obesity]; Bock et al., 2016 [preferences for health insurance]). Regarding preferences for health insurance, Pfarr and Schmid (2016) analyse the effect of the health income ratio on the willingness to pay for health insurance.[7] Studying participants' interest in redistribution of resources towards social public health insurance, they find net beneficiaries (relatively lower income or relatively lower health) to be in favour of an allocation towards the ones in need. Moreover, these participants also state higher preferences for an extension of healthcare resources.

Nevertheless, this review also contains studies which find no correlation between income and willingness to pay. For the topic of prevention, this is only one study that also exclusively surveys students. Furthermore, the participants of this study show at least a higher general willingness to pay if they assess their financial situation to be above the group's average (Siol et al., 2017 [preferences for oncological genetic testing]). However, there are also studies where the reason for the missing relationship is not apparent (e.g. Beikert et al., 2013 and Schiffner et al., 2003 [treatment of skin conditions]; Bock et al., 2017 [longitudinal study on factors of willingness to pay for health insurance]; Krammer & Heinzerling, 2014 [melanoma treatment]).

Besides income, there is a positive relationship between education and employment status, and the willingness to pay for healthcare found in the literature. However, controlling for income causes them to lose their statistical significance, potentially due to their interrelationship (e.g. Augustin et al., 2018). Nevertheless, the positive effect of education and employment on the willingness to pay remains statistically significant in some cases, even when controlling for income (education: Mayer et al., 2019 [genetic testing for prostate cancer] and Bock et al., 2016 [preferences for health insurance]; employment: Himmler et al., 2020 [prevention of infectious diseases]).

Statutory health insurance. In principle, having statutory health insurance is obligatory in Germany. Under certain circumstances exempting from compulsory insurance and taking out private insurance is possible. One major reason is exceeding a certain income limit (Federal Ministry of Health, 2020). Correlation between income and insurance coverage and, therefore, mitigation of the effect of the insurance type on the willingness to pay is assumed. Against ecxpectation, being insured with statutory

[7]The study by Pfarr and Schmid (2016) builds upon and tests the assumptions of the model by Gouveia (1997).

health insurance reduces the willingness to pay for healthcare even when controlling for income (Ahlert, Breyer, & Schwettmann, 2016 [differences in stated preferences for a QALY due to survey techniques; further details in section 3.2.3]; Bock et al., 2016 [factors of willingness to pay for health insurance]). One explanation for the difference might be the higher price consciousness of people with private health insurance. While medical services are paid for directly by the statutory health insurance, those with private insurance pay the bill first and then receive the money back from their insurance company (Sueddeutsche Zeitung, 2016).

For the studies not finding a relationship between the type of health insurance and willingness to pay it is noticeable that these have either a specific topic or a specific participant group. Köberlein and Klingenberger (2011) examine the willingness to pay for dental procedures. The proportion of services paid for privately by patients is much higher for dental procedures than for all other specialities (Balzter, 2019). Therefore, a relatively greater price consciousness of statutorily insured persons is assumed for this medical discipline. Siol et al. (2017) examine the preferences for oncological genetic testing. Participants are students who are either insured by law through their parents or, in rare cases, as children of civil servants privately insured. In both cases, financing runs through their parents. Furthermore, it can be assumed that students generally have a lower awareness of illness due to their age. Unfortunately, none of the reviewed studies tested cost awareness, income and health insurance coverage simultaneously.

Age. In the existing health economic literature, several studies examine the effect of age on willingness to pay. In principle, it can be assumed that health declines with increasing age. Income is expected to increase with age and then to decrease with retirement. In line with these assumptions, studies find the correlation between age and willingness to pay to disappear once they control for income and health status (Augustin et al., 2018 [melanoma treatment]; Schmitt et al., 2008 [treatment of skin conditions]). Consistent with the conjecture that the correlation between income and age is concave shaped, the highest willingness to pay is found for participants aged 25-50 years in comparison to younger and older participants (Schmitt et al., 2008 [treatment of skin conditions]). Controlling only for the health state, Sikorski et al. (2012) (obesity prevention) and Günther et al. (2007) (treatment of depression) find willingness to pay to increase with age. Few studies present results that show the willingness to pay to depend on the queried subjects' age despite controlling for health and income. However, these studies have special characteristics. Leukert-Becker and Zweifel (2014) find a positive effect of age on the willingness to pay for

health insurance. To be precise, older participants and especially retirees, show a higher preference for maintaining the status quo in terms of their health insurance services. A second study examines factors influencing the adoption of mobile health apps. Willingness to pay for these apps decreases with age (Lupiáñez-Villanueva, Folkvord, & Vanden Abeele, 2020).

Gender. Assuming an effect of income on willingness to pay, it stands to reason that a large share of the relationship between gender and willingness to pay is due to the gender pay gap (Blau & Kahn, 1999; Graf, Brown, & Patten, 2018). Several studies indeed find no effect of gender when controlling for income (e.g. Augustin et al., 2018 [melanoma treatment]; Schmitt et al., 2008 [skin condition treatment]; Siol et al., 2017 [oncological genetic testing]; Leukert-Becker & Zweifel, 2014; Pfarr & Schmid, 2016 [preferences for health insurance]). However, health economic literature also presents results that show men's willingness to pay for health to be higher even when controlling for income (Hammerschmidt, Zeitler, & Leidl, 2003 [comparison of the results of discrete choice experiments and payment cards conducted with diabetic patients]; Himmler et al., 2020 [warning system for infectious diseases]; Bock et al., 2016 [preferences for health insurance]). These results are in line with more general findings regarding the willingness to pay for public goods (Brown-Kruse & Hummels, 1993). Moreover, differentiating between the stated amount of willingness to pay and the general willingness to pay, the former is found to be higher for men while women seem to have a higher general willingness to pay (Ahlert et al., 2016 [effect of survey methods; see section 3.2.3]). Note that all of the mentioned studies use only fictitious scenarios when conducting their willingness to pay surveys. Brown and Taylor (2000) present results that show gender-specific differences to appear only in fictitious scenarios. In experiments where participants actually carry out a positive willingness to pay, they find no difference.

Marital status, children, single parenthood, household size. With whom people live seems to have only little influence on their willingness to pay for health. Preferences are found to be independent of the marital status, the number of children (Krammer & Heinzerling, 2014 [melanoma treatment]; Mayer et al., 2019 and Siol et al., 2017 [oncological genetic testing]), and whether participants are single parents (Lauer et al., 2020 [prevention of childhood overweight]). Regarding the household size, two studies find it to affect the willingness to pay. Hammerschmidt et al. (2003) [diabetes treatment] find a lower willingness to pay in patients who live in bigger households.

Augustin et al. (2018) [melanoma treatment] present results that show physicians living alone to have a lower willingness to pay.

East Germany. The reunification between East Germany (former German Democratic Republic) and West Germany took place in 1990. Since then, differences between the two populations have been studied by a wide range of disciplines (Connolly, 2020). These studies show for example that "East Germans are more in favour of redistribution and state intervention than West Germans" (Alesina & Schuendeln, 2005, p. 1508). However, this is found to be especially true for older people who lived under communism and conversion is predicted (Alesina & Schuendeln, 2005). Several recent studies find no difference between the two populations regarding the evaluation of healthcare (Köberlein & Klingenberger, 2011 [dental treatment]; Leukert-Becker & Zweifel, 2014 [preferences for health insurance services]; Pfarr & Schmid, 2016 [redistribution through health insurance]; Sikorski et al., 2012 [prevention of obesity]). Caution is warranted for those studies that do find a relationship but do not control for income differences between East and West Germany (e.g. Schomerus, Angermeyer, Matschinger, & Riedel-Heller, 2008 [prevention of depression]; see Statistical Offices of the Federal and State Governments, 2020 and Federal Statistical Office of Germany, 2020 for income differences between East and West Germany). Nevertheless, one study controlling for the effect of income finds people living in East Germany to have a lower willingness to pay (for a QALY) (Ahlert et al., 2016) [effect of survey methods].

3.2.3 Survey methods

So far, I have referred to the influence of individuals' characteristics on the willingness to pay in the health economic literature. Health state, having a certain disease, risk perception, harming habits, income, education, employment, type of health insurance coverage, age, gender, and even place of residence are found to influence the willingness to pay for healthcare. To be precise, they affect the stated willingness to pay in surveys. Studies, however, differ regarding their survey methods. They use various survey forms (questionnaire, interview), elicitation methods (payment cards, discrete choice), payment forms (insurance premium, out-of-pocket) and payment frequencies. Moreover, the treatment effects presented in the respective studies differ (health improvement, life extension). In the prominent area of willingness to pay for a quality adjusted life year, several studies have already found a correlation between

the survey methodology and the stated willingness to pay (see Nimdet et al., 2015 for a comprehensive review.) In the German healthcare context, similar effects are found as well. In the following, these effects are presented.

Elicitation method. Using contingent valuation to elicit individuals' preferences, there are two prominent ways to disclose willingness to pay: discrete choice and payment cards (Diener et al., 1998). Results are found to differ between these two methods (c.f. Hammerschmidt et al., 2003, examining the convergent validity of the two methods, finding unanticipated yes/no responses). However, it must be taken into account that Hammerschmidt et al. (2003) also use different forms of data collection. Payment cards are used in face-to-face interviews, while a questionnaire is used to conduct the discrete choice experiment. It is precisely this difference between the survey forms that potentially affects results as well. A personal interviewer, for example, is found to increase the willingness to pay (Ahlert et al., 2016).

Effect of the treatment. More precisely, Ahlert et al. (2016) examine the willingness to pay for a quality adjusted life year. Hereby they distinguish between measures that extend life expectancy and those that improve health. Their results show a higher number of positive willingness to pay statements for the improvement of the quality of life then for a life extension. However, when analysing only the positive statements, they find queried subjects to prefer life extension.

Present preference. Moreover, Ahlert et al. (2016) find participants to prefer immediate health gains. Queried subjects were less willing to pay any positive amount of money for a health gain at the end of their life than for a health gain in one year. In fact, results show, the more immediate the health gain, the higher the willingness to pay. This result is consistent with the basic expectation that a health gain at an earlier stage is considered more valuable. The National Institute for Health and Care Excellence's (NICE) official recommendation is to discount QALYs at 3.5% per year (Whitehead & Ali, 2010). Whether the participants' evaluation in the study by Ahlert et al. (2016) is time-consistent cannot be answered here.[8]

Payment frequency. Note that the necessary payment for the treatment in the study by Ahlert et al. (2016) is basically immediate in the form of a single amount. In a deviating scenario, they test the effect of an instalment payment over four years. This causes participants to state a twice as high total amount which they are willing

[8]See O'Donoghue and Rabin (1999) analysing present biased preferences.

to pay. A similar result for participants from Denmark is found by Gyrd-Hansen, Jensen, and Kjaer (2014), who find the willingness to pay to be higher if stated in the form of a monthly payment than a yearly one.

Hypothetical scenario. The phenomenon of stated preferences differing from actual behaviour is known as the hypothetical bias (c.f. Fifer, Rose, & Greaves, 2014; Hensher, 2010). In the case of preferences for healthcare in Germany, emphasising that the queried subjects are in a hypothetical scenario without health insurance and therefore need to pay for the intervention themselves increases the queried subjects' willingness to pay (Ahlert et al., 2016). Methods to reduce this hypothetical bias can be found at Blumenschein, Blomquist, Johannesson, Horn, and Freeman (2008).

General willingness to pay. Several of the reviewed studies ask participants not only for the amount they are willing to pay but also for their general willingness to pay. Liebe et al. (2011), analysing the willingness to pay for public environmental goods, distinguish between the in-principle willingness to pay and the stated amount of willingness to pay. Their results show that income has an influence on the amount of willingness to pay while the general decision for or against payment is independent of income. A comparison of the differences between general willingness to pay and the amount of willingness to pay can be found at Cragg (1971).

Regarding the preferences for healthcare, asking participants for their general willingness to pay (binary yes/no filter) before eliciting the amount of money they are willing to pay is found to increase the zero responses (Ahlert et al., 2016). The reason for this result is seen by Ahlert et al. (2016) in the increased prominence of the response option €0. Therefore, Ahlert et al. (2016) and Gyrd-Hansen et al. (2014) [Denmark] are of the opinion that a binary filter biases results and should be avoided.

In my opinion, another interpretation is also conceivable. The binary filter (general willingness to pay) might act as a kind of hurdle. This hurdle makes the participants question the default option of using the treatment and consequently also paying for it. Instead, queried subjects start to decide consciously for or against the treatment and state their willingness to pay accordingly. See Thaler and Sunstein (2003) for information on the "status quo bias" to use the default setting.

For the studies reviewed in this paper, it is striking that except for the study by Ahlert et al. (2016), only studies on the topic of prevention ask participants for their general willingness to pay. For this topic, the general willingness to pay is even regularly queried (e.g. Kesztyüs et al., 2014, Lauer et al., 2020 and Sikorski et al.,

2012 [obesity prevention]; Schomerus et al., 2008 [prevention of depression]; Mayer et al., 2019 and Siol et al., 2017 [oncological genetic testing]).

Survey structure. The health economic literature presents results that show the willingness to pay to depend on survey methods such as the elicitation method, the presented scenario, the frequency of payment, and the existence of a question regarding the general willingness to pay. Moreover, the willingness to pay is found to be even affected by the position of questions within the survey as well as the order of the monetary willingness to pay options itself (Ahlert et al., 2016).

Summing up, the health economic literature presents results that show the willingness to pay for healthcare in Germany to be affected by factors besides the treatment's benefit. These factors are the individuals' health and socio-economic characteristics as well as the survey methods used. Table 8 provides an overview of the determinants, the topics covered and the associated studies.

determinant	topic	author(s)
health status	disease treatment	Augustin et al. (2018); Beikert et al. (2013, 2014); Hammerschmidt et al. (2003); König et al. (2005); Radtke et al. (2009); Rasch et al. (2009); Schiffner et al. (2003); Schmitt et al. (2008)
	health insurance	Bock et al. (2017); Leukert-Becker and Zweifel (2014); Pfarr and Schmid (2016)
being a patient	disease treatment	Augustin et al. (2018); Braun et al. (2000); Krammer and Heinzerling (2014); Günther et al. (2007); Rasch et al. (2009)
	prevention	Kesztyüs et al. (2014); Lauer et al. (2020)
	health insurance	Sennhauser and Zweifel (2009)
risk and exposure	prevention	Mayer et al. (2019); Siol et al. (2017)
harming habits	health insurance	Bock et al. (2017)
income	disease treatment	Augustin et al. (2018); Schmitt et al. (2008)
	prevention	Kesztyüs et al. (2014); Lauer et al. (2020); Mayer et al. (2019)
	health insurance	Bock et al. (2016); Pfarr and Schmid (2016)
education	prevention	Mayer et al. (2019)
	health insurance	Bock et al. (2016)
employment	prevention	Himmler et al. (2020)
insurance coverage	disease treatment	Ahlert et al. (2016)
	health insurance	Bock et al. (2016)
age	disease treatment	Lupiáñez-Villanueva et al. (2020)
	health insurance	Leukert-Becker and Zweifel (2014)
gender	disease treatment	Ahlert et al. (2016); Hammerschmidt et al. (2003)
	prevention	Himmler et al. (2020)
	health insurance	Bock et al. (2016)
household size	disease treatment	Augustin et al. (2018); Hammerschmidt et al. (2003)
east Germany	disease treatment	Ahlert et al. (2016)
elicitation method	disease treatment	Ahlert et al. (2016); Hammerschmidt et al. (2003)
health improvement or life extension	disease treatment	Ahlert et al. (2016)
present preference	disease treatment	Ahlert et al. (2016)
payment frequency	disease treatment	Ahlert et al. (2016)
hypothetical scenario	disease treatment	Ahlert et al. (2016)
general willingness to pay	disease treatment	Ahlert et al. (2016)
survey structure	disease treatment	Ahlert et al. (2016)

Table 8: Determinants of willingness to pay for healthcare in Germany. Only those determinants are mentioned where a relationship to the willingness to pay is found. The effect of the variables education, employment, insurance coverage, age and gender are controlled for income. The effect of age is also controlled for the queried subjects' health state.

3.3 Concluding Remarks

A large number of studies investigate the respective willingness to pay and its factors for very different topics in the field of healthcare. Very few studies, however, summarise these factors, and they do so only for very specific topics. This paper, therefore, has addressed the question which factors influence individuals' evaluation of healthcare in general. The focus here was placed on the German context. Based on a review of findings in health economics, I have in particular emphasised the distinction between two types of determinants; characteristics of the participants and methodology of the survey. Characteristics were further divided into two classes: health and socio-economic.

In principle, the results of the individual studies agree on the effects and their direction. Willingness to pay increases as health declines. This is especially the case if the respondents actually suffer from the corresponding disease. The perception of the own risk and exposure correlates positively with the willingness to pay. Harming habits (e.g. smoking), on the other hand, reduce the willingness to pay for healthcare. Furthermore, income, education and employment have the expected positive effect. Being insured by statutory health insurance and living in East Germany (both controlled for income) are found to have a negative impact on the willingness to pay. Queried subjects' age, gender and the size of their household seem to affect their willingness to pay. However, the effect direction differs between the studies.

Interestingly, some determinants are not examined at all for certain topics (e.g. effect of risk perception on willingness to pay for health insurance). Moreover, it is striking that determinants for which an effect is found in principle do not seem to have any influence in several studies of a certain topic (e.g. no correlation is found between health status and willingness to pay for the topic of prevention while this effect is found several times for the other two topics.)

General findings regarding the influence of study methodology on participants' stated preferences are also confirmed for the German healthcare context. Survey form (questionnaire, interview), elicitation method (discrete choice, payment cards), presented scenario (health improvement, life extension) and emphasis on its hypothetical nature, a question regarding the general willingness to pay and even the question order are found to affect the queried subjects' willingness to pay. Regarding the results of this review, isolated effect deviations for some determinants in certain studies might be explained by this influence of the survey methodology.

The health economic literature (German context) analyses a variety of determi-

nants of willingness to pay. However, they are all essentially covered by models from basic economic theory (e.g. disposable income as upper boundary of willingness to pay; higher use value of patients compared to non-patients' existence value). Further potential determinants are provided by psychological and sociological theories (c.f. Liebe et al., 2011). These are, for example, trust in the cooperation and fairness of others (theory of public goods: Kollock, 1998; Ostrom, 2000; Fehr & Schmidt, 1999) and awareness of need and responsibility (norm-activation model: Schwartz, 1977; Schwartz & Howard, 1982). For more details, see Table C.5 in the Appendix.

The conclusion from the results of this study is twofold. If one wants to take the peoples' preferences into account for decisions on resource allocation, the elicited preferences from multiple willingness to pay studies should be considered. For this, standardisation regarding the variables controlled for in these studies is necessary. This review presents a first overview of potential determinants. From a different perspective, considering the characteristics of a respective target group for which a decision is made might be an option.

Conclusions

In the essays presented in this thesis, I analysed determinants potentially affecting the evaluation of healthcare in Germany. The first study deals with the pricing process of pharmaceuticals. These prices defined on an institutional level seem to depend only to a small extent on the benefit of the respective pharmaceutical. Therefore, there must be factors besides the actual benefit of the drug that influence the evaluation. Price negotiations are conducted by individuals on behalf of institutions. It is very likely that the decisions of these individuals are influenced by a wide variety of personal factors (c.f. Katona, 1975). I was interested in finding out what variables influence people's evaluation of pharmaceuticals. Indeed, preferences stated by participants of a willingness to pay survey depended not only on their perception of the pharmaceutical's benefit. Their characteristics (e.g. conservative values) affected their willingness to pay as well.

The first two studies focussed on the evaluation of pharmaceuticals. In a third study, I analysed the preferences for healthcare in general, conducting a literature review. In line with the previous results, the health economic literature finds the willingness to pay to depend on several factors besides the treatment's actual benefit. These factors can be assigned to two categories: Characteristics of the study participants and methodology of the study. The characteristics studied in the literature are mainly health (e.g. health status, being a patient) and socio-economic (e.g. income, age) characteristics.

In the context of this work, I have shown that the (perceived) benefit of a treatment is only one of the determinants that influence individual evaluation. However, the determinants studied are essentially rooted in economics. Other disciplines such as psychology and sociology offer theories from which further potential factors regarding healthcare preferences could be derived.

To conclude, with regard to drug price negotiations, it would certainly make sense to adapt the processes so that the influence of the representatives' characteristics on

the negotiation outcome is reduced. Also, a standardisation of preference studies (willingness to pay) would probably make them more usable as a basis for healthcare decisions. Nevertheless, I believe that the fundamental question is different. Should healthcare be evaluated solely on the basis of its effectiveness? Or should, for example, the preferences of the target group of a particular treatment be taken into account when making decisions on their behalf. With the work presented in this thesis, I hope I have contributed to this topic and potential future discussions.

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Appendix A

A.1 Sensitivity Analyses

In addition to the main analysis, we conducted seven sensitivity analyses clustered into four different groups. Further information regarding the groups can be found below. The results of the sensitivity analyses (M7-M13) are provided in Table A.1.2. For all models, there is no change in the main results compared to our final model M6 presented in the main body of the text. In M12, however, the variable measuring the extent of the additional benefit becomes statistically insignificant. This only strengthens the point made in the paper.

Group 1: Three additional versions of the point score for the extent of the additional benefit (see Table A.1.1 & Table A.1.2) were analysed in models M7 to M9.

extent benefit / point score	M6	M7	M8	M9
major	6	6	6	6
considerable	5	5	4	5
minor	3	4	3	2
non quantifiable	4	3	5	4
no added benefit	2	2	2	1
lesser benefit	1	1	1	0

Table A.1.1: Sensitivity analyses. Transformation of the extent of the additional benefit into different point scores for each model.

Group 2: Two analyses using dummy variables were conducted (see Table A.1.2). M10 uses a binary variable for the existence of a weighted additional benefit (extent and certainty) while M11 tests whether the indication / patient group has an additional benefit (extent / certainty) which is weighted by the *population size* afterwards. A point score at and above 0.5 is defined as an added benefit.

Group 3: M12 (see Table A.1.2) displays the results of using data of the patient group with the highest extent of the additional benefit granted by the Federal Joint Committee for the corresponding EBA.

Group 4: Here we consider a model without outliers, excluding 8 EBAs with a Cook's that exceeds the threshold of 4/n from M6 in a separate sensitivity analysis in M13 (see Table A.1.2) (Bollen & Jackman, 1985).

premium	M6	M7	M8	M9	M10	M11	M12	M13
launch	0.960***	0.958***	0.958***	0.959***	0.960***	0.962***		0.967***
extent additional benefit	0.172*							0.146*
extent additional benefit M7		0.167**						
extent additional benefit M8			0.184*					
extent additional benefit M9				0.142*				
additional benefit per EBA (yes / no)					0.090*			
additional benefit patient group (yes / no)						0.084*		
certainty additional benefit	0.151	0.131	0.172	0.079				0.202*
extent * certainty	-0.058							-0.061*
extent * certainty M7		-0.052						
extent * certainty M8			-0.064					
extent * certainty M9				-0.047*				
launch high							0.984***	
extent high (additional benefit)							0.062	
certainty high (additional benefit)							0.043	
extent high * certainty high							-0.012	
renegotiation	0.224***	0.226***	0.221***	0.219***	0.226***	0.228***	0.218***	0.213***
arbitration	-0.120**	-0.124**	-0.120**	-0.125**	-0.114**	-0.114**	-0.128**	-0.112**
constant	-0.690***	-0.674***	-0.719***	-0.482***	-0.305***	-0.301***	-0.472***	-0.660***
N	187	187	187	187	187	187	183	178
R-sqr	0.948	0.948	0.948	0.948	0.947	0.947	0.964	0.968

Table A.1.2: Sensitivity analyses. Comparison of M6 (final model) to seven sensitivity analyses models;
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

A.2 Renegotiation

In order to test in how far renegotiations influence our results, we excluded all 69 renegotiated EBAs leaving 118 EBAs eligible for analysis. Again, all main results remain unchanged; cf. Table A.2.

premium	M6	M14
launch	0.960***	0.970***
extent (additional benefit)	0.172*	0.230*
certainty (additional benefit)	0.151	0.257
extent * certainty (interaction)	-0.058	-0.084
renegotiation	0.224***	0.000
arbitration	-0.120**	-0.225**
constant	-0.690***	-0.874***
N	187	118
R-sqr	0.948	0.937

Table A.2: Comparison of M6 (final model) to M14 (excluding renegotiated EBAs); * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Appendix B

B.1 Sensitivity Analysis

We conduct an ordered probit regression, treating the independent variables as interval scaled (willingness to pay: M5; added benefit: M7). Moreover, we use dichotomous independent variables (one if item on six-point Likert-scale is greater than three, zero otherwise) (willingness to pay: M6; added benefit: M8).

	(M1) willingness to pay b/se	(M5) willingness to pay b/se	(M6) willingness to pay b/se
lung cancer	reference	reference	reference
psoriasis	-76.487***	-0.092	0.070
	(21.11)	(0.10)	(0.09)
heart failure	-2.989	0.198*	0.227*
	(20.09)	(0.09)	(0.09)
copd	-61.424**	-0.076	-0.072
	(20.23)	(0.09)	(0.09)
fictitious price	reference	reference	reference
no price information	-83.966***	-0.298***	-0.299***
	(17.28)	(0.08)	(0.08)
real price	-55.749**	-0.177*	-0.178*
	(17.30)	(0.08)	(0.08)
added benefit	20.028***	0.215***	0.915***
	(3.67)	(0.02)	(0.08)
statutory health insurance	-68.499**	-0.311**	-0.326**
	(23.08)	(0.11)	(0.11)
conservative	5.020**	0.006	0.144*
	(1.70)	(0.01)	(0.07)
consume	7.705**	0.028*	0.047
	(2.93)	(0.01)	(0.04)
social security	-14.957*	-0.081**	-0.208*
	(6.28)	(0.03)	(0.10)
system confidence	6.884	0.051**	0.361**
	(4.22)	(0.02)	(0.13)
female	-25.844	-0.082	-0.108
	(14.84)	(0.07)	(0.07)
constant	-16.153	n/a	n/a
	(64.95)	n/a	n/a
N	1032	1032	1032

M1: Linear regression; interval scaled explanatory variables.
M5: Ordered probit regression; interval scaled explanatory variables.
M6: Ordered probit regression; dichotomous explanatory variables.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table B.1.1: Sensitivity Analysis. Factors influencing the willingness to pay.

	(M4) added benefit b/se	(M7) added benefit b/se	(M8) added benefit b/se
lung cancer	reference	reference	reference
psoriasis	1.879***	1.044***	1.034***
	(0.16)	(0.09)	(0.09)
heart failure	0.506**	0.254**	0.252**
	(0.16)	(0.09)	(0.09)
copd	0.219	0.106	0.094
	(0.16)	(0.09)	(0.09)
system confidence	0.114***	0.062***	0.262*
	(0.03)	(0.02)	(0.11)
social security	0.230***	0.120***	0.292**
	(0.05)	(0.03)	(0.09)
female	-0.262*	-0.142*	-0.143*
	(0.12)	(0.06)	(0.06)
constant	3.987***	n/a	n/a
	(0.38)	n/a	n/a
N	1032	1032	1032

M4: Linear regression; interval scaled explanatory variables.

M7 Ordered probit regression; interval scaled explanatory variables.

M8: Ordered probit regression; dichotomous explanatory variables.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table B.1.2: Sensitivity Analysis. Factors influencing the perception of the added benefit.

B.2 Heckman Correction

Considering only those subjects recommending the pharmaceutical leads to a selection bias. A two-step Heckman correction is conducted to control for this (Model M7).

	(M1) willingness to pay b/se	(M7) conditional willingness to pay b/se
lung cancer	reference	reference
psoriasis	-76.487***	-116.190***
	(21.11)	(26.96)
heart failure	-2.989	-45.666
	(20.09)	(26.16)
copd	-61.424**	-117.331***
	(20.23)	(26.18)
fictitious price	reference	reference
no price information	-83.966***	-117.552***
	(17.28)	(21.26)
real price	-55.749**	-76.794***
	(17.30)	(21.10)
added benefit	20.028***	n/a
	(3.67)	n/a
statutory health insurance	-68.499**	-75.943**
	(23.08)	(27.64)
conservative	5.020**	6.904***
	(1.70)	(2.04)
consume	7.705**	11.157**
	(2.93)	(3.60)
social security	-14.957*	-16.048*
	(6.28)	(7.93)
system confidence	6.884	6.017
	(4.22)	(5.35)
female	-25.844	-37.475*
	(14.84)	(18.15)
constant	-16.153	167.024*
	(64.95)	(82.90)
		recommendation
advantage	n/a	0.349***
	(n/a)	(0.03)
constant	n/a	-1.701***
	(n/a)	(0.17)
N	1032	1035

M1: Willingness to pay is assumed to be zero for participants not recommending the new pharmaceutical.
M7: Heckman two-step correction to control for selection bias. Only participants who recommend the new pharmaceutical are able to state a willingness to pay. The selection model is controlled for the four different indications.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table B.2: Heckman Correction.

B.3 Questionnaire

The study was conducted on German participants. Therefore the original questionnaire is in German. In order to make it accessible to a broader audience, we have translated it into English. Small changes in the questionnaire lead to twelve different treatments (four different diseases and for each disease three different kinds of price information). As an example, treatment 2 (disease: psoriasis; price information: real price) can be found on the following pages.

Questionnaire

Dear Sir or Madam,

thank you for participating in this survey.

This questionnaire deals with the prices of new pharmaceuticals.

The survey is part of a doctorate. It serves exclusively scientific purposes. The data will be used confidentially and anonymously.

Thank you very much for your participation.

2

Questionnaire No.

Part 1

Questionnaire No.

This survey is part of a scientific project. The data collected in the following is for research purposes only. Your data will be treated anonymously and confidentially.

Age:		Gender:	□ female □ male □ divers

□ single
□ married
□ widowed
□ divorced

_____

At which university / college / university of applied sciences are you studying?

□ Bachelor (not teaching profession)	Magister
□ Bachelor (teaching profession)	Staatsexamen (not teaching profession)
□ Master (not teaching profession)	Staatsexamen (teaching profession)
□ Master (teaching profession)	Other degrees: _____

□ Sport Science, Sports Education	Agricultural, Forestry and Nutritional Scienc
□ Law, Economics and Social Sciences	Engineering Sciences
□ Mathematics, Natural Sciences	Art, Music
	Other: _____

□ Number of university semesters:

□ Statutory health insurance (SHI)	Other: _____
□ Private health insurance	

□ less than €200
□ €200 to €300
□ €301 to €400
□ €401 to €500
□ €501 to €600
□ €601 to €700
□ €701 to €800
□ more than €800

4

Questionnaire No.

General Questions

Not willing to take risks at all	**Very willing take ri**

How satisfied are you **currently** with the following areas of your life?

- With your family life?	□ 2	□ 4	□ 5

- Being there for others	□ 2	□ 4	□ 5
- Having a happy marriage / partnership	□ 2	□ 4	□ 5

Susanne is 27 years old, single, living in Lüneburg, student and BaföG recipient. She donates €20 p month for the homeless of the city. Her friends regularly criticise her for this. She should rather u the little money she has for herself. Susanne says she likes to help those who are not doing well. Please indicate if you could imagine acting similar to Susanne.

1	2	3	4	5	6

5

Questionnaire No.

Questions on consumer behaviour

□ less than €5,000 €20,001 to €50,000 □ €5,000 to €10,000 more than €50,000 □ €10,001 to €20,000

□ less than €100 €301 to €500 □ €100 to €200 more than €500 □ €201 to €300

□ less than €50 €201 to €300 □ €50 to €100 more than €300 □ €101 to €200

□ I have never smoked	Yes, occasionally
□ No, not anymore	Yes, daily

□ Never	5 - 6 days per week
□ 1 -2 days per week	Daily or almost daily
□ 3 - 4 days per week	

How important is the social security system in Germany to you?

□ Equality	Freedom

- Worldwide	□ 2	□ 4	□ 5

1	2	3	4	5	6

6

Questionnaire No.

State of health (Under each heading, please tick the ONE box that best describes your health TODAY.)	
I have slight problems in walking about	❑
I am unable to walk about	❑
I have slight problems washing or dressing myself	❑
I am unable to wash or dress myself	❑
I have slight problems doing my usual activities	❑
I am unable to do my usual activities	❑
I have slight pain or discomfort	❑
ANXIETY / DEPRESSION	
I am moderately anxious or depressed	❑

7

Questionnaire No.

health is TODAY.

- This scale is numbered from 0 to 100.
- 100 means the best health you can imagine. 0 means the worst health you can imagine.
- Mark an X on the scale to indicate how your health is TODAY.
- Now, please write the number you marked o the scale in the box below.

YOUR HEALTH TODAY = ☐

The best health you can imagine

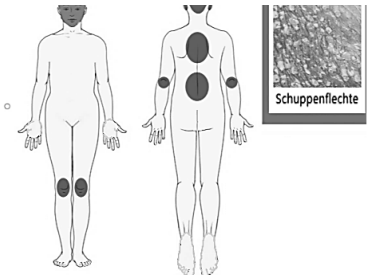
8

Questionnaire No.

Part 2

9

Questionnaire No.

Your Assessment
 and a net income of €2,500 per month. **Disease:** Matthias suffers from a chronic illness. He h psoriasis, an inflammation of the skin with painful reddish spots that form white scales. Matthias' ears, face, knees, elbows and back are particularly affecte Due to the severe itching he sleeps badly and is ofte exhausted and tired during the day. The complaints come in waves. **Previous drug:** There is no drug to cure psoriasis. Matthais has already received creams, ointments, some medication and injections. This only slightly alleviated his symptoms. **New drug:** For a new drug against psoriasis, the following effect was proven in studies compared to the previous drugs: There are no more symptoms in the face and neck and the skin area hurts less. The quality of life can be improved. The drug has no side effects that could lead to discontinuation of therapy and no other relevant side effects. **Administration of medication:** Up to now Matthias has been taking up to 3 tablets daily, he wo inject himself the new medication every 4 weeks.

□ □ □ □ □ □ □

	Thank you very much for your participation

Questionnaire No.

Matthias' **previous drug** costs in total:

The health insurance company pays a part of the costs for Matthias' previous medication. The **current, own co-payment** of Matthias for the **previous medication** is:

A treatment of Matthias with the **new drug** costs in total:

The health insurance company pays part of the costs of the new drug. If Matthias decided to tak the **new drug**, what co-payment would you accept **per month** if you were Matthias?	
□ €51 to €100 □ €101 to €150 □ €151 to €200 □ €201 to €250 □ €251 to €300 □ €301 to €350 □ €351 to €400 □ €401 to €450 □ €451 to €500	€601 to €650 €651 to €700 €701 to €750 €751 to €800 €801 to €850 €851 to €900 €901 to €950 €951 to €1,000 more, please specify €_____

□ yes, many times ↓	□ yes, sometimes ↓	rarely	er
□ I could not afford the co-payment. □ I did not think the treatment was so important after all.		Both Other: _____	

Thank you very much for your participation.

Appendix C

Literature Search

A literature survey was conducted in May and June 2020. I searched for literature in the following two databases: LIVIVO (2020) and PubMed (2020). Further information regarding the search strategy (C.1), the PICO(S) framework, the inclusion and exclusion criteria (C.2) and the sample selection process (C.3) and the reviewed studies (C.4) can be found below.

C.1 Search strategy

The database search for studies on willingness to pay for health in Germany was conducted with an explicit search term using boolean operators (Bramer, De Jonge, Rethlefsen, Mast, & Kleijnen, 2018). The search term can be found in Figure C.1.

((willingness to pay) OR (willingness to copay) OR (willingness to co-pay)) AND germany AND (pharmaceutical OR pharmaceuticals OR medicine OR medicines OR drug OR drugs OR health OR healthcare OR (health care) OR treatment OR treatments OR surgery OR surgeries OR surgical) AND (survey OR questionnaire OR questionary OR study OR (contingent valuation) OR (discrete choice))

Figure C.1: Search term using boolean operators.

C.2 PICO(S) framework, inclusion and exclusion criteria

A PICO(S) framework was defined (see Miller & Forrest, 2001 and Scells et al., 2017). Inclusion and exclusion were derived from it. The PICO(S) framework and the criteria can be found in Figure C.2 below.

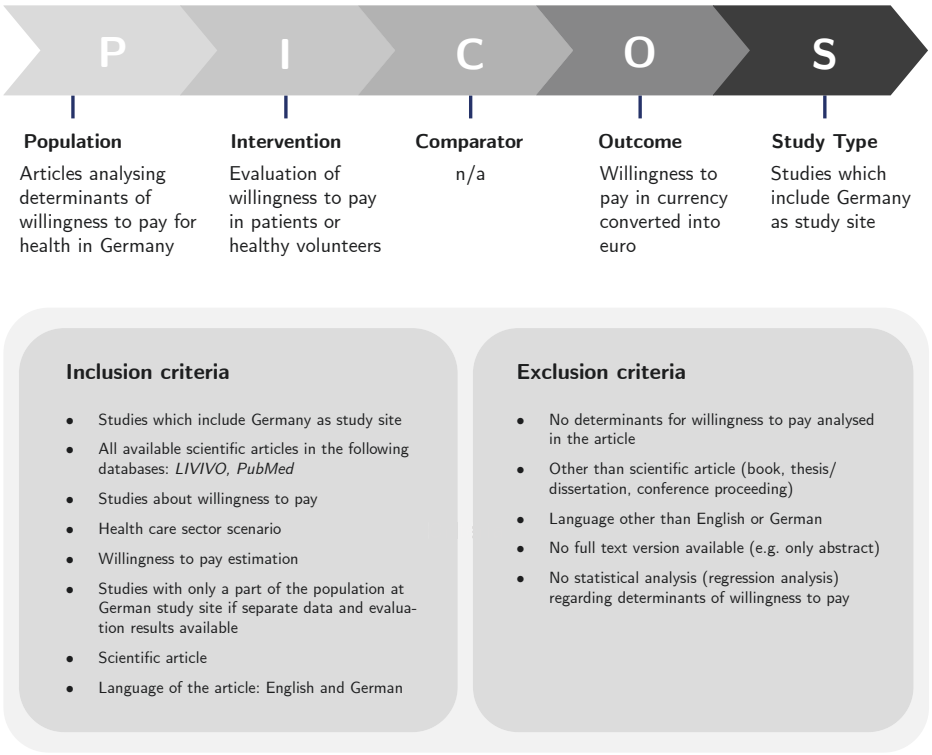


Figure C.2: PICO(S) Framework to define the systematic literature search strategy. Inclusion and Exclusion Criteria to define which prospective studies are to be included in the review and which disqualify from being included.

C.3 Sample selection

Searching the databases with the pre-defined search term (see Figure C.1) caused 196 hits on LIVIVO and 228 hits on PubMed including duplicates within each database and within all search hits of both sources. Excluding duplicates per database led to 173 hits (23 duplicates) on LIVIVO and 226 hits (2 duplicates) on PubMed. Matching both databases led to 297 unique studies. After full-text review of these studies using the pre-defined PICO(S) framework, and inclusion and exclusion criteria (see Appendix C.2), a total amount of 36 articles considered in this survey. An overview of the sample selection process can be found in Figure C.3 below. A list of the 36 studies can be found in Table C.4.

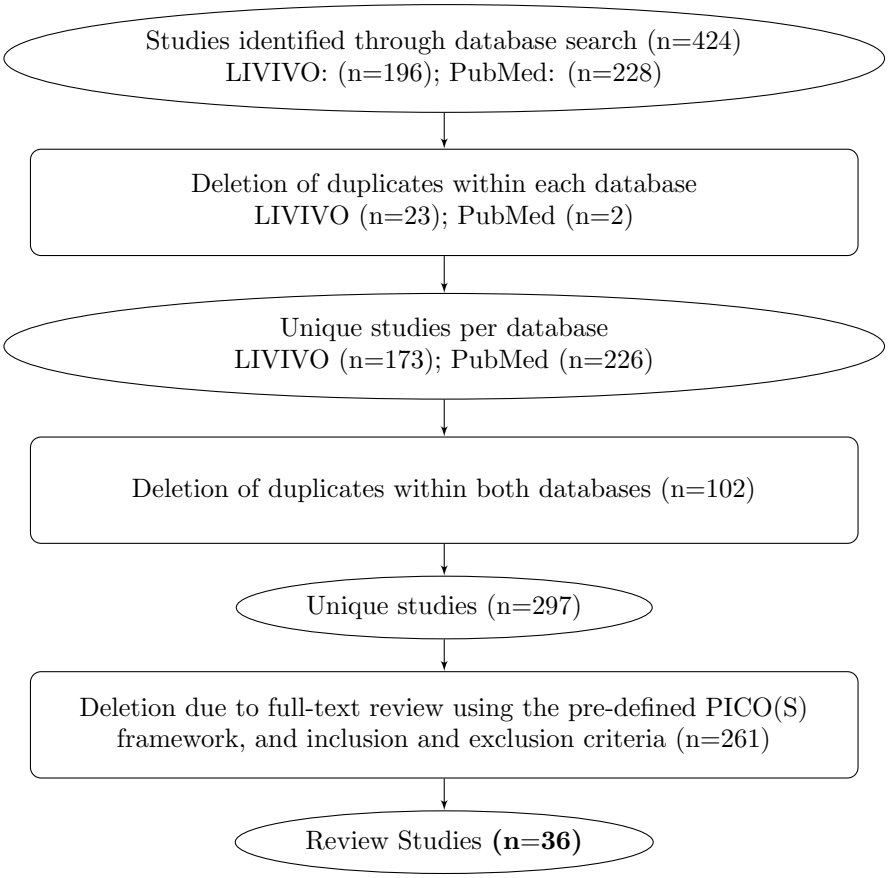


Figure C.3: Study selection. Number of excluded studies in rectangle boxes. Number of remaining studies in round ellipses boxes. PICO(S) framework, and inclusion and exclusion criteria can be found in Figure C.2.

C.4 Reviewed Studies

An overview of the author, content and medical discipline of the 36 reviewed studies can be found below. Conducting the literature survey we followed the Preferred Reporting Items for Systematic (PRISMA) guidelines (see Moher, Liberati, Tetzlaff, & Altman, 2009).

reference	**content**	**medical discipline**
Adam et al., 2019	analyse patients' preferences regarding the treatment process to assess utilities not captured by clinical parameters.	complementary medicine
Ahlert et al., 2016	examine differences in stated preferences for life extension and health improvement due to survey techniques.	not specified
Augustin et al., 2018	use low-risk melanoma patients' willingness to pay to assess their burden of disease and compare it with the willingness to pay of their treating physicians.	oncology
Aumann, Treskova, Hagemann, & von der Schulenburg, 2016	analyse determinants of willingness to use and willingness to pay for smoking cessation aids to contribute to the development of smoking cessation strategies.	pulmonology
Beikert et al., 2013	test the validity of willingness to pay to assess the burden of disease for patients with rosacea.	dermatology
Beikert et al., 2014	assess patients' burden of disease due to atopic dermatitis using willingness to pay and quality of life.	dermatology
Bishai, Brice, Girod, Saleh, & Ehreth, 2007	analyse the effect of price, benefit and information on parents' willingness to pay for vaccination.	not specified
Bock et al., 2016	assess elderlies' willingness to pay for health insurance and the factors influencing their preferences.	geriatrics
Bock et al., 2017	analyse the effect of longitudinal changes in several factors on the willingness to pay for health insurance.	geriatrics
Braun et al., 2000	evaluate the epidemiology of erectile dysfunction and assess the willingness to pay for treatment of people suffering from the disease and healthy subjects.	urology
[Günther et al., 2007]	assess the burden of depressive disorders using the stated preferences (willingness to pay, time-trade-off, EQ-5D) of participants with and without depression.	psychology
Hammerschmidt et al., 2003	test the convergent validity of contingent valuation methods by comparing the results of dicrete choice experiments and payment cards conducted with diabetic patients.	endocrinology

Table C.4 continued from previous page

reference	content	medical discipline
Himmler et al., 2020	evaluate the cost-benefit ratio of early warning systems for infectious diseases using a willingness to pay survey.	infectiology
Hodgkins et al., 2012	analyse factors influencing the adherence of patients with ulcerative colitis.	gastroenterology
Kesztyüs et al., 2014	assess parents' willingness to pay for the prevention of childhood overweight.	bariatrics
[Köberlein & Klingenberger, 2011]	evaluate factors influencing the decision for foreign dentures or dental treatment abroad.	odontology
[König et al., 2005]	evaluate the construct and concurrent validity of different preference-based methods (EQ-5D, time-trade-off, willingness to pay) to measure the burden of disease due to depression.	psychology
Krammer & Heinzerling, 2014	analyse the preferences (willingness to pay, side effects and quality of life vs length of life) of patients, physicians and healthy controls for melanoma treatment.	oncology
Lauer et al., 2020	evaluate longitudinal changes in parental willingness to pay and its determinants for the prevention of childhood overweight.	bariatrics
Leukert-Becker & Zweifel, 2014	analyse preferences for health insurance by assessing participants' willingness to pay to obtain the status quo of their health insurance benefits.	not specified
Lupiáñez-Villanueva et al., 2020	evaluate the factors influencing the adoption of and willingness to pay for mobile health apps.	not specified
Mayer et al., 2019	analyse preferences for testing of prostate cancer in affected men after their radical prostatectomy.	oncology
Niens, Strack, & Marggraf, 2014	assess parents' perceived risk of food-related hazards and their willingness to pay to reduce this risk.	pediatrics
Pfarr & Schmid, 2016	conduct an empirical experiment to test the assumption by Gouveia (1997) that preferences for the extent of statutory health insurance are affected by a health-income ratio.	not specified
Plöthner, Schmidt, Schips, & Damm, 2018	evaluate preferences for different attributes (e.g. test accuracy, test costs, identified diseases) of genetic testing.	not specified
Radtke et al., 2009	evaluate the disease burden of vitiligo by assessing the reduction in quality of life and the willingness to pay of patients.	dermatology

Table C.4 continued from previous page

reference	content	medical discipline
Rasch et al., 2009	examine the factors influencing the willingness to pay of menopausal-aged women for treatment.	gynaecology
Rasche et al., 2018	analyse preferences for features of a fall prevention smartphone app and assess the willingness to pay for it.	geriatrics
Schiffner et al., 2003	analyse and compare changes in different measures of quality of life (willingness to pay, time-trade-off, disease specific health state measures: PDI and PASI) in psoriasis patients.	dermatology
Schmitt et al., 2008	assess health utilities of patients suffering from psoriasis and atopic eczema, and the general population using different measures (willingness to pay, time-trade-off, EQ VAS).	dermatology
Schomerus et al., 2008	assess the publics' attitude (including their willingness to pay) towards programs for the prevention of depression.	psychology
Sennhauser & Zweifel, 2009	evaluate preferences of patients and healthy subjects regarding the coverage of a diabetes pharmaceutical by the health insurance and the associated financing forms (health insurance contribution vs copayment).	endocrinology
Sikorski et al., 2012	analyse public attitudes and the determinants affecting it regarding the prevention of obesity.	bariatrics
[Siol et al., 2017]	analyse students' preferences for oncological genetic testing.	oncology
Thiel et al., 2013	assess the preferences of patients (university hospital and non-university hospital) regarding an additional funding for certified centers in the form of additional health insurance fees or reduced remuneration for non-certified centers.	gynaecology
Wiesemann, Mueller-Buehl, Scheidt, Boehme, & Scheuermann, 2004	analyse the effect of an educational course about health promotion on patients' willingness to pay out-of-pocket for this issue.	general practice

Table C.4: Reviewed studies. Studies in German language in squared brackets.

C.5 Theories on determinants of willingness to pay

A discussion about different theories to explain individuals' willingness to pay for public environmental goods can be found at Liebe et al. (2011). They consider models from economics, psychology and sociology. The determinants derived from their work can be found in the table below. Whether these determinants also play a role regarding preferences in the German healthcare context has not been examined yet.

Theories	**Determinant**	**Information**	**Reference**
Basic economic model	Income	Constrain by disposable income	Carson et al., 2001
	Use of public good	Use value > existence value	Carson et al., 2001
Theory of public goods	Dilemma concern	Free riding: "individual rationality leads to collective irrationality"	Kollock, 1998
	Trust in other people's cooperation	Believe in willingness to pay of others increases own willingness to pay	Ostrom, 2000
	Fairness	Deviation from economic assumptions	Fehr & Schmidt, 1999
Attitude-behaviour paradigm	Topic (e.g. environmental) concern	Economic: preferences (choices between alternatives); Psychological/Sociological: attitudes (behaviour can be predicted by attitudes)	Green & Tunstall, 2001; Kahneman, Ritov, & Schkade, 1999
Theory of planned behaviour	Intention	Intention to perform a behaviour is determinant of the respective behaviour	Ajzen, 1991
	Attitude toward paying	Subjective evaluation	Studies regarding the three determinants:
	Subjective norm	Social pressure	Ajzen, Brown, & Rosenthal, 1996; Meyerhoff, 2006;
	Perceived behavioural control	Perceived effort to perform behaviour	Moisseinen, 1999; Pouta & Rekola, 2001
Altruistic/moral behaviour	General warm glow and subjective obligation to pay	Satisfaction leads to utility due to feelings of moral obligation; good feeling might be independent from whether people will be better off (embedding effect: derived utility independent from quantity of provided good; utility might vary between goods	Kahneman & Knetsch, 1992
Norm-activation model	Awareness of need and responsibility to pay	Developed to explain (altruistic) helping behaviour; personal norm leads to moral obligation when certain conditions are fulfilled: awareness of need and responsibility for paying	Schwartz, 1977; Schwartz & Howard, 1982

Table C.5: Theories on determinants of willingness to pay. Adapted from Liebe, Preisendörfer, & Meyerhoff, 2011.

Curriculum Vitae

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Fähigkeiten

- Mitarbeiterführung
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- Problemlösungsorientiert
- Zielorientierte Kommunikation
- MS Office, SAP ERP, SAP BI und Stata
- Buchhaltungskenntnisse (HGB, IFRS, US-GAAP
- Deutsch (Muttersprache), English (verhandlungssicher), Spanisch (Grundkenntnisse)

Zertifikate & Mitgliedschaften

Zertifikate

- Six Sigma Projektmanagement
- Professional Scrum Master I
- Market Access von Medizinprodukten
- Erstattung von Arzneimitteln
- Elemente der Arzneimittelpreisgestaltung
- Kosten-Nutzen-Analysen
- Statistische Methoden
- Wissenschaftliche Forschung & Didaktik
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Mitgliedschaften

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- Health Technology Assessment International (HTAi)

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04/2018 bis 04/2021

Leitung Controlling
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02/2016 bis 03/2018

Trainee
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03/2014 bis 01/2016

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- Junge Liberale – Studentische Hilfskraft (2009-2010)
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