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UNIVERSITÄT DUISBURG ESSEN

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Imprint

Ruhr Economic Papers

Published by

RWI Leibniz-Institut für Wirtschaftsforschung
Hohenzollernstr. 1-3, 45128 Essen, Germany

Ruhr-Universität Bochum (RUB), Department of Economics
Universitätsstr. 150, 44801 Bochum, Germany

Technische Universität Dortmund, Department of Economic and Social Sciences
Vogelpothsweg 87, 44227 Dortmund, Germany

Universität Duisburg-Essen, Department of Economics
Universitätsstr. 12, 45117 Essen, Germany

Editors

Editorial Office

Ruhr Economic Papers #707

Responsible Editor: Volker Clausen

ISSN 1864-4872 (online) – ISBN 978-3-86788-825-7

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Bibliografische Informationen der Deutschen Nationalbibliothek

Die Deutsche Bibliothek verzeichnet diese Publikation in der deutschen Nationalbibliografie; detaillierte bibliografische Daten sind im Internet über: *http://dnb.d-nb.de* abrufbar.

Das RWI wird vom Bund und vom Land Nordrhein-Westfalen gefördert.

http://dx.doi.org/10.4419/86788825
ISSN 1864-4872 (online)
ISBN 978-3-86788-825-7

Johanna Kokot[1]

Does a Spouse's Health Shock Influence the Partner's Risk Attitudes?

Abstract

The purpose of this study is to investigate the effect of a spouse's health shock on own risk attitudes. A spouse's health shock (i.e., the occurrence of a severe disease) can influence own expectations about the probability of falling ill. Moreover, an indisposition of the spouse, which may disrupt the ability and efficiency in sharing the everyday responsibilities, can increase mental and financial pressure, and thus would lead to a reduction of own risk willingness. On the other hand, a health shock may act as a wake-up call to enjoy life and may increase risk willingness. Using German Socio Economic Panel data, this study reveals that a health shock suffered by the spouse decreases own risk willingness. The effect is more pronounced the more serious the health shock is. The findings have implications for health insurance decisions and policy evaluations.

JEL Classification: C81, D01, D19, D81, I10, I12

Keywords: Health shock; risk attitudes; spouses

July 2017

1 Johanna Kokot, UDE. – I am grateful to Hendrik Schmitz, Simon Decker, Matthias Westphal, Lisa Maria Schmitz, Farzaneh Shamsfakhr, as well as to participants at the EuHEA PhD student-supervisor conference in Barcelona 2016 and the Annual Conference of the German Association for Health Economics 2017 for the support and helpful comments. – All correspondence to: Johanna Kokot, University of Duisburg Essen, Faculty of Economics and Business Administration, Berliner Platz 6-8, 45127 Essen, Germany, e-mail: johanna.kokot@ibes.uni-due.de

1 Introduction

Attitudes towards risk affect the socio economic status of a household, for example entrepreneurial activity, migration, and households' allocation of financial assets (Guiso and Paiella, 2008). They also have implications for decisions regarding health insurance choice (see, e.g., Cohen and Einav, 2007; Barseghyan et al., 2013) and health care (López-Pérez et al., 2015; Prosser and Wittenberg, 2007). For example, Prosser et al. (2002) reports that risk-seeking patients with multiple sclerosis are less likely to opt for a treatment. These are decisions, which are mostly made at the family level and with implications for the whole household. Consequently, it is important to consider risk attitudes of all household members. However, depending on the bargaining power of each of the spouses, eventually the risk preferences of either dominates the decision making process of the household.[1]

From economic theory perspective risk preferences are expected to be constant over time (Stigler and Becker, 1977). However, a variety of studies has shown that risk preferences are not stable over time (Schurer, 2015) and may be affected by several events. Among them are, in particular, economic shocks such as job losses (Sahm, 2012; Hetschko and Preuss, 2015), poverty (Haushofer and Fehr, 2014; Yesuf and Bluffstone, 2009; Guiso and Paiella, 2008), or financial crises (Browne et al., 2015; Malmendier and Nagel, 2011). But also life events are shown to reduce risk willingness, e.g., child birth (Görlitz and Tamm, 2015), marriage (Browne et al., 2016), and health shocks (Decker and Schmitz, 2016).[2]

Although the impact of one person's health shock on its own risk aversion has been recently investigated (Decker and Schmitz, 2016), there is no research on the risk aversion effect of a spouse's health shock. This is relevant because changes in health status may affect not just the individuals who fall ill themselves, but also their family members, in particular the spouse.[3] This is particularly important, since more than half of the population age 20 and

[1]See, e.g, Yilmazer and Lich (2015) for choices on portfolio asset allocation. With respect to risky decisions, experimental evidence shows that couples behave differently than each spouse separately (De Palma et al., 2011). However, the joint decision is often found to be similar to the husband's preferences. But the contribution of women increases with their income (Carlsson et al., 2013; De Palma et al., 2011).

[2]Sahm (2012) only finds out a little impact of major life events.

[3]Spillover effects have been recently studied with respect to the effects of unemployment on mental health (Marcus, 2013; Bubonya et al., 2014), and with respect to the fear of unemployment on mental health (Bünnings et al., 2015).

older is married or lives in a partnered couple, e.g. 63% in Europe and 51% in the US.[4] A severe disease of the spouse may disrupt the ability and efficiency in sharing the everyday responsibilities and may induce additional work concerning hiring external care givers or providing own informal care (see, e.g., Jayadevappa et al. (2010) for analyses on spousal burden of prostate cancer). It can also increase medical expenditure and decrease household income.

This paper aims to analyze whether individual risk preferences are affected from the spouse's health shock, i.e. the diagnosis of a severe disease. I use data of the German Socio Economic Panel (SOEP) providing information on specific diseases, such as cancer, stroke, and cardiovascular diseases. The specification of the health shock measure based on specific diseases provides a good opportunity to understand which kind of diseases drives the health shock effect on risk. A regression adjusted matching is used to take into account the observable differences between individuals with and without a health shock. Very detailed panel data on socio-economic status as well as individual characteristics (e.g., past risk attitude) allow me to control for individual heterogeneity.

Spouse's illness may affect risk aversion through the following three channels. (i) A spouse's health shock may reduce household wealth (Wu, 2003) which in turn leads to lower risk willingness (e.g., Hetschko and Preuss, 2015; Haushofer and Fehr, 2014; Guiso and Paiella, 2008). Specifically, prior literature on the relationship of spouses' health shocks and labour market outcomes provides evidence that individuals respond to a partner's health shock by either reducing their employment or increasing it in order to deal with enhanced uncertainty about the future (e.g., Coile, 2004; Van Houtven and Coe, 2010; García-Gómez et al., 2013; Jeon and Pohl, 2016; Liu, 2016). Especially this income uncertainty is shown to be a significant factor of a higher degree of absolute risk aversion (Guiso and Paiella, 2008). Moreover, individuals might compensate foregone income of the ill spouse, or help paying additional medical and other expenses associated with the disease.[5] (ii) Beyond the ability to manage work with caregiving responsibilities, a spouse's health shock may also change the expectations

[4] http://www.pewsocialtrends.org for the US and http://ec.europa.eu/eurostat for Europe.

[5] In general, increased financial pressure which manifests in psychological and physiological stress is shown to increase risk aversion in laboratory experiments (Cingl and Cahlíková, 2013).

about number of remaining years of common life.[6] This can make health shocks act like a wake-up call and encourages the spouses to enjoy remaining life, joint leisure time and lower the risk assessment. (iii) Another channel through which partner's health shock may influence own risk attitude might be the additional information about potential health risks. The underlying intuition is that individuals may not know the consequences of potential health risks such as smoking, obesity, or alcohol consumption.[7] Accordingly, the demonstration of consequences by the spouse may provide information, which the individual uses to learn about own health risks. However, this channel seems to be of minor importance for smoking (Khwaja et al., 2006; Palali and van Ours, 2015).

The key findings of the present study can be summarized as follows: A spouse's health shock increases individual risk aversion. Compared to a self-experienced health shock this effect is smaller, but not negligible. The spillover health shock hardly depends on the kind of disease. Less severe diseases and chronical diseases of a spouse play a minor role in reducing own risk willingness. I find little evidence of any negative spillover effect on risk aversion of husbands in response to their wives' health shock. The risk aversion for wives, however, is increasing following their husbands' health shock. Importantly, these results are highly robust to a number of sampling restrictions and model specifications.

The paper is organized as follows. I first illustrate the estimation strategy (Section 2). Section 3 presents the data, describes the construction of the treatment and control group, and gives an overview on the conditioning variables. Section 4 provides descriptive statistics. Results are presented in Section 5, and conclusions are in Section 6.

2 Estimation Strategy

For the estimation, I use a framework in which individuals' risk aversion is driven by both their own characteristics and the characteristics of the spouse. I answer the question on how a health shock experienced by the spouse affects own risk aversion. Later, I will compare the results with effects of self-experienced health shocks.

[6] For instance, in a qualitative study on cardiac diseases Mahrer-Imhof et al. (2007) observed that some couples perceive the disease as a positive experience that brings them closer together.

[7] This intuition is also proposed by Viscusi (1992) and Clark and Etilé (2002).

This study focuses on the average treatment effect on the treated (ATT), i.e., I estimate the effect of health shocks on risk willingness for those whose spouse currently suffered from a severe disease. The identifying assumption for the ATT is that no unobserved variables exist that determine the health shock and simultaneously influence a change in risk attitudes. That is, in the absence of a health shock the risk attitudes of the treated (spouse of individual with health shock) and controls (similar individuals whose spouse do not experience a health shock) follow the same trend. I use regression adjusted matching. This procedure is also applied by Decker and Schmitz (2016) and Marcus (2014). First, I perform a propensity score matching based on a logit regression to balance between the treatment and control group. Second, I use the generated weights to run a weighted OLS. I use kernel matching – a weighted regression of counterfactual outcome on an intercept with weights given by the kernel weights (Smith and Todd, 2005). Weights depend on the distance between each individual from the control group and the individual with spouses' health shock for which the counterfactual is estimated. The matching is based on Epanechnikov kernel, which matches only control observations within a specific interval around each treated observation. As applied by Heckman et al. (1997), I use a bandwidth of 0.06.[8]

I run a cross sectional model in which I regress individual risk willingness Y_{it} in t on year dummies, spouse's health shock, household variables, and other individual control variables of both the individual and its spouse. My estimation strategy relies on detailed pre-determined controls in $t-1$ in order to reduce threats of causality. I estimate the following model:

$$Y_{it} = \alpha + \beta_1 health\_shock_p + X'_{it-1}\gamma + X'_{pt-1}\varphi + X'_{ht-1}\delta + \epsilon_i \qquad (1)$$

with i indicating the individual of interest, p indicating spouse's characteristics, and h indicating household characteristics. The dependent variable Y_{it} is measured on a discrete $[0-10]$ scale. Still, my estimates of the effect of a health shock may be biased due to possible time-varying correlation in the unobserved factors that simultaneously influences individuals' current risk attitude and their spouses' health shock.

To interpret the health shock effects it is important to consider that risk attitudes might be correlated between spouses (Dohmen et al., 2012). One explanation can be found in the

[8]For the estimation, I use the psmatch2 Stata command.

theory of positive assortative mating: individuals tend to start a family with others having a similar risk attitude (Bacon et al., 2014). According to the theory, individuals have preferences over both themselves and their partners. Rational choice models of mate selection assume that individuals search for the best match amongst potential partners and compete with one another via their own resources. These resources include various forms of human and social capital, and the quality of match is determined by the joint productivity of partners' resources in a marital production function (Becker, 1973). Resources that are complementary in the production of marital output should give rise to marital homogamy (positive assortative mating).[9]

Moreover, one has to take into account that individuals may anticipate the health shock of their spouses from a certain point onwards, e.g., due to their life style. Increasing physician visits, increasing age, or risky life style may trigger, step by step, an update in the information set and thus may affect risk willingness before the spouse's health shock occurs.

To summarize, one has to rule out that an increase of risk willingness of one member of the couple leads to an increase of risk willingness of the other member and finally to an increased probability of a health shock. Considering this challenge, the advantage of this study is that it controls for unobserved heterogeneity by including information about own and partner's previous risk with a sufficient time delay to reduce an anticipating bias. Moreover, the data allows to control for own and partner's previous risky behavior (smoking, alcohol, body-mass index). It provides also information on the disease history of both spouses including unfavorable health features that are symptoms of more severe diseases, such as diabetes and high blood pressure. Thus, the data allows for a causal interpretation of spouses' health shocks.

3 Data

The German Socio-Economic Panel (SOEP) is a large panel data set that is representative of the adult population living in Germany (see Schupp and Wagner (2002) and Wagner et al. (2007) for a detailed description of the SOEP). I use information from six waves collected in the years between 2008 and 2013. The SOEP combines extensive sociodemographic and

[9]It could also be optimal to have one member of the couple who is risk-seeking and another who is risk averse (Chiappori and Reny, 2016; negative assortative mating).

health information with measures of preferences. One advantage of the data set is that it follows all household members and not just the household head. Thus, information on couples and its development is available.

3.1 Health Shock Measure

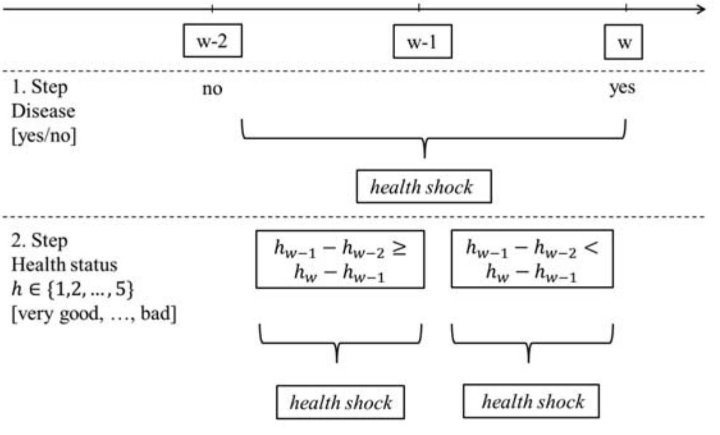
The existing literature provides a variety of definitions for health shocks. Some measure it as changes in physical ability (Decker and Schmitz, 2016). Others include hospitalizations (García-Gómez et al., 2013). Some use one concrete disease, such as cancer (Jeon and Pohl, 2016; Hollenbeak et al., 2011), or a mix of specified (Van Houtven and Coe, 2010; Wu, 2003), or unspecified diseases (Liu, 2016). However, different kinds of diseases may have very different effects for the spouse, e.g., chronic conditions as diabetes may require spouse's assistance with a diet instead of providing intense informal care. Moreover, depending on the time of recovery, different spouses' responsibilities may occur, e.g., hiring external care givers, providing own informal care, and thus rearranging work responsibilities.

In this study, I follow Van Houtven and Coe (2010) and use a health shock measure that is based on a mix of diseases. The advantage of this measure is that it captures information about the kind of illness causing the health shock. Specifically, I use two questions of the SOEP and construct the health shock variable in two steps. In a robustness check, I restrict the sample with respect to the first step only (Section 5.6). Figure 1 illustrates the construction of the health shock measure. The first step identifies the occurrence of a health shock. It is based on the question on whether an individual ever suffered from one or more of given diseases. The diseases are displayed as a list with the following default options: diabetes, asthma, migraine, dementia, cancer, stroke, blood pressure, depression, heart disease. Additionally, the response options include a free text field to fill in other diseases. The question was first introduced in 2009 and ever since is included every two waves (henceforth w). I restrict the health shock to the most severe and acute diseases among the default options (cancer, stroke, and heart disease).[10] Furthermore, I use answers from the free text field revealing, e.g., multiple sclerosis or Parkinson disease.

[10] A point to be noted is that diseases are not further specified. Thus, one cannot distinguish between e.g., heart attack and coronary stenosis, or prostate cancer and lung cancer.

Given the individual is observed in $w-2$, a health shock is observed if either one or at least one of the diseases is claimed in w for the first time. That is, the indicator becomes 1 if the individual suffers from stroke, cancer, heart disease, or other diseases between the two SOEP interviews $w-2$ and w.[11] If I observe a disease in $w-2$, I do not treat this as health shock as I cannot determine the starting point of the disease.[12] However, I use this observation to control for former diseases to have an effect on the general risk perception.

Figure 1: Construction of health shock measure



Notes: The figure presents an overview of the construction of the health shock measure. The health shock measure is constructed in two steps. The first step uses explicit diseases and a procedure of exclusion to determine the occurrence of a health shock on a two-year time frame. The second step uses the self-assessed health status to obtain the precise time of the health shock.

The first step only allows for an accuracy of health shocks within a two-year interval. To attribute the health shock to a specific wave, in particular, 2010, 2011, 2012, or 2013, respectively, I use in a second step information on the self-reported health status, which is included every year in the SOEP. It entails five integer categories ranging from 1 (very good) to 5 (bad).[13] In the previous literature the self-reported health status is found to decline due to a health shock, even after recovery (Wagstaff and Lindelow, 2014). Moreover, it also serves as good predictor of future health care utilization, especially for more serious diseases

[11]This approach ensures sufficient sample sizes and is similar to Van Houtven and Coe (2010) and Coile and Gruber (2007) who analyze the effects of health shocks on labour supply and retirement decisions.

[12]A health shock is identified in w, independent from its confirmation in $w+2$. Combinations of health shocks are not excluded.

[13]The exact question is: "How would you describe your current health? [very good/ good/ satisfactory/ poor/ bad].

(Doiron et al., 2015).[14] Note that some general problems may arise with the use of self-reported health status, e.g., reporting errors which vary with socio-economic characteristics (Bago d'Uva et al., 2008; Van Doorslaer et al., 1997). However, for the interest of the current paper this might be a minor problem as only within-subject differences are relevant.

To implement the adjustment of the second step, I compare the three self-reported health states for the relevant two-year interval (i.e., the difference between h_{w-2} and h_{w-1} versus the difference between h_{w-1} and h_w) and set the health shock to that interview year that shows the larger deterioration of health, i.e., $w-1$ or w, respectively.[15] Given a constant deterioration of health over the time, I assume the health shock to occur in $w-1$. After applying the second step, 67% of health shocks are associated to $w-1$. In particular, the average individual deterioration of the self-reported health status due to a health shock is 0.05 points on the scale of 1 to 5 for those whose health shock is set to $w-1$ and it is 0.16 points for those whose health shock is set to w. For all individuals with a health shock the average deterioration of self-reported health is 0.21 points. Descriptive values of self-reported health for both spouses are reported in the appendix (Table A2).

In total, I observe 899 health shocks of spouses. Health shocks spread across all observed survey years with 2010 showing the most health shocks (43%). The average self-reported health status for spouses with a health shock is 3.56, while it is 2.68 for those without a health shock. Health shocks arise more frequently for males (57%) than for females (43%). They distribute over age from 22 to 92 with the majority of spouses age 65 and older. Health shocks consist of heart diseases (53%), cancer (33%), stroke (14%) and other diseases (3%). Table A1 in the appendix displays a detailed list of diseases that are captured by "other diseases". The health shock indicator includes 38 simultaneous diseases, of which most (87%) correspond with heart diseases. The most frequently observed pre-existing condition of all health shocks is high blood pressure (43%).

One limitation regarding the measurement of the health shock is that the data does not reveal direct information on the persistence or intensity of health shock. That means that all diseases have equal weight in the health shock measure. Other health shock measures might be also

[14] Johnston et al. (2009) find that self-reported health underestimate the income/health gradient. However, it is only shown for a chronic condition).

[15] For example: Given the health status sequence is 2, 4, 5 for $w-2$, $w-1$, and w, respectively, then the health shock is determined between $w-2$ and $w-1$.

available in the SOEP, but have several disadvantages. For example, an alternative measure may rely on days absent from work. Here, one cannot control for the kind of shock and the intensity. Moreover, with this measure I would restrict the panel to employed individuals only. Given the distribution of health shocks across ages, this would reduce more than half of health shock observations. Another health shock measure would be the length of hospital stay. The advantage of this variable would be that it is not restricted to employed individuals. However, hospital stay may also be caused by less severe and chronical illnesses. Furthermore, I cannot ascertain the starting point of the disease as the stay may be indicated by follow-up medical treatment.

3.2 Treatment and Control Group

Treatment and control group consist of couples who live together in the same household irrespective of their marital status. According to this assumption, about 90% of the couples in the sample are married. The others live together in a marital cohabitation.[16] I include couples irrespective of age and own and spouses' previous health status. The treatment group consists of individuals, whose spouse suffered a health shock. I do not consider health shock effects of co-resident children and parents. For the analysis of the health shock effect of spouses I exclude individuals with an own health shock.[17]

To simplify the analysis, I restrict the treatment group to individuals with the first observed health shock in the sample. The control group composes of individuals with a spouse with no health shock. Members of the control group (like the treatment group) continue to participate in the survey for at least three interviews in a row that compose at least two health shock indication years, i.e. 2009 and 2011 or 2011 and 2013. Furthermore, this means that I exclude the observations for the year 2010 if it is the first observation of the individual in the SOEP. According to the definition of health shocks, I also exclude individuals whose entrance to the SOEP is later than 2011.

[16]To simplify the analysis, I do not include couples with the same sex. Furthermore, note that the structure of my sample implies that each individual is observed to be part of only one unique couple.

[17]Consequently, I do not consider simultaneous health shocks – which would amount 6% of health shocks. Including own health shocks does not change the results. However, the interpretation must be treated with caution, as the control for own health shocks constitutes as an endogenous variable.

3.3 Measure of Risk Willingness

I use a self-reported measure of risk attitude. The question about risk attitudes is part of the standard questionnaire. The primary variable of interest based on the question that asks individuals for their attitude towards risk in general.[18] Answers are given on an 11-point scale whereas 0 means "unwilling to take risks" and 10 means "fully prepared to take risks".[19] This question is included in the 2008-2013 waves. Technically, I locate the (lagged) health shock effect of the spouse at the same period that the risk attitudes are measured, as the question on the diseases refers to past time and the risk measure refers to actual attitudes. The general risk question has been analyzed by various studies and is also experimentally validated: the self-assessed risk measure turned out to be a good predictor for risk taking behavior in the incentivized experiment (see Dohmen et al., 2011; Galizzi et al., 2016).[20] Figure 2 describes the frequency distribution of risk willingness in the sample, grouped by individuals with and without a spouse's health shock. Each bar in the figure indicates the fraction of individuals choosing a number of risk willingness on the 11 item scale. The mean risk aversion is 4.40 with a standard deviation of 2.23. The median response is 5, but a substantial fraction of individuals states their risk willingness in the range between 2 and 8. As only a small fraction of individuals assess themselves as very willing to take risks, a notable mass chooses the extreme values of risk aversion (0 and 1).

3.4 Conditioning Variables

It is possible that health shocks are endogenous (see Section 2). This might be particularly true for own experienced diseases. When health shocks occur indirectly (as a spouse's disease), endogeneity is reduced as own influence on the partner falling seriously ill is limited.

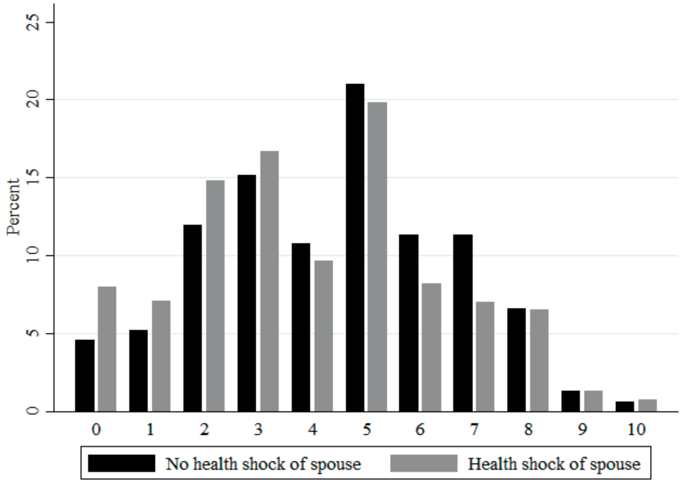
The richness of the SOEP data allows to include a variety of conditioning variables. Table 1 provides an overview of the conditioning variables. I control for pre-treatment individual characteristics as well as for household variables. Moreover, I control for the same set of spouses' variables as these variables might develop in the same way within a couple over

[18]There is no question on attitudes for specific health risks after 2009.

[19]The exact wording of the question is: "How do you see yourself: Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks? Please tick a box on the scale, where the value 0 means: 'unwilling to take risks' and the value 10 means: 'fully prepared to take risks'".

[20]Note, however, that transferring the general measure on specific individual attributes (smoking status, body-mass-index, consumption of junk food or their likelihood of regularly saving) must be drawn with caution (Galizzi et al., 2016).

Figure 2: Distribution of risk willingness



Notes: The graphic displays the distribution of risk willingness based on pooled survey years 2010 to 2013. The exact wording of the question is: "How do you see yourself: Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks? Please tick a box on the scale, where the value 0 means: "unwilling to take risks" and the value 10 means: "fully prepared to take risks". Number of observations: 29,940.

years. The control variables include also demographic, education level, employment status, migration, and living in West/East Germany. Furthermore, I include pre-treatment risk willingness as it is arguably a good predictor of current risk willingness. To capture time trends, I additionally control for the survey year, using 2010 as reference year.

Poor health of one spouse can influence the partner's health outcomes (Litzelman et al., 2016; Schmitz and Westphal, 2015). Additionally, a severe health shock does not often come as an unexpected shock, as it occurs following previous other diseases, e.g., heart disease, migraine, high blood pressure, asthma, depression. For instance, high blood pressure is considered to be a major risk factor for heart diseases. Thus, those who suffered from any disease long ago may show a long term effect accompanied by an increased risk aversion. Therefore, I consider the following pre-treatment health related characteristics for both spouses: (1) the initial health status by including physical and mental health score based on the SF-12 questionnaire,[21]

[21] The mental health score has been proven to be valid (Gill et al., 2007).

Table 1: Overview of the conditioning variables

Risk willingness $(t-2)$	11 categories (unwilling to take risks,..., fully prepared to take risks)
Demographic	
Female	0 = male, 1 = female
Migrant	1 = moving to Germany, 0 = else
West	1 = West Germany, 0 = East Germany
Children	Number of children
Length of partnership	observed length of partnership in years
Age	age in years
Age squared	age squared in years
Survey year	2010, 2011, 2012, 2013
Labour Market & Education	
Income $(t-1)$	logarithm of annual household income
Unemployed $(t-1)$	1 = unemployed in $t-1$, 0 = else
Full time $(t-1)$	1 = full time employed in $t-1$, 0 = else
Part time $(t-1)$	1 = part time employed in $t-1$, 0 = else
Retired $(t-1)$	1 = retired in $t-1$, 0 = else
Other job status $(t-1)$	1 = irregularly job, maternity leave, military, 0 = else
Academic school track	1 = academic school track degree (Abitur), 0 = else
Intermediate school	1 = intermediate school, 0 = else
Basic school	1 = no degree, lower secondary degree, 0 = else
Health & Health Risks	
Mental health $(t-1)$	based on SF-12 questionnaire, ranging from 0 to 100
Physical health $(t-1)$	based on SF-12 questionnaire, ranging from 0 to 100
Previous heart disease	1 = heart disease in the past, measured in $t-2$, 0 = else
Previous stroke	1 = stoke in the past, measured in $t-2$, 0 = else
Previous cancer	1 = cancer in the past, measured in $t-2$, 0 = else
Previous high blood pressure	1 = blood pressure in the past, measured in $t-2$, 0 = else
Previous migraine	1 = migraine in the past, measured in $t-2$, 0 = else
Previous diabetes	1 = diabetes in the past, measured in $t-2$, 0 = else
Previous asthma	1 = asthma in the past, measured in $t-2$, 0 = else
Previous depression	1 = depression in the past, measured in $t-2$, 0 = else
Other previous disease[a]	1 = other disease in the past, measured in $t-2$, 0 = else
BMI $(t-1)$	body mass index, in kg/m^2
Smoking $(t-1)$	1 = smoking in $t-1$. 0 = else
Alcohol $(t-1)$	1 = regular consumption of alcohol in $t-1$, 0 = else

Note: The table describes the coding of the conditioning variables. For the analysis, each variable is included for both the individual and the spouse. A pre-treatment variable is indicated by $(t-1)$ or $(t-2)$, respectively. [a] A list of other diseases is reported in the appendix (Table A1).

(2) the body mass index (BMI), defined as individual body weight divided by the square of the individual's height, (3) previous diseases which are not identified as health shock. These diseases comprise the health shock-relevant diseases as well as other diseases like diabetes, asthma, migraine, dementia, blood pressure, or depression. I also control for behavior that is thought to increase health risks, as alcohol consumption and smoking.[22] On household level, I include the logarithm of income, number of children, and length of the partnership.

To prevent the pre-treatment covariates to be affected by the health shock, all pre-treatment variables are set at $t-1$, and thus, are close to the treatment in t. However, I make two exceptions. First, previous diseases are measured in $t-2$, while the exact year of occurrence is unclear as the data provides no information about diseases before 2009.[23] Second, to prevent risk effects due to first signs of a severe disease before diagnosis, pre-determined risk willingness are assigned at $t-2$. In a robustness check I also show that the results of a regression with pre-determined risk willingness with timing $t-1$ do not change fundamentally (Table A4 in the appendix).

4 Descriptive Statistics

Table 2 presents summary statistics separately for couples with affected spouse (treated) and non-affected spouse (controls) used in the empirical analysis. Treated and (unmatched) controls differ considerably in their observable characteristics. Treated individuals are about eight years older than controls and are to a larger extent retired. The individuals with direct affected spouse differ from their counterparts in gender (58% of males are exposed to health shocks), and in their initial physical, but not initial mental health. Cigarette and alcohol consumption does not differ between both groups. Treated are less likely to have children under 18 at home than controls. Income does not differ largely. It is notable that treated are much more risk averse than controls in $t-2$.

[22] The question regarding smoking behavior is part of the questionnaire in 2008, 2010, and 2012. Smoking refers to the last given observation in $t-1$. Questions regarding alcohol consumption are part of the questionnaires in 2008 and 2010. Alcohol consumption includes the regularly consumption of wine, spirits, or beer referring to the last actual state in $t-1$. Individuals are distinguished based on the consumption frequency of "regularly", "from time to time", "rare", and "never".

[23] Note that for individuals whose first observation in the data set is later than 2010, a previous disease refers to 2011 and prior to that year.

A matching may smooth the differences between control and treatment group. Regarding relevant variables for the matching it should be clear that only variables that are unaffected by participation (or the anticipation of it) should be included in the model.[24] However, the main purpose of the estimation is not to predict selection into treatment as good as possible, but to balance all covariates. In the current analysis, matching reduces these disparities in the conditioning variables; see Column 3 for values of matched controls and Column 5 for the bias of matched controls. After matching no difference is significant and the standardized bias never exceeds the critical value of 5%. Remaining differences will be addressed in the regression.[25] After excluding observations that do not confirm the common support condition[26], the sample comprises 29,940 observations which are distributed over 5,096 couples. An individual is observed, on average, 2.2 survey years.

Table 2: Summary statistics for treated, controls and matched controls before treatment

		Control		Standardized Bias (%)	
Variable	Treated	Unmatched	Matched	Unmatched	Matched
Risk willingness (t-2)	4.11	4.40	4.11	-12.90	-0.30
Risk willingness_p (t-2)	4.28	4.40	4.29	-5.20	-0.40
Female	0.59	0.50	0.59	17.80	0.10
Migrant	0.14	0.16	0.14	-7.10	-0.40
Migrant_p	0.14	0.16	0.14	-5.60	0.00
West	1.28	1.26	1.28	5.10	-0.10
Children	0.33	0.74	0.32	-45.90	0.70
Length of partnership	8.40	8.00	8.41	6.60	-0.20
Age	62.10	53.25	62.18	67.90	-0.60
Age_p	63.02	53.27	63.10	74.90	-0.60
Age squared	4007.10	3025.30	4018.20	66.00	-0.70
Age squared_p	4122.50	3026.30	4133.80	73.8	-0.8
Year 2011	0.19	0.28	0.19	-19.8	-0.2
Year 2012	0.25	0.22	0.25	6.5	0.4
Year 2013	0.13	0.21	0.13	-19.6	-0.2
Income (t-1)	10.44	10.60	10.44	-28.3	1.1
Unemployed (t-1)	0.18	0.16	0.18	6.9	-0.1
Unemployed_p (t-1)	0.20	0.16	0.20	11.1	-0.1
Full time (t-1)	0.24	0.42	0.24	-39.4	0.8
Full time_p (t-1)	0.23	0.42	0.22	-41.9	1
Part time (t-1)	0.08	0.14	0.08	-20.6	0.3
Part time_p (t-1)	0.06	0.14	0.06	-26.7	0.5
Retired (t-1)	0.43	0.19	0.43	52.8	-0.9
Retired_p (t-1)	0.45	0.19	0.45	56.2	-0.9
Academic school track	0.17	0.22	0.17	-13.3	0.5
Academic school track_p	0.19	0.22	0.19	-8	0.2

Continued on next page

[24] Note, I use the same set of variables for matching and for the regressions.

[25] Entropy balancing (Hainmueller and Xu, 2013), which is also applied by Marcus (2013) reveals similar results.

[26] Those observations are to a great extent characterized by individuals with lower age, more children, higher labour force participation, higher physical health and lower pre-treatment risk aversion.

Table 2: (Continued)

Variable	Treated	Control		Standardized Bias (%)	
		Unmatched	Matched	Unmatched	Matched
Intermediate school	0.32	0.39	0.32	-13.1	0.3
Intermediate school_p	0.30	0.39	0.30	-18.7	0.2
BMI (t-1)	26.90	26.55	26.91	7.8	-0.3
BMI_p (t-1)	27.27	26.55	27.26	15.6	0.1
Mental health (t-1)	51.58	50.92	51.60	7	-0.2
Mental health_p (t-1)	50.95	50.91	51.03	0.4	-0.9
Physical health (t-1)	45.63	48.94	45.58	-33.3	0.5
Physical health_p (t-1)	44.52	48.94	44.53	-45.9	-0.1
Heart disease	0.14	0.08	0.14	17.8	-0.2
Heart disease_p	0.09	0.08	0.09	1.5	-0.2
Stroke	0.03	0.01	0.03	11.9	0.4
Stroke_p	0.04	0.01	0.04	16.6	2.1
Cancer	0.06	0.04	0.06	11.7	-0.4
Cancer_p	0.04	0.04	0.04	3	-0.2
Blood pressure	0.36	0.26	0.36	22.9	-0.3
Blood pressure_p	0.43	0.26	0.43	36.7	-0.4
Migraine	0.06	0.06	0.06	-0.1	0.6
Migraine_p	0.06	0.06	0.06	1.8	0
Diabetes	0.12	0.07	0.12	15.6	-0.1
Diabetes_p	0.15	0.07	0.14	23.7	1.1
Asthma	0.04	0.04	0.04	0	0.6
Asthma_p	0.06	0.04	0.06	7.7	0
Depression	0.05	0.05	0.05	1.7	-0.2
Depression_p	0.06	0.05	0.06	5.1	0.1
Other disease	0.01	0.01	0.01	-2.7	0.2
Other disease_p	0.01	0.01	0.01	2.9	-0.1
Smoking (t-1)	0.22	0.24	0.22	-4.7	0.3
Smoking_p (t-1)	0.23	0.24	0.22	-4.1	1
Alcohol (t-1)	0.17	0.20	0.17	-7.9	-0.2
Alcohol_p (t-1)	0.22	0.20	0.22	5.8	0.5

Notes: The first three columns present mean of selected variables for treated individuals, controls and matched controls. Spouse's variables are characterized by the ending "_p". Standardized bias is the percentage difference of the sample means in the treated and non-treated subsample as a percentage of the square root of the average of the sample variances in the treated and non-treated groups (formulare from Rosenbaum and Rubin, 1985). Number of observations: treated: 899; unmatched controls: 29,338; matched controls: 29,041.

5 Results

5.1 Effects of a Health Shock of the Spouse

First, I present results from simple OLS estimations of the empirical model. All estimation results report robust standard errors, corrected for possible correlation of the error term across individuals from the same household. The corresponding results are presented in Table 3. Full results are presented in the appendix.

Table 3: Results – Health shock of the spouse

Risk willingness	(1)	(2)	(3)
Health shock of spouse	-0.445***	-0.162**	-0.156**
	(0.079)	(0.068)	(0.067)
Survey year	Yes	Yes	Yes
Individual + household controls	No	Yes	Yes
Matching	No	No	Yes
# Observations	30,238	30,238	29,940

Notes: The table presents the effect of a spouse's health shock on the spouse's risk willingness, whereas low values of risk indicate high risk aversion and high values indicate high risk willingness. The first row displays the health shock effect. The first column refers to a simple OLS regression with time dummies, and the second column includes all conditioning variables without matching. Column 3 presents the results for the matching estimator with all covariates. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors are at household level.

In the simple specification, I find a significant negative effect of a spouses' health shock on risk willingness when controlling for the year of interview only (Column 1). I can thus conclude that the treatment effect does not originate from time trends in risk aversion. After adjusting for all control variables the negative effect remains (Column 2). The effect is statistically significant at 5 percent level with risk willingness decreasing by .16 points on the scale of 0 to 10 compared to the control group individuals. This implies a difference of about 7% of a standard deviation of risk aversion. Incorporating matching does not change the results (Column 3). The results are also robust if I instead run ordered probit regressions.[27] I found similar results and similarly significant robust coefficients. In the following, I will refer to the above results in Column 3 as baseline specification.

[27]Note, using the OLS model will result in violations of the assumptions of OLS. However, the practical effect of violating these assumptions is minor and the simplicity of interpreting an OLS outweighs the technical correctness of an ordered logit or probit model.

5.2 Distributional Regressions

In this section, I provide further evidence on the whole distribution of risk willingness as the significance and interpretability of means is limited. Accordingly, a growing literature uses distributional methods (Jones et al., 2015; Fortin et al., 2011; de Meijer et al., 2013). For the present analysis, I use a sequential approach, which is also applied by Decker and Schmitz (2016). Risk willingness is coded as $y \in \{0, 1, \ldots, J\}$ where J denotes the total number of distinct values. The outcome y can be expressed as a sequence of binary indicator models, where each indicator reflects a range of categories up to item j conditional on all items smaller than j. Thus, each of the J outcomes can be reached only step-by-step, starting with the lowest category. The cumulated probabilities of the discrete outcome are related to

$$Pr[y \neq j|x] = F(\alpha_j - x'\beta_j) \quad j = 0, \ldots, J \tag{2}$$

The parameters can be estimated by running j models where $y \neq j$ observations are included, respectively. This estimation is simplified since no further restrictions on the parameter space are required.[28] I present results from 10 distributional regressions. The corresponding Table 4 shows detailed values of cumulative distribution as well as the effect of a spouse's health shock on risk willingness for each category. The effect of a health shock is the relative difference between two categories as one has to subtract the probability mass of the lower category. A positive coefficient (in percentage points) implies that for the treatment group it is more likely to choose a lower category of risk willingness than for the control group.

I observe that a health shock significantly increases the probability of individuals reporting categories "1", "2", and "3" on the risk aversion scale. Additionally, the coefficient of category "4" is significant, but here the health shock effect decreases compared to category "3". Thus, for those reporting low risk willingness (up to the median risk of 5), the effect of health shock on risk willingness is mostly negative. The results suggest that health shocks are only of significant concern for those reporting relatively low risk willingness. The coefficient associated with category "7" turns out to be negative and is statistically significant. This implies that

[28] Note, for ordered categorical variables Greene (2014) and Boes and Winkelmann (2006) suggest ordered logit or ordered probit models. However, the scale of risk willingness is sufficiently large to loom simplicity of interpreting OLS results larger than exact explanation of binary models. A similar approach is done by Schneider et al. (2012) who use a generalized ordered probit model consisting of 4 binary models sequentially contrasting lower categories against remaining (higher) categories.

Table 4: Cumulative predicted probabilities

j		0	1	2	3	4	5	6	7	8	9
$P(y \leq j)$ in %	No hs_p	6.66	13.01	26.16	41.70	52.40	73.90	84.09	93.08	98.52	99.52
	Hs_p	8.02	15.11	29.91	46.57	56.25	76.06	84.30	91.31	97.89	99.22
Effect of spouse's health shock (in %)		1.36	2.10*	3.75***	4.87***	3.85**	2.16	0.21	-1.77**	-0.63	-0.30

Notes: The table presents the effect of one spouse's health shock (hs_p) on the partner's risk willingness for the entire distribution of risk willingness, whereas low values of risk indicate high risk aversion and high values indicate high risk willingness. The first two rows present the cumulative predicted probabilities based on 10 OLS regressions. Values are given percent scaled up by a factor of 100. The last row presents the health shock effect in percentage points. The same covariates and matching procedure as in specification 3 in Table 3 is applied. The results rely on 29,940 observations and 5,096 couples. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

the probability mass is lower for individuals with a spouse's health shock, implying that the control group is more willing to choose categories associated with excessive risk taking. Taken together, the results suggest the need for additional consideration of the distribution of risk willingness.

5.3 Individual Health Shocks

In addition, I examine the direct relationship of individual self-experienced health shocks and risk aversion when living in a couple. For the estimation, I use the same explanatory variables as for spillover health shocks in the baseline specification.[29] I find a health shock effect of -0.180 points on the scale of risk willingness which is significant at 1% level. This implies 8% of the standard deviation of risk willingness (2.23). These results are consistent with Decker and Schmitz (2016) who use grip strength losses as health shock. They find a slightly larger robust health shock effect of about 11% of a standard deviation of risk willingness in a linear specification. However, in their sensitivity analyses with specific health conditions as health shock measure they find a lower health shock effect.[30]

5.4 Differences among Male and Female

Prior literature provides evidence that males differ from females in risk perception (Croson and Gneezy, 2009; Outreville, 2014). However, regarding the reaction on the financial crisis

[29] Accordingly, I exclude individuals with a spouse's health shock.

[30] However, the comparison should be treated with caution as there are notable differences between both studies, e.g., Decker and Schmitz (2016) not only include both single and partnered individuals, but also use different control variables and kernel bandwidth. Moreover, the health shock measure does not distiguish between chronic and acute diseases.

in 2009, Browne et al. (2015) do not find large differences between men and women. With regard to mental health and unemployment of one spouse Marcus (2013) finds similar effects of spouses' mental health irrespective of the sex of affected spouse. The effect is more pronounced if the husband enters unemployment. Studies considering the effects of spousal health shocks on labor market outcomes find inconsistent effects for male and female reactions. For instance, Coile (2004) shows that wives decrease their labor market participation in reaction of a severe health shock of the husband, but finds no effect for husbands. In contrast, García-Gómez et al. (2013) find that wives are more likely to start working in case their husbands fall ill, while husbands are more likely to stop working when their wives fall ill. Hollenbeak et al. (2011) find this increasing effect for wives who were employed before their husbands' health shocks.[31]

I will investigate whether health shocks of spouses are perceived differently with regard to risk willingness. Although a spouse's health shock appears to have effects on the partner's risk aversion overall, there might be differences when separating between woman and men regarding the indirect suffering from a health shock. One channel could be that wives might be more empathetic to be affected by husbands' health shocks than husbands. Other channels could originate from husbands' larger labour force participation compared to wives for the age generation of the sample. Thus, I expect wives' risk aversion to increase more in response to husbands' health shocks. I estimate the health shock effect for male and female separately. Table 5 gives the corresponding estimated values.

Table 5: Results – male and female health shocks

	Health shock of male spouse	Health shock of female spouse
Health shock effect of spouse	-0.179**	-0.147
	(0.086)	(0.068)
# Observations	14,464	14,534
# Health shocks	530	368

Notes: The table presents the effect of a spouse's health shock separated by the sex of spouse. Column 1 displays the effect on female risk willingness when the husband suffers from a health shock. Column 2 shows the effect on male risk willingness when the wife suffers from a health shock. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors are given at individual level.

Comparing the results with the baseline specification, I find similar but weakly significant effects for women whose husband got ill. However, once I only look at how women's health shock

[31]In terms of retirement decisions, Van Houtven and Coe (2010) find that husbands are slightly more likely to retire in response to their wives' health shocks, but that wives' decision to retire is not affected by a health shock of the husband.

affects husbands' risk aversion, the effect size is similar, but becomes statistically insignificant. One reason could have been the smaller number of female health shocks. Nevertheless, applying distributional regressions reveals significantly more probability mass for lower values of risk willingness for both female and male spouses. Having in mind that females are on average more risk averse than males (3.9 vs. 4.9 points), however, the health shock effect is similar in relative terms.

5.5 Age of Spouses with Health Shock

The average age for individuals with spouse's health shocks is 63 with a median age of 65. Thus, half of the health shocks occur during retirement. In the following, I restrict the sample to individuals whose spouse is older than 64 and therefore in German statutory retirement age. This reduces the sample size to 7,662 observations. For this group I observe 505 health shocks of the spouse. Compared to the full sample, average risk willingness is reduced to 4.16 with a standard deviation of 2.28. The results of the estimation are presented in Table A5 in the appendix. For this age group the health shock effect is -0.229 points in terms of the scale of risk willingness. This implies an increase of risk aversion of about 10% of a standard deviation and is by about 3% greater than the health shock effect for the full sample. Diseases for this age group are often more serious and may imply greater changes in life of households or increase fear of the future. For individuals with a spouse younger than 65 estimates are small and insignificant, suggesting that the overall health shock effect is driven by older individuals. The results are similar if I subdevide the sample at age 65 of the indirect affected spouse. Hence, older individuals are not only more risk averse than younger ones, but also seem to loom health shocks of spouses larger. Younger individuals seem to better compensate effects of negative health shocks of spouses.[32]

5.6 Robustness of the Health Shock Specification

As described in Section 3, the health shock indicator is based on a selection of severe diseases. However, the boundary between severe and slightly ill cannot be drawn precisely and depend much on the kind of disease. Individuals with seriously ill partners are likely to take care of

[32] Note that income effects can be excluded as possible cause. In a robustness check, I regress the difference of actual and previous logarithmized income in t-1 and t-2 on the same explanatory variables as in the baseline model. I do not find any significant effects of health shocks.

more domestic tasks, and may be more responsible for their partners' health care. In this case, the spillover effect will be larger for seriously ill spouses. In the following, I control for the effect of chronical and mental diseases as asthma, high blood pressure, dementia, depression, and diabetes. They may occur slowly, be less severe and less permanent, or can become chronic. They may nevertheless influence expectations of the future, the daily life, and consequently, risk willingness of the spouse. For the analysis, I expand the present health shock indicator by consecutively adding each of the remaining diseases. With this approach, I take into account the low sample when considering each disease separately. The results are presented in Table 6.

Table 6: Extended health shock definition – Results

Additional disease	Asthma	Diabetes	Migraine	Dementia	High blood pressure	Depression
Health shock effect	-0.142**	-0.110*	-0.104*	-0.156**	-0.045	-0.105*
	(0.063)	(0.062)	(0.060)	(0.067)	(0.051)	(0.058)
# Observations	29,428	29,950	29,968	29,122	26,593	28,793
# Health shocks	1,066	1,096	1,150	914	1,617	1,215

Notes: The results are based on six OLS regressions. Each column displays the results, which rely in the baseline diseases (cancer, stroke, heart disease, and other diseases) and additionally on one of following diseases: asthma, diabetes, migraine, dementia, high blood pressure, or depression. The same conditioning variables and matching is applied. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors are in parentheses and clustered at household level.

It can be shown that the health shock effect decreases by adding most of the above mentioned diseases. For adding asthma, diabetes, depression, migraine, or dementia the overall effect still persists, but is even lower than that in the baseline specification. For high blood pressure the effect of spouse's health shock is smaller and becomes insignificant.[33] The results show a clear relationship between the severity of disease and effect on spousal risk willingness. Spousal risk willingness may be less affected when the disease carries a greater likelihood of survival.

In a further sensitivity analysis, I consider a health shock specification without the time adjustment based on self-assessed health. Due to the two-year interval between questions regarding diseases, this implies that health shocks are observed in w (the corresponding survey years are 2011 and 2013) but actually may have occurred in $w-1$ (2010 and 2012). Therefore, I run two control estimations for both w and $w-1$ separately. The results are

[33]The lower number of observations, especially for the health shock specification with additional high blood pressure originates from excluding own health shocks from the sample.

given in the appendix (Table A6).[34] Compared to the baseline specification with self-assessed health, the health shock effect increases by about 1% on 8% of a standard deviation of risk willingness (2.21) if the health shock is assigned to $w-1$. For w, the effect is to somewhat smaller and not significant, suggesting that the spillover health shock effect is less permanent. Thus, the precise specification seems to be more appropriate for analyzing short term health shock effects.

So far, I excluded the case of experiencing own health shocks from the sample. With this approach I also disregard the case that health shocks might occur simultaneously for both spouses. If I include those observations in the sample – which means additional 2404 observations and 105 health shocks – the health shock effect decreases by about 1% of the standard deviation of risk willingness. The reason for this may be that an occurring additional own health shock is likely to influence own risk willingness to a larger extent than a spouse's one. However, controlling for own health shocks in the estimation would have caused endogeneity problems, because a spouse's health shock and own health shock might be correlated. In addition, an increase of risk aversion due to a spouse's health shock might affect the probability of becoming ill.

6 Conclusion

In this paper I analyze individual responses to a health shock of the spouse with regard to own risk attitude. Using data from the German Socio Economic Panel from 2008 to 2013, this paper finds evidence that individuals significantly choose lower values of risk on the scale of 0 to 10 in response to the health shock of the spouse. Moreover, I find that a spouse's health shock reduces the partner's risk willingness by about 7% of a standard deviation. Indeed, this effect is somewhat smaller compared to a self-experienced health shock, but not negligible. Especially for individuals older than 65 the effect seems to be more pronounced (10% of a standard deviation). In general, the decrease in wife's risk willingness is larger when the husband gets ill. In contrast, the risk willingness of husbands is not affected by a severe disease of the wife. I also find that the health shock effect depends on the severity of disease.

[34] Taking into account that a health shock in w may have occurred in $w-1$, I also run regressions with covariates referring to $t-2$ instead of $t-1$. This does not lead to different results.

While cancer, stroke and heart diseases drives the higher effects on risk behavior, the impact of chronical and mental diseases is lower.

However, although the data allows observing different kinds of diseases, these diseases are treated with the same weight as the data does not allow for distinguishing between severities of each disease causing the health shock. For example, different cancer diagnoses imply different survival probabilities, e.g., lung cancer (low survival probability) or prostate cancer (high survival probability), and therefore may cause different reactions in risk willingness. Overall, my results provide important evidence on intra-household change of risk willingness in response to a spouse's severe health shock.

Importantly, the findings are robust to a number of sampling restrictions and model specifications. In order to obtain estimates with a causal interpretation, this study depends on a measure capturing an unintended disease of a spouse. It uses a large number of household, individual, and spouse variables to account for both unobserved and observed heterogeneity. Moreover, to balance the conditioning variables a regression adjusted matching method is applied.

The findings of this paper add to the literature on adjustment of risk attitudes. It has also impact on economic modelling of household decisions, where risk is a relevant factor. The results have also implications for cost-effectiveness analyses when accounting for uncertainty. For instance, in the approach of Garber and Phelps (1997) optimal cost effectiveness ratios depend on individual risk aversion. The knowledge of health shock effects on risk can also be used to evaluate welfare effects caused by changes in health insurance or life insurance. In that sense, the findings of this paper have consequences for the allocation of medical care resources and for social panning of medical investments. Optimal policy is bound to depend on the nature of household interactions. It seems essential to target both partners in order to think about health shock effects. However, the analysis only focuses on responses of spouses. Future research may analyze health shock effects of other family members, as children or parents. Nevertheless, the results provide an empirical first step on the potential role of health shocks in the family context.

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Appendix

Descriptive statistics

Table A1: Detailed list of diseases included in "other diseases"

Disease	# Obs.
Amputation of leg	2
Borreliosis	3
Brain bleeding	3
Embolism	2
Loss of eyesight	2
Multiple sclerosis	8
Parkinson disease	4
Shingles	2
Thrombose	4

Note: These diseases are obtained from the free text field in the questionnaire.

Table A2: Health status over time

	Spouse with health shock				Spouse without health shock			
	Physical health	Mental health	Health status	Obs.	Physical health	Mental health	Health status	Obs.
$\triangle(t-2,t-1)$	0.183	-0.188	0.681	899	-0.198	-0.100	0.086	899
$\triangle(t-1,t)$	-2.167	-1.163	-0.214	899	-0.704	-1.339	0.002	899
$\triangle(t,t+1)$	-0.902	-0.375	-0.274	755	-0.158	-0.255	0.024	741

Notes: Average differences of health status for both spouses over time. The health shock refers to t. Physical and mental health score is based on the SF-12 questionnaire and range from 0 to 100, with higher scores indicating better health. Health status ranges from 1 to 5, with 5 indicating better health in this table. Negative values indicate a deterioration of health.

Results

Table A3: Full results – health shocks of spouses

	(1)	(2)	(3)
Health shock of spouse	-0.445***	-0.162**	-0.156**
	(0.0789)	(0.0681)	(0.0669)
Year 2011	0.233***	0.242***	0.311***
	(0.0251)	(0.0249)	(0.0882)
Year 2012	0.467***	0.528***	0.606***
	(0.0289)	(0.0341)	(0.0834)
Year 2013	0.154***	0.104***	0.225**
	(0.0314)	(0.0328)	(0.103)
Female		-0.469***	-0.432***
		(0.0337)	(0.0978)
Migrant		0.00828	0.102
		(0.0401)	(0.113)
Migrant_p		-0.100**	-0.0632
		(0.0394)	(0.108)
West		0.135***	0.0867
		(0.0352)	(0.0866)
Children		-0.00783	0.00890
		(0.0164)	(0.0725)
Length of partnership		-0.000633	0.00947*
		(0.00199)	(0.00516)
Age		-0.0101	-0.0211
		(0.0116)	(0.0399)
Age_p		0.000593	0.0403
		(0.0113)	(0.0378)
Age squared		0.0000294	0.000177
		(0.000107)	(0.000338)
Age squared_p		-0.000000458	-0.000375
		(0.000104)	(0.000307)
Risk willingness (t-2)		0.476***	0.459***
		(0.00745)	(0.0175)
Risk willingness_p (t-2)		0.0232***	0.0525***
		(0.00711)	(0.0165)
HH_Income		0.147***	0.0753
		(0.0359)	(0.0808)
Unemployed (t-1)		-0.0481	0.00902
		(0.0521)	(0.148)
Unemployed_p (t-1)		0.0336	-0.0535
		(0.0514)	(0.159)
Full time (t-1)		-0.0252	0.0642
		(0.0485)	(0.154)
Full time_p (t-1)		-0.0710	-0.0224
		(0.0495)	(0.160)
Part time (t-1)		-0.0223	-0.00379
		(0.0509)	(0.173)
Part time_p (t-1)		0.0331	-0.0388
		(0.0528)	(0.191)
Retired (t-1)		-0.0786	0.0420
		(0.0653)	(0.157)
Retired_p (t-1)		0.00628	-0.0711
		(0.0653)	(0.170)
Academic school track		0.0250	0.213*
		(0.0403)	(0.110)

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Table A3: (Continued)

	(1)	(2)	(3)
Academic school track_p		-0.0177	0.0700
		(0.0407)	(0.104)
Intermediate school		0.0451	0.112
		(0.0335)	(0.0831)
Intermediate school_p		0.0147	0.0116
		(0.0333)	(0.0842)
BMI (t-1)		0.00646**	0.0287***
		(0.00322)	(0.00854)
BMI_p (t-1)		-0.00716**	-0.0114
		(0.00323)	(0.00804)
Mental health (t-1)		0.00929***	0.0107**
		(0.00143)	(0.00417)
Mental health_p (t-1)		-0.00221	-0.000122
		(0.00139)	(0.00394)
Physical health (t-1)		0.00571***	0.00864**
		(0.00160)	(0.00413)
Physical health_p (t-1)		0.00124	0.000128
		(0.00158)	(0.00407)
Heart disease (pre-treatment)		-0.0464	-0.206*
		(0.0512)	(0.109)
Heart disease_p (pre-treatment)		0.0446	-0.102
		(0.0514)	(0.131)
Stroke (pre-treatment)		-0.00228	-0.269
		(0.124)	(0.205)
Stroke_p (pre-treatment)		-0.235**	-0.187
		(0.114)	(0.190)
Cancer (pre-treatment)		0.0968	-0.0439
		(0.0668)	(0.146)
Cancer_p (pre-treatment)		-0.0572	-0.336*
		(0.0692)	(0.172)
Blood pressure (pre-treatment)		-0.00359	0.128
		(0.0331)	(0.0830)
Blood pressure_p (pre-treatment)		0.0457	-0.00130
		(0.0325)	(0.0809)
Migraine (pre-treatment)		0.0120	0.0256
		(0.0547)	(0.180)
Migraine_p (pre-treatment)		0.0755	-0.231
		(0.0532)	(0.146)
Diabetes (pre-treatment)		0.0366	0.153
		(0.0548)	(0.117)
Diabetes_p (pre-treatment)		-0.0405	-0.0282
		(0.0521)	(0.112)
Asthma (pre-treatment)		-0.0269	-0.0116
		(0.0616)	(0.172)
Asthma_p (pre-treatment)		0.0424	-0.196
		(0.0596)	(0.141)
Depression (pre-treatment)		-0.101	-0.0833
		(0.0618)	(0.146)
Depression_p (pre-treatment)		-0.0378	-0.0723
		(0.0634)	(0.162)
Other disease (pre-treatment)		-0.0600	-0.222
		(0.146)	(0.201)
Other disease_p (pre-treatment)		0.139	0.336
		(0.140)	(0.226)

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Table A3: (Continued)

	(1)	(2)	(3)
Smoking (t-1)		0.131***	0.207**
		(0.0327)	(0.0898)
Smoking_p (t-1)		0.0320	0.0987
		(0.0324)	(0.0876)
Alcohol (t-1)		0.0283	0.146
		(0.0321)	(0.0997)
Alcohol_p (t-1)		0.0224	-0.0621
		(0.0325)	(0.0856)
_cons	4.216***	0.246	-0.877
	(0.0260)	(0.446)	(1.176)
N	30,238	30,238	29,940

The table presents the effect of a spouse's health shock on the other partners risk willingness, whereas low values of risk indicate high risk aversion and high values indicate high risk willingness. The first row displays the health shock effect. The first column refers to a simple OLS regression with time dummies, and the second column includes all conditioning variables without matching. Column 3 presents the results for the matching estimator with all covariates. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors are at household level.

Table A4: Robustness of results – pre-treatment risk willingness in $t-1$

Risk willingness	(1)	(2)	(3)
Health shock of spouse	-0.464***	-0.133**	-0.134**
	(0.079)	(0.067)	(0.066)
Survey year	Yes	Yes	Yes
Individual + household controls	No	Yes	Yes
Matching	No	No	Yes
# Observations	30,541	30,541	30,316

Notes: The table presents the effect of a spouse's health shock on the partner's risk willingness, whereas low values of risk indicate high risk aversion and high values indicate high risk willingness. Same covariates as in the baseline specification are used. Only exception: Pre-treatment risk willingness refers to $t-1$. The first row displays the health shock effect. The first column refers to a simple OLS regression with time dummies, and the second column includes all conditioning variables without matching. Column 3 presents the results for the matching estimator with all covariates. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors are at household level.

Table A5: Results separated by age

	Age < 65	Age ≥ 65
Health shock effect of spouse	-0.058	-0.229**
	(0.094)	(0.092)
# Observations	21,793	7,662
# Health shocks	393	505

Notes: I consider a sample separated by the age of spouse with the first column presenting age < 65 and the second column presenting age ≥ 65. Conditional variables equal conditional variables of the baseline specification, except from the retirement status of the spouse in age ≥ 65. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors are at household level.

Table A6: Results – health shock specification without self-assessed health status

	Health shock of spouse in w	Health shock of spouse in $w-1$
Health shock effect	-0.065	-0.175**
	(0.069)	(0.068)
# Observations	14,981	15,225
# Health shocks	872	891

Notes: I consider a health shock specification without the time adjustment based on self-assessed health. This implies that health shocks are observed only in w (the corresponding survey years are 2011 and 2013) but actually may have occurred in $w-1$ (2010 and 2012). For this, I run two control estimations for both w and $w-1$ separately. Conditional variables equal conditional variables of the baseline specification. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors are at household level.