

BROKE, ILL, AND OBESE: IS THERE AN EFFECT OF HOUSEHOLD DEBT ON HEALTH?

BY MATTHIAS KEESE

Ruhr Graduate School in Economics and University Duisburg–Essen

AND

HENDRIK SCHMITZ*

University Duisburg–Essen and RWI

We analyze the association between household indebtedness and different health outcomes using data from the German Socio-Economic Panel from 1999 to 2009. We control for unobserved heterogeneity by applying fixed-effects methods and furthermore use a subsample of constantly employed individuals plus lagged debt variables to reduce problems of reverse causality. We apply different measures of household indebtedness, such as the percentage shares of household income spent on consumer credit and home loan repayments (which indicate the severity of household indebtedness) and a binary variable of relative overindebtedness (which indicates a precarious debt situation). We find all debt measures to be strongly correlated with health satisfaction, mental health, and obesity. This relationship vanishes for obesity after controlling for unobserved heterogeneity while it stays significant with respect to worse physical and mental health.

JEL Codes: D12, D14, I12

Keywords: debt, fixed-effects, health satisfaction, mental health, obesity

1. INTRODUCTION

Household indebtedness has notably risen in the last years. In 1993, the volume of outstanding loans of banks to private households in Germany amounted to about 390 billion euros. In 1995 it exceeded 600 billion for the first time, and since 2005 it has always been more than 1,000 billion euros with about 80 percent falling upon home loans.¹ From 1998 to 2008, average consumer debt has risen from 1,300 to 1,700 euros per household. At the same time, the average mortgage debt has increased from 18,600 to 24,500 euros per household (Federal Statistical Office, 2008).

Without question, the possibility to take out a loan and to incur debt is usually welfare enhancing for the household since it enables consumption smooth-

Note: Financial support by the RGS Econ and the Leibniz Association is gratefully acknowledged. We thank two anonymous referees for very helpful suggestions to improve the paper. We are grateful for comments during presentations at the DGGOE Conference (Berlin), SMYE (Luxembourg), ESPE (Essen), IRDES Workshop (Paris), SOEP User Conference (Berlin), Health.Happiness.Inequality (Darmstadt) and the RGS Workshop (Duisburg-Essen).

*Correspondence to Hendrik Schmitz, University Duisburg–Essen, Fachbereich Wirtschaftswissenschaften, Schützenbahn 70, 45117 Essen, Germany (hendrik.schmitz@uni-due.de).

¹The loan figures are taken from time series data provided by the Deutsche Bundesbank (<http://www.bundesbank.de>).

ing over time. However, it may also be harmful if individuals involuntarily run into financial distress or overindebtedness. This may be the case if individuals underestimate the financial burden of repaying debt in the future or if unexpected shocks like job loss or disability cause repayment arrears. Indeed, overindebtedness of private households has become a widespread phenomenon. In Germany, for instance, 2.8 million households (7.1 percent of all households) were overindebted in 2007 (Zimmermann, 2008). Indeed, the upgrowth of private indebtedness has slowed down since its peak in 2006 but the recent credit crunch and the successive economic crisis might increase the number of households facing severe debt-related financial difficulties.

Apart from other problems that come along with debt-related financial problems (e.g., the intertemporal misallocation of financial resources and private insolvency), debt might affect the health status for several reasons. First, it may provoke stress and foster mental distress, especially if households are confronted with high repayments. This permanent distress may cause psychosomatic conditions and, consequently, may worsen the physical health status as well. Second, high repayment burdens tighten the financial situation. Thus, individuals may save on costly medical care utilization and health protection such as, for example, healthy food, that is often seen to be more expensive than junk food.

Analyzing the effect of household debt on health is important for several reasons. If debt has adverse health effects, this will require a stronger effort of policy makers to prevent households from entering a precarious debt situation. This will be particularly important if people run into a poverty trap, i.e., if deteriorated health (due to indebtedness) induces job loss which results in even higher relative debt burdens. Moreover, only the precise knowledge of which health aspect is affected by debt problems allows one to react in an appropriate manner—i.e., adverse effects on mental health call for different solutions than obesity caused by debt burdens. While one solution to the first problem would be to strengthen debt counseling and to improve financial literacy, especially debt literacy (Lusardi and Tufano, 2009), some authors suggest increasing the availability of healthy food by low-pricing campaigns to react to obesity caused by debt problems (Münster *et al.*, 2009).

Another reason to analyze the effects of debt on health is to learn more about the socioeconomic gradient in health. The existing literature consistently finds that, around the world, poorer households are in worse health (e.g., Goldman, 2001) but it is difficult to find a causal effect of income on health. Debt-related financial distress (usually correlated with low income) could be a pathway to deteriorated health and, therefore, could add to the explanation of the income gradient in health.

There is support in the literature for a correlation between debt burdens and bad physical and mental health (see, e.g., Marmot *et al.*, 1997b; Kempson, 2002; Brown *et al.*, 2005; Duygan-Bump and Grant, 2009). However, up to now, it is not entirely clear if debt problems are also causal for health problems. In our analysis, we use data from the German Socio-Economic Panel (SOEP) for the years 1999–2009 and go beyond most of the existing literature that provides a descriptive picture of the relationship between debt and health. The complex association between indebtedness and health induces several econometric challenges. Most

importantly, unobservable factors may coincide with financial problems and bad health. To rule out omitted variable bias due to unobserved heterogeneity, we exploit the panel-nature of our data and use fixed-effects methods.

Another potential problem arises from reverse causality. Since the German health insurance system covers basically all medical expenses we can exclude a direct effect of health on debt due to high medical bills. However, individuals may become unemployed or be forced to leave the labor market due to an adverse health shock and, consequently, get into trouble repaying their debt. In one specification we deal with this indirect effect of health on debt problems by looking at a subsample of constantly employed individuals, thus excluding individuals that might have stopped working due to bad health. Moreover, we control for changes in household composition that are due to divorce, separation, or death of the partner. These events might have their own effects on health and the financial situation. In a final specification, we rely on lagged debt variables to ensure that starting the debt repayment was prior to the observed health outcome so that the effect we seek to identify does indeed go from debt to health and not vice versa.

Our dependent variables are three different health measures: overall health satisfaction, mental health, and being obese. Our main explanatory variables are three different measures of household indebtedness: consumer debt and housing loan repayments as a share of household income, as well as a binary variable indicating overindebtedness. We find a negative correlation between household debt and health. On average, indebted individuals report being less satisfied with their health status, have worse mental health, and are more likely to be obese. Taking unobserved heterogeneity into account, we find that household debt does indeed worsen health satisfaction and mental health. In contrast, the likelihood of being obese is not significantly affected by debt. Our results largely hold for all three debt measures. Thereby, repayments for home loans and for consumer debt exhibit broadly similar effects on health. The results are also robust to the two specifications (a different subsample and lagged variables) that are less vulnerable to reverse causality problems.

The paper proceeds as follows: in Section 2, we provide an overview of the empirical literature on debt and health. Section 3 presents the data and econometric methods. Estimation results are reported in Section 4. Section 5 presents some robustness checks while Section 6 concludes.

2. LITERATURE REVIEW

There is a vast literature on the relation between health and socio-economic status (SES), virtually always finding an income gradient in health, both within and between countries; see studies by Marmot *et al.* (1991, 1995, 1997a) and Wilkinson (1998), and surveys of Goldman (2001) and Wilkinson and Pickett (2006) as examples. However, evidence on the causal effect of income on health is mixed (see, e.g., Smith, 1999; Adams *et al.*, 2003; Frijters *et al.*, 2005; Lindahl, 2005).

As an indirect effect of a life event that frequently coincides with a precarious financial situation, one strand of the literature analyzes the effects of unemployment on health. Because authors usually control for the income drop due to job loss, the effect of unemployment on health also captures non-monetary impacts,

especially in countries with fairly generous unemployment insurance systems such as Germany. Job loss can be seen as a pathway for the socio-economic gradient if income per se is not causal for bad health while life events such as unemployment (usually correlated with low income) are. The evidence on the effect of unemployment on health, however, is mixed (for recent studies, see, e.g., Browning *et al.*, 2006; Eliason and Storrie, 2009; Kuhn *et al.*, 2009; Salm, 2009; Sullivan and von Wachter, 2009; Schmitz, 2011).

Only a few contributions deal explicitly with issues concerning household indebtedness and health. Moreover, the causal relation between health and debt still remains unclear. Brown *et al.* (2005) estimate an ordered probit model with a GHQ12 score as the dependent variable that captures the answers to different questions on psychological well-being. They show that psychological distress is higher among household heads with a higher amount of outstanding non-mortgage debt using the British Household Panel Survey. In contrast, they find no significant effects for mortgage debt. However, they do not estimate a panel model and “cannot firmly establish that [their] parameter estimates are the causal effects” (p. 657).

Using data from the British Families’ and Children’ Survey (FACS), Lenton and Mosley (2008) find an impact of being indebted on both physical and mental health. With the same dataset, Bridges and Disney (2010) find a link between perceived debt problems and self-assessed depression of mothers. Both studies account for the possible interaction between debt and health by estimating simultaneous-equation models that require strong exclusion restrictions. For instance, Bridges and Disney (2010) assume that debt directly affects the mental health status but not vice versa. Thus, they explicitly rule out reverse causality problems. Duygan-Bump and Grant (2009) use the European Community Household Panel. Their analysis of different European countries yields the finding that arrears are often followed by adverse health shocks. Drentea (2000) as well as Drentea and Lavrakas (2000) find associations between credit card debt and health problems, namely anxiety (the former study) as well as different subjective and objective health measures (the latter one). However, both studies are only cross-sectional and use representative but rather small samples of adults in the U.S. state of Ohio. Webley and Nyhus (2001) focus on the economic and psychological determinants of consumer debt. Their results from dynamic analyses of Dutch panel data indicate an association between debt in previous periods and psychological outcomes in later periods.

3. DATA AND EMPIRICAL STRATEGY

We use data from the German Socio-Economic Panel (SOEP) for the years 1999 to 2009.² This dataset started in 1984 and surveyed more than 20,000 persons in about 11,000 households in the 2008 wave (Wagner *et al.*, 2007). The question-

²The data used in this paper were extracted using the Add-On package PanelWhiz v3.0 (July 2008) for Stata. PanelWhiz was written by Dr. John P. Haisken-DeNew (john@panelwhiz.eu). The PanelWhiz generated DO-file to retrieve the SOEP data used here and any Panelwhiz Plugins are available upon request. Any data or computational errors in this paper are our own. Haisken-DeNew and Hahn (2006) describe PanelWhiz in detail.

naire surveys both the individual and the household level. For instance, health-related variables are captured on an individual base, while we obtain information on debt in the household questionnaire only. The respective household characteristics (such as debt repayments, net household income, and household composition) are assigned to each member of the household.

We base our analysis on adult individuals below the age of 65 since the elderly usually do not take out loans in the same magnitude as do working-age individuals. At the same time, they naturally face more health problems. In the regression analysis it is difficult to control for these non-linear effects, i.e., for the spurious positive correlation between debt and health. Therefore, our analysis focuses on the active population.

We apply three different measures of relative indebtedness. They do not reflect debt stocks, but debt repayments. We argue that the impact of a debt burden on personal stress is reflected by the relative burden it puts on the household budget. Specifically, we argue that the share of household income dedicated to debt repayments constitutes an adequate measure of a household's debt intensity. Consequently, the first debt measure we apply is the ratio of consumer credit repayments and household net income. The higher this measure, the higher is the relative debt burden the household faces.³ The second measure is the ratio of home loan repayments and household income. We include both ratios in one regression to check whether different debt types (secured housing debt vs. presumably unsecured consumer debt) exhibit different effects on health.

However, while small relative debt burdens may not come along with high stress levels, a precarious financial situation may have a strong impact on personal well-being. Thus, a third debt measure is a binary variable indicating whether a household is overindebted (Zimmermann, 2007). A household will be considered overindebted if its net income after debt repayments (for home loans and consumer credit) falls below the social assistance level (and if the household is indeed indebted). Thereby, the potential social assistance a household would obtain constitutes the socially accepted subsistence level. Since the social assistance level takes household size and composition into account, it also serves as an equalizing factor to improve the comparability of debt burdens and income between different household types. Social legislation changed several times in the last years. To ensure comparability over the entire observation period, we calculate the potential social assistance level for 2009 and deflate the computed amounts to earlier periods.

After excluding observations with unreasonably high debt ratios (more than 0.7), we use information from 32,132 individuals with 176,468 observations in person-year form. Table 1 illustrates the development of household debt in our sample over time. The average ratio of debt repayments for consumer credit and income ranges between 2 and 4 percent. For home loans, the mean ratio amounts to 5.5–6.5 percent. However, conditional on having a certain debt type, the mean values are notably higher: up to 13.3 (consumer debt) and 20.4 percent (housing debt), respectively. Between 22 and 29 percent of the sample live in households

³The exact question is: "Aside from debts on loans for home and property ownership, are you currently paying back loans and interest on loans that you took out to make large purchases or other expenditures? How high is the monthly rate that you pay on these loans?" This implies a typical month of debt repayment and no extraordinary repayment.

TABLE 1
DESCRIPTIVE STATISTICS: INDEBTEDNESS TREND OVER TIME

	1999	2001	2003	2005	2007	2009
Consumer debt/income (all HH)	3.9	3.7	3.7	2.5	2.4	2.5
Housing debt/income (all HH)	5.5	5.8	6.5	6.6	6.5	6.1
Consumer debt/income (HH with consumer debt)	13.3	12.6	12.8	11.2	10.5	10.6
Housing debt/income (HH with home loans)	20.0	19.8	19.9	20.4	20.0	19.4
HH has consumer debt	29.1	29.2	29.1	22.3	22.8	23.6
HH has housing debt	27.8	29.7	32.9	32.6	32.8	31.7
Overindebted HH	7.6	6.2	5.6	5.5	5.1	4.3
Observations	11,533	17,570	17,406	15,975	15,112	14,536

Notes: All figures are in percent. Consumer debt/income: ratio of debt repayments (consumer credit) and household net income. Housing debt/income: ratio of debt repayments (home loans) and household net income. HH with a debt ratio larger than 0.7 excluded.

Source: SOEP, 1999–2009. Own calculations.

with consumer loan repayments, up to 33 percent in households with home loans. The time trends of the two debt types show a somewhat different evolution. Consumer indebtedness peaked around the turn of the millennium. As for housing debt, the figures are relatively stable since the peak around 2003. The share of individuals living in overindebted households has decreased over the observation period. Nevertheless, about 4–5 percent of the sample lives in an overindebted household. However, these sample descriptions are possibly influenced by different factors. First, there was a major SOEP refreshment in the 2000 wave. Since then, we observe a slightly aging panel. Second, we focus on debt repayments. The evolution of debt stocks may have exhibited a different path.

The debt measures are only available at the household level. Moreover, the SOEP does not ask for the liability of the debt. Thus, we cannot identify the debtor within the household. Therefore, we attain the same debt measures to all adults in a household. We argue that this procedure is justified because a household's debt repayment is perceptible to all household members (e.g., due to consumption reductions of all members). At the same time, all household members may derive utility from the durable and non-durable goods financed by loans. Moreover, cohabiting couples are likely to conclude their loan agreements jointly. Therefore, if debt burdens have an impact on health, these effects should be detectable for all household members.

As regards the health status, we employ three different measures: (1) the satisfaction with health, a self-stated measure on an 11-point scale, ranging from 0 (totally happy) to 10 (totally unhappy); (2) a mental health score between 0 and 100 (with higher values implying a worse mental health), which is calculated using explorative factor analysis based on answers to the SF12v2 questionnaire in the SOEP and explained in detail in the Appendix; and (3) a binary indicator for obesity, defined as a body mass index of more than 30. Health satisfaction is widely used in the literature to proxy the health status, for example by Frijters *et al.* (2005), Jones and Schurer (2011), or Schmitz (2011). It is subjective but it might be

TABLE 2
SAMPLE MEANS OF HEALTH MEASURES

	Full Sample	HH with Consumer Debt	HH with Home Loans	Overin-debted HH	Observations Full Sample
Health satisfaction	3.1	3.2	3.0	3.3	176,468
MCS	50.1	51.1	50.0	52.2	63,849
Obesity in %	14.3	16.4	13.4	17.8	65,350

Notes: MCS = Mental health score. Higher values = worse health.

Source: SOEP, 1999–2009. Own calculations.

the preferred measure when we think of health in terms of the utility derived from it. While health satisfaction is asked in each year, the mental health score and the body mass index are only available biennially between 2002 and 2008. Therefore, the number of observations is smaller in these regressions using the latter two measures.

Table 2 reports means of the three health measures. According to all health measures, those who have to repay consumer debt and those who live in overindebted households are in worse health. This holds in particular for overindebted households. In contrast, households with home loans are even in better health compared to the entire sample. The average health satisfaction is slightly better (3.0 vs. 3.1, respectively), the mental health scores are similar (50.0 and 50.1, respectively), and the probability of being obese is smaller (13.4 and 14.3 percent, respectively). This reflects the fact that those who are in better health and in a better financial situation are also more likely to actually get a home loan.

Obviously, Table 2 does not tell anything about a causal effect of debt on health. Several reasons may lead to the correlation. In particular, observable and unobservable third factors might affect both bad health and debt. To account for this we run the following regression model:

$$\text{health}_{it} = \beta \text{debt}_{ht} + \gamma X_{it} + v_i + \varepsilon_{it}$$

where health_{it} is one of the three health measures of individual i at time t , and debt_{ht} includes either the repayment ratios of consumer and housing debt or the indicator of overindebtedness of household h . Socio-economic covariates (discussed below) and a constant are captured by the vector X_{it} . The error term is composed of a time-invariant part v_i and a time-varying part ε_{it} . Debt is measured at the household level, so we cluster standard errors on household level (over all waves). This is a valid approach since we have very many groups of households with typically only a couple of members in each of them (e.g., Donald and Lang, 2007). As a baseline specification we estimate the parameter vectors β and γ by OLS. As a robustness check we included the lagged dependent variable as a regressor to allow for a dynamic specification and the discrimination between short- and long-term effects of debt on health. These kinds of models make high demands on the data, however, and we discuss at more length in Section 5 why we prefer the simpler static approach.

Unobservable factors could be, for instance, time preferences or risk aversion. Risk loving individuals might have a higher propensity to take out a loan. At the

same time, they might care less for preventive health behavior (like medical check-ups or non-smoking). Although we are able to include a rich set of covariates and, thus, control for a great deal of observable heterogeneity between financially sound and indebted households, these unobserved factors are likely to lead to biased estimates of the effect of debt on health. One solution to this endogeneity problem could be an instrumental variable approach. However, in practice, it is very hard to find convincing (that is, strong and valid) instruments. Here, we exploit the fact that we have a panel. In addition to OLS, we control for the unobserved heterogeneity by using fixed-effects estimation methods. Thereby, we assume that the unobserved effects like risk aversion or time preferences are time-constant and can be captured by v_i . We argue that the assumption of these personality traits being invariant over a short period of time is much less restrictive than the (also) non-testable assumptions of valid instruments.⁴

A second potential reason for the observed correlation is that bad health might cause debt problems. If this is the case, the fixed-effects estimates will turn out to be biased and we overestimate possible negative health effects of debt. Reverse causality could result from several sources. Bad health increases the demand for health services. In principle, this could cause high bills for hospital treatments or expensive drugs with the need to take out a loan to pay for them. Yet, this is not a problem at all in Germany, where basically every individual has comprehensive health insurance coverage that pays for all treatments and drugs, except for fairly small copayments. However, bad health reduces the productivity, hence the ability to generate income. For instance, Arrow (1996) and Riphahn (1999) show that bad health increases the risk of job loss. Unemployment, in turn, is often seen as a trigger of overindebtedness. Indeed, Keese (2009) finds that unemployment increases the risk of overindebtedness in Germany. To take this potential problem into account we use, in one specification, a subsample of individuals who have been working constantly between 1999 and 2009. That is, we disregard all individuals who were unemployed or out of the labor force at least once in the observation period and might subsequently have problems to repay debt. By doing this, we exclude all those who possibly lost their job or left the labor market due to health problems. Consequently, the results in this specification are only representative for the constantly working population. If the unemployed suffer more from debt repayment—conditional on their income, of course—we might underestimate average health effects. The same would hold if health effects of debt are stronger for already impaired persons which are potentially excluded from the sample of the constantly employed. The estimation results in Section 4 suggest that the estimated coefficients do not vary much between both specifications (full sample vs. constantly employed), making us confident that possible selection issues coming along with this sample selection are empirically not too important.

Table 3 compares the subsamples of individuals who never changed their employment status between 1999 and 2009 and of individuals who did so at least

⁴Clearly, the ideal way to determine a causal effect would be truly exogenous variation in debt repayment. This requires good social or natural experiments which are typically not available in this context. However, Karlan and Zinman (2009) provide an example of a randomized experiment on debt.

TABLE 3
DESCRIPTIVE STATISTICS FOR SUBGROUPS

	Always Employed	Not Always Employed
Consumer debt/income (all HH) in %	3.5	3.0
Housing debt/income (all HH) in %	7.4	5.3
HH has consumer debt in %	28.9	24.4
HH has housing debt in %	36.8	26.8
Consumer debt/income (HH with consumer debt) in %	12.0	12.2
Housing debt/income (HH with home loans) in %	20.2	19.7
Overindebted HH in %	4.0	6.7
Health satisfaction	2.9	3.3
MCS	49.5	50.7
Obese in %	13.7	14.7
Observations	78,000	98,468

Notes: MCS = Mental health score. Higher values = worse health.
Source: SOEP, 1999–2009.

once. Average health satisfaction is worse in the latter group (score of 2.9 vs. 3.3). These people also have a worse mental health score and they are more likely to be obese. Thus, the working group is healthier. The group of constantly working individuals also has, on average, higher debt repayments (consumer debt: 3.5 vs. 3.0 percent; home loans: 7.4 vs. 5.3 percent). This is due to a higher likelihood of being indebted and points to the fact that these people are more likely to actually get a loan when they demand one. Likewise, this could reflect a higher willingness to take risks (and, thus, a credit) when people have a job. Conditional on having debt repayments, the shares of debt repayments to income are very similar in both groups. Overindebtedness, however, is much less common among those constantly participating in the labor market.

We include a wide range of control variables in our regressions, such as age, the presence of children in the household, education, employment status, and health insurance status (public or private health insurance), and we distinguish between West and East Germany. In addition, we include the net equivalent household income and an indicator of being homeowner to control for effects of income and wealth on health. Apparently, income and wealth are also correlated with being indebted. We control for these two factors in order to prevent omitted variable bias and to separate a possible effect of debt on health from other influencing factors related to the income and wealth position of the household. Importantly, we control for the marital status. The death of the partner, separation, or divorce are likely to have an impact on the health status. In addition, loss of the breadwinner, household split-up, or funeral costs may increase debt burdens. We therefore include dummy variables for being widowed or divorced in the regression to rule out that these life events affect our results. Sample means of all covariates are reported in Table A2 in the Appendix.

Using the subsample of constantly employed individuals rules out the possibility that ill individuals lose their job and run into financial trouble afterwards. However, it does not account for the potential problem that individuals have phases of melancholy or depression in which they temporarily lose control of their

financial affairs (e.g., self-medication by increased shopping financed with consumer loans). Although it is debatable if the share of affected individuals is large enough to bias the results, we use, as a final specification, lagged debt variables, again with the entire sample. Together with the fixed-effects specification this ensures that changes in debt predate changes in health. We are aware that this does not fully solve problems of reverse causality if lagged health affects lagged debt and both variables are autocorrelated. Nevertheless, both specifications (the subsample and the lagged debt specification) should be seen as robustness checks to support the theoretical discussion above that the main direction of causality goes from debt to health. Likewise, we bear in mind that the interpretation of the thus estimated parameters differs somewhat from the original ones (it can be interpreted as a medium-term effect of past debt on health).

4. ESTIMATION RESULTS

Tables 4 and 5 report the estimation output. The results of the benchmark OLS regressions of all health measures on the two debt ratios and the overindebtedness indicator, respectively, are displayed in column (1) in the tables. For the sake of brevity we only report the coefficients of the debt variables. Full estimation results are presented in Tables A2 to A7 in the Appendix.

The OLS regressions show that even after controlling for a large set of covariates, indebted individuals are in worse health, according to all debt and health measures. As displayed in column (1) in Table 4, an increase in the debt-repayment-to-income ratio (consumer credit) by 10 percentage points is associated with a higher expected value of health satisfaction of 0.169 (note again that this means worse health satisfaction). Given that the standard deviation of health satisfaction is 2.126 (see Table A1), this means an increase by 8 percent of a standard deviation. Interestingly, the unconditionally positive association between health and home loans (Table 2) turns into a negative relationship once we condition on observable variables like household income. The respective coefficient implies an increase of about 0.05 with a 10 percentage points increased repayment ratio. Being overindebted (Table 5) is associated with a 0.203 higher value of the health satisfaction variable, or 10 percent of a standard deviation. Similar results hold for mental health where, as an example, the same increase in relative consumer credit debt is associated with an increase of about 8 percent of a standard deviation (given the standard deviation of 9.772, see Table A1). Likewise, the higher the debt burden, the more frequent is obesity. The latter relationship, however, only holds for consumer debt.

Due to potential endogeneity problems as discussed above, these benchmark results should not be interpreted as causal impacts of debt on health. Column (2) shows the fixed-effects results for debt repayment (Table 4) and overindebtedness (Table 5). As expected, the sizes of the coefficients diminish notably in most specifications. Apparently, unobservable factors that both influence health and debt problems play an important role in explaining the correlation between debt and health. Still, the effects are highly significant in the health satisfaction and the mental health regression. For instance, the above discussed increase in consumer debt repayments by 10 percentage points of income imply a worse health satisfac-

TABLE 4
REGRESSION RESULTS: DEBT REPAYMENTS

Dependent Variable	Explanatory Variables	OLS Full Sample (1)	FE Full Sample (2)	FE Alw. Employed (3)	FE Lagged Vars (4)
Health satisfaction	Consumer debt/income	1.692*** (0.117)	0.290*** (0.076)	0.216** (0.103)	0.155** (0.078)
	Housing debt/income	0.534*** (0.109)	0.218** (0.086)	0.256** (0.110)	0.160** (0.071)
MCS	Consumer debt/income	7.406*** (0.823)	1.607** (0.750)	3.109*** (0.988)	1.155 (0.757)
	Housing debt/income	2.357*** (0.645)	2.487*** (0.768)	3.168*** (0.987)	1.490** (0.689)
Obese	Consumer debt/income	0.148*** (0.019)	-0.003 (0.017)	0.012 (0.025)	-0.030* (0.017)
	Housing debt/income	0.018 (0.015)	0.004 (0.017)	0.004 (0.023)	0.007 (0.015)

Notes: Standard errors in parentheses, clustered on household level; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Source: SOEP, 1999–2009. Full estimation results in Tables A2–A7 in the Appendix.

TABLE 5
REGRESSION RESULTS: OVERINDEBTEDNESS

Dependent Variable	Explanatory Variables	OLS Full Sample (1)	FE Full Sample (2)	FE Alw. Employed (3)	FE Lagged Vars (4)
Health satisfaction	Overindebted	0.203*** (0.036)	0.057** (0.024)	0.037 (0.036)	0.018 (0.023)
MCS	Overindebted	0.972*** (0.264)	0.673*** (0.234)	0.615* (0.350)	0.196 (0.236)
Obese	Overindebted	0.020*** (0.006)	-0.001 (0.005)	-0.007 (0.009)	0.006 (0.006)

Notes: Standard errors in parentheses, clustered on household level; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Source: SOEP, 1999–2009. Full estimation results in Tables A2–A7 in the Appendix.

tion by 0.029 units and a worse mental health by 0.1607. Both translate into changes of about 1.5 percent of a standard deviation. Again, the direction of the effect of debt on health is the same for consumer credit and home loans. While the strength of the impact on health satisfaction is similar for both debt types, home loans do have a greater affect on the mental health status. Being overindebted is associated with an increase of 0.057 of the health satisfaction variable and a reduction in the mental health score by 0.673, or 3 and 7 percent of a standard deviation of the respective variables. This is an effect of notable size.

After controlling for fixed effects, the likelihood of being obese is not significantly affected either by the magnitude of debt repayments or by overindebtedness, with estimated coefficients of virtually zero. Therefore, the observation of a higher incidence of obesity in the group of overindebted households is apparently not caused by the debt situation but by other factors.

Our findings remain stable when we restrict the sample to individuals who constantly participated in the labor market. The fixed-effects results for this subgroup are reported in column (3) in Tables 4 and 5. For both debt-repayment-to-income ratios, there is a significant effect on health satisfaction and on the mental health score. In all cases, the health status deteriorates in response to a tightened debt situation. Home loan repayments are somewhat worse for mental health than consumer credit repayments. Contrary to our expectations, the magnitudes of effects of debt in the subsample of individuals without a change in their employment status are even a little stronger compared to the entire sample (for mental health). As regards obesity, results are similar to those for the entire sample. There is no causal effect of the household's debt situation on the probability of being obese. Concerning overindebtedness, the effect on health satisfaction nearly halves in this subsample (0.037, which is also insignificant) but the one on mental health and obesity is almost as in the full sample.

Column (4) in Tables 4 and 5 presents results from fixed-effects specifications with lagged debt variables (debt repayment and overindebtedness in $t - 1$). The magnitudes of the effects decrease further. For example, consumer debt and homeloan repayments still have a significantly negative impact on health satisfaction, but the effects of a 10 percentage point increase reduce to less than 1 percent of a standard deviation. Similar results hold for mental health where the effects are somewhat stronger compared to health satisfaction but insignificant in the case of consumer debt. The latter result might be explained by a reversed causality effect from mental health to consumer debt (due to the "shopping therapy") which is less likely in this specification and only applies to consumer debt and not to housing loans. However, this interpretation should be done very cautiously since the coefficient of 1.155 is not zero but just imprecisely estimated. Unsurprisingly, all effects in this specification are smaller since we measure contemporaneous effects of past indebtedness. In particular, lagged overindebtedness does not seem to affect the health measures significantly.

To sum up, there is evidence for negative effects of debt on health satisfaction and mental health, but not on the likelihood of being obese. This suggests that the link between debt and health problems is via mental distress and not via the need to reduce the consumption of healthy food due to financial constraints. With a 1–2 percent increase of a standard deviation after a 10 percentage point increase in relative debt repayments, the magnitudes of effects of debt on health satisfaction and mental health appear to be small but fall in the range of other studies looking at effects of income on health (Ettner, 1996; Lindahl, 2005). Overindebtedness is associated with a much stronger health effect in terms of standard deviations. Nevertheless one should conclude that there is a moderate effect of debt on health.

Interestingly, our results are similar for both debt measures, although they differ in some aspects. While the ratios of repayments and income weight a change in relative debt repayments equally irrespective of whether the household is on a low or on an already high debt level, the indicator for overindebtedness represents a change from a sound to a precarious financial situation. The health status responds to the debt burden, irrespective of whether it is secured (like mortgage debt) or unsecured (like consumer credit). For mental health, we find that housing debt is even more strongly associated with a bad health status. The reason for this

difference might be that secured debt induces higher stress because it implies the loss of a property in case of consumer insolvency.

5. ROBUSTNESS CHECKS

We check for the robustness of our results by varying the estimation methods, the health variables, and the sample composition. The results of all robustness checks are not presented here but are available upon request. First, health satisfaction is an ordinal measure, hence ordered logit or ordered probit might be preferred over ordinary least squares which assumes cardinality of the outcome variable. Ferrer-i-Carbonell and Frijters (2004) report that there is little difference in the resulting effects between linear fixed-effects models and their fixed-effects ordered logit. As a robustness check, however, we estimated an approximation of their proposed fixed-effects ordered logit as is widely used in the recent literature and explained in detail by, for example, Schmitz (2011). A drawback of this estimator (as well as with the normal fixed-effects logit estimator) is that one cannot calculate marginal effects without imposing further assumptions on the fixed effect. We therefore preferred the linear approach. In the case of obesity, we also used the standard fixed-effects logit estimator. In all specifications the results are qualitatively the same as in Tables 4 and 5, thus underlining Ferrer-i-Carbonell and Frijters' conclusion of no big difference. Results are available upon request.

Second, we use an indicator for overweight (BMI exceeding 25) and the body mass index as outcome variables instead of obesity. This does not affect the results at all. While overindebted individuals have a higher body mass index and are more likely to be overweight, fixed-effects results show that there is no causal effect of debt on the body mass index.

Third, we restrict the analysis to household heads only, instead of including all adult household members. This would be the preferred specification when assuming that household heads make financial decisions of the household independently and are the only household members that suffer from overindebtedness and financial distress. The results stay broadly the same. The relation between debt and health in the household is irrespective of who the financial decision-maker is and who legally owes the debt burden.

Fourth, we take a closer look into the debt measures. A relative debt burden can increase due to higher debt repayments or due to reductions in income. Similarly, a household can become overindebted after a change in debt repayment, income, or subsistence level. It could be argued that the three different channels through which an increase in relative indebtedness may occur have different effects on health. In our dataset, in most cases, an increase (or decrease) in relative indebtedness is mainly driven by changes in the debt repayment and not by changes in income. Nevertheless, we repeat our analysis and exclude all observations for which income changes are the dominating factor for changes in relative indebtedness. These are about 8 percent of all observations and this sample restriction does not alter the results.

Fifth, we exclude marital status, household income, and homeownership from the regressions. Marital status may directly be affected by the debt situation, and the latter two are by construction highly correlated with the debt measures. As

argued above, we prefer to include them in the regressions to reduce potential omitted variables biases but they might impose “bad controls” problems. Results are not dependent on inclusion of the three measures.

One might prefer a dynamic panel specification to our static model but dynamic panel models have two drawbacks in applied work. First, there is a variety of different possibilities to estimate them (e.g., “System GMM” vs. “Difference GMM,” different choices of lag length of instruments) and the results are often not robust to the choices made. Second, they are very data demanding and require at least three waves for just identified models. For proper specification tests one even needs more waves (e.g., four waves for overidentifying restrictions tests and five to perform an AR(2)-test using the differenced error terms). Since we only have four waves for two of our three variables, we disregard the dynamic specification and estimate a static model in the preferred version. As a robustness check, however, we estimated a dynamic panel model yielding no big differences compared with the static one. That is, the coefficients of the debt measures were very similar compared to the static model while the coefficient of the lagged dependent variable was around 0.11–0.166 depending on the health measure. Hence, there do not seem to be strong differences between short- and long-term effects of debt and, overall, the static model is justifiable.

Finally, we test for another possible pathway of worse health due to debt problems. It might be that indebted individuals forego doctor visits to save on the (albeit fairly low) copayments. Therefore, we use the number of doctor visits within the last three months prior to the interview as an outcome variable and also control for the health status of the respondents. The results suggest that people in indebted households are actually more likely to attend the doctor. Thus, the hypothesis of debt leading to less doctor visits—and, thus, being one pathway for the worse health status of indebted individuals—due to the financial burden of copayments can be rejected.

6. CONCLUSION

We analyze the relationship of household indebtedness and physical as well as mental health using a large and representative panel dataset, the German Socio-Economic Panel for the years 1999–2009. We use several measures that display different aspects of individual health, namely health satisfaction, a mental health score, and an indicator of obesity. Our explanatory variables of main interest are three measures of household debt: monthly debt repayments for consumer credit as share of household income, home loan repayments as a share of income, and a binary indicator of overindebtedness. We address several empirical challenges resulting from the complex relation of debt and health, such as endogeneity problems due to unobserved heterogeneity affecting both the debt situation and the health status. We do this by using fixed-effects methods, by including lagged debt variables, and by constructing a subsample unaffected by unemployment or a drop out of the labor market in the entire observation period.

In accordance with the existing literature, we find that indebted individuals are more likely to be in bad health. This correlation holds for all three health measures. Our results from fixed-effects regressions suggest that both health sat-

isfaction and mental health moderately deteriorate with the debt burdens and, similarly, are negatively affected in case the household is overindebted. While we find that obese individuals are more likely to be indebted, this correlation vanishes after controlling for unobserved heterogeneity. The results are qualitatively the same for all debt measures, indicating that unsecured debt (consumer credit) and secured debt (home loans) are similarly associated with the respondents' health status. As regards the ratios of debt repayments and income, we come to similar conclusions when restricting the sample to individuals participating in the labor market over the entire observation period. Moreover, the lagged ratios of debt repayments and income have a significant effect on health (in contrast to the lagged indicator of relative overindebtedness), however, with a weaker impact compared to the contemporaneous debt measures.

Our results add to the literature on the socio-economic gradient in health. There is a debate on whether income is causal to the gradient or not. Our results suggest a moderate effect of debt on health. Since a precarious debt situation and low income are correlated, indebtedness might be a pathway for the gradient. Moreover, negative health effects of debt might cause individuals to enter a poverty trap, since bad health is shown to increase the likelihood of losing the job. In turn, unemployment further tightens the financial situation of the indebted households. In any case, however, the results are not able to fully explain the gradient. At best they add a small part to the explanation.

As a limitation due to the absence of valid instruments, we cannot be fully certain that our results reflect causal effects from debt to health. We argued above that it is unlikely that bad health directly causes debt in Germany with its almost full cover insurance system. Using the subgroup of constantly employed individuals to further reduce endogeneity concerns induces the problem of a somewhat selective sample. However, the findings that the results, at large, do not change if we concentrate on this subgroup leaves us confident that selection issues should be of minor importance. Moreover, these regressions should be regarded as robustness checks. However, endogeneity problems might also result from omitted time-varying variables that are correlated with both the debt situation and the health status—variables that do not cancel out by the fixed-effects approach. One candidate for such a variable could be alcohol abuse. We think that the channel through which alcohol abuse affects the debt situation is most likely the involved job loss. As far as this is true, we account for that in the specification using only constantly employed individuals. Nevertheless, the potential problem of time-varying omitted variables is not solved econometrically.

To the amount that individuals do not take negative health effects into account when making a decision on taking out a loan, negative health effects represent a welfare loss. In that case political action should raise its attention more strongly toward overindebtedness. Usually mentioned strategies in the debt literature to reduce overindebtedness might be even more beneficial when negative health effects of debt are added to the problems that come along with overindebtedness. These strategies are, for example, the improvement of financial literacy, with a special focus on debt literacy (Lusardi and Tufano, 2009). One way could be to include opportunities and risks associated with loan contracts, leasing, and payments by installments into the school curricula. Other strategies are adequate

fundings of debt counseling agencies to support households affected by financial problems to reschedule debt payments. While further research is needed to prove both that people do not take health risks of debt into account and that the mentioned strategies are actually effective, our results might encourage a more critical discussion on the spreading credit culture in Western societies. In the light of our results we strongly recommend further research on the costs and benefits of household debt. In contrast, direct action, such as increasing the availability of healthy food by low-pricing campaigns, as called for in the literature (Münster *et al.*, 2009), does not seem to be an appropriate measure.

REFERENCES

- Adams, P., M. D. Hurd, D. McFadden, A. Merrill, and T. Ribeiro, "Healthy, Wealthy, and Wise? Tests for Direct Causal Paths between Health and Socioeconomic Status," *Journal of Econometrics*, 112(1), 3–56, 2003.
- Arrow, J., "Estimating the Influence of Health as a Risk Factor on Unemployment: A Survival Analysis of Employment Durations for Workers Surveyed in the German Socio-Economic Panel (1984–1990)," *Social Science and Medicine*, 42(12), 1651–9, 1996.
- Bridges, S. and R. Disney, "Debt and Depression," *Journal of Health Economics*, 29(3), 388–403, 2010.
- Brown, S., K. Taylor, and S. Wheatley Price, "Debt and Distress: Evaluating the Psychological Cost of Credit," *Journal of Economic Psychology*, 26(5), 642–63, 2005.
- Browning, M., A. Moller Dano, and E. Heinesen, "Job Displacement and Stress-Related Health Outcomes," *Health Economics*, 15(10), 1061–75, 2006.
- Donald, S. G. and K. Lang, "Inference with Difference-in-Differences and Other Panel Data," *Review of Economics and Statistics*, 82(2), 221–33, 2007.
- Dretea, P., "Age, Debt and Anxiety," *Journal of Health and Social Behavior*, 41(4), 437–50, 2000.
- Dretea, P. and P. J. Lavrakas, "Over the Limit: The Association among Health, Race and Debt," *Social Science and Medicine*, 50(4), 517–29, 2000.
- Duygan-Bump, B. and C. Grant, "Household Debt Repayment Behaviour: What Role do Institutions Play?" *Economic Policy*, 24(57), 107–40, 2009.
- Eliason, M. and D. Storrie, "Does Job Loss Shorten Life?" *Journal of Human Resources*, 44, 277–302, 2009.
- Ettner, S. L., "New Evidence on the Relationship between Income and Health," *Journal of Health Economics*, 15(1), 67–85, 1996.
- Federal Statistical Office, *Wirtschaftsrechnungen, Einkommens- und Verbrauchsstichprobe, Geld- und Immobilienvermögen sowie Schulden privater Haushalte*, 15(2), Federal Statistical Office, Wiesbaden, 2008.
- Ferrer-i-Carbonell, A. and P. Frijters, "How Important is the Methodology for the Estimates of the Determinants of Happiness?" *Economic Journal*, 114(497), 641–59, 2004.
- Frijters, P., J. P. Haisken-DeNew, and M. A. Shields, "The Causal Effect of Income on Health: Evidence from German Reunification," *Journal of Health Economics*, 24(5), 997–1017, 2005.
- Goldman, N., "Social Inequalities in Health: Disentangling the Underlying Mechanisms," in M. Weinstein and A. Hermlin (eds), *Strengthening the Dialogue between Epidemiology and Demography. Annals of the New York Academy of Sciences*, 945, 118–39, 2001.
- Haisken-DeNew, J. P. and M. Hahn, *Panelwhiz: A Flexible Modularized Stata Interface for Accessing Large Scale Panel Data Sets*, 2006 (<http://www.panelwhiz.eu>).
- Jones, A. M. and S. Schurer, "How Does Heterogeneity Shape the Socioeconomic Gradient in Health Satisfaction?" *Journal of Applied Econometrics*, 26(4), 549–79, 2011.
- Karlan, D. and J. Zinman, "Observing Unobservables: Identifying Information Asymmetries with a Consumer Credit Field Experiment," *Econometrica*, 77(6), 1993–2008, 2009.
- Keese, M., "Triggers and Determinants of Severe Household Indebtedness in Germany," *Ruhr Economic Paper*, No. 150, 2009.
- Kempson, E., *Over-Indebtedness in Britain. A Report to the Department of Trade and Industry*, Department of Trade and Industry, London, 2002.
- Kuhn, A., R. Lalive, and J. Zweimüller, "The Public Health Costs of Job Loss," *Journal of Health Economics*, 28(6), 1099–115, 2009.
- Lenton, P. and P. Mosley, "Debt and Health," University of Sheffield Working Paper No. 2008004, Department of Economics, 2008.

- Lindahl, M., "Estimating the Effect of Income on Health and Mortality using Lottery Prizes as Exogenous Source of Variation in Income," *Journal of Human Resources*, 40(1), 144–68, 2005.
- Lusardi, A. and P. Tufano, "Debt Literacy, Financial Experiences, and Overindebtedness," National Bureau of Economic Research Working Paper #14808, 2009.
- Marmot, M. G., G. D. Smith, S. Stansfeld, C. Patel, F. North, J. Head, I. White, E. Brunner, and A. Feeney, "Health Inequalities among British Civil Servants: The Whitehall II Study," *Lancet*, 337(8754), 1387–93, 1991.
- Marmot, M., M. Bobak, and G. Davey-Smith, "Explanations for Social Inequalities in Health," in B. C. Amick, S. Levine, A. R. Tarlov, and D. Chapman Walsh (eds), *Society and Health*, Oxford University Press, Oxford, 172–210, 1995.
- Marmot, M., H. Bosma, H. Hemingway, E. Brunner, and S. Stansfeld, "Contribution of Job Control and Other Risk Factors to Social Variations in Coronary Heart Disease Incidence," *Lancet*, 350(9073), 235–39, 1997a.
- Marmot, M., C. D. Ryff, L. L. Bumpass, M. Shipley, and N. F. Marks, "Social Inequalities in Health: Next Questions and Converging Evidence," *Social Science and Medicine*, 44(6), 901–10, 1997b.
- Münster, E., H. Rueger, E. Ochsmann, S. Letzel, and A. M. Toschke, "Overindebtedness as a Marker of Socioeconomic Status and its Association with Obesity: A Cross-Sectional Study," *BMC Public Health*, 9(2), 286, 2009.
- Riphahn, R. T., "Income and Employment Effects of Health Shocks. A Test Case for the German Welfare State," *Journal of Population Economics*, 12(3), 363–89, 1999.
- Salm, M., "Does Job Loss cause Ill Health?" *Health Economics*, 18(9), 1075–89, 2009.
- Schmitz, H., "Why Are the Unemployed in Worse Health? The Causal Effect of Unemployment on Health," *Labour Economics*, 18(1), 71–8, 2011.
- Smith, J. P., "Healthy Bodies and Thick Wallets: The Dual Relation between Health and Economic Status," *Journal of Economic Perspectives*, 13(2), 145–66, 1999.
- Sullivan, D. and T. von Wachter, "Job Displacement and Mortality: An Analysis Using Administrative Data," *Quarterly Journal of Economics*, 124(3), 1265–306, 2009.
- Wagner, G. G., J. R. Frick, and J. Schupp, "The German Socio-Economic Panel Study (SOEP): Scope, Evolution, and Enhancements," *Journal of Applied Social Science Studies (Schmollers Jahrbuch)*, 127(1), 139–69, 2007.
- Webley, P. and E. K. Nyhus, "Life-Cycle and Dispositional Routes into Problem Debt," *British Journal of Psychology*, 92(3), 423–46, 2001.
- Wilkinson, R. G., "Equity, Social Cohesion, and Health," in S. Strickland and P. Shetty (eds), *Human Biology and Social Inequality*, Cambridge University Press, Cambridge, 58–75, 1998.
- Wilkinson, R. G. and K. E. Pickett, "Income Inequality and Population Health: A Review and Explanation of the Evidence," *Social Science and Medicine*, 62(7), 1768–84, 2006.
- Zimmermann, G. E., "Wer ist überschuldet und was sind die Ursachen der Überschuldung," in SCHUFA Holding AG (ed.), *Schuldenkompass 2007: Empirische Indikatoren der privaten Ver- und Überschuldung in Deutschland*, Wiesbaden, 91–116, 2007.
- , "Entwicklung des Ausmasses überschuldeter Privathaushalte 2007," in SCHUFA Holding AG (ed.), *Schuldenkompass 2008: Empirische Indikatoren der privaten Ver- und Überschuldung in Deutschland*, Wiesbaden, 121–29, 2008.

SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article:

Table A1: Sample Summary Statistics

Table A2: Regression Results: Health Satisfaction—Debt Repayments

Table A3: Regression Results: Health Satisfaction—Overindebtedness

Table A4: Regression Results: Mental Health—Debt Repayments

Table A5: Regression Results: Mental Health—Overindebtedness

Table A6: Regression Results: Obesity—Debt Repayment

Table A7: Regression Results: Obesity—Overindebtedness

Table A8: SF-12v2 Questionnaire in the SOEP