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Tobacco Smoking and Exercising Habits: What Has Socioeconomic Status Got to Do With It?

Andreas Andersson (23776) and Veronica Nelson (23171)

Abstract: There is a large and growing literature regarding unhealthy lifestyle habits and their relationship with socioeconomic status. In this paper, we build on previous literature by exploiting the introduction of the German minimum wage in 2015 and adding the notion of immediate socioeconomic changes to analyze the causal effect of commonly used measures of socioeconomic status on tobacco smoking and exercising habits. We conclude that the previously established positive relationship between socioeconomic status and unhealthy lifestyle habits seems to hold, although our estimations indicate that the relationship with income may be smaller than previously believed. We further find that small and medium income increases show no immediate effect on these habits and that becoming unemployed may in fact lead to individuals adopting healthier habits.

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1 Introduction

The relationship between health and socioeconomic status (SES) is well established. There are various lifestyle habits that affect the health outcomes of an individual, and the literature on such habits suggests that SES is also strongly connected to these behavioral outcomes. However, the mechanisms by which SES affects choices regarding such lifestyle habits are ambiguous.

In this paper, we will make use of German panel data and exploit the introduction of a minimum wage, implemented in 2015, to analyze the causal impact of commonly used measures of SES on tobacco smoking and exercising habits. First, our aim is to contribute to the general understanding of which features of the socioeconomic measures that may impact lifestyle choices. Second, we hope to provide clarity regarding the effect of the German minimum wage specifically on tobacco smoking and exercising habits among those affected by the reform.

The negative effects of tobacco smoking are well-established in the literature. There is a strong relationship between smoking and mortality, as well as with other types of ill health (Østbye, 2002) and many of the issues related to smoking have been publicly known since the mid-60s. Lack of physical activity is also related to a series of negative health outcomes, not least through increased risk of obesity. For example, physical function in early old age (Hillsdon et al., 2005), increased risk of premature mortality (Warburton, Nicol, and Bredin, 2006), lower quality of life (Dolan, Peasgood, and White, 2008), and a higher risk of disease (Haskell et al., 2007).

To explain why individuals continue to consume harmful goods despite the risks, Becker and Murphy (1988) introduced the model of rational addiction. The model has ever since served as the economic building block in understanding consumption of harmful goods. The authors model addiction as a stock of past consumption. As such, the utility from consumption in a given period depends on past consumption. The framework thus allows for individuals to maximize their life-time utility by increasing consumption of harmful goods in each period. Although Becker and Murphy's model does provide insights as to why addiction may vary between individuals, it does not explicitly address why we would observe different patterns of consumption across socioeconomic groups.

Grossman's model of health demand from 1972 might provide another piece to this puzzle

(Grossman, 1972). The author treats health as a form of capital and models it to enter individuals' utility directly, since a larger health stock lowers the number of sick days, and indirectly, as fewer sick days allows for more time spent on other kinds of production. In this setting, human capital improves efficiency in all kinds of production, including health. In addition, a higher wage implies higher marginal utility from market production, thus motivating more investment in one's health.

While Becker and Murphy's model provide an explanation as to why individuals would commence, and primarily, continue with harmful practices, Grossman's model of health demand provides an economic rationale regarding the relationship between health and SES.

Both models have, of course, also received criticism over the years. For example, in several instances a higher income reflects a compensation for health distortions in market production (Fuchs, 2004), in which case, it is not evident that higher income would motivate increasing investment in one's health stock (Cropper, 1977). Moreover, since these models were developed, numerous researchers from various academic disciplines have contributed with insights concerning the relationship between SES and unhealthy behaviors. The field of behavioral economics addresses findings on present-time bias, risk-preferences, and self-control to explain the evolution of harmful behaviors as well as SES (see Pampel, Krueger, and Denney, 2010).

While the topic of SES, health, and health-related behaviors has been studied extensively from various perspectives, it appears that insights on the relationship between minimum wages and health are limited. Although the relationship between income and health has been examined, there is still much uncertainty about the health effects of higher minimum wages (see Lenhart, 2017).

The research on various measures of socioeconomic status and health-related outcomes in general is vast, the theories and the findings contained within the topic are sometimes complementary, sometimes contradicting. In his reflective paper on the subject, Victor Fuchs (2004) concludes that "Most quantitative estimates (and some qualitative inferences) of the relation between socioeconomic variables and health are context specific. Policy decisions, therefore, should be based as much as possible on empirical research that covers the relevant contexts".

In this study, we set out to examine the degree of correlations between education, income,

and unemployment on the one hand and smoking and exercise habits on the other, the impact of immediate changes in income and employment status, as well as the effect of the minimum wage on tobacco smoking and exercise habits in the German context. As such, our objective is to answer the question *To what extent has recent changes in commonly used measures of socioeconomic status an effect on smoking and exercising?*.

We hope to contribute to the literature in two ways. First, we aim to widen the literature regarding unhealthy lifestyle habits, SES, and health in the German context by comparing an endogenous analysis of connections between static SES and unhealthy lifestyle habits to changes in SES, bringing us closer to a causal understanding of the connection between SES and such habits. Second, we provide additional insight regarding the health effects of the German minimum wage reform. When evaluating such a policy, it is important too consider all the positive and negative effects, including health effects. Both of these contributions may render insights for policymaking regarding the optimal magnitude and timing of policy responses in order to maximize societal welfare. We thus argue that our analysis, ex ante, may prove to be highly policy relevant.

The rest of this paper is structured as follows. This introduction section is followed by a literature review. Section three provides a more comprehensive theoretical background. Section four and five describe our data and empirical strategy. Section six shows our results and an analysis of these. Sections seven and eight include a discussions on our results and finally a summarized conclusion, respectively.

2 Literature Review

The relationship between SES and health has been studied extensively for decades. Behavioral differences as a mediating factor has since long been suggested as one explanatory feature (Feinstein, 1993). Socioeconomic status as such is a complex concept, however, Galobardes et al. (2006) provide a concise description of various measures of SES, explaining their theoretical origin and explanatory capacity. According to the authors, SES can be understood from a life-course perspective, where

circumstances during childhood, such as parents' education, influence the child's educational outcomes, which in turn affects their future income and risk of unemployment. As such, determining causality or disentangling the mechanisms by which SES determines behaviors, causing differences in health outcomes, is challenging. For example, education may enhance cognitive skills that make the individual more receptive to health-related information, but the measurement also reflects social inheritance.

The literature on SES and health-related behaviors is vast and keeps expanding. In describing the current state of knowledge, we have narrowed the focus to studies that are relevant to our analysis in terms of the variables, mechanisms or geographical scope studied. These are described in the sections that follow. First, we cover findings on the relationship between various measures of SES and behavioral outcomes. Second, we cover findings on the relationship between changes in SES or other circumstances and changes in behavioral outcomes. Third, we describe findings on the mechanisms that have been hypothesized to channel the effect of SES on health-related behaviors.

While the first category of studies focuses on establishing when SES matters, the second category narrows down to establishing causality. These two categories are in many instances not interchangeable. Although some aspects of SES can vary within individuals across time, allowing for quasi-experimental analysis, others are close to constant and do not easily lend themselves to any kind of randomization. Finally, the third category attempts to explain why SES comove with, or cause changes, in behaviors.

2.1 The Relationship Between SES and Unhealthy Lifestyle Habits

Previous research suggests a positive relationship between SES and tobacco smoking, frequency of exercise, and healthy dietary habits. It appears that not only present SES matters in terms of behavioral outcomes, but a lingering connection between childhood circumstances and later outcomes persists.

Gilman, Abrams, and Buka (2003) study smoking through a life course perspective, analyzing the association between both SES during childhood and later in life on smoking initiation, regular

use, and cessation. The authors find a strong connection between childhood SES and all transitions of cigarette use. Their results also indicate a strong relationship between adult SES and regular smoking as well as the propensity to quit. When combining childhood and adult SES, it appears that some of the measures capturing childhood circumstances still matter, suggesting that individuals with lower SES and a low-SES background are particularly prone to become regular smokers and refrain from quitting.

A similar study was conducted by Soteriades and DiFranza (2003) in which the authors investigate the connection between the SES of parents and adolescent smoking. Using survey data from Massachusetts, they examine 12–17 year old adolescents and either classify them as established smokers (>100 cigarettes smoked) or non-smokers (<100 cigarettes smoked). Parental educational attainment and household income is used to proxy for SES. The authors find that each additional step down in terms of parental education and household income increases the risk of adolescent smoking by 28 and 30 percent respectively. Controlling for parental smoking does mitigate some of the effect, but estimates are still statistically significant. The findings of Bird, Staines-Orozco, and Moraros (2016) are in line with this. They use Mexican data on tobacco use and their findings include that tobacco use is strongly correlated with adolescents livings in households of low SES as well as having parents that smoke.

The connection between physical activity, dietary habits, and SES is examined by, for example, Øvrum (2011) who uses a latent class model (LCM) to estimate the demands for fruits and vegetables, and physical activity, respectively. Two subgroups are identified in the population; The first has high latent demands for the respective healthy behavior. The explanatory power of SES proves to be low within this group. The other group has low latent demands. Among this group, SES appears even more important in explaining variation than in conventional models estimating average effects over the entire population. Additionally, the authors find that SES is important for the distribution of individuals to each respective group, as those with high SES are more likely to belong to the healthier high-demand group.

As described in Grossman's model health (described more in detail in section 3.1) can be

understood as a capital stock. Therefore, both previous and current health investments may prove important for future health outcomes. Given this perspective on health, the connection between SES and physical activity among school children could be of relevance. Peralta et al. (2019) examine school level SES and its association with physical activity, fitness, and fundamental movement skill in Australia. They find that, even though levels of physical activity are below recommendations in general, children attending high-SES primary schools are significantly more likely to conduct physical activity to a higher extent. However, there is no clear pattern for secondary schools. Despite this, children in high-SES schools are more likely to achieve healthy fitness at both school levels.

While SES is important in understanding health-related behaviors, some studies have found that the strength of the connection varies with other characteristics.

Merino Ventosa and Urbanos-Garrido (2016) use data from Spain to study the relationship between obesity and SES for men and women respectively. They find significant inequality in the obesity distribution, with the less affluent being more obese, on average. This effect is stronger among women than among men. The study focuses on correlations, and cannot distinguish causal relationships, but they try to disentangle factors that are important in explaining the relationship between SES and obesity. In summary, among the most important explanatory factors in their analysis are, except a non-explained direct effect of SES, physical activity in both leisure time and in main activity, although in different directions, with differences in leisure time amplifying inequality. An additional important factor is sleep habits, which in fact goes in different directions for men and women. These findings, along with the observation that dietary habits fail to show statistical significance, leads to the authors recommending promotion of physical activity in leisure time and better sleep habits for low-SES women to curb obesity in general and decrease "anti-poor" distribution of obesity in particular.

Engberg et al. (2017) consider different types of fatigue (general fatigue (GF), physical fatigue (PF), reduced activity (RA), and mental fatigue (MF)) and use a range SES variables, physical activity, sitting time, and self-reported health as explanatory variables. Their findings include that

higher age correlates with lower levels of GF and MF, and that women display more fatigue on all measures. As for SES, proxied by education level, higher SES was associated with a lower level of fatigue for GF, PF, and RA for men, and PF and MF for women. Lower physical activity and more sitting time are both correlated with higher fatigue on all scales but for mental fatigue, while better perceived health indicated lower fatigue on all scales. This is an interesting outcome partly as the direction of causality cannot be clearly distinguished. The authors note that the fact that low-SES individuals are more prone to be fatigued may enforce lower physical activity in the group as a higher fatigue level may negatively affect the motivation for exercise.

Although women of lower SES seem to display more adverse outcomes in relation to their male peers, the severity of the health consequences due these differing outcomes is ambiguous.

Rogers et al. (2010) build on previous literature regarding sex differences in mortality by adding SES and health behaviors to the mix. He uses US data and finds that while prevalence of health behaviors and a range of SES factors differ between sexes, no evidence of differential effects on mortality based on gender can be established. Further, his data shows that women both consume less alcohol and smoke less. However, they generally display lower SES and conduct less physical activity.

The connection between alcohol consumption and SES, although not in focus in this paper, and the literature on this topic is interesting in a broader sense to understand how SES affects health outcomes. While the relationship between SES and smoking, physical activity, and dietary habits broadly point in the same direction, the co-movements between SES and alcohol consumption seem more complex.

Cheah (Cheah, 2015) aims to establish which socioeconomic factors that correlate with light and heavy alcohol drinking respectively for non-Muslims in Malaysia. His findings include that light alcohol drinking (defined as below 15 units per week), which may have beneficial effects, is correlated with higher income, higher education, living in an urban environment, and being unemployed. Further, health deterring heavy alcohol drinking (defined as above 15 units per week) is correlated with being younger, male, employed, non-single, having lower income, lower education,

and living in a rural environment. He argues that this partly may be due to younger individuals and rural dwellers are more likely to be unaware of the risks of heavy drinking and the potential benefits of light drinking.

While the results of Cheah (Cheah, 2015) indicate a negative relationship between unemployment and alcohol consumption, other studies suggest the contrary.

Popovici and French (2013) examine the relationship between unemployment and alcohol consumption and find a significant positive connection between the two. Further, they find a positive relationship between job loss and health deterring drinking patterns, such as the number of binge-drinking days and the probability of alcohol abuse. However, it should be noted that their analysis assumes the direction of the causal relationship, which is a serious limitation. There may also be issues with the unemployment variable operationalized by the authors, a dummy variable taking the value one if an individual has been jobless for at least a month in the past year. The indicator does not distinguish between voluntary job loss, non-voluntary job loss, nor exogenous job loss (such as a plant closure). Neither does it take into account the actual length of an unemployment spell.

Lewer et al. (2016) considers a variety of SES measures, such as education, income, occupational position, and living in a deprived area (compared to an affluent area) to observe drinking patterns by examining to what extent individuals of low and high SES exceed certain drinking thresholds in the British setting. They note that individuals of low SES generally consume less alcohol and are less likely to exceed recommended limits for episodic and weekly drinking. However, this group of individuals are simultaneously significantly more likely to exceed the higher thresholds. For example, they find that individuals in the lower income quintile had 2.30 times the odds of exceeding the highest threshold for weekly drinking of over 680 g for women and over 880 g for men. However, they only have 0.60 times the odds to exceed the recommended weekly limit of 112 g and 168 g respectively for women and men. These findings indicate that aggregate data may hide drinking patterns which may prove important when analyzing the relationship between SES and drinking, as low-SES individuals are simultaneously more likely to be both abstainers and extreme binge

drinkers.

Regarding the topic of minimum wages and its potential effect on SES and health, Lenhart (2017) examines the impact on population health using variation in minimum wages over three decades in the 24 OECD countries that had a minimum wage during this time. He discovers a negative relationship between the Kaitz index, which relates the minimum wage to the mean wage of the country in question, and a range of death causes proven to be more prevalent among low-SES individuals. He also finds a positive relationship between the Kaitz index and life expectancy. Further, he examines possible mechanisms that could drive the effect and estimates that a 10 percent increase in the index is associated with a 231.24 g per capita reduction in tobacco consumption. Most of the effect found in the study is driven by developing countries, indicating that individuals with very low incomes could drive most of the effect. However, this is an aggregate effect and it is unclear how much of the difference that is driven by tobacco consumption. Moreover, Lenhart's study was conducted before the German minimum wage could be analyzed. His results provide guidance as to what consequences the German minimum wage might yield, but also stresses the relevance of an analysis of the German case in particular.

2.2 Causal Relationships

In order to establish a causal relationship between SES measures and health-related behaviors, researchers have strived to find exogenous variation in the measures employed and/or utilize longitudinal data that allows for empirical approaches which mitigate issues of endogeneity.

Two studies closely related to the outcomes and setting analyzed in this paper, were conducted by Kaiser, Bauer, and Sousa-Poza (2016) and Marcus (2014).

Kaiser, Bauer, and Sousa-Poza (2016) make use of German plant closures in order to secure non-endogenous data on job losses, and thus avoid the potential issue of reverse causality between deterring health behavior and job loss. The authors find that with the regular endogenous estimate, smoking seems to display a positive relationship with job loss, while physical activity decreases, indicating that entering unemployment may drive unhealthy behaviors. However, when using the

non-endogenous data on job loss, the relationship between unemployment and tobacco smoking is not statistically significant. For physical activity the relationship changes sign, indicating that individuals in fact improve their activity level upon job loss. Similar effects are found for alcohol consumption (which changes from increasing upon job loss to insignificant) and unhealthy diets (which changes from insignificant to improving upon job loss). The authors do tests for heterogeneous effects and find that younger people increase smoking while older people decrease smoking upon job loss. Interestingly, marriage has different effects for smoking and physical activity, with only singles improving physical activity and married individuals smoking significantly less. The authors claim that these findings are strongly indicative of reverse causality regarding the relationship between unemployment and unhealthy lifestyle habits. However, it cannot be excluded that the effect is driven by general differences between individuals working at closing plants and those who work at other plants or in other sectors. The paper also raises questions regarding variation in the sample, not least for the subgroup analyses when examining heterogeneous effects.

Marcus (2014) studies the same data to examine the relationship between involuntary job loss and negative health outcomes in terms of smoking and body mass index (BMI). He strives to distinguish causal effects, and his findings include that non-smokers display increased likelihood of commencing smoking after losing their job. However, he finds no evidence neither of smokers intensifying their smoking behavior or reducing their possibilities to quit smoking. He notes that individuals that are younger, single, and from a lower SES prior to job loss start smoking to a relatively higher extent. In terms of BMI he finds that involuntary separation from a position leads to an increase, on average, especially for women and overweight individuals. He concludes by arguing that the counter-cyclical trend in health behaviors does not seem to be driven by individuals who lose their job. However, it should be noted that the robustness check for reverse causality, which is barely discussed in the paper, in which the author employs a similar method on plant closures as Kaiser, Bauer, and Sousa-Poza (2016), yields insignificant estimates on the effect of job loss on BMI, as for the general smoking participation estimate for the entire population. Smoking initiation among non-smokers is still statistically significantly positive in the robustness check.

Although there is a direct economic effect of unemployment, there might also be other mechanisms at play following the change in employment status which potentially could shift behaviors. To the best of our knowledge, the relationship between mere income changes to changes in health-related behaviors has not been studied as extensively.

Based on the same conclusion, Young-Hoon (2012) motivates his analysis of changes in household income and smoking behavior in the Canadian context. While the author finds no significant relationship between income changes as such and smoking cessation or initiation, his results indicate that respondents whose income shifted from below to above the poverty threshold were more likely to quite smoking than those who remained below the threshold. While within-subject variation is at the heart of the analysis in the case of Young-Hoon (2012), Marcus (2014), and Kaiser, Bauer, and Sousa-Poza (2016) other researchers have made use of random shocks to individuals' SES life-time evolution.

Maclean (2015) concludes, in the US setting, that young individuals who graduate during an economic downturn, and thus face higher unemployment and possibly lower potential salary, are more likely to report binge and/or heavy drinking in the future. Cutler, Huang, and Lleras-Muney (2015) study the same issue in the European setting. Their findings regarding drinking are in line with those of Maclean (2015). Additionally, they also find similar implications regarding tobacco smoking and obesity, with higher unemployment rate at graduation being associated with worse health outcomes in all regards.

The studies mentioned above devote their attention to the connection between changes in SES and changes in behaviors. Another strand of literature, also investigating causality, makes use of price changes instead. Focusing on price elasticities across SES-groups, such studies provide insights regarding differences in behavioral response to economic incentives.

Sen (2012) uses US gasoline prices to examine how a change in the price of driving affects physical activity. She finds that higher gasoline prices positively affect physical activity in general, both in terms of participation and time spent. The effect is, however, smaller for low-SES groups and minorities. Additionally, the author states that while many types of activities are affected,

the largest effect is seen for moderate physical household work, which she claims indicates that the income effect may dominate the substitution effect. Since low-SES individuals outsource less household work, and drive less, to begin with, the price change will have less of an effect on this group.

Eisenberg and Okeke (2009) also investigate the responsiveness among SES group with regard to physical activity, but use US weather conditions as "price shocks" to exercise. They find that a decrease in temperature leads to less physical activity, especially for low education and income groups. Their analysis further examines indoor and outdoor activities and conclude that the better access to indoor exercise facilities for high-SES groups may explain some of the difference.

While the papers by Sen (2012) and Eisenberg and Okeke (2009) focus on the direct behavioral response to price changes, Settele and van Ewijk (2018) investigate if such behavioral alterations may pose a mediating effect in SES to the next generation. The authors rely on previous findings concluding that low-SES women are more likely to smoke during pregnancy, which is associated with negative health outcomes for the child. They further note that tax rates on cigarettes decrease smoking among pregnant women. They use US variation in cigarette tax rates and educational outcome to test this mechanism by examining the effect of tax rates during pregnancy on educational outcomes (grades and school enrolment) on the child. They find that high tax rates on smoking significantly increases educational outcomes for children from low-SES households. No effect is found for children from high-SES households.

2.3 Mechanisms

The studies mentioned in the previous section, investigating the impact of price changes, do provide insights as to why SES can matter. Access to indoor training facilities (as proposed by Eisenberg and Okeke, 2009), or the mother's access to cigarettes may play a role in explaining differences in frequency of exercise and educational attainment, respectively. Such specific findings are, however, unlikely to solemnly explain the extent by which SES matters for health-related behaviors. For example, the results presented by Settele and van Ewijk (2018) suggest a substitution effect, while

Young-Hoon (2012) investigate the income effect, finding that individuals who leave poverty are more likely to quit smoking.

Understanding the mechanisms by which SES affects behaviors therefore requires more comprehensive theories. Although the mechanisms as such are not in focus in our empirical analyses, they contribute in formulating expectations regarding the relationship between SES and behavioral outcomes in various contexts.

There is a strong connection between self-reported health outcomes and financial strain. Prentice, McKillop, and French (2017) examine whether the relationship is mediated by health-related behaviors including smoking, heavy drinking, and overweight. However, they find that these three effects only explain 4.9 percent of this correlation. They do find that financial strain does increase impulsivity, but argue that this has little effect on unhealthy behaviors. On a similar theme, Evans and Popova (2017) conduct a meta study on how different cash transfer programs in low- and middle-income countries affect the consumption of temptation goods, defined as alcohol and tobacco. If financial stress causes increased consumption of such goods, cash transfers would thus possibly lower the consumption. Their estimates are indeed negative, however they do not show statistical significance. Although they are note able to conclude that exogenously increased incomes in the countries studied decrease consumption of these goods, cash transfers do not seem to cause an increase in the consumption of temptation goods either.

Another paper that builds on the literature by adding the notion of psychological distress and relationship status besides SES is authored by Reczek, Liu, and Brown (2014). They cite earlier research claiming that married different-sex individuals show lower smoking risk than cohabiting different-sex individuals and extend this by adding in cohabiting same-sex individuals and examine how much of this effect is explained by SES and psychological distress. The authors analyze US data from before the federal legalization of same-sex marriages (BBC News, 2015), and thereby exclude the very few married same-sex couples from their analysis. They find that both groups of cohabiters do experience similar levels of smoking risk to one another, but significantly higher than married different-sex couples. The generally less beneficial outcomes for non-married individuals

in terms of employment status, poverty status, insurance coverage, and psychological distress does explain some of the difference, but not in entirety. They also find that the higher education level of same-sex cohabiting unions shows opposite results and in effect "protects" this group from even higher smoking levels.

Another potential mechanism by which SES might impact behaviors that has been suggested is time-preferences, studied by Peretti-Watel, L'Harridon, and Seror (2013). The authors study the connections between time preferences, SES, and smoking by using a cross-sectional telephone survey. To determine SES, they employ a monthly low-income-threshold on €1 500, education, occupation, employment status, and a range of controls such as age and gender. Further, they use the relationships they find to examine if differential time orientation may explain the connection between low-SES and a range of smoking outcomes, such as views on anti-tobacco campaigns, fear of smoking-related cancer, and risk perception of smoking. Their results indeed indicate a connection between their indicators for lower SES and present time bias as well as between present time bias and smoking status in France. However, while present time bias has explanatory power, it does not explain the entire effect seen between SES and smoking.

While financial strain and time preferences capture individual level characteristics, other researchers have explored the impact of surroundings and social context.

Chuang et al. (2005) use individual cross sectional survey data from Northern California to examine the effect of neighborhood SES and convenience store concentration on tobacco smoking among the adult population between 1979 and 1990. Their findings include that lower neighborhood SES is significantly associated with higher levels of smoking when controlling for individual characteristics. Further, they find that convenience store concentration, which they measure using density of and distance to the stores, also has a significant positive relationship with smoking.

Hitchman et al. (2014) test whether low-SES smokers are more likely to have more smoking friends and whether they are more likely to gain and less likely to lose smoking friends over time. Their results show that low-SES smokers do in fact report more smoking friends than moderate- and high-SES smokers in Australia, Canada, UK, and US. They also find that that they are more

likely to net gain them over time. Further, the smokers who are male, young, and live with a smoker report more smoking friends and a higher net gain of smoking friends over time. Based on these results, the authors conclude that smoking is highly concentrated in low-SES social networks, which may drive inequality in smoking.

Pampel (2006) takes a different approach and examine the relationship between SES and smoking through the channel of cultural tastes. He aims to build on the theory that the mechanism of the relationship is related to economic or social resources by adding the notion of cultural resources. Using US data, he finds a negative relationship between classical music and smoking, and the opposite for bluegrass, jazz, and heavy metal music, even when controlling for SES. He argues that his findings suggests that smoking may be used as a cultural taste to distinguish one's lifestyle from others.

Nikolaou (2009) adds to the notion that context matters for unhealthy lifestyle habits, in this case smoking. He uses data from four countries in Southern Europe (Greece, Italy, Portugal, and Spain). These countries have different smoking patterns compared to, for example, the US or countries in Northern Europe, and the author illustrates how this differing cultural context render differential outcomes with respect to SES. The correlation between income and smoking takes the shape of an inverse-U-relationship for women in all countries and for men in Italy and Portugal, while it is reverse for men in Greece. He finds no relationship between unemployment and smoking for women while men in Portugal and Greece smoke less when unemployed. Women with higher educational attainment smoke less in Italy, but more in the other three countries, while men with higher educational attainment smoke less in only Greece and Italy. The fact that these findings differ quite substantially from those found in other contexts indicates that situational aspects are indeed important.

The literature clearly supports the existence of a relationship between the SES of an individual and the socioeconomic environment that surrounds her, and a variety of health-related behaviors, not least the ones studied in this paper.

It is however not evident in which situation a socioeconomic component will affect a certain

behavior. Findings such as those presented by Eisenberg and Okeke (2009), and Settele and van Ewijk (2018) contribute in explaining the relationship through a strict economic perspective where agents respond to prices and incentives. The study by Young-Hoon (Young-Hoon, 2012), however, suggests the necessity of incorporating theories closer to behavioral economics, such as the role of psychological distress and time-preferences in decision making. The fact that individuals who leave poverty are more likely to quit smoking would otherwise appear impossible.

The results of, for example, Gilman, Abrams, and Buka (2003), Cutler, Huang, and Lleras-Muney (2015), and Maclean (2015) further emphasize the importance of experiences early in life in order to understand behavioral evolution. These findings indicate that the relationship between SES and behavioral outcomes must also be understood from a life-course perspective. It could be the case that unemployment early in life is more important than unemployment in the previous year in explaining smoking behavior among middle-aged people.

To conclude, the current state of knowledge is straggly in this aspect, thus motivating further research to disentangle the relationship between SES and health-related behaviors in various settings.

3 Theoretical Background

3.1 Economic Theory on Unhealthy Lifestyle Habits

The first model to explain agents' demand for health was developed in the early 1970s by Michael Grossman (Grossman, 1972). The author recognized that the demand for health services differed from the traditional understanding of consumer demand, in that the consumer does not derive utility from the services as such. What they actually demand is "better health", which includes various production inputs. The purpose of Grossman's model was thus to provide an economic understanding of the determinants of an agent's demand for good health.

In Grossman's model, health is treated as a capital stock. Everyone is endowed with an initial stock, which depreciates over time, but increases with investment. Agents produce health

investments and other commodities according to a series of household production functions. They use some form of health services, time, and human capital as inputs to produce health. The equilibrium conditions require that the value of the marginal product of the health stock equates the price of health capital. The former depends on the wage rate, and the agent's subjective utility of "healthy days". Since human capital is used as an input to produce both health investment and other goods, the model predicts that agents with higher education will produce a larger health stock, all else equal. Moreover, since the return from the health stock increases with wage, the optimal health stock is higher for for agents with a higher wage.

Throughout the years, the model has been extended in various ways to incorporate, for example, health insurance, uncertainty, and family interaction, and, of course, been criticized for its simplifying assumption (see Zweifel, 2012).

In recent years, the model has been criticized for disregarding the social aspects of health evolution. Among other shortcomings, Sepehri (2015) points out that the model ignores the importance of socioeconomic determinants in shaping health and health-related behaviors.

According to the original model, individuals would gain a higher return from their health stock if the return from market production would increase. A wage increase would thus result in higher demand for health. Whether this would reflect in healthier lifestyle habits is not evident; when Grossman elaborated on the model almost thirty years later, he described that while consumption of harmful goods are tearing on the health stock, they may be used as inputs to produce well being (Grossman, 2000). Hence, one would expect that the potential change in consumption of cigarettes following a wage increase would depend on the ratio between the utility from smoking and the increase in rate of return from the health stock.

While Grossman approached the issue of health by explaining why individuals strive to improve their health, the canonical model on addiction, developed by Becker and Murphy (1988) starts off from the opposite end.

Prior to the introduction of the *rational addiction model*, addiction had been viewed as an aberrant behavior in terms of economic theory. Becker and Murphy, however, claimed that the

phenomenon in fact could be explained within a rational choice framework.

In the model, agents derive utility from two types of goods, non-addictive and addictive. Agents maximize their life-time utility with respect to non-addictive goods, addictive goods and their stock of addiction, which is determined by their initial stock and past consumption. The initial stock can be thought of as an event that triggers the first consumption occasion.

Becker and Murphy were able to show that for highly addictive goods, the steady state of the stock in unstable. Consumption will therefore keep increasing for deviations above the steady state, and decrease for deviations below the steady state. Moreover, individuals are more prone to become addictive the higher their discount rate on he future.

The empirical evidence of the model is mixed. Gruber and Köszegi (2001) for example, employ the model to study behavior among tobacco smokers and find that while individuals are forward looking, the model is much more accurate when allowing for agents to be time inconsistent. Bask and Melkersson (2004) found the model to perform well in predicting alcohol consumption, but their findings were also consistent with the notion of deviating behavior among smokers compared to he model.

It is not evident in which direction the model would predict alterations to the path of consumption following changes in employment or income. On the one hand, a permanent change in earnings shifts the budget constraints for all types of consumption. But on the other, if consumption of addictive goods lowers expected future earnings, the shadow price rises with higher earnings. Moreover, the authors argue that changes in the individuals life circumstances can trigger commencement of consumption.

The model has, of course, also faced critique since it was introduced. Despite the extensions and improvements of the original framework, an important critique remains in that the model is not falsifiable. Given that the model was constructed to provide economic rationale to addictive behavior, and predictions of rational addiction models have influenced policy making, this is an important point as it essentially concerns the question of whether the model is able to capture the nature of addiction at all (Rogeberg, 2020).

To summarize, the basic assumptions underlying the theories on demand for health and unhealthy goods predict that higher earnings raise the cost of bad health. There are however nuances to this relationships that depend on the effect on expected earning and utility from a specific type of consumption or behavior. Moreover, considering the critique surrounding these theories, there are likely additional layers of nuances that further could alter the predictions of the models in specific settings.

3.2 German Institutional Settings

Harmful lifestyle habits have received political and academic attention for a lengthy period. Apart from the potential health effects for the individual, there are also externalities of health-related behaviors.

Tobacco smoking induces second-hand smoke on the surroundings of the smoker and increases health care expenditure (Ruprecht et al., 2016). Low physical activity and the associated increased risk for obesity has several potentially negative health effects which also may lead to increased costs for health care services (Centers for Disease Control and Prevention, 2019).

Historically, Germany has been a country with a high prevalence of tobacco smoking, although it seems to be declining over time (Walker, 2004). The trend towards decreased smoking has been particularly strong among adolescents of 12–17 years of age, and young adults aged 18–25 (Ghosh, 2013). According to a 2017 microcensus the total share of smokers in the German population was 22.4 percent, of which 18.8 percent were considered regular smokers. Smoking was more prevalent among men in every age bracket (Statistisches Bundesamt, 2021).

The decline in smoking prevalence has come hand in hand with increased regulation, but whether regulation caused the decline is unclear.

The federal government has placed a nationwide ban on public smoking, including restaurants, bars, and the like, which has been in place since 2007 (Ghosh, 2013). Despite the nationwide ban, the rules regarding smoking take different forms across the German states. As the federal government does not have the authority to impose the ban on the state level, each individual state must pass

the ban, resulting in differences in both implementation and enforcement (How To Germany, 2021).

Physical activity levels in Germany are comparable to other European countries. The WHO recommends that an individual conducts at least 2.5 hours of weekly aerobic physical activity and conduct one muscle-strengthening activity per week. According to Finger et al. (2017), compliance with both these recommendations was at 20.5 percent and 24.7 percent for women and men respectively. While German compliance to the recommendations might appear weak, Germany was in fact placed sixth in Europe in 2014 (Eurostat, 2021a). Although the differences across SES-groups are not massive, it is still evident that those with higher educational attainment and higher income meet the WHO recommendations to a higher degree (Eurostat, 2021a; Eurostat, 2021b).

Turning the attention to subjective health measures, the share of the German population with good or very good perceived health has been stable below the EU average (Eurostat, 2021c). It is unclear why the levels of perceived health are lower in Germany compared to other EU nations, but one might hypothesize that the measure is lower among the former eastern states or that the increased immigration to Germany since around 2008 (Koptyug, 2021) affects the estimate.

Yet, the fact that the average perceived health of the German population is lower than that of many other European states is puzzling and calls for further analysis of health-related matters in the context of Germany.

3.3 German Labor Market

The German labor market has, overall, seen an undoubtedly positive development over the last few decades after several structural economic reforms and favorable cyclical factors. Not least employment has improved considerably. However, these benefits have been heterogeneously distributed and the German Gini coefficient increased sharply in the early 2000s and stabilized at a higher level. These phenomena are complex and many factors may affect outcomes, but wage moderation may explain an important part of the observed development.

The German labor market has faced a number of serious challenges over time. During the Great

Depression the German Economy was hit hard, and in early 1932 the unemployment rate rose up to 24 percent and the real GDP decreased at an annual rate of 8.3 percent between 1929 and 1932 (Dimsdale, Horsewood, and van Riel, 2006). These challenges played a part in leading the way for the Nazi "machtübernahme" in the 1930s. A more recent shock to the German labor market took place the early 1990s in lights of the German reunification. The labor market of the former East Germany was severely underdeveloped compared to that of West Germany and progress was slow. The unemployment rate in the former East Germany doubled, up to around 20 percent, between 1991 and 2004 (Snower and Merkl, 2006).

Since then, the German labor market has seen an undoubtedly positive development throughout the last few decades. Between 2000 and 2014 the employment rate among those aged between 25 and 65 years increased by about ten percentage points. During this period, the German economy saw an increasing employment rate, shrinking unemployment, a lower retirement rate, and an increased female labor market participation (Steiner, 2017). This positive development has been especially strong for older and female workers.

Moreover, with regard to unemployment rates (OECD, 2018), Germany seems to have coped better than other OECD countries following the global financial crisis, albeit younger men saw decreased employment levels in light of the crisis (Steiner, 2017). Casares and Vázquez (2018) compare the German labor market to that of Spain between 1996 and 2013. Their findings include that Germany has lower levels of wage rigidity, a higher flexibility in hours per worker, and a lower level of unemployment. This indicates a more flexible labor market where a larger share of the cyclical variation is seen in wages rather than in employment compared to their European peers.

The positive trend for the German labor market throughout most of the period examined in this paper, indicates that the socioeconomic measures of the German population in some regards may have improved over time as large groups have entered the labor market and more households consist of two working adults as female labor market participation increases. Additionally, the lower retirement rate likely has a positive impact on incomes among retirement-eligible groups. As previous research has found that wealthier individuals display better health status, a relationship

that is particularly evident among the elderly (Schwandt, 2018), the development has the potential to improve health in this group.

Two important Germany-specific labor market factors that are important to consider when discussing these developments are marginal employment, and the Hartz reforms.

Marginal employment, often referred to as mini- and midi-jobs, are two forms of employment which are heavily subsidized through lower tax rates and lower contributions to social security. A "mini-job" is a job with monthly salary below €450. "Midi-jobs" provide a monthly salary of up to €850 per year with the tax reduction being phased out as income increases (Fichtl, 2015).

The Hartz reforms were a series of labor market reforms implemented in Germany between 2003 and 2005. First, the reforms aimed to increase labor demand by facilitating employment of temporary workers and subsidize employee training. Second, the Federal Employment agency was restructured in order to improve labor market efficiency. Third, policy interventions targeted at the unemployed was redesigned for the purpose of increasing labor supply (Bradley and Kügler, 2019).

Many attempts to analyze the effects of the Hartz reforms and their role in the improvement of the German labor market has been made. The findings are however mixed. While some researches claim that the reforms indeed affected unemployment rates (see Stephan and Lecumberry, 2015; Bauer and King, 2018) others state that the reforms merely decreased wages without having a marketed effect on employment (Bradley and Kügler, 2019). In addition, other findings indicate that the improvements in terms of German unemployment were cyclical and that the reforms had little effect on low-skilled workers (Bofinger, 2017).

Given the research on the Hartz reforms, it is possible that they contributed to increase overall inequality.

Germany did indeed experience a historically large rise in inequality during the period of the reforms. Using equivalized labor income to analyze the factors driving the development, Biewen and Juhasz (2012) find that the most important driver was increased inequality in labor incomes. Moreover, during the first decade of the 2000s, capital income's share of disposable income began rising (Fräßdorf, Grabka, and Schwarze, 2011). Given that capital in general is more unevenly

distributed than labor income, this likely contributed to the development as well.

To summarize, the German labor market has undoubtedly undergone vast transitions during the past decades. With regard to the theory and literature on the relationship between SES and health, it is plausible that these changes have altered health-related measures or differences across SES groups.

3.4 German Minimum Wage Reform

Germany introduced a statutory minimum wage from the first of January 2015. The level was initially set at €8.50 and is supposed to be a general minimum wage for the entire German labor market. However, there are some exceptions to the law. For example, minors, trainees, students in compulsory training as part of a university course, and young individuals doing their entry-level qualifications are all exempt. Long-term unemployed individuals are not eligible until after six months at a new job. Additionally, many sectors had a collectively bargained minimum wage already in place at the time. If these were lower than €8.50 they were allowed to use their agreed upon lower rate until the end of 2016 (Deutscher Gewerkschaftsbund, 2015).

The minimum wage was introduced mainly as an effort to tackle working poverty, with many full-time working individuals and mini-jobbers having a hard time to finance their subsistence without additional benefits from the government. Further, proponents argued that it would boost consumer spending, benefiting growth (Guerra, 2014). In total, about 6 million workers, corresponding to about 15 percent of the population were expected to be affected by the reform (Pothier, 2014). The reform thus had the potential to boost income among low-SES groups. On the other hand, if the reform were to lead to major job loss some individuals might see negative shocks to their SES.

Several attempts to analyze the German minimum wage have been made, and the results are somewhat mixed. A few findings, however, remain consistent over several of the analyses of the reform.

The ex ante estimations of about 15 percent of the population being affected by the reform is generally supported in the literature, although estimate are somewhat lower than this. Caliendo,

Schröder, and Wittbrodt (2019) estimate that about 10–14 percent of the eligible work force earned less prior to implementation while Bruttel (2019) estimates it to about 11 percent. As expected, the reform is generally believed to have increased hourly wages at the bottom of the wage distribution substantially (see e.g. Bruttel, 2019; Caliendo, Schröder, and Wittbrodt, 2019). The estimates vary somewhat, Burauel et al. (2020) estimate the effect on hourly wages to 6.5 percent while Bossler and Gerner (2020) estimate it to between 3.8 and 6.3 percent. However, some analyses find evidence for a small reduction in hours (Bruttel, 2019; Caliendo, Schröder, and Wittbrodt, 2019; Bossler and Gerner, 2020) as the observed increase in monthly salaries is lower. On the other hand, Burauel et al. (2020) quantifies the increase in monthly salaries to 6.6 percent, which is larger than the estimated increase in hourly wages.

In terms of effects on employment the short-term effects are estimated to be very small, although somewhat negative, but it is generally difficult to isolate the effects of the reform from general trends. (Bruttel, 2019; Caliendo, Schröder, and Wittbrodt, 2019). Bossler and Gerner (2020) estimate the employment loss in affected establishment to approximately 1.7 percent, corresponding to about 50 000 jobs. However, they note that this effect is driven by a reduction in hiring rather than an increase in layoffs.

Further, there could potentially be scope for avoiding actions or other spillover effects. Caliendo, Schröder, and Wittbrodt (2019) argues that the potential for avoiding actions is small, given that large groups are covered by the reform. However, in terms of spillovers the findings are unclear. Bruttel (2019) reports mixed effects, but does not try to disentangle this himself. Bossler and Gerner (2020) on the other hand uses robustness checks in the form of redefining their control group based on survey questions to try and exclude potential spillover effects and find no substantial changes on results or conclusions. A range of other outcomes are analyzed by Bruttel (2019), for example the factors of dependency on welfare and the risk of poverty which were argued as arguments for the reform are analyzed. He finds no evidence of neither reduced welfare dependency nor reduced risk of poverty. Additionally, he finds evidence of price increases and profit reductions among labor-abundant companies.

As the reform has only been in place for a few years, only the short-term effects have been analyzed (this, of course, also applies to our analysis). In general we can summarize the findings regarding the reform to have increased wages in the lower part of the wage distribution. Also, monthly salaries increased, but to a lesser degree. Additionally a small decrease in employment was experienced, but rather from reduced hiring than from layoffs. Many already employed individuals of low SES has thus experienced positive income shocks due to the reform, while fewer previously unemployed individuals seem to have entered employment after the reform. Given the unclear evidence regarding spillovers it is hard to say how those who previously earned just above the new floor were affected and whether employment was switched to exempt sectors or positions, although the literature shows little support for the latter.

Finally, an issue that is common in the literature regarding the implementation of the German minimum wage is that of compliance. Several authors report finding substantial evidence for widespread non-compliance with the law (Bruttel, 2019; Caliendo, Schröder, and Wittbrodt, 2019). Burauel et al. (2020) estimate that in the first quarter of 2016 roughly 1.8 million eligible individuals still earn below the minimum wage threshold. Bossler and Gerner (2020) point out that their analysis may be subject to effects from increased black market employment after the reform. This is something that should be kept in mind throughout our analysis.

4 Data

To perform our analysis, we rely on data from the German Socio-Economic Panel study (SOEP) (Goebel et al., 2019; SOEP, 2019). The panel includes around 15 000 households with around 30 000 individuals, covering information on the household as well as the individual level. In 1990, the panel was expanded to include households in the former East German states. Throughout the years, the panel has also expanded to include immigrant and refugee samples. All samples of the study are multi-stage random samples, clustered at the regional level.

The study surveys various topics, the main ones being population and demographics, education

and qualifications, occupational dynamics, earnings, housing, health, preferences and values, and satisfaction with life. Some questions within each topic are repeated every year, while others are asked irregularly or only once. In general, responses are collected through face-to-face interviews with each member of the sampled household (Goebel et al., 2019).

The SOEP is distributed in several data sets, differing in terms of topic, format, and degree of processing. To conduct this study, we combine *original data* and *generated data*. The original data comprises the direct answers from respondents and correspond to the actual survey questions. In the generated data sets, information from the original data are combined to obtain a user friendly panel, to which additional variables can be merged (Kara, Zimmermann, and SOEP Group, 2019).

For the purpose of this paper, we exclude observations prior to 2002, since smoking habits were not surveyed up until then.

4.1 Description of Variables

The main independent variables operationalized in our estimations include education, income, and unemployment. First, we study the cross-sectional correlations, and second, we use a fixed effects specification and a quasi-experiment with the objective to disentangle causality, between these factors and outcomes regarding smoking status, number of cigarettes consumed per day, and frequency of exercise. The main variables used in this paper are described in further detail below.

Exercise: Questions on exercise have been posed irregularly, but reoccurring throughout the waves. The responses have been combined in a generated variable in which the frequency of participation in sport or exercise have been coded into a four level scale, where *1=Almost never or never*, *2=Several times a year*, *3=At least once a month*, and *4=at least once a week*. This variable is used as the outcome variable measuring the degree of exercise (Grabka, 2020). Descriptive statistics are shown in table 1 below, including mean, standard deviation, minimum and maximum values, and number of observations of all dependent variables. On average, respondents exercise more than several times a year, but less than every month. Exercise habits seem to vary quite a lot

across respondents, considering that the standard deviation is higher than 1 on a four level scale.

Smoking: Every other year between 2002 and 2018, respondents are asked whether they smoke cigarettes (Kara, Zimmermann, and SOEP Group, 2019). In addition, those respondents who do smoke are asked to report how many cigarettes per day they consume (SOEP, 2019). Reading from table 1 below, approximately a third of all respondents are current smokers. On average, those who do smoke consume just under 16 cigarettes per day. Since the maximum number of cigarettes consumed per day sums to 200, it seems that there are a few outliers among the smoking respondents. Indeed, we find that 95 percent of the smokers consumed 29 cigarettes or fewer per day.

Table 1: Descriptive statistics: Dependent variables

	mean	sd	min	max	N
Smoking status	.32	.47	0	1	139,639
Nr cig	15.56	8.98	1	200	42,806
Exercise	2.52	1.33	1	4	143,665

Education: The German education system comprises various tracks already from lower secondary education. While compulsory education in general starts at age six and lasts nine years, students choose different tracks already at ages ten to twelve. The range of educational choices following lower secondary education depend on the track chosen (Eurydice, 2020). While different combinations of lower secondary education, vocational training, and upper secondary education can be interpreted as equivalent to high school degree (Couch, 1994), years of schooling and type of schooling vary depending on the combination of educational profile (SOEP Group, 2019). As such, it is not straight forward to interpret the results from a quantitative analysis where years of schooling is employed as independent variable in the context of Germany. On the one hand, years of schooling does not necessarily capture the respondents' labor market outlooks. On the other, educational attainment

with respect to diplomas might not sufficiently capture competencies or ability. Therefore, a measure which considers both years of schooling and educational attainment is necessary in order to understand the impact of education on individual outcomes. Other studies in which GSOEP data is employed have made use of various measures to quantify educational attainment (see e.g Choi, Joesch, and Lundberg, 2008; Fossen and Büttner, 2013; Becchetti, Massari, and Naticchioni, 2014; Le Moglie, Mencarini, and Rapallini, 2019).

In constructing our variable indicating educational attainment, we have strived to capture the possible degrees obtained, mirroring labor market prospects, based on the years of education among the respondents. To determine appropriate cutoffs, we rely on Fossen and Büttner (2013), who also use years of schooling to proxy for different levels of educational attainment. Their proxies, which are displayed in the box below this section, closely follow the codebook descriptions (see SOEP Group, 2019) on educational information in the data set. However, our educational indicators deviate from those of the authors regarding upper secondary education and tertiary education, respectively.

Fossen and Büttner argue that at least thirteen, but fewer than eighteen, years of schooling usually corresponds to the higher secondary school degree Abitur, which qualifies for university studies. Further, they use 18 years of schooling as cutoff to proxy for university studies. However, we find that most respondents with an Abitur degree who have not pursued tertiary education have attended school for at least thirteen years but fewer than 15 years. Those with a university degree or a technical college degree, on the other hand, constitute the majority among those who have studied for fifteen years or more. Therefore, we use somewhat different cutoffs (see the box below for comparison).

Moreover, descriptive statistics for each educational category are displayed in table 2 below. The majority of respondents have studied more than 10.5 years, but fewer than 13 years, which is the interval constructed to proxy for vocational degree (indicated by the dummy labeled educ_voc).

Table 2: Descriptive statistics: Education

	educ_low	educ_voc	educ_med	educ_high
Mean Years of education	8.693	11.23	13.71	16.93
N	39506	161582	32595	63851

Educational dummies		
Cutoffs Fossner and Büttner	Our used cutoffs	Proxied group
educ<10.5 y	educ<10.5 y	Lower/intermediary school degree
10.5 y $\leq$ educ $<$ 13 y	10.5 y $\leq$ educ $<$ 13 y	Lower/intermediary school degree and vocational training
13 y $\leq$ educ $<$ 18 y	13 y $\leq$ educ $<$ 15 y	High School degree qualifying for higher studies
18 y $\leq$ educ	15 y $\leq$ educ	Higher education

Unemployment: The relationship between unemployment and the outcome variables are studied in the cross-sectional analysis as well as the fixed effects analysis.

Unemployment is defined by a binary variable, taking on the value 1 if the respondent is officially registered unemployed at the Federal Employment Agency, and 0 otherwise.(Kantar Public, 2019). Among the 303 045 observations for which there is information on the circumstances regarding their employment status, there are 21 076 occurrences of unemployment.

While we assume the cross-sectional analysis to suffer from omitted variable bias when unemployment is operationalized as the independent variable, we expect issues of endogeneity to primarily reflect time-invariant factors such as innate ability and educational track. Hence, we do not expect omitted variable bias to be a cause for concern in the fixed-estimation. It could however be the case that respondents with worse health, caused by unhealthy habits, are more likely to become unemployed. Therefore, the issue of reverse causality cannot be ruled out in either estimation.

Income: The SOEP provides extensive information on the economic circumstances of households as well as individuals. In this study, we use generated variables on household post-government income as well as individual labor earnings.

Galobardes et al. (2006) state that income impacts health outcomes directly and indirectly, by bounding the individual's material opportunities and shaping their psychological disposition. The authors describe that the relationship between income and health are mediated through different mechanisms, such as behaviors. Since the main benefit of employing income, rather than other variables, as a measurement of SES is its precise indication of material living standards, disposable income is preferable to gross income. While there are drawbacks of using household income compared to other income measures, it is still indicative of living standard and opportunities of household members (Duncan et al., 2002).

Hence, we proceed by employing a log transformed generated variable indicating household income after taxes and transfer in the cross-sectional as well as in the fixed effects estimations. Income is harmonized to 2002 prices.

Figures 1–3 depict the sample distribution of household income. The histogram displayed in figure 1 reveals high variation in income among respondents with the highest incomes. (Note that the histogram only includes the bottom 99 percent, due to the variation in the top 1 percent). Figure 2 depicts maximum income per income decile 1–9. The median income in the sample is approximately €40 000 per year. Finally, figure 3 depicts maximum income per income millile 900–1 000 (that is, the 10th decile, divided in 100 groups). In contrast to deciles 1–9, it seems as if incomes are very unevenly distributed in the very top, with a small group earning incomes much higher than the rest of the sample.

While log household income is the measure operationalized in the cross-sectional and fixed effects estimations, we rely on individual labor earnings for the the quasi experimental model in order to determine whether the respondents were affected by the introduction of the minimum wage reform in 2015. We follow Gülal and Ayaita (2020), using a variable indicating the respondents' gross

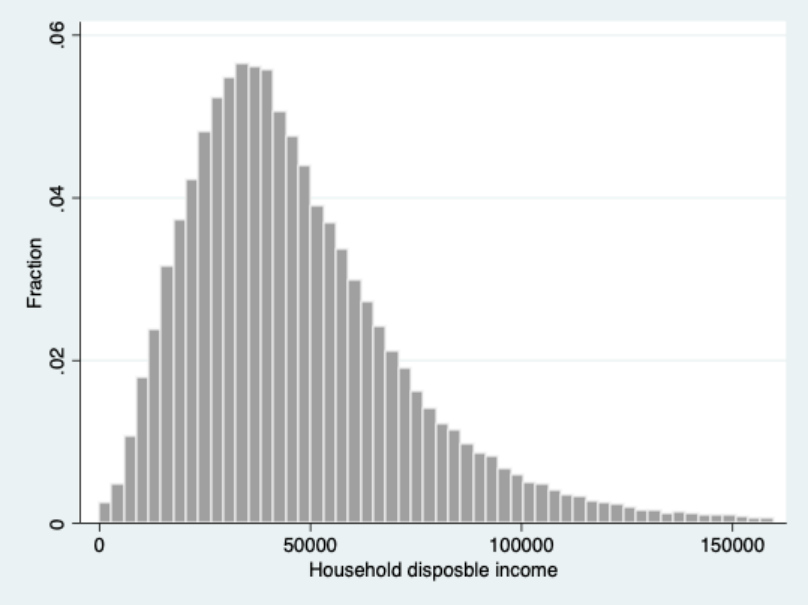


Figure 1: Sample distribution over incomes

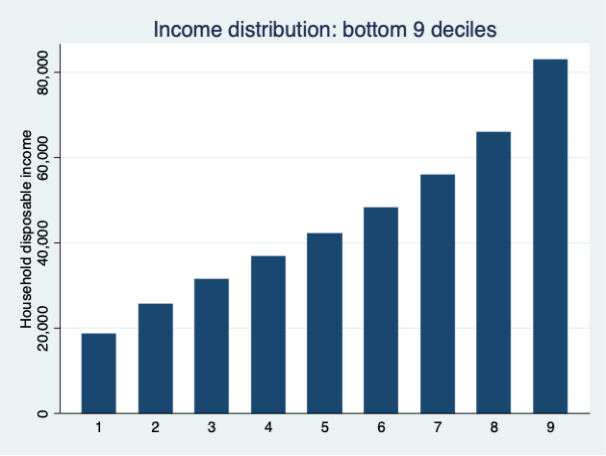


Figure 2: Max income income, deciles 1–9

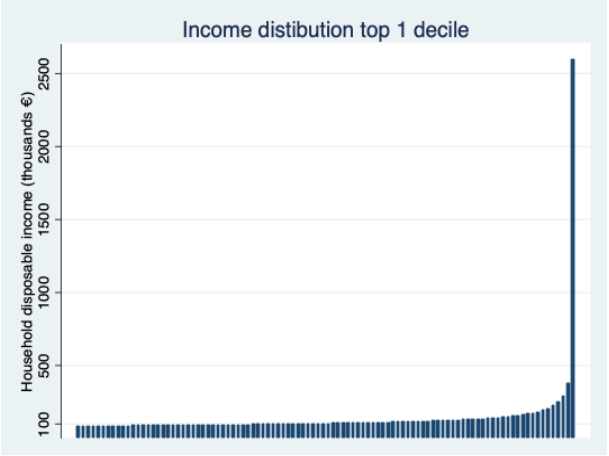


Figure 3: Max income, milliles 900–1 000

labor earnings (including overtime payment but excluding irregular kinds of compensations such as bonuses) in the month prior the interview (SOEP Group, 2019). In line with Gülal and Ayaita (2020), we determine the respondents' hourly wage by multiplying their average weekly working hours with 4.3, which are the average number of weeks per month, and finally divide their monthly compensation with working hours per month.

Finally, generated indicators for age, marital status, number of children, federal state, region of origin, and occupational change are used as control variables in this study (Grabka, 2020). Additional information on the variables indicating region of origin and occupational change, respectively, is included in appendix A.

5 Empirical Strategy

Our empirical analysis consists of three main parts. First, we investigate the correlation between observed socioeconomic variables and behavioral outcomes by conducting cross-sectional regressions. The purpose of this part is not to study causality, but to establish that the co-movements between variables in our sample follow expectations based on previous literature, namely that higher incomes and higher educational attainment are associated with less smoking and more exercise, whereas unemployment should correlate with more smoking and less exercise.

Second, we perform fixed effects regressions, analysing the effect of socioeconomic changes on lifestyle outcomes. Namely, we study the effect of changes in employment status and household disposable income, respectively, on frequency of exercise and smoking habits. As such, the impact of material circumstances on lifestyle outcomes are isolated from time-invariant individual characteristics that may cause bias, such as social heritage and environment. Compared to the cross-sectional analysis, the fixed effects estimation is thus an improvement in establishing causality. One should however add that our fixed-effects estimation lends itself to a narrow definition of causality. As Galobardes et al. (2006) note, SES can be viewed from a life course perspective, where early childhood experiences affect outcomes later in life. Our specification, however, only considers the

immediate effect of socioeconomic changes during adulthood. In addition, the fixed-effects analysis does not solve for issues of reverse causality. Lifestyle habits impact health, and health might affect income and labor market outcomes.

Moreover, the fixed effects specification measures the average within-subject effect of changes in income and employment status across the entire sample. This might lead us to underestimate the impact on specific groups. The results presented in the papers by Young-Hoon (2012), Eisenberg and Okeke (2009), and Settele and van Ewijk (2018), discussed in the literature review, suggest that changes in economic circumstances or costs may have particular bearing on exercise and smoking habits among individuals with low SES. If this group differs in terms of health-related behaviors compared to others *and* displays higher responsiveness to economic incentives in their behaviors, they are of particular importance to study.

To circumvent the issues of reverse causality and underestimation of effects, we continue with a third analysis. Our final specification is a quasi-experimental design in which only low-wage earners are included. With a diff-in-diff approach, We study the impact of the introduction of the minimum wage reform in Germany in 2015, comparing behavioral outcomes between respondents whose hourly wage was below the minimum wage to respondents whose hourly wage was just above the minimum wage prior to the reform.

It is common within economics, and a range of other fields, to use $P < 0.10$, $P < 0.05$, and $P < 0.01$ as thresholds for statistical significance. This is often criticized as it leaves room for a non-negligible risk of false positives. We therefore, in line with the reasoning of Benjamin et al. (2018), use lower thresholds to reduce the risk of type I-errors in our analysis.

5.1 Cross-sectional Specification

The first part of our analysis consists of three basic specifications merely establishing co-movements between socioeconomic variables and behavioral outcomes:

$$Y_{it} = \alpha_1 + \beta_1 educ_voc + \beta_2 educ_med + \beta_3 educ_high + \gamma' X_{it} + \delta_t + \epsilon_{it} \quad (1)$$

$$Y_{it} = \alpha_1 + \beta_1 educ_voc + \beta_2 educ_med + \beta_3 educ_high + \beta_4 HH_inc + \gamma' X_{it} + \delta_t + \epsilon_{it} \quad (2)$$

$$Y_{it} = \alpha_1 + \beta_1 educ_voc + \beta_2 educ_med + \beta_3 educ_high + \beta_4 unemp + \gamma' X_{it} + \delta_t + \epsilon_{it} \quad (3)$$

Education is indicated on a four level scale, each level represented by a dummy. The excluded category is the lowest level of educational attainment. β_1, β_2 and β_3, respectively, denote the average effect of educational attainment on smoking status, number of cigarettes, and frequency of exercise, compared to the lowest level of educational attainment. γ captures the effect of individual-level controls, $X_i t$, including sex, age, age square, marital status, number of children, federal state, and origin. Year fixed effects are also included, denoted by δ_t.

In equation 2, we introduce the effect of household disposable income. The average effect of household disposable income, measured in logs, on the outcome variable is denoted by β_4. Equation 3 is similar to equation 2, but instead of household disposable income, we include a dummy indicating if the respondent is unemployed. The average effect of unemployment on the outcome variables, is captured by β_4 in equation 3.

There are different ways to perform a cross-sectional analysis on panel data. In order to keep as much variation as possible, we run the cross-sectional estimations on all samples and cluster standard errors on individual level. As such, we treat each observation as unique, but account for the fact that most respondents are included in more than one year. Moreover, respondents who are younger than 25 years or 65 years or older are excluded in order to limit the analysis to individuals who have completed their education and are of working age.

5.2 Fixed-Effects Specification

To conduct the second part of our analysis, we define two general specifications:

$$Y_{it} = \alpha_1 + \beta_1 HH_inc + \gamma' X_{it} + \delta_t + \theta_i + \epsilon_{it} \tag{4}$$

$$Y_{it} = \alpha_1 + \beta_1 unemp + \gamma' X_{it} + \delta_t + \theta_i + \epsilon_{it} \tag{5}$$

$$\tag{6}$$

The estimator on the independent variable, β_1, denotes the average effect of changes in household disposable income and employment status within respondents. Employment includes part time work, but excludes other activities such as studies and parental leave.

As in the cross-sectional estimation, household disposable income is measured in logs to obtain linearity in parameters and the sample is restricted to respondents of working age.

Individual time-invariant factors are captured by θ_i. Since the specification relies solely on within-subject variation, variables such as gender and origin are not controlled for. However, between time periods, individuals might be exposed to events that cause lifestyle changes. Therefore, a vector of controls, X_{it}, is included to capture changes in marital status, age, number of children, whether the respondent has moved between federal states or experienced a change in occupational status, apart from unemployment.

5.3 Quasi-Experimental Design

For the third empirical approach, we draw on Gülal and Ayaita (2020) to construct the specifications. With a diff-in-diff estimation, Gülal and Ayaita use SOEP data to evaluate the effect of the introduction of a minimum wage in 2015 on well being.

In their main analysis, the treatment group is defined as respondents who are employed and receive hourly wages below €8.50 per hour prior to the reform. The control group is restricted to employees who receive hourly wages between €8.50 and €12.75 prior to the reform. Only individuals who are employed full-time or part-time, both prior to the reform and after the reform are included. Apprentices, interns, and self-employed individuals are excluded since they were not targeted by

the minimum wage, as are respondents under the age of 18. Finally, respondents who are 65 years or older have often retired and are therefore excluded as well.

In line with Gülal and Ayaita, we define treatment and control groups according to their wage in 2014, the year prior to the reform. Respondents with a wage below the minimum wage of €8.50 in 2014 are included in the treatment group and respondents with a wage of €8.50 or 50 percent higher are included in the control group. We also follow the authors in excluding individuals from the treatment group whose wage was more than 50 percent higher than the minimum wage in 2015, since such a large wage increase likely is induced by other events than the reform. In total the treatment and control groups consists of 1,748 and 2,769 observations respectively in 2014.

Whereas the treatment and control groups are defined in accordance with the introduction of the minimum wage, our outcome variables do not perfectly match the treatment year. The data set contains information on frequency of exercise in 2013 and 2015 and information on smoking habits in the years 2014 and 2016. We therefore measure differences in outcomes between 2013 and 2015 in the case of exercise and 2014 and 2016 in the case of smoking.

With these consideration, we define two specifications:

$$y_{it} = \beta_0 + \beta_1 Treat + \beta_2 Year + \beta_3 Treat * Year + \gamma' X_{it} + \epsilon_{it} \tag{7}$$

$$y_{it} = \alpha_0 + \alpha_1 Treat + \alpha_2 Year + \alpha_3 Treat * Year + \gamma' X_{it} + \epsilon_{it} \tag{8}$$

Treat is a dummy variably taking on the value 1 if the respondent belongs to the treatment group. β_1 in equation (7) thus captures average time-invariant differences between the treatment and control group, respectively. *Year* is a dummy indicating the post treatment period, which is 2015 in the case of equation (7). Hence, β_2 captures time trends, going from 2013 to 2015, that are common for both groups. The main coefficient of interest, β_3 indicates the average difference in the change of exercise habits between treatment and control groups, going from 2013 to 2015 – i.e, the treatment effect. The coefficients in equation (7) and equation (8) are alike in all respects,

but the dummy variable *Year*. Whereas *Year* in equation (7) takes on the value 1 in 2015 and 0 in 2013, *Year* in equation (8) takes on the value 1 in 2016 and 0 in 2014. As in the previous specifications, X_{it} is a vector of individual levels controls. The controls include gender, age, age squared, educational level (as defined in section 4.1), a binary variable indicating if the respondent is married, number of children, federal state, and a binary variable indicating nationality other than German. Standard errors are heteroscedasticity-robust and clustered at individual level.

The controls included deviate in some aspects from the controls chosen by Gülal and Ayaita (2020). Although we follow the authors in including gender, age, age squared, and marital status, our controls for education differs somewhat from theirs. Whereas they have only taken achieved degree into account when constructing their educational indicators, our educational indicators proxy for degrees with respect to number of years of education (see section 4.1). As such, we maintain comparability to our previous specifications. For the same purpose, we include controls for federal state in which the respondent reside, number of children, and if the respondent has other national origin than German. Finally, we have not included controls for branch. First, Gülal and Ayaita study the impact of the minimum wage on *Life Satisfaction*, *Job Satisfaction* and *Pay Satisfaction*. While one might expect a connection between branch in which the respondent is employed and their subjective contentment with their labor market situation, the connection is not as obvious with the outcome variables studied in this paper. Second, the authors make use a very broad classification of occupations, comprising six categories. As such, the potential connection between the outcome variables in our analysis and their occupational indicators appears even more dubious.

6 Results

6.1 Cross-sectional Analysis

The results from the cross-sectional analyses are presented in tables 3–5. First, it is evident that higher educational attainment is related with less smoking and higher frequency of exercise.

The omitted educational degree is the lowest level, which corresponds to having completed no

more than lower secondary schooling. Since the variable *Smoking status* is binary, where 0 indicates non-smokers and 1 indicates smokers, the coefficients on the educational dummy variables indicate the extent of smoking in each group, compared to the omitted group.

Reading from table 3, there are 9.83 percent fewer smokers, or equivalently the chance of being a smoker is 9.83 percent lower, among the group who received vocational training following lower secondary schooling (*educ_voc*). Among the group who has a high school diploma which qualifies them for higher studies (*educ_med*), there are 21.1 percent fewer smokers. Finally, among the group with the highest educational attainment (*educ_high*), there are 26,3 percent less smokers. There seems to be high precision in the estimates. Standard errors are small, at approximately 1 percentage point given the outcome variable.

When adding the effect of household income in table 4, the relationship between educational attainment and smoking status becomes slightly weaker. The difference among the group who has obtained the highest educational qualifications is 3.6 percentage points lower with this specification. The coefficient on household income itself is nearly negligible. Although the estimate is statistically significant at the one percent level and standard errors are low, a 1 percent increase in income is only associated with 0.0006 percent less risk of being a smoker, which we argue is negligible. It could be the case that the effect of income is largely captured by educational attainment. There is a caveat to this interpretation, however. The properties of the income and educational scales, respectively, are quite different. While the variables indicating education divide respondents into four broad categories, the income variable captures much smaller differences among the respondents. If we were to add similar cutoffs to the income measurement as to educational attainment, the importance of income compared to education might appear different.

Moreover, among smokers, it appears that higher educational attainment is associated with fewer cigarettes consumed. On average, smokers with a vocational degree consume almost 1.3 cigarettes fewer per day than smokers with only a lower secondary degree. Smokers with a high school diploma smoke nearly 3 cigarettes fewer per day compared to smokers with only a lower secondary degree. Lastly, smokers who have obtained the highest educational qualifications smoke

nearly four cigarettes fewer per day compared to the baseline group. Standard errors are low also in this estimation, corresponding to between a fifth and a third of a cigarette per day for the different coefficients. The effect of adding income to the regression in table 4 displays only a marginal effect on the coefficients concerning the number of cigarettes consumed in each educational category, and the coefficient for income itself is negligible.

The outcome variable *Exercise* ranges from 1 to 4. As such, dividing the coefficients on educational groups by four provides the percentage change in frequency of exercise in relation to the scale. The coefficient on *educ_voc* is 0.483, implying that the group on average exercises 12 percent more than the baseline group. Differently put, approximately 12 percent of respondents in this group appreciate that there frequency of exercise corresponds to the level above the average among the baseline group. The coefficients on *educ_med* and *educ_high* are both close to 1, implying that these groups exercise, on average, around to 25 percent more than the baseline group. For each category of education, standard errors are very small compared to the coefficients, indicating high precision in the estimates. In line with the previous specifications, the addition of income has a fairly small effect on estimates. The estimate for those with highest educational attainment decreases with around 5 percentage points, compared to the baseline group, when income is added.

Table 5 displays the results from the specification were unemployment serves as the independent variables. Although unemployment is positively correlated with smoking status and number of cigarettes, and negatively associated with exercise, and the standard errors indicate high precision, the estimates on unemployment are overall smaller in magnitude than in the case of education. This suggests that while unemployment as a measure of SES might contribute in understanding health-related behaviors, it is not necessarily the most important feature on an aggregate level. These estimates are nonetheless likely plagued by omitted variable bias. Respondents who smoke, consume more cigarettes, and exercise less might well share other characteristics, such as low patience, anxiety, fatigue, etcetera, that explain both their behavioral outcomes and probability of being unemployed.

The issue of omitted variable bias is of course relevant for education and income as well. Apart

from the characteristics mentioned above, the independent variables employed might not be causal as such, but merely channel the effect of childhood SES. Moreover, the specifications do not take parental habits into account, which might be more important in predicting whether the respondent smokes or exercises often and, in addition, pose an effect on educational attainment, income, and risk of becoming unemployed.

These potential causes of omitted variable bias are, on the other hand, all of time-invariant kind and thus ruled out in the fixed-effects results discussed in the next section.

Table 3: Cross-section

	(1) Smoking Status	(2) Nr cig	(3) Exercise
educ_voc	-0.0983***	-1.298***	0.483***
	(0.008)	(0.223)	(0.019)
educ_med	-0.211***	-2.953***	0.917***
	(0.010)	(0.312)	(0.024)
educ_high	-0.263***	-3.829***	1.147***
	(0.009)	(0.289)	(0.021)
male	0.0909***	3.712***	-0.0889***
	(0.005)	(0.150)	(0.012)
age	0.0139***	0.540***	0.0162***
	(0.002)	(0.051)	(0.004)
age, squared	-0.000195***	-0.00525***	-0.000275***
	(0.000)	(0.001)	(0.000)
married	-0.0881***	-0.888***	-0.0100
	(0.007)	(0.218)	(0.017)
widowed	-0.00400	0.168	-0.138**
	(0.018)	(0.552)	(0.044)
divorced	0.0951***	0.630*	-0.117***
	(0.010)	(0.279)	(0.024)
separated	0.0763***	1.123**	-0.0812**
	(0.013)	(0.377)	(0.031)
Nr child	-0.0126***	0.0312	-0.0929***
	(0.002)	(0.072)	(0.005)
_cons	0.284***	5.767***	1.936***
	(0.036)	(1.088)	(0.092)
Time fixed-effects	Yes	Yes	Yes
State fixed-effects	Yes	Yes	Yes
Region of origin	Yes	Yes	Yes
N	139 238	42 617	143 169

Standard errors in parentheses

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

Table 4: Cross-section

	(1) Smoking Status	(2) Nr cig	(3) Exercise
log HH income	-0.0609***	-0.448**	0.345***
	(0.004)	(0.150)	(0.010)
educ_voc	-0.0846***	-1.199***	0.405***
	(0.008)	(0.222)	(0.018)
educ_med	-0.186***	-2.774***	0.774***
	(0.010)	(0.311)	(0.024)
educ_high	-0.227***	-3.577***	0.943***
	(0.009)	(0.292)	(0.021)
male	0.0924***	3.721***	-0.0971***
	(0.005)	(0.150)	(0.012)
age	0.0177***	0.559***	-0.00523
	(0.002)	(0.052)	(0.004)
age, squared	-0.000236***	-0.00546***	-0.0000476
	(0.000)	(0.001)	(0.000)
married	-0.0652***	-0.711**	-0.135***
	(0.007)	(0.220)	(0.017)
widowed	-0.00984	0.147	-0.0996*
	(0.018)	(0.551)	(0.044)
divorced	0.0878***	0.586*	-0.0707**
	(0.010)	(0.280)	(0.023)
separated	0.0672***	1.078**	-0.0225
	(0.013)	(0.379)	(0.031)
Nr child	-0.0109***	0.0473	-0.102***
	(0.002)	(0.072)	(0.005)
_cons	0.800***	9.746***	-0.997***
	(0.048)	(1.660)	(0.125)
Time fixed-effects	Yes	Yes	Yes
State fixed-effects	Yes	Yes	Yes
Region of origin	Yes	Yes	Yes
N	139 208	42 612	143 147

Standard errors in parentheses

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

Table 5: Cross-section

	(1) Smoking Status	(2) Nr cig	(3) Exercise
unemp	0.133***	0.880***	-0.347***
	(0.007)	(0.177)	(0.017)
educ_voc	-0.0887***	-1.215***	0.455***
	(0.008)	(0.223)	(0.019)
educ_med	-0.196***	-2.818***	0.876***
	(0.010)	(0.312)	(0.024)
educ_high	-0.248***	-3.696***	1.104***
	(0.009)	(0.290)	(0.021)
male	0.0899***	3.708***	-0.0863***
	(0.005)	(0.150)	(0.012)
age	0.0140***	0.541***	0.0159***
	(0.002)	(0.051)	(0.004)
age, squared	-0.000198***	-0.00527***	-0.000269***
	(0.000)	(0.001)	(0.000)
married	-0.0810***	-0.819***	-0.0298
	(0.007)	(0.218)	(0.017)
widowed	0.00230	0.227	-0.153***
	(0.018)	(0.551)	(0.043)
divorced	0.0928***	0.618*	-0.112***
	(0.010)	(0.279)	(0.023)
separated	0.0748***	1.117**	-0.0808**
	(0.013)	(0.377)	(0.031)
Nr child	-0.0138***	0.0180	-0.0892***
	(0.002)	(0.072)	(0.005)
_cons	0.262***	5.582***	2.002***
	(0.036)	(1.085)	(0.092)
Time fixed-effects	Yes	Yes	Yes
State fixed-effects	Yes	Yes	Yes
Region of origin	Yes	Yes	Yes
N	139 238	42 617	14 3169

Standard errors in parentheses

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

6.2 Fixed-effects Analysis

Tables 6–7 display the results from the fixed-effect estimations. When smoking status serves as the outcome variable, the estimate on changes in household income shares the same sign as the estimate in the cross-sectional estimation, but is now smaller and no longer statistically significant. The standard errors are similar to the cross-sectional estimation, which could be indicative of lower precision. The standard errors were, however, very low to begin with.

The estimate on changes in household income when the number of cigarettes smoked is the outcome variable, on the other hand, is now positive, contrary to the cross-sectional estimation. A potential reason for the sign-shift is that high-income smokers might have different smoking habits compared to low-income smoker. If, for example, high-income smokers primarily consume cigarettes on social occasions, whereas low-income smokers consume a constant number of cigarettes regardless of occasion, high income smokers might smoke less on average. When such differences are ruled out, the results from the fixed effects estimation would suggests that regardless of stationary differences in habits, higher income leads to higher consumption. Moreover, both the point estimate and the standard errors have roughly changed by the same magnitude compared to the cross-sectional estimation, suggesting that the precision of the point estimate is not compromised in the fixed-effects regression. However, while the estimate is statistically significant and displays high precision, it lacks economic significance. A 1 percent increase in household income is associated with 0.002 more cigarettes consumed per day.

Likewise to the case of smoking status, there is no shift in sign on the estimate for frequency of exercise, and standard errors are comparable to the cross-sectional estimation. The estimate is however smaller in magnitude and no longer statistically significant.

One might suspect that there may be delays in habits following an income change. For example, viewing addiction as a stock in accordance with rational addiction theory, an income increase in one period may induce increased cigarette consumption for several periods ahead. As a robustness check, we therefore run the same regressions, but including two income lags. The estimates on changes in household income from these regressions are, however, very similar to the estimates in

table 6. Moreover, the estimates on the lags are not statistically significant. The results from this specification are included in Appendix B.

Interestingly, when unemployment is used as the independent variable, all three estimates have shifted sign compared to the cross-sectional estimation. In the case of there actually being a causal effect of unemployment on the outcome variables, this could be indicative of an income effect – lower income and more spare time cause less smoking and higher frequency of exercise. The estimates are, however, much smaller compared to the cross-sectional estimations, the relationship between unemployment and smoking status is no longer statistically significant and the implied effect of unemployment on frequency of exercise is very small in magnitude.

The effect of unemployment on the number of cigarettes consumed per day is statistically significant and could potentially be economically significant as well. The estimate suggest that unemployment would lower consumption by nearly third of a cigarette per day, which corresponds to nearly 120 cigarettes per year. In relation to the point estimate, the standard error is however relatively high. Whether unemployment is of actual importance to the number of cigarettes consumed is therefore somewhat ambiguous.

To summarize, the effect of experiencing changes in household disposable income does not seem to have an impact on smoking or exercise habits. The signs on the unemployment estimates suggests that there might be an income effect, but based on the magnitude and precision of the point estimates, we are not able to establish whether this indeed holds true.

Finally, the signs on the estimates do suggest that our fixed effects specifications suffer less from reverse causality compared to the cross-sectional estimations. If the opposite would have been the case, we would expect to see a negative relationship between household income and number of cigarettes consumed as well as between unemployment and exercise, and a positive relationship between unemployment and smoking habits. Of course, we cannot completely rule out that reverse causality affects the estimates as it could simply reduce the magnitude of the coefficients or, incidentally, go in the opposite direction.

Table 6: Fixed-Effects

	(1) Smoking Status	(2) Nr cig	(3) Exercise
log HH income	-0.00230	0.234*	0.00717
	(0.002)	(0.094)	(0.009)
age	-0.00644***	-0.150***	0.00248*
	(0.000)	(0.010)	(0.001)
married	-0.0546***	-0.717**	-0.141***
	(0.005)	(0.228)	(0.020)
widowed	-0.0296*	-0.00719	-0.148**
	(0.013)	(0.533)	(0.052)
separated	-0.0181*	0.187	-0.0651*
	(0.008)	(0.295)	(0.029)
divorced	-0.0321***	-0.302	-0.0911**
	(0.007)	(0.289)	(0.028)
Nr child	-0.00603***	-0.0824	-0.0429***
	(0.001)	(0.063)	(0.006)
_cons	0.664***	20.07***	2.543***
	(0.024)	(0.956)	(0.095)
Time fixed-effects	Yes	Yes	Yes
Changed Bundesland	Yes	Yes	Yes
Occupational change	Yes	Yes	Yes
N	139 207	42 612	143 147

Standard errors in parentheses

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

Table 7: Fixed-Effects

	(1) Smoking status	(2) Nr cig	(3) Exercise
unemp	-0.00414	-0.321**	0.0667***
	(0.004)	(0.124)	(0.014)
age	-0.00648***	-0.143***	0.00339***
	(0.000)	(0.009)	(0.001)
married	-0.0573***	-0.656**	-0.150***
	(0.005)	(0.227)	(0.020)
widowed	-0.0338*	-0.106	-0.160**
	(0.013)	(0.533)	(0.052)
separated	-0.0182*	0.194	-0.0761**
	(0.008)	(0.295)	(0.029)
divorced	-0.0327***	-0.273	-0.103***
	(0.007)	(0.289)	(0.028)
Nr child	-0.00744***	-0.106	-0.0454***
	(0.001)	(0.063)	(0.006)
_cons	0.662***	22.67***	2.553***
	(0.010)	(0.420)	(0.043)
Time fixed-effects	Yes	Yes	Yes
Changed Bundesland	Yes	Yes	Yes
N	139 238	42 617	143 169

Standard errors in parentheses

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

6.3 Quasi-Experimental Design

The quasi-experimental analysis is conducted by performing a difference-in-differences estimation. There are two main assumptions that must hold true in order for the estimation to render unbiased results. First, since we instrument an income increase with the implementation of the minimum wage, wages among the treatment group, *and the treatment group only*, must have increased due to the reform. Second, the analysis relies on the assumption that the outcomes studied would have followed the same trend in the treatment and control groups in the absence of the reform.

In order to establish whether wages actually increased in the treatment group due to the reform, we regress hourly wages on the binary variable indicating treatment status, a binary variable indicating the year of treatment (i.e, a dummy variable that takes on the value 0 in 2014 and 1 in 2015), and an interaction term between the two. The same controls as in the main analysis were included.

The results are reported in table 8 below and displayed graphically in figure 4, respectively. The estimate for the variable indicating the year of treatment reveals that hourly wages were on average almost €1 higher for both groups in 2015 compared to 2014. The estimate on the treatment status variable shows that hourly wages are on average €4.168 lower in the treatment group compared to the control group, irrespective of year. Finally, the estimate on the interaction term reveals if the treatment group received higher wages due to the introduction of the minimum wage. The estimate is indeed positive, indicating that hourly wages in the treatment group on average increased by nearly €0.3 after the reform, and the estimate is statistically significant at the 1 percent level. The increase is however quite subtle. Considering the results on the relationship between income and the outcome variables from the cross-sectional and fixed effects estimations, the wage increase following the minimum wage reform might be too small in magnitude to alter smoking and exercise habits.

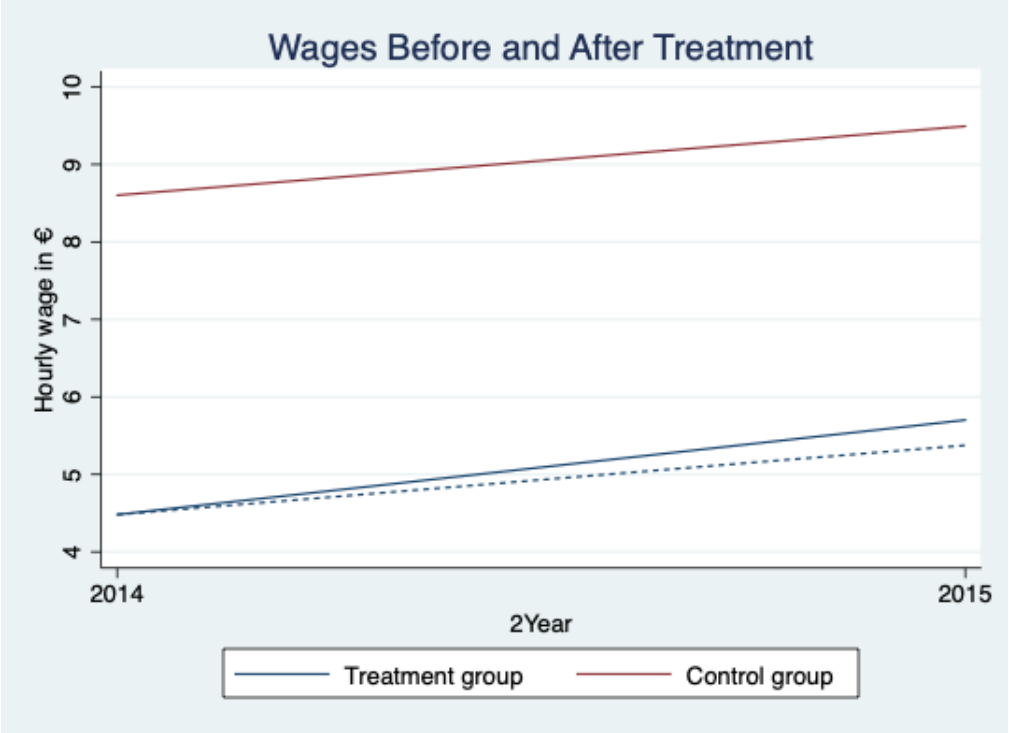


Figure 4: Exercise

Table 8: Treatment effect on wages

	(1) Hourly Wage
Year	0.893***
	(0.074)
Treat	-4.120***
	(0.052)
Year*Treat	0.328***
	(0.092)
All controls	Yes
N	8 769

Standard errors in parentheses

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

The credibility of the second assumption, i.e, that the treatment group displays linear trends with the control group, is demonstrated in the figures 5–7. The graphs display mean differences between the treatment and control groups in the years before and after treatment. From figure 5, it appears that the treatment group exercises less frequently on average than the control group, but the difference only seems to materialize in levels prior to treatment and not in trends. No apparent difference in either trends or levels in terms of smoking status prior to treatment can be distinguished from figure 6. Finally, figure 7 displays the mean difference in number of cigarettes consumed. While there appears to be a small difference in mean-levels, the width of the confidence interval suggests that this is not necessarily the case. No apparent difference in trends before treatment emerges.

Although figures 5–7 indicate that the treatment and control groups followed the same trend in outcomes prior to treatment – which is a necessary condition to continue with the analysis – the figures show no indication of a change in habits in the treatment group post treatment.

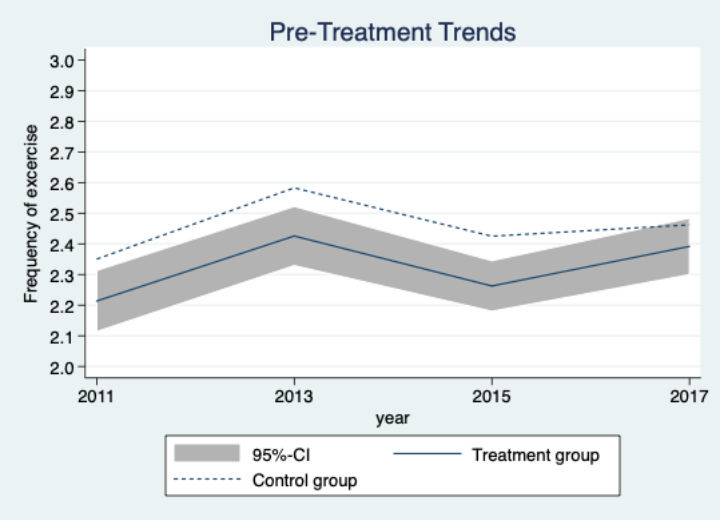


Figure 5: Exercise

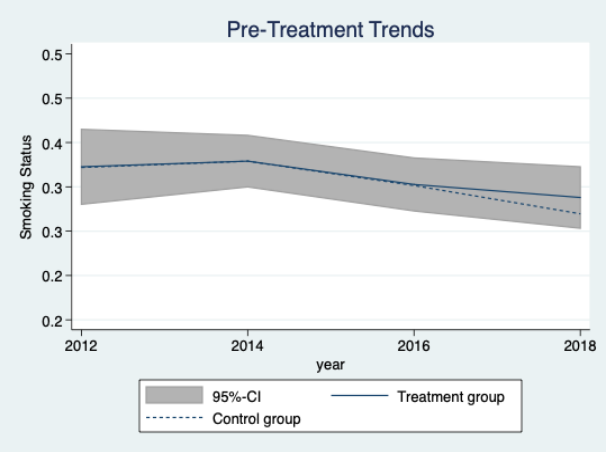


Figure 6: Smoking status

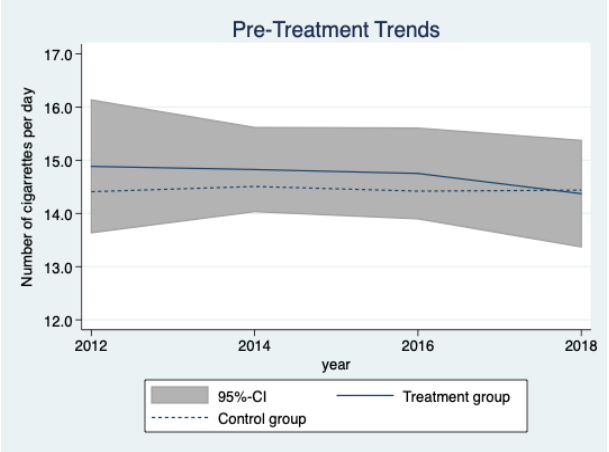


Figure 7: Cigarettes/Day

The notion of the absence of a treatment effect is confirmed by the results in table 9, which display the estimates from the quasi-experimental design. The coefficients on the interaction term, $Treat * Year$, reveal if the treatment group changed their smoking and exercise habits due to the introduction of the minimum wage. The signs on the estimates mirror the implication from the fixed-effects analysis using unemployment as an independent variable. A positive effect of income on smoking habits and a negative effect of income on frequency of exercise could imply the presence of an income effect. However, no such conclusion can however be drawn. Considering that the point estimates of the treatment effect are small and do not show statistical significance, it is more likely that the introduction of the minimum wage had no measurable effect on the behaviors studied.

In line with Gülal and Ayaita 2020, we also run the regressions with relaxed restrictions on employment status among the treatment group after the introduction of the minimum wage. The treatment and control groups are defined in the same way as in the previous specification, but additionally, treated respondents who are either unemployed or have no information on employment status in the post treatment period are included. The regressions rendered very similar results to the estimates that are displayed in table 9, and can be found in appendix C.

Table 9: Treatment Effect

	(1) Smoking Status	(2) Nr cig	(3) Exercise
Treat	0.0132	1.053**	-0.178***
	(0.015)	(0.400)	(0.049)
Year	-0.0207**	-0.265	-0.122***
	(0.007)	(0.233)	(0.029)
Treat*Year	0.00252	0.0187	-0.0158
	(0.012)	(0.381)	(0.048)
age	0.0192***	0.568***	-0.0363**
	(0.005)	(0.129)	(0.013)
age, squared	-0.000241***	-0.00599***	0.000256
	(0.000)	(0.002)	(0.000)
educ_voc	-0.0917***	-0.803	0.188***
	(0.020)	(0.506)	(0.053)
educ_med	-0.222***	-3.464***	0.669***
	(0.026)	(0.742)	(0.073)
educ_high	-0.225***	-2.345**	0.749***
	(0.025)	(0.731)	(0.070)
male	0.110***	3.773***	-0.254***
	(0.014)	(0.376)	(0.038)
married	-0.130***	-0.817*	-0.0305
	(0.015)	(0.381)	(0.041)
Nr child	-0.00870	0.0473	-0.0828***
	(0.007)	(0.190)	(0.018)
Non-German origin	0.0132	-1.437**	-0.251***
	(0.021)	(0.507)	(0.058)
_cons	0.161	1.673	3.473***
	(0.098)	(2.843)	(0.274)
State fixed-effects	Yes	Yes	Yes
N	8 543	3 064	7 437

Standard errors in parentheses

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

7 Discussion

In line with previous research, the results from our cross-sectional estimations confirm a positive relationship between SES, measured by educational attainment, income, and unemployment, and healthier behavioral outcomes in terms of tobacco smoking and exercise habits. The connection between income and the outcome variables in our estimations, however, proved weak in relation to previous findings.

In order to disentangle what features of SES that might have a causal impact on health-related behaviors, we performed fixed-effects estimations and a quasi-experimental analysis in which the focus was dedicated to the impact of income changes among low-income workers. The results from these specifications suggest no, or subtle, immediate effects of slight income changes and unemployment on smoking and exercise habits.

Theory suggests that income is an important factor when making choices that has bearing on one's health. Higher income implies higher return from "good health" and, potentially, a higher alternative cost of consuming harmful or addictive goods. On the other hand, a higher income also allows for more consumption of all kinds of goods. Individuals will choose their level of health investment and consumption of harmful goods according to a scheme that maximizes their overall utility.

Conversely, income is also a widely used measure of SES and has been found to correlate with smoking and exercise habits in numerous papers. In the study by Soteriades and DiFranza (2003), the importance of household income and parental education appeared equivalent in terms of importance for adolescent smoking. While adolescents are not in focus in this study, the relationship is observed in various settings. Øvrum (2011) incorporates household income as a measure of SES and is able to establish that SES indeed contributes in explaining the variation of latent demand for healthy behaviors among the low-demand group, as well as the division into high and low demand groups, respectively. Furthermore, Cheah (2015) and Lewer et al. (2016) were also able to distinguish a negative relationship between income and harmful drinking habits.

With regard to the theoretical predictions and the empirical findings mentioned above, one

might have expected to see a stronger connection between income and the outcome variables in our cross-sectional specification as well as in our fixed effects estimations.

On the other hand, the income measures employed in the studies referred to above, were constructed in a different manner than ours. While we made use of the entire income variation, estimating the effect of a one percentage change in household disposable income, the authors of the studies mentioned approximated SES by larger income classes, e.g quartiles, quintiles, or deciles. Hence, our measure would produce smaller estimates by design.

Although the relationship between income changes and smoking and exercise did not prove strong in the fixed effects estimation, the quasi-experimental estimation might have rendered a more pronounced effect. There are indeed studies that point in the direction of a larger behavioral effect among low-income groups in particular, following income or price changes.

Young-Hoon (2012), for example, finds no effect of income changes as such on smoking behaviors, except in the case where the income change coincides with transcending the poverty line. In terms of exercise, Eisenberg and Okeke (2009), who use educational and income categories to determine SES, conclude that individuals of lower SES (in terms of both measures) seem to display higher elasticity of behavior to external circumstances. Since their results appear to reflect the fact that individuals with lower income are more dependent on low-cost alternatives, it is possible that income increases among this group could materialize in a higher frequency of exercise. In addition, the closely related study to ours by Lenhart (2017) showed improvements of several health measures following the implementation of minimum wages, and also indicated that these improvements could be related to tobacco consumption.

Our null-results in the last estimation might, of course, reflect that there in fact is no contemporaneous effect of small and moderate income changes on smoking and exercise habits for any socioeconomic group. After all, many studies in which income is used to proxy for SES study the impact of income as a stationary variable, in which case, it might well mirror upbringing and experiences earlier in life, rather than having a direct impact in itself. This also applies to studies in which responsiveness to price changes across socioeconomic groups are studied. Moreover, while the

experimental design only included low-income earners, that is not necessarily equivalent to studying individuals around the poverty threshold, which is the case in the study by Young-Hoon (2012).

Alternatively, there was no contemporaneous effect of the minimum wage specifically among the groups studied. As Lenhart (2017) noted, the effect of minimum wages appeared to be stronger in developing countries. This echoes the notion of cultural and social environment, discussed by Hitchman et al. (2014) and Nikolaou (2009). If higher income would allow for consumption of goods and services in a manner by which one's social context changes, thus inducing behavioral changes, it would likely require much larger jumps to observe an effect. In addition, it is not evident that the effect would be immediate.

While cultural and social environment are likely important in shaping behaviors, alleviated financial stress due to the introduction of the minimum wage could have implied behavioral changes. Moreover, the minimum wage could also have relaxed the budget constraint among the treatment group and increased future expected earnings, thereby raising the return from "good health", or simply allowed for more consumption, including of harmful goods such as cigarettes.

Curbing financial stress or changing economic incentives would however require a sufficient increase in earnings. Regardless of whether the effect of the reform on hourly wage was sufficient as such, the research, as discussed in section 3.4, is inconclusive regarding the effect on monthly earnings following the minimum wage. Although there is reason to believe that the hourly wage indeed improved, it might have been counteracted by fewer hours worked.

While we did not find support for an effect of continuous or small income changes on behavioral outcomes, the results from the estimations using unemployment as the independent variable rendered some intriguing insights. Given these results, the signs of the coefficients from the quasi-experimental estimation could suggest an interesting implication.

From the cross-sectional estimations, unemployment seems to correspond with unhealthier smoking and exercise habits. The fixed-effects estimation, however, reveals that the relationship is likely not causal. In the case of an effect of unemployment on smoking and exercising, it goes in the direction of healthier habits. Our findings are in line with those of Kaiser, Bauer, and Sousa-Poza

(2016), who conclude that exogenous layoffs seem to cause healthier habits concerning diet and exercise. Conversely, the signs of the coefficients from the analysis of the minimum wage reform point toward more smoking and less exercise in the treated group.

First, this implies that, on average, a change in the budget constraint, with respect to both time and income, triumphs other potential mechanisms, at least for groups of low SES.

Second, in the particular case of unemployment, being laid off might not be an event that induces commencement of smoking. As smoking in most cases is unlikely to impair productivity and deteriorate future earnings, worse smoking habits following unemployment might have appeared probable in the light of rational addiction theory, unless unemployment is expected to permanently lower future earnings.

To summarize, theory and previous empirical work suggests that changes in income and employment status may alter behavioral outcomes with respect to smoking and exercise, if not for all socioeconomic groups, so for those at the lower end of the distribution. Moreover, various mechanisms have been proposed in order to disentangle the possible channels by which these socioeconomic measures could shape lifestyle habits in different settings. Although our results are slightly suggestive of a negative relationship between income and health-related habits, and a positive relationship between unemployment and health-related habits, in the short run, our estimates lack either the statistical or economic significance required to serve as supporting evidence to any of the relationships found in previous studies.

Disentangling the causal impacts of different measures of SES on health related behaviors is challenging. The measures are often interconnected and difficult to identify separately. However, since there evidently is a positive relationship between SES and health related behaviors, continued efforts are required in order to produce policy relevant implications as to the measure and timing with greatest potential to alter the behavior of interest. Our results are indicative of weak effects of unemployment and slight income changes during adulthood on smoking and exercise in a Western European setting. This does, however, not exclude the potential effect of larger income changes, nor does it falsify an eventual effect in the case of a different timing in life. Finally, our estimations might

have rendered different results in another cultural setting. Continued analysis of these matters is an important task for future research.

7.1 Limitations

In addition to the limitations of our study discussed in the previous section, namely the focus on immediate responsiveness in behaviors and the modest wage increase in the treatment group following the minimum wage reform, given the outcome variables studied, there are a few caveats which need to be addressed.

The source of the SOEP data are the respondents themselves. There are several potential sources of bias in self-reported estimates. Respondents may be inclined to overestimate their exercise habits as well as underestimate their smoking habits (see Arp Adams et al., 2004; Connor et al., 2009), and fail to report accurate annual income (Bound, Brown, and Mathiowetz, 2001). If misreporting is systematic across the population, the results will be biased. Moreover, respondents may overestimate their hours worked and potentially underestimate their monthly earning (though there is reason to believe that the latter is a minor issue, see Bound, Brown, and Mathiowetz, 2001). If this were to be the case, treated and untreated respondents in our final estimation may have been confounded. There may also be miss-reporting in the unemployment indicator (see Bound, Brown, and Mathiowetz, 2001), although the issue is likely mitigated in the SOEP data since respondents are explicitly asked if the are registered unemployed at the Federal Employment Agency (Kantar Public, 2019).

Another potential issue in our specifications is the risk of policy changes throughout the examined period. A change in nationwide regulations would be offset by the fact that we use year fixed effects in the specifications where this is relevant. However, as mentioned above, Germany has a somewhat decentralized political system where states have high legislative autonomy (How To Germany, 2021). If one, or several, states alter legislation or enforcement of legislation in a way that changes individuals' unhealthy habits, this could potentially bias our estimates.

The previously conducted analyses of the minimum wage reform point towards two matters that

could affect our analysis and our findings. The evidence regarding spillovers of the reform is mixed (Bruttel, 2019; Bossler and Gerner, 2020). If the reform has lead to increased wages also among the group that previously earned close to, but above, the new minimum wage at €8.50 our control group would also be affected by the reform, which would bias our estimates towards a zero-effect. Considering that hourly wages increased by almost €1 in the control group between 2014 and 2015 we cannot exclude that spillovers of the minimum wage reform played a part in this increase.

Additionally, several analyses points towards substantial non-compliance with the reform (Bruttel, 2019; Caliendo, Schröder, and Wittbrodt, 2019). This, supposedly, widespread cheating of the system would lead to lower hourly wage increases than the legislators intended when the reform was implemented. Regardless of the wider economic implications of this issue and its potential consequences for employees and firms, it could potentially affect our estimates as we would find lower wage increases in the treatment group than expected ex ante. Of course, our specification considers the actual wage increase and captures the result of the reform in practice. However, the effect of the German minimum wage reform on hourly wages, and by extension potentially on smoking behavior and exercise, would then be higher absent of the compliance issues.

Disentangling the causal impacts of different measures of SES on health related behaviors is challenging. The measures are often interconnected and difficult to identify separately. However, since there evidently is a positive relationship between SES and health related behaviors, continued efforts are required in order to produce policy relevant implications as to the measure and timing with greatest potential to alter the behavior of interest. Our results are indicative of weak effects of unemployment and slight income changes during adulthood on smoking and exercise in a Western European setting. This does, however, not exclude the potential effect of larger income changes, nor does it falsify an eventual effect in the case of a different timing in life. Finally, our estimations might have rendered different results in another cultural setting. Continued analysis of these matters is an important task for future research.

8 Conclusion

This paper uses German SOEP data to analyze the causal impact of socioeconomic status (SES) on the unhealthy lifestyle habits of tobacco smoking and exercising habits. From our analyses we note that there is a strong negative relationship between education and these unhealthy behavioral outcomes and a positive relationship between unemployment and these habits. Further, in comparison with previous research, the results from our estimations propose a potentially weaker, although still negative, relationship between income and these unhealthy habits habits.

Our analyses show that a small or moderate income change has no, or negligible, immediate effects on tobacco smoking and exercising habits. It is possible that the immediate effect is trivial compared to other factors, such as SES during upbringing and cultural context, or that a substantially larger income change is required to observe an effect on habits. This also holds true for the particular case of the German introduction of a minimum wage, as we, contrary to the suggestions of previous research, found no effect on the health-related behaviors studied. Additionally, our findings regarding entering unemployment are coherent with the findings of Kaiser, Bauer, and Sousa-Poza (2016), indicating healthier habits after job loss. This is possibly due to a negative income shock affecting the budget constraint or individuals or due to more spare time available for investment in healthy behavior.

We cannot draw any strong conclusions regarding causality based on our estimates. However, we can conclude that our study strengthens the literature regarding a positive relationship between SES and more healthy habits. Further, our findings indicate that entering unemployment can lead to healthier habits and that immediate effects of income changes may be of less importance than the current literature suggests. Both these findings do, however, require further research to appreciate the magnitude of and mechanisms behind these effects, and examine possible heterogeneous effects not picked up in our specifications.

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Appendices

A Control Variables

In table 6, controls for occupational change are included. The indicators are based on a vector containing information on the respondents' labor force status. The vector comprises 12 categories, displayed in the table below.

Labor Force Status	
Label	No of occurrences 2002–2018, age range 25–64
Non-working without further information	39,570
Non-working, and older than 65	9
Non-working, and currently in a training program	3074
Non-working, on maternity leave	8,394
Non-working, in military/community service	14
Non-working, and registered unemployed	21,076
Non-working but occasional second job	2,040
Non-working, but working past 7 days	1,482
Non-working but regular second job	2,123
Working	222,337
Working, but non-working past 7 days	2,925

Moreover, the cross-section regressions include controls for the respondents origin. Rather than adding controls for nationality, since there nearly 140 different nationalities represented in the sample studied, we have divided them into nine regional categories, described in the table below.

Region of Origin		
Region	Reported Nationality	No of occurrences in sample
Germany	German	262,012
Turkey and the Balkans	Turkey, Ex-Yugoslavia, Greece, Romania, Bulgaria, Albania, Croatia, Bosnia-Herzegovina, Macedonia, Kosova-Albania, Serbia, Montenegro	14,630
Europe	Italy, Spain, Austria, France, Denmark, Great Britain, Sweden, Norway, Finland, Switzerland, Poland, Hungary, Portugal, Czech Republic, Ireland, Moldavia, Ukraine, Estonia, Latvia, Luxembourg, Belgium, Holland, Slovenia, Slovakia, Belarus, Lithuania	10,595
North America and Oceania	USA, Australia, Jamaica, Canada, New Zeeland, Cuba, Dominican Republic, Samoa	538
South and Central America	Chile, Bolivia, Mexico, Argentina, Columbia, Venezuela, Brazil, Peru, El Salvador, Cosa Rica, Ecuador, Uruguay, Honduras	318
Asia	Korea, Indonesia, Philippines, Japan, India, Thailand, Bangladesh, Sri Lanka, Nepal, China, Vietnam, Malaysia, Taiwan, Cambodia	851
Middle East	Iran, Syria, Israel, Arabia, Iraq, Lebanon, Jordan, Kurdistan, Yemen, Palestine	8,353
Russia and Central Asia	Russia, Afghanistan, Kazakhstan, Kyrgyzstan, Tajikistan, Pakistan, Uzbekistan, Azerbaijan, Georgia, Mongolia, Armenia, Turkmenistan, Republic of Kabardino-Balkaria, Caucasus, Chechnya, Ingushetia	3,781
Africa	Benin, Ethiopia, Ghana, Tunisia, Nigeria, Morocco, Algeria, Mozambiquie, Egypt, Somalia, South Africa, Eritrea, Burkina Faso, Zambia, Angola, Namibia, Kenya, Libya, Botswana, Guinea, Ivory Coast, Seychelles, Uganda, Mali, Cameroon, Sudan, Congo, Togo, Chad, Afric, Sierra Leone, Senegal, Gambia, Zimbabwe, Rwanda, Niger	1,629

B Fixed-Effects Estimation Including Income Lags

Table 10: Fixed-Effects

	(1) Smoking Status	(2) Nr cig	(3) Exercise
log HH income	-0.00343	0.301*	0.00586
	(0.003)	(0.125)	(0.012)
L1	0.00256	0.0349	0.0158
	(0.003)	(0.128)	(0.012)
L2	-0.00325	0.115	0.00286
	(0.003)	(0.118)	(0.011)
age	-0.00623***	-0.121***	0.0126***
	(0.000)	(0.013)	(0.001)
married	-0.0468***	-0.229	-0.133***
	(0.007)	(0.299)	(0.026)
widowed	-0.0273	0.668	-0.179**
	(0.015)	(0.640)	(0.062)
separated	-0.0115	0.988**	-0.0588
	(0.009)	(0.375)	(0.037)
divorced	-0.0241**	0.375	-0.0469
	(0.009)	(0.371)	(0.036)
Nr child	-0.00768***	-0.132	-0.0413***
	(0.002)	(0.078)	(0.007)
_cons	0.668***	15.90***	1.839***
	(0.038)	(1.536)	(0.154)
Time fixed-effects	Yes	Yes	Yes
Changed Bundesland	Yes	Yes	Yes
Occupational change	Yes	Yes	Yes
N	101 483	30 100	105 374

Standard errors in parentheses

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

C Treatment Effect with Relaxed Employment Constraint

Table 11: Inclusion of Treated Respondents Not Employed Afer Treatment

	(1) Smoking Status	(2) Nr cig	(3) Exercise
Treat	0.0130	1.080**	-0.179***
	(0.015)	(0.405)	(0.049)
Year	-0.0206**	-0.272	-0.123***
	(0.007)	(0.233)	(0.029)
Treat*Year	0.0140	0.241	-0.00713
	(0.011)	(0.357)	(0.047)
age	0.0188***	0.585***	-0.0385**
	(0.005)	(0.133)	(0.012)
age, squared	-0.000237***	-0.00619***	0.000280
	(0.000)	(0.002)	(0.000)
educ_voc	-0.0901***	-0.695	0.187***
	(0.020)	(0.515)	(0.053)
educ_med	-0.224***	-3.473***	0.673***
	(0.027)	(0.753)	(0.072)
educ_high	-0.222***	-2.059**	0.747***
	(0.026)	(0.746)	(0.070)
male	0.111***	3.789***	-0.247***
	(0.015)	(0.397)	(0.037)
married	-0.130***	-0.796*	-0.0303
	(0.016)	(0.391)	(0.040)
Nr child	-0.00940	0.0658	-0.0817***
	(0.007)	(0.192)	(0.018)
Non-German Origin	0.0175	-1.435**	-0.251***
	(0.022)	(0.513)	(0.058)
_cons	0.165	1.196	3.511***
	(0.100)	(2.974)	(0.272)
State fixed-effects	Yes	Yes	Yes
N	8 367	3 031	7 503

Standard errors in parentheses

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