Mind over Money...

To what extent does income contribute to the participation and initiation of unhealthy behaviours?

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Abstract

This study examines different attitudes (; affective states) towards unhealthy behaviours, formalised by smoking and excessive alcohol consumption, resulting from fluctuations in disposable income in a sample of Dutch individuals who participated in the Dutch Household Survey. Additionally, a distinction is made between present- and future-oriented individuals to analyse whether they react differently to these fluctuations. After adjusting for time- and locational fixed effects and accounting for other vital demographical proxies, the results of a multiple OLS regression indicated that disposable income plays an essential role in the tendency to participate in unhealthy behaviours, with adverse fluctuations to a greater extent. In sum, smoking negatively affects income, while excessive alcohol consumption is positively associated with income. Moreover, present-oriented individuals tend to react more extensively when a fluctuation occurs, arguing that income plays a significant role in the addiction theory implied by Becker and Murphy (1988). Lastly, if disposable income decreases compared to the year prior, both present- and future-oriented individuals tend to drink alcoholic beverages more extensively. These findings are discussed concerning previous literature, and further suggestions for future research are made.

Keywords: Affective State; Stress; (SES) Income; Unhealthy Behaviour; Addiction

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Introduction

As a society, we are more than ever concerned with the assessment of (risky) choices, considering safety regarding, e.g., war and terrorism, investment opportunities, climate change, and vital considerations concerning our health. An essential factor in making these choices is an individual's affective state, consisting of moods and emotions (Schall, 2010), which is known to influence decision-making. Prior research in the field of neuroeconomics provides evidence that emotional processes contribute to decision-making (Van't Wout et al., 2006). Additionally, it is well known that individuals under pressure tend to make suboptimal decisions (Byrne et al., 2015).

Stress is the body's response to pressure. Many different situations or life events can cause stress, and stress can initiate unhealthy behaviours. A proxy that can depict certain situations or life events and, therefore, the affective state is the socioeconomic status (hereafter SES). Moreover, it is well documented that individuals with a lower socioeconomic status have much worse health outcomes and shorter lives compared to those with a higher socioeconomic status (Smith, 2007; Glymour et al., 2014). Socioeconomic status is characterised by education, employment, and income (Cohen et al, 2006a).

The relevance of findings on the consequences of an individual's SES on making (un)healthy choices (; altering the affective state) can be widely interpreted. First, it can help understand how to intervene in some aspects of SES to improve healthy behaviour, and provide insight on how addiction relates to SES. Moreover, it gives a better understanding of predicting, stimulating, and analyzing healthy behaviour due to changes in SES. Lastly, the effectiveness of legislation implemented by the government that aims to discourage unhealthy behaviour, can be evaluated. In this paper, the focus will lie on the income component of SES, as earlier work suggests that changes in income are an important proxy in determining one's affective state (Kahneman & Deaton, 2010; Killingsworth, 2020; Killingsworth et al., 2023), in which adverse shocks defer from positive shocks: increases in income have a lower effect on the affective state than equal decreases in income (Boyce, et al., 2013).

More than half of the population that participates in cigarette consumption dies from the consequences it has on their health; in the Netherlands this accounts for approximately 19.000 individuals (Castagna, 2023). Jelinek (z.d.), a treatment facility for addicts, states that 477.000 people are assumed to be addicted to or abuse alcohol and 539.000 to tobacco. In recent news, an interview was published about a Dutch individual who had to decide whether to buy weekly groceries or cigarettes (Sevill, 2023). This decision-matrix can be seen as an unaccounted effect in the ongoing battle against unhealthy behaviours; increased excise duty taxes to discourage consumption. And, it shows the relevance of understanding addictiveness. Research indicates that smokers with financial stress are likelier to quit but less likely to try or succeed (Siahpush et al., 2009). Low SES, ergo low income, is associated with higher smoke prevalence rates (Yun et al., 2015; Charitonidi et al., 2016), while alcohol consumption is assumed to be positively affected by income; alcohol/income puzzle (Auld, 2005). This research attempts to uncover the possible incentive a change in income generates in the choice of participating in consuming unhealthy goods by researching:

“ To what extent does the affective state, formalised by fluctuations in disposable income, contribute to the participation in the consumption of unhealthy goods?”.

In addition, a distinction will be made between income cohorts to study if low-income individuals perceive fluctuations differently than high-income individuals. People in poverty are assumed to discount the future more extensively, which is directly related to a negative affective state (Haushofer & Fehr, 2014). Moreover, disadvantaged people tend to engage in present-oriented decision-making rather than planning for future decision-making (Mani et al., 2013). Thus, individuals are prone to restrain their focus on the present while ignoring the future when faced with insufficient income to make ends meet (Bak & Yi, 2020). Therefore, a second phenomenon is researched:

*“Do present****-oriented individuals interpret fluctuations in income on the participation in unhealthy behaviours differently than future-oriented i****ndividuals?”.*

This paper will follow a structured format. The following section (2) will provide a theoretical foundation on the association between income and the affective state, the connection to economic theory, and an overview of different proxies that can initiate unhealthy behaviours. The third (3) section will be dedicated to the data used in this study, and how proxies are operationalised. An empirical strategy will be provided in section four (4), followed by section five (5): results. This study will conclude (6 & 7) by comparing the estimated results with prior theory, limitations, and avenues for further research.

Theoretical Basis

This section presents the theoretical foundation that forms the basis for the research conducted in this study. Firstly, an overview is presented in which concepts and theories are explained by reviewing prior research. Secondly, the hypotheses that stem from the theoretical basis are presented. Furthermore, this section will conclude with a conceptual model.

Socioeconomic status

A vital keyword used in this research is SES. It can be seen as a multifaceted and complex concept, encompassing independent objective characteristics as subjective interpretations of people's ratings of their SES (Navarro-Carillo et al., 2020). Oakes and Andrade (2017) define SES as a measure that indicates access to collectively desired resources, material, money, power, friendship networks, healthcare, leisure time, or educational opportunities. Moreover, access to these resources is pivotal in facilitating the success and well-being of individuals and groups within society. They argue that societies are dynamic bodies in which mismeasurement of SES will mute the causes and effects of changing structures and that it matters because it has been related positively to health and life outcomes for as long as social groups have existed; a graphical relation is presented in Figure 1.

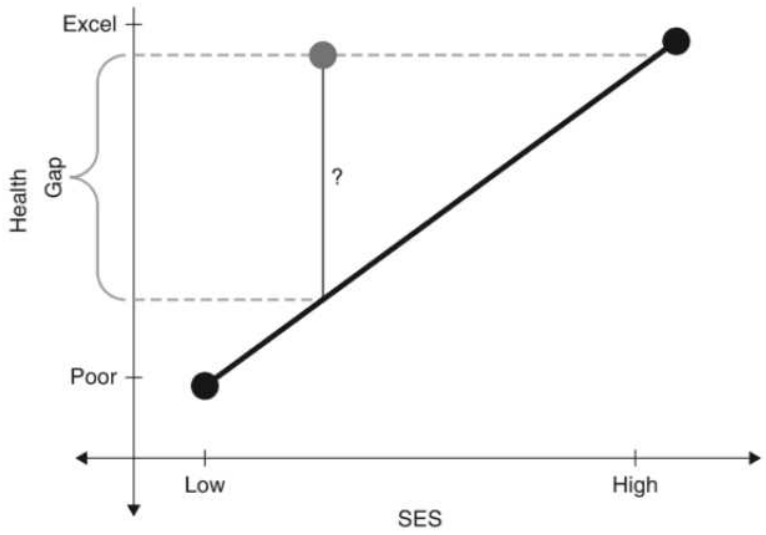


Figure 1. Fundamental graph of Public Health, obtained from *Methods in Social Epidemiology ch. 2.*

This relation aligns with other studies in which lower SES is associated with 'much' worse health outcomes and shorter lives than those with a higher socioeconomic status (Smith, 2007; Glymour et al., 2014). Moreover, in Great Britain, the impact of less advantaged SES over a lifetime led to an approximate doubling of the proportion of extreme post-waking cortisol levels; cortisol is the hormone related to stress, and an increased risk of having abnormal cortisol pattern (Li et al., 2007). In addition, lower income and education were also independently associated with higher evening levels of cortisol. These associations were independent of race, age, gender, and body mass (Cohen et al., 2006a; Cohen et al., 2006b). So, SES is negatively associated with cortisol levels. To be more case-specific: low-income

and education attainment generates higher stress levels. Hence, low-SES environments, neighbourhoods, are stressful and reduce the reverse capacity to manage stress, increasing vulnerability to negative emotions and cognitions (Gallow & Matthews, 2003). Lund et al. (2010) conducted a systematic review to understand the relationship between common mental disorders (CMD) and low-and middle-income countries better. In total, 115 studies were reviewed, and most reported a positive, consistent association between poverty indicators (education, housing, social status, SES, and financial stress) and CMD.

As indicated earlier, the focus lies on the Income component of SES, which belongs to the independent objective characteristic of measuring SES and can be a potentially simple scalar quantity that can be readily collected.

Affective State and income

This study aims to understand one's perception of income fluctuations on the use of harmful goods better. In order to do so, income will be considered a proxy of a respondent's affective state. To consider this a proxy, a better understanding of the affective state and its relation to income are needed.

According to Schnall (2010), emotions and moods are part of the affective state, which differ in some respects. Emotions arise from external and internal triggers that hold personal significance and can be easily influenced by various factors (Scherer, 2005). In contrast, moods can arise without a clear connection to a specific event and can persist for extended periods (Frijda, 2000). Hence, changes in an individual's emotional state can fuel a desire for immediate satisfaction through impulsive buying behaviour. Conversely, impulsive buying and consuming the purchased (harmful) goods can influence the emotional state (Gardner & Hook, 1988). Watson and Tellegen (1985) introduced the concept of positive and negative affect as two distinct, independent dimensions that represent positive and negative emotions, respectively. In addition, negative affect (hereafter NA) has been defined as a "general dimension of subjective distress and unpleasurable engagement that subsumes a variety of aversive mood states, including anger, contempt, disgust, guilt, fear, and nervousness, with low NA being a state of calmness and serenity" (Watson, Clark & Tellegen, 1988) (p. 1063).

"Money buys happiness"- a commonly used catchphrase that has been discussed and researched for many years. Two essential papers tried answering this question while using different methods. Firstly, Kahneman and Deaton (2010) used dichotomous questions about the preceding day and reported a flattening pattern: happiness increased with log(income) up to a threshold and then flattened. Contrary, however, Killingsworth (2021) used experience sampling with a continuous scale and reported a linear-log pattern in which (average) happiness rose consistently with log(income). In addition, both authors collaborate to find a coherent interpretation by reviewing both studies (Killingsworth et al., 2023). In this paper, the following hypothesis was stated, consisting of two propositions: 1) There is an unhappy minority whose unhappiness diminishes with rising income up to a threshold, then shows no further progress; 2) In the happier majority, happiness continues to rise with income even in the high range of incomes. Both propositions were proved to be correct.

Moreover, households can experience financial-related psychological stress when they do not have adequate income, wealth, or debt to afford economic hardship (Friedline et al.,

2020). In addition, a different study analysed household economic panel data from five countries to estimate an approximate impact of economic well-being on happiness. The findings suggest that economic circumstances statistically affect life satisfaction for both wealth and income (Headey et al., 2004). Boyce et al. (2013) confirm the association between higher income and greater well-being and highlight that adverse income shocks differ from positive shocks: income increases have a much lower effect on well-being than equal decreases in income (Boyce et al., 2013).

The above analysis of prior research provides a base for using income as a proxy for the affective state; an increase in income can be interpreted as an increase in happiness, while a decrease can be interpreted as a decrease in happiness. Unfortunately, this interpretation must be considered cautiously due to the multifaceted nature of the affective state; not only financial situations induce emotions that affect the affective state. More proxies will be introduced and explained to account for the multifaceted nature of the affective state.

Rational theory of addiction

The dependent variable consists of unhealthy behaviours from consuming harmful products, smoking, and drinking. However, why do people participate in the consumption of harmful products?

Standard economic theory states that consumer behaviour is based on preferences and budget constraints consumers face when trying to maximise their utility from consumption. So, demand for unhealthy behaviours can be considered the result of consumer utility maximisation under budget constraints (Clements & Zhao, 2005). This maximisation is related to economic forces, such as the prices for goods and income (Saffer & Chaloupka, 1999). Nevertheless, there is a difference in how to treat goods with an addictive character.

The concept of addiction was first implemented by Marshall (1920), who noted that repeatedly consuming good music could increase an individual's taste for that specific type of music. Moreover, addiction is said to have three main components (Cawley, 2011), namely:

- Reinforcement: Current consumption is complementary to past consumption;
- Tolerance: More additional consumption is needed to obtain the same level of satisfaction as before, implying that addiction could potentially be harmful;
- Withdrawal: Abstaining the addictive good generates less utility than consuming it

These components form the basis for ***the theory of rational addiction***.

As implied by Becker and Murphy (1988), rational means that individuals maximise utility consistently over time, and a good is potentially addictive if increases in past consumption raise current consumption. Their theory stresses the importance of addictions of unstable steady-state consumption levels by deriving long-and short-run demand functions for addictive goods. While establishing these functions, they can incorporate temporary stressful events into permanent addictions, such as divorce, unemployment, losing a loved one, and other stressful events. In addition, goods that are addictive to most people tend to have a bimodal distribution of consumption, with one mode located near abstention. It is, therefore, vital to understand how addiction works when assessing unhealthy behaviours including illicit drugs.

Poverty is assumed to lower the willingness to take risks and to forgo current income in favour of higher future incomes: (temporal) discounting. Discounting the future can be seen

as a direct result of negative affect (Haushofer & Fehr, 2014). Binkley (2010) also finds that low-income consumers make less healthy choices because they face lower costs in terms of forgone future utility. Moreover, the standard view is implied that present-oriented individuals are potentially more addicted to harmful goods than future-oriented individuals (Becker & Murphy, 1988). Their analysis explains that an increase in past consumption leads to a smaller rise in the total price when the future is more heavily discounted. Thus, the assumption is triggered that people who live in poverty are assumed to be present-oriented individuals (Mani et al.,2013; Bak & Yi, 2020) and, thus, more vulnerable to addictive goods.

Stress, its counterpart, and unhealthy behaviour

A significant body of research studies the relationship between stress and the affective state. In this research, stress will be explained according to the definition presented by Van der Ploeg (2013)[1]. Stress can be seen as a subjective interpretation of a disturbed equilibrium between stressors and the capacity to bear those stressors. Stressors are, in short, situations in which environmental demands tax an individual's adaptive capacity. The response to these stressors encompasses the cognitive, emotional, and psychological changes an individual experiences (Kassel et al., 2003). The opposite of stress can be conceptualised as a state of calmness and serenity (Watson et al., 1988).

How do stress and its opposite influence participation in unhealthy behaviours, formalised by smoking and excessive alcohol consumption? There are various types of psychological stress that promote the uptake of smoking: household dysfunction, adverse childhood experiences, parental divorce, negative life events, acute and chronic stressors, and perceived stress (Kassel et al., 2003).

Azagba & Sharaf (2011) use a latent class model to capture responses to job stress on smoking and alcohol consumption. Their results differ for two "types" of individuals, light and heavy users. For light smokers, stress has a positive association on smoking intensity; more stress is more cigarettes consumed. And, also, for the consumption of alcohol for heavy users.

Financial stability, in the form of income, plays a significant role in smoking and drinking consumption. Financial stress is commonly defined as the manifestation of physical- or mental health symptoms resulting from challenges in making ends meet (Friedline et al., 2021). Moreover, scarcity changes how people allocate attention: focussing on some issues while neglecting others (Shah et al., 2012).

An empirical finding worth noting is the alcohol/income puzzle, which implies a positive relationship between income and alcohol consumption. Moderate drinking is associated with 10% higher income, and heavy drinking with 12% higher income than abstention among Canadian prime-aged males (Auld, 2005). The role of indirect effects of alcoholism on income is also of importance. It occurs through reduced educational attainment and an increased probability of divorce; both influence income negatively (Mullahy & Sindelar, 1994). As for tobacco cigarettes, perceived stress is strongly linked to nicotine withdrawal symptoms in both genders, with a more significant impact on women, as dependent smokers need nicotine to remain feeling normal (Lawless et al., 2015). So, tobacco use does not alleviate

[1] Appendix Fig. 1

stress but increases it (Parrot, 1999). Lastly, among Swiss young men, a higher SES exhibited higher rates of alcohol and illicit drug use, whereas those with lower SES were related more to tobacco use, in which income and education level had different impacts on substance use (Charitonidi et al., 2016).

Another essential factor that can potentially play a role in the consumption of harmful products depends on geography: area and neighbourhood effects. The former is assumed to have contextual effects on health-related behaviour independent of individual characteristics (Yun, 2015). Neighbourhood disadvantages are moderately associated with drug-related behaviours (Boardman et al., 2001). Moreover, living in higher-poverty neighbourhoods presents a risk of smoking above and beyond multiple aspects of SES and other potential components relating SES to smoking (Cambron et al., 2019). In addition, neighbourhood income and its distribution are linked to higher rates of alcohol and marijuana use but not to cigarette use (Galea et al., 2007).

In summation

This section started with explaining the definition and components of SES and in what way this relates to health. Earlier works state that this association has a positive character; in other words, individuals with low SES (e.g., low-income and education level) are considered less healthy. To be more specific, it affects one's perception of stress and well-being.

Secondly, the relationship between income and affective state is explained by explaining the concept of affective state and assessing existing theory from this domain.
The affective state, consisting of emotions and moods, is then explained according to the definition of Watson et al. (1988), which distinguishes between negative and positive affective states. Prior research has suggested a positive relationship between affective state and income. In addition, this relation reacts stronger to decreases in income than increases. So, a decrease in income is considered to have a more substantial influence on the assumed happiness of an individual; negative affective state.

Hypothesis 1; "A decrease in income has a larger effect on the consumption of unhealthy behaviours than an increase."

The following subsection explains the general consumption theory and its relation to unhealthy consumer goods. This link is made by considering the theory of rational addiction. Moreover, the dependent variables in this study tend to have an addictive nature which holds that present-oriented individuals are potentially more addicted to harmful goods than future-oriented individuals. In addition, consumer behaviour of people in poverty tends to act the same as potentially more addicted individuals, namely by discounting the future heavily. The direct effect of a negative affective state generates this tendency.

Hypothesis 2: "Present-oriented individuals will be less affected in their consumption of harmful products when an income fluctuation occurs."

Lastly, the relationship between unhealthy behaviours and stress, the latter being a driver of affective state, is explained through prior research. It becomes clear that individuals who experience low-income and low educational attainment are more vulnerable to smoke initiation. As for smoking itself, perceived stress is strongly linked to nicotine withdrawal symptoms in both genders, with a more significant impact on women, as dependent smokers

need nicotine to remain feeling normal. However, the consumption of alcohol is considered to have a positive relationship with income; alcohol/income puzzle. Moreover, other stressful events also seem to affect whether to smoke or drink significantly, e.g., divorce or losing a close friend or family member.

Hypothesis 3a: "The prevalence rate of smoking is negatively related to income".

- ***This effect will be lower for present-oriented individuals***

Hypothesis 3b: "The prevalence rate of excessive alcohol consumption is positively related to income".

This study aims to understand the relation between (dis)stressful events, translated to fluctuations in income, and participating in smoking or excessive drinking. As noted, an important consideration to take into mind is neighbourhood characteristics:

Hypothesis 4: "Individuals that live in places with a high grade of urbanisation perceive income fluctuations on their behaviour differently than those living outside of it ".

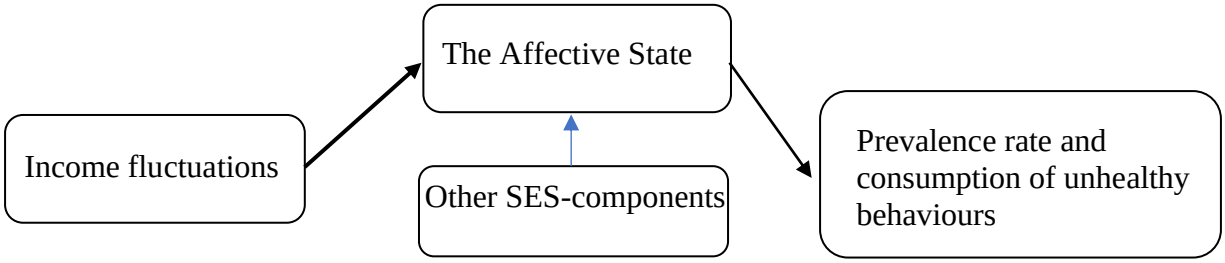


Figure 2: Conceptual model

Data

Study population

The Dutch Central Bank household survey is a longitudinal study that collects information on economic and psychological determinants of the saving behaviour of Dutch Households by self-completed questionnaires. Firstly initiated in 1993, the original sample consisted of approximately 2000 households in which all members older than 16 were asked to fill in six questionnaires, consisting of (1) General information about the household, (2) Household and Work, (3) Accommodation and Mortgages, (4) Health and Income, (5) Assets and Liabilities, and (6) Economic and psychological concepts. All households that provided at least one member that filled in the questionnaires in 1993, wave 1, formed the basis of the panel surveyed in subsequent years (Marchano, n.d.). As stated in the codebooks of the DHS datasets, it is, in some research cases, more practical to use aggregated data; therefore, two modules are added to and derived from the DHS data to account for aggregated income and aggregated wealth.

Data collection

The primary requirement is to establish the individual's perception of income fluctuations by assessing their smoking and excessive alcohol consumption. For this research, several questions are selected to fit the data according to the hypotheses made in section two. The questions with the highest relevance are presented below.

- GEZ7: “Rookt u (wel eens) sigaretten?”;
  - Whether a respondent (from time to time) smokes.
- GEZ8: “Hoeveel sigaretten rookt u per dag?”;
  - How many cigarettes an individual smokes daily.
- GEZ9: “Drinkt u gemiddeld meer dan vier glazen alcoholistische dranken per dag?”
  - Whether a respondent drinks, on average, more than four glasses of alcohol a day.

Thus, questionnaire (4) and the aggregated income dataset are essential. Additionally, questions from the (1) questionnaire are added to account for individual and demographic-specific factors. Moreover, variables from the other questionnaires are considered to model other proxies of SES[2].

The period of interest is 2002-2022, for which all used codes to refer to a question are stable and consistent over the whole time horizon. Moreover, Dutch tobacco control policies saw a marked improvement between 2000 and 2004 but stagnation after that (Nagelhout et al., 2011).

The subsequent step involves the consolidation of all datasets containing the questions of interest into one unified dataset for a specific year. This step is done by creating a unique indicator, denoted with an arbitrary number, for every respondent, which consists of a specific household number (***nohold***) and household member number (***nomem***):

[2] See Appendix Table 1.

$$ID = nohhold * 100 + nomem$$

Stata/SE 17.0 is used to perform this data merging using the "merge 1:1" command. During this process, some respondents are excluded due to missing responses to the questions of interest.

Then, to consolidate all the years into a single panel dataset covering the desired period, the datasets are converted to .csv files for compatibility with Python. In Python, a time-specific variable, "jaar," is added, representing a specific year. Once all years are stored in one dataset, it is converted to a .dta file which allows loading the data into Stata again. Using the command ***xtset*** and the time-and-panel variables, ***Stata*** can treat the dataset as panel data.

Lastly, maintaining singleton groups in linear regressions where fixed effects are nested within clusters can overstate the statistical significance and lead to incorrect inference (Correia, 2015). Hence, a respondent was required to participate in at least two waves in which he answered all questions considering their health and income; 366 observations were dropped. These steps resulted in an unbalanced panel dataset of 22978 observations, equal to 3260 Dutch respondents, measured over 21 years.

Operationalisation

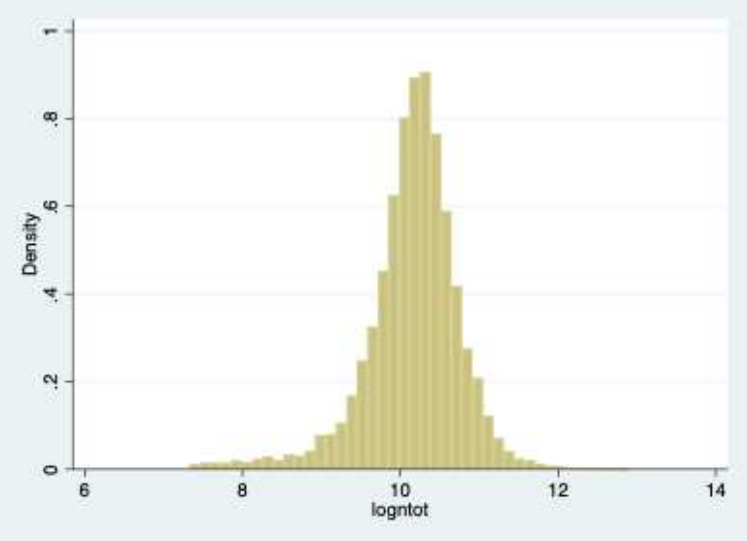
In this section, the key concepts will be narrowed to concessive measurements, which allows this study to model and analyse the associations between the income fluctuations of a respondent and the prevalence of smoking and excessive alcohol consumption.

A respondent's disposable income was assessed as a continuous exposure, subtracted from the aggregated income dataset. It depicts a univariate measure that is part of SES, and an advantage is that they offer (potentially) simple scalar quantities that can be readily collected, as is the case in this study (Oakes & Andrade, 2016). Moreover, it stems from gross income, for which taxes and premiums are deducted in order to generate an individual's disposable income. Using disposable income has the advantage of more accuracy due to the idea that individuals typically make financial decisions based on disposable income. However, one important note while using disposable income as a proxy is that if gross income was unavailable, it generated a missing value for disposable income.

A log transformation was used to stabilise the variance, increase normality, and account for income growth rates. When such transformation is applied, checking for non-positive and zero values is necessary because those will be specified as missing values. Lastly, to test for outliers, a Grubbs test is performed. This test is usually performed when there is one single outlier but is often extended to detect multiple outliers. There were 197 outliers detected and dropped. In total, there are 18761 log-income observations. In the figure below a histogram is provided of the log-income distribution[3].

[3] See Appendix Graph 1.

The variable income will be treated differently in two manners; first, the overall association between disposable income and unhealthy behaviours is given. Secondly, a binary variable distinguishes between high- and low- income using the modal disposable income, equal to approximately €30.000, in which ***1*** accounts for present-oriented individuals.[4].



Graph 1: Histogram distribution log-disposable income

The dependent variables consist of unhealthy behaviours, mainly focussed on smoking and drinking, which are in line with prior research covering unhealthy behaviours (Ferretti, 2015). The former still is one of the leading preventable causes of illness and death in the Netherlands (Castagna, 2023).

Smoking

The respondents were asked whether they smoked daily, sometimes, or not: a categorical variable. In this research, the former two answers are merged while the last answer is kept. So, the assumption has been made to depict those who smoke sometimes as smokers; light, moderate, and heavy smokers are placed under one numerator, which was previously done by Bentley et al. (2021). Hence, smoking is treated as binary, in which ***1*** corresponds with an active cigarette smoker.

The number of cigarettes consumed per day

The follow-up question asked the respondents to approximate their daily cigarette use, if they indicated smoking daily, by choosing between two options: less than 20 cigarettes (moderate) or more than 20 cigarettes (heavy). This question generated a missing value if the respondent filled in to smoke sometimes, indicating a light smoker, or answered not to smoke. As noted, light smokers are treated as smokers; therefore, the following assumption is made: Light smokers are assumed to be moderate smokers. A moderate Dutch smoker is assumed to smoke approximately ten cigarettes daily (Kloosterman et al., 2023), while a heavy smoker is assumed to smoke a package daily. So, a categorical variable is created and divided into three categories: none (0), moderate (10), and heavy (20). In addition, a dependent variable is created for ***smokers*** only to assess the effect of income on consumption.

[4] Note: non-values are considered

Excessive alcohol consumption

This variable indicates whether a respondent drinks, on average, more than four glasses per day. No changes are made for this binary variable.

As indicated in the theoretical basis, more proxies of SES influence an individual's affective state and, therefore, their attitude towards participating in cigarette and alcohol consumption. These proxies are explained below and can be seen as control variables.

Education attainment is seen as one of the main components in measuring the SES of an individual. The DHS survey asked respondents about their highest attained education level. There were nine options to choose from, but in the newly generated dataset, two options dropped due to 0 observations in those categories. In addition, 19 observations were dropped due to a missing value. In this study, those seven categories[5] are divided into three categories, namely: primary, secondary, and tertiary educational attainment.

1. Primary: Basic education, including special secondary education
2. Secundair: high school + secondary vocational education (;MBO)
3. Tertiair: higher professional education (; HBO) and academic education (; WO)

This division is in line with the "Standaard Onderwijsindeling 2021 (editie 2022/23) ", an annually released report of the CBS in which education attainments are classified into different subgroups.

Age is included due to the changes in attitude towards unhealthy behaviour. In the Netherlands, an individual is considered an adult if they reach the age of 18. In this study, age will be composed of three cohorts: young (<30), middle-aged (>=30 & <67), and old (>=67). ***Gender*** is included as a binary variable: ***men (0)*** and ***women (1)***. Prior research stipulates the differences between men and women on different stress experiences and how it affects the consumption of unhealthy behaviours. Women experience more daily stress, with more chronic problems, conflicts, daily demands, and frustrations. Men, however, experienced more stress related to work, finances, and relationships with friends and lovers (Matud, 2004; Gaunt & Benjamin, 2007). Thus, adding the variable gender is relevant and awakens the assumption that the affective state of men is more vulnerable to fluctuations in income than women.

As with ***marital status***, divorce tends to relate to alcoholism. Moreover, it can be seen as a stressful event that influences an individual's affective state. Married individuals experience better health outcomes and longer life expectancy than never married, divorced, or widowed individuals. However, unhappy marriages provide fewer benefits than happy ones (Lawrence et al., 2018). The variable consisted of a question with six possible answers: widow, never married, divorced, married, married in community of property, and living together. These are subdivided into two categories; the former are categorised as ***alone (0)*** and the latter as ***together (1)***. Being alone or living together can affect whether to participate in unhealthy behaviours, like smoking and drinking too much alcohol.

Another vital component in establishing the SES is ***wealth***. The overall wealth effect from housing is more potent than that from financial wealth (Sierminska & Takhtamanova, 2007). So, the emphasis on wealth in this study will lie in its illiquid part: homeownership.

[5]See Appendix (pie) graph 2.

Moreover, it protects from unfavorable social conditions (Evans et al., 2003). To account for homeownership, a binary variable is generated to depict ***ownership***. Thirty-one observations are dropped due to missing values about their illiquid wealth.

An essential component in establishing one's illiquid wealth is the occurrence of ***mortgages***. Olszewski & Matel (2022) defined mortgage repayment problems as housing cost stress. They find that a large proportion of Polish borrowers are in difficult financial situations. At the same time, it is noticed that their situation is still better than that of market rent tenants. The DHS survey provides data about respondents' mortgages and the number of mortgages. The former is represented by a binary variable and the latter by a continuous variable varying from 0 to 5.

Another important measure that influences the affective state is ***occupation***. In order to make a clear distinction between respondents who work, are jobless, or enjoying their pension benefit, two variables are generated. These variables are based on "BEZIGHEI" and "BET"[6], which considers primary occupancy and whether a respondent performs paid work. In the appendix, an explanation table is provided for how "BEZIGHEI" is treated when generating the two binary variables for work and pension[7]. If both variables are equal to zero, the respondent under consideration is considered jobless. Moreover, if a respondent is enjoying his/her old age income but is said to be performing paid work, the respondent is assumed to be part of the working population. Being jobless is positively related to cigarette smoking and alcohol consumption, but to a greater extent for moderate users (Azagba & Sharaf, 2011).

In addition***,*** two crucial environment-specific questions are taken from the DHS survey to represent ***neighbourhood/province specifics***. First, 11 dummies are created to divide the respondents into their home provinces. When all dummy variables equal zero, the province under consideration equals Drenthe. 645 observations are dropped due to missing province values. Secondly, the respondents were asked about their municipality's urbanization grade. This categorical variable varies from being very urban (=1) to being not urban (=5).

As Becker and Murphy (1988) mentioned, the price of a certain (addictive) good plays a vital role in an individual's budget allocation decision. Over the last decades, it became clear that implying excise duties on harmful products was considered most effective in smoking and drinking cessation (Chaloupka et al., 2019; Keeler et al., 2020). To account for the changes in price for both alcohol and cigarettes, and for other types of restrictions implied by the Dutch government to reduce unhealthy behaviour and various crises, the variable ***year*** is added and will depict the ***time-fixed effects***. So this allows for controlling underlying observable and unobservable systematic differences between observed time units.

[6] See Appendix table 1.
[7] See Appendix table 2.

Descriptive Statistics

Table 1 provides a descriptive overview of the variables relevant to this study. As noted, the independent variable has fewer observations than the dependent and control variables. The dataset used in this study can be characterised as an unbalanced panel set, which implies that only some respondents have data on their disposable income ready at the moment of questioning. The independent variable is normally distributed due to a small standard deviation; small spread. In addition, the binary variable for present-oriented individuals includes non-positive values and assumes the condition holds irrespective of wave participation.

Moreover, the mean of all dependent variables lies closer to zero values; the majority of the sample under consideration does not participate in unhealthy behaviours. In Table 2, the frequency rates of unhealthy behaviours are presented. There are 4219 smokers, of which 646 are labelled 'heavy smokers' and 261 of those observations do it in combination with excessive alcohol consumption. Interestingly, however, are the observations of excessive alcohol consumption among non-smokers, as nicotine and alcohol are highly co-abused (Sharma et al., 2015).

Table 1: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Dependent Variables					
Smoke	22965	.184	.387	0	1
Cig. consumption	22965	2.233	5.025	0	20
Alcohol abuse	22965	.06	.238	0	1
Independent variable					
Logntot	18761	10.153	.602	7.326	12.905
Present oriented	22965	.495	.410	0	1
Control variables					
Age	22965	56.721	15.226	19	97
Gender	22965	.708	.455	0	1
Marital status	22965	.679	.467	0	1
Education	22965	4.924	1.48	1	7
Owner	22965	.716	.451	0	1
Mortgage	22965	.536	.499	0	1
# mortgages	22965	.729	.862	0	5
Work	22965	.448	.497	0	1
Pension	22965	.254	.435	0	1
# kids	22965	.491	.933	0	6
Provinces	22965	7.741	2.998	1	12
Urban	22965	2.94	1.313	1	5

Table 2: Frequency statistics unhealthy behaviour

	No Alcohol Abuser			Alcohol Abuser			
Cig. Consumption	None	Moderate	Heavy	None	Moderate	Heavy	Total
None-smoker	17910	-	-	836	-	-	18746
Current Smoker	-	3027	646	-	285	261	4219
Total	17910	3027	646	836	285	261	22965

The control variables provide insights that the majority of the population are future-oriented middle-aged married men who obtained a diploma in tertiary education and have their own house. A slight majority bought their house with additional capital from a third party, for which the average number of mortgages varies between zero and one. But, relatively women tend to smoke and consume excessive alcohol more than men[8].

Accordingly, most respondents live in South Holland, North Holland, and North Brabant and are situated in an urban municipality[9].

Below, a Pearson's correlation matrix is provided to check whether the variables correlate extensively. If yes, it can affect the predicted outcomes of the model under consideration. As presented in the table below, it becomes clear to treat (housing) ***wealth*** with caution due to collinearity. It also confirms that it can estimate both ***log(income)*** and ***inc_change*** in one model due to a relatively low correlation.

Table 3: Pairwise correlations dependent and independent variables

Variables	(1)	(2)	(3)	(4)	(5)	(6)
(1) smoke	1.00					
(2) consumption	0.94***	1.00				
(3) a_abuse	0.14***	0.18***	1.00			
(4) logntot	-0.04***	-0.05***	0.04***	1.00		
(5) present_or	0.03***	0.04***	-0.03***	-0.69***	1.00	
(6) inc_change	-0.01	-0.01	0.01**	-0.23***	0.29***	1.00

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 4: Pairwise correlations independent and control variables.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) logntot	1.00												
(2) present_or	-0.69***	1.00											
(3) inc_change	-0.23***	0.29***	1.00										
(4) gender	0.24***	-0.16***	0.02**	1.00									
(5) age	-0.04***	0.05***	0.03***	0.15***	1.00								
(6) marital_st	0.11***	-0.09***	0.02***	0.34***	0.05***	1.00							
(7) education	0.28***	-0.21***	0.00	-0.01*	-0.21***	0.01	1.00						
(8) Owner	0.31***	-0.22***	0.03***	0.16***	0.05***	0.32***	0.15***	1.00					
(9) Mortgage	0.27***	-0.17***	0.02**	0.08***	-0.09***	0.23***	0.14***	0.68***	1.00				
(10) nrmort	0.23***	-0.17***	0.01*	0.07***	-0.09***	0.19***	0.12***	0.53***	0.78***	1.00			
(11) work	0.12***	-0.14***	-0.07***	-0.05***	-0.43***	0.04***	0.15***	0.09***	0.12***	0.12***	1.00		
(12) pens	-0.05***	0.06***	0.04***	0.13***	0.62***	0.05***	-0.09***	0.04***	-0.06***	-0.07***	-0.53***	1.00	
(13) num_k	0.10***	-0.11***	-0.02***	0.05***	-0.37***	0.24***	0.05***	0.15***	0.16***	0.19***	0.24***	-0.28***	1.00

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

[8] See Appendix table 3.
[9] See Appendix table 4.

Empirical Strategy

The merged dataset has, as indicated earlier, an unbalanced character.

$$n < N * T$$

The aim is to estimate the causal effect of log-income fluctuations on the prevalence rate of unhealthy behaviours, formalised by smoking and excessive alcohol consumption. The initial assumption is that these fluctuations influence an individual's affective state and, thus, the initiation or cessation of unhealthy behaviours. The basis lies in the theory of rational addiction, in which the most simple form can be expressed as:

$$C_t = \beta_0 + \beta_1 P_t + \beta_2 C_{t-1} + \beta_3 Y_t + \varepsilon_t$$

In which current consumption of the addictive good depends on the price of the good, the previous level of consumption, and the individual's income. In this study, the theory will partially align with the model above formalised by adding a binary variable that depicts whether the change in disposable income was negative or positive compared with the previous year. This study's assumption states that a negative fluctuation will affect the affective state more than a positive fluctuation and has, therefore, a more significant effect on the prevalence rate of unhealthy behaviour.

This study finds inspiration from the statistical models Anderson et al. (2020) and Bentley et al. (2021) used while estimating the association between log income and unhealthy behaviours. The former investigates whether excise duties influence youth marijuana use and uses a logit model in order to estimate this effect:

$$Y_{ist} = \beta_0 + \beta_1 CigaretteTax_{st} + X1'_{ist}\,\beta_2 + X2'_{ist}\,\beta_3 + v_s + w_t + \varepsilon_{ist}$$

Where ***i*** indexes individuals, ***s*** indexes States and ***t*** indexes years. Additionally, v and w represent state-and time-fixed effects, respectively. These fixed effects are interesting as they translate to the year and urbanisation grade dummy variables used in this study. The dependent variable is, in both scenarios, binary of nature, whether someone smokes or drinks excessively. However, prior research points out that the best strategy to estimate the causal effects of treatments on binary outcomes is using linear regressions, log-income on unhealthy behaviour. Furthermore, nonlinear models become unsuitable in the presence of fixed effects (i.e., nested models) (Gomila, 2021). This statement must be considered cautiously, as it depends on the type and field in which the research takes place.

Bentley et al. (2021) used the following formula in order to estimate their models generated from the Household, Income, and Labour survey (Australia) data:

$$y_{it} = X_{it}\beta + \alpha_i + \mu_{it}$$

Where ***y*** is the dependent variable, tobacco and alcohol use (Yes/No), observed for individual ***i*** at time ***t***, and ***X*** is the time-variant regressor factor.

A regression analysis will be performed since the coefficients can be seen as the marginal effects of unhealthy behaviour. In addition, it makes it easier to adjust for individual time-varying covariates and account for time-invariant covariates. Fortunately, this makes it possible to make comparisons within people over time, as promoted by using fixed effects estimators. Nevertheless, reducing bias using these models may come at the expense of precision (Gunasekara et al., 2014). This process is repeated for all three dependent variables.

$$Unh.Behv._{it} = \beta_0 + \beta_1 \log(income) + \beta_2 Dummy\,\Delta Inc._{t-1} + X1'_{it}\,\beta_2 + Prov.dummy_i + i.year_t + i.urban_i + \varepsilon_{it}$$

Where *X1'* represents the used control variables, also, the binary variable is equal to "one" if an individual experienced a negative fluctuation in income, this variable can potentially capture a distinct impact on the outcome that is not fully captured by ***log income*** alone.

So, using linear regressions allows for direct interpretation of the coefficients as probabilities and is safe when fixed effects are included in the model under consideration. Moreover, to account for fixed effects, three variables are included to depict ***time***, ***provinces,*** - and the ***urbanisation grade*** fixed effects. Both ***year*** and ***urban*** are implemented as factor variables, with the base being 2002 and ***very urban***.

Results

In order to fully understand the estimated marginal effects of income fluctuations on smoking, excessive alcohol consumption, and the daily number of cigarettes smoked, 12 regression models were run. These models enable this study to identify whether the affective state, formalised by disposable income, could change attitudes towards unhealthy behaviours. Table 5 shows the effects of the independent variables of interest on the participation in unhealthy behaviours, when accounted for control variables. All effects discussed in this section are considered individually, ceteris paribus.

Firstly, the model ran without control variables but with estimators to account for fixed effects.[10]. (log) Disposable income had an effect that was statistically significantly different from zero in all four models. From an economic perspective, the results imply that income has a negative association with smoke initiation and cigarette consumption, while this association is positive for excessive alcohol consumption. The latter confirms the alcohol/income puzzle.

Moreover, a dummy variable was added that indicates whether the change in income was negative compared to the year prior to measure whether negative income changes have a specific influence on the outcome, independent of the income level. A decrease in annual disposable income decreases the tendency to smoke and the number of cigarettes consumed for the whole sample. For current smokers, however, it increases the number of cigarettes consumed. Additionally, it increases the tendency to consume excessive alcohol. In sum, a one percent decrease in income increases the prevalence rate of smoking behaviour (whole sample) but is partially offset if the fluctuation is negative. For current smokers, a negative fluctuation strengthens the marginal effect of a one percent decrease in income on the number of cigarettes consumed. A one percent decrease in income decreases the tendency to consume excessive alcohol. However, this effect is partially offset due to a stronger incentive to abuse alcohol when annual disposable income decreases. In addition, this effect will be partially offset if this fluctuation is negative. The four models align with the first hypothesis: a decrease in income has a more significant effect on the consumption of unhealthy behaviours than an increase.

But will this hypothesis still be valid when accounted for control variables? The directions of the estimated coefficients are in line with the prior models but with less power. Moreover, the predictors are not statistically different from zero in the case of ***smoke*** and ***current smoker***, while only ***logntot*** is statistically different from zero for ***consumption (**)***. In

[10] See Appendix table 5.

the case of excessive alcohol use, both predictors significantly differ from zero with ***log disposable inc. (***)*** and ***inc_change*** (*). So, when controlled for other predictors, the models decrease in significance. However, the economic interpretation stays in place: a decrease in income has a more significant effect than an increase.

In addition, middle-aged individuals tend to participate more in unhealthy behaviours, while old-age individuals show a lower tendency towards unhealthy behaviours. However, individuals who indicate being a current smoker from the old-age cohort have a higher tendency to consume more cigarettes than the middle-aged cohort. Men are assumed to be more vulnerable to becoming problematic drinkers, while women tend to smoke more cigarettes than men. The latter is not statistically different from zero and should be treated cautiously. Being married considerably negatively affects the participation and consumption of unhealthy behaviours. Individuals that obtained a tertiary or secondary diploma participate less in excessive alcohol consumption and the number of cigarettes consumed compared to those with a primary diploma, implying that education is a relevant factor. The marginal effect of homeownership on the participation in unhealthy behaviours is statistically significantly different from zero and indicates a negative effect for smoking + consumption (whole sample). At the same time, a positive association exists between owning and excessive drinking. Having a mortgage is negatively associated with excessive alcohol consumption and the number of cigarettes consumed if an individual is assumed to be a current smoker. The number of mortgages offsets the latter; having a mortgage decreases the tendency to consume more cigarettes, while the number of mortgages implies the opposite.

For the second hypothesis, it was assumed that present-oriented individuals would be less affected in the consumption of harmful products when an income fluctuation occurs. The models show a small positive association between being a present-oriented individual and smoking, while it indicates a negative effect on excessive alcohol consumption.[11]When ***inc_change*** is considered, present-oriented individuals have a lower tendency to smoke and consume cigarettes, but it increases the tendency to consume excessive alcohol. Present-oriented individuals are more affected in their consumption of harmful products when income fluctuates than future-oriented individuals. This result contradicts the hypothesis but must be considered cautiously, as only the effect of income on excessive alcohol consumption is statistically different from zero. Lastly, if the current smoker is present-oriented, the number of cigarettes smoked will increase; this effect is not statistically different from zero. However, it aligns with hypothesis 3a: income fluctuations are negatively related to the prevalence rate and smoking consumption, while this effect is less for present-oriented individuals. And 3b, the prevalence rate of excessive alcohol is positively related to income; a 1% increase in disposable income leads to a .009% higher chance of participating in excessive alcohol consumption. Additionally, it also depends on the orientation of the individual.

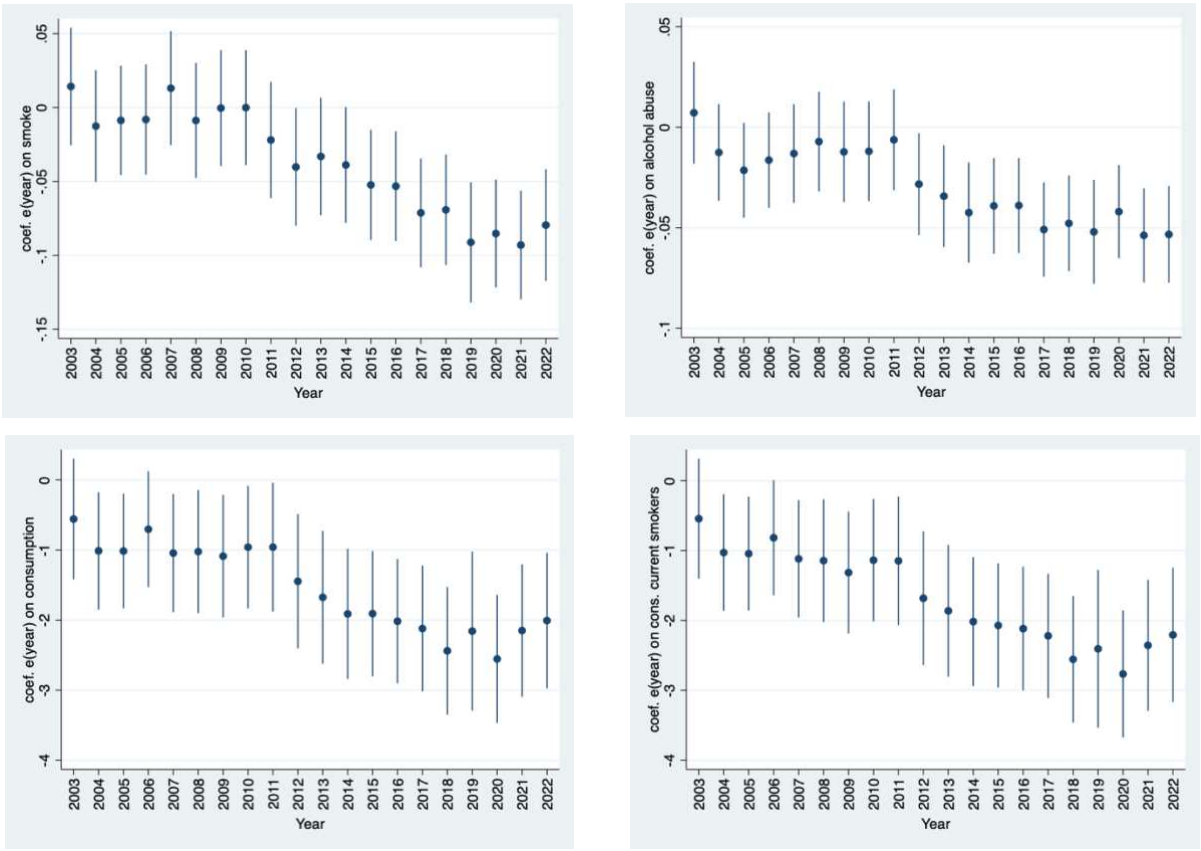
The grade of urbanisation correlates negatively with unhealthy behaviours[12]. So, living in a city does not give an incentive to the cessation of smoking. On the contrary, living in a country municipality significantly affects the prevalence rate and consumption of unhealthy behaviours. This result is in line with hypothesis 4: Individuals that live in cities perceive

[11] See Appendix table 6.
[12] See Appendix graph 2.

income fluctuations differently than those who live in the countryside. North Brabant, Overijssel, and Zeeland are positively associated with the prevalence rate and smoking consumption. However, when the focus is solely on current smokers, all provinces indicate a (weak) decrease in the consumed cigarettes. If all province dummies are equal to zero, the model estimates the rate for Drenthe[13].

To account for time fixed effects factor variable year, as visualised in graph 2. Over the years, the model shows a decrease in the prevalence rate of smoking. This decrease is in line with Dutch legislation regarding the discouragement of smoking. For current smokers, the time-fixed effects affect the consumption of cigarettes to a lesser extent but also show a negative relation over the years. As for excessive alcohol consumption, the overall trend shows a decreasing effect on drinking more than four alcoholic beverages daily. Two notable changes are those between 2011/12 and 2019/20'; the former is unexpected as the financial crisis was still the day's topic. The latter can be explained as the increased appetite for alcohol due to COVID-19, in which binge drinking became very popular.

All models in this study have a low adjusted R-squared, which indicates underfitting. Adding additional relevant features or using a complex model might help. Additional observations could increase the goodness of fit of the current model. In sum, the models are not good enough to predict the dependent variable but merely allow for understanding the economic relationship between the outcome and predictor variables.



Graph 2a, b, c & d: Fixed time effects on (a) the prevalence rate of smoking, (b) the effect on the tendency to become an excessive drinker, (c) and (d) the effect on number of cigarettes consumed for the whole sample and for current smokers.

[13] See Appendix Graph 3.

Table 5: Tendency of unhealthy behaviours, with time-and location fixed effects.

	(1) Smoke	(2) Consumption	(3) Alcohol Abuse	(4) Current Smoker
Log disp. Inc.	-.008	-.139**	.009**	-.16
	(.005)	(.07)	(.003)	(.136)
inc_change	-.005	-.053	.006*	.056
	(.006)	(.076)	(.004)	(.147)
1bn. Young				
2. Middle-aged	.064***	1.039***	.004	1.257***
	(.015)	(.193)	(.01)	(.365)
3. Old	-.052***	-.331*	-.011	1.683***
	(.015)	(.199)	(.01)	(.398)
gender	.001	.018	.048***	-.003
	(.007)	(.087)	(.004)	(.163)
marital_st	-.055***	-.792***	-.023***	-.687***
	(.007)	(.085)	(.004)	(.162)
1bn. Primair				
2. Secundair	.058***	.581**	-.037***	-1.15**
	(.019)	(.246)	(.012)	(.525)
3. Tertiair	.007	-.107	-.037***	-1.693***
	(.019)	(.25)	(.012)	(.533)
Owner	-.069***	-.856***	.01*	.007
	(.009)	(.117)	(.006)	(.239)
Mortgage	.004	-.135	-.013*	-.879***
	(.01)	(.131)	(.007)	(.29)
# mort	-.003	.035	-.002	.349**
	(.005)	(.064)	(.003)	(.137)
2002bn.year				
2003	.009	.013	.003	-.454
	(.02)	(.26)	(.013)	(.434)
2004	-.02	-.47*	-.016	-.95**
	(.019)	(.247)	(.012)	(.422)
2005	-.015	-.415*	-.025**	-.895**
	(.019)	(.242)	(.012)	(.413)
2006	-.015	-.345	-.019	-.671
	(.019)	(.244)	(.012)	(.417)
2007	.002	-.221	-.016	-1.002**
	(.02)	(.252)	(.012)	(.426)
2008	-.023	-.516**	-.009	-1.013**
	(.02)	(.255)	(.013)	(.443)
2009	-.016	-.471*	-.013	-1.15***
	(.02)	(.256)	(.013)	(.442)
2010	-.018	-.458*	-.012	-.947**
	(.02)	(.254)	(.013)	(.443)
2011	-.042**	-.755***	-.006	-.965**
	(.02)	(.257)	(.013)	(.466)
2012	-.059***	-1.06***	-.027**	-1.5***
	(.02)	(.26)	(.013)	(.485)
2013	-.045**	-.927***	-.033**	-1.713***
	(.02)	(.26)	(.013)	(.479)
2014	-.049**	-1.021***	-.041***	-1.942***
	(.02)	(.256)	(.013)	(.469)
2015	-.064***	-1.197***	-.037***	-1.893***
	(.019)	(.244)	(.012)	(.452)
2016	-.062***	-1.184***	-.038***	-2.005***
	(.019)	(.242)	(.012)	(.45)
2017	-.077***	-1.373***	-.049***	-2.15***

	(.019)	(.241)	(.012)	(.453)
2018	-.075***	-1.403***	-.045***	-2.509***
	(.019)	(.245)	(.012)	(.461)
2019	-.103***	-1.664***	-.047***	-2.188***
	(.021)	(.266)	(.013)	(.575)
2020	-.095***	-1.628***	-.038***	-2.646***
	(.018)	(.238)	(.012)	(.462)
2021	-.102***	-1.666***	-.049***	-2.218***
	(.019)	(.24)	(.012)	(.477)
2022	-.092***	-1.528***	-.049***	-2.118***
	(.019)	(.247)	(.012)	(.49)
1bn. Strong Urban				
2. Urban	-.05***	-.67***	-.026***	-.244
	(.01)	(.124)	(.006)	(.229)
3. Mod. urban	-.045***	-.592***	-.028***	-.111
	(.01)	(.133)	(.007)	(.253)
4. Few urban	-.08***	-1.127***	-.03***	-1.117***
	(.01)	(.135)	(.007)	(.273)
5. No urban	-.101***	-1.397***	-.044***	-1.073***
	(.011)	(.146)	(.007)	(.298)
NH	-.001	-.152	.016**	-.968***
	(.01)	(.13)	(.006)	(.262)
ZH	-.03***	-.479***	0	-.789***
	(.01)	(.129)	(.006)	(.262)
FR	-.004	-.083	-.011	-.011
	(.014)	(.184)	(.009)	(.378)
GR	-.01	-.408**	-.041***	-1.289***
	(.016)	(.208)	(.01)	(.415)
LI	-.049***	-.642***	-.003	-.545
	(.012)	(.154)	(.008)	(.37)
NB	.005	-.024	-.005	-.614**
	(.009)	(.122)	(.006)	(.246)
OV	.031**	.227	.005	-.679**
	(.013)	(.169)	(.008)	(.312)
UT	-.029**	-.467***	.002	-.908***
	(.013)	(.17)	(.008)	(.344)
ZE	.053***	.416*	-.014	-1.034**
	(.017)	(.22)	(.011)	(.402)
_cons	.404***	5.827***	.046	16.773***
	(.06)	(.781)	(.039)	(1.541)
Observations	18761	18761	18761	3390
R-squared	.065	.069	.022	.068
Adj R^2	.063	.067	.02	.056

Standard errors are in parentheses
**** p<.01, ** p<.05, * p<.1*

Discussion

An individual's affective state is considered to influence risk-taking tendencies over time. In this study, the aim was to determine this association from an economic perspective. The affective state was formalised as income, and the risk-taking tendencies took the form of unhealthy behaviours: smoking and excessive alcohol consumption. The study demonstrates an association between income fluctuations and unhealthy behaviours and supports the theory that adverse fluctuations have a more significant impact on unhealthy behaviours, as the affective state. While examining the association between income and unhealthy behaviours, a proxy was added to depict whether an individual could be considered present-oriented, indicating whether an individual could be seen as more vulnerable to addiction due to low income. The data suggest that present-oriented individuals are more influenced when a fluctuation in income occurs. This result contradicts the hypothesis that present-oriented people were less affected by income fluctuations in their consumption of unhealthy behaviours. Lastly, it is shown that the grade of urbanisation and home province plays a vital role in the prevalence rate and consumption of unhealthy behaviours. Individuals living in country municipalities are the least vulnerable to income fluctuations associated with initiating and consuming unhealthy behaviours. Hence, this is in line with the hypothesis in which it was stated that individuals living in cities perceive fluctuations in income differently and, therefore, act accordingly on the participation in unhealthy behaviours. Provinces, however, show a general relation that when an individual lives outside of the Randstad, they tend to be more vulnerable to smoke initiation and consumption. In contrast, individuals from Randstad provinces tend to be more vulnerable to alcohol abuse.

Firstly, this study confirms the prior theory on the relationship between SES indicators and unhealthy behaviours. Chen and Morrow (2020) implied that households could experience financial-related stress when they do not have adequate income or wealth. In addition, stress promotes the uptake of smoking (Kassel et al., 2003). This study's results align with both, as indicated by the negative association between disposable income and smoke initiation and consumption. However, it does not hold for excessive alcohol consumption, for which a positive association was found. Fortunately, this finding provides a stronger foundation for the alcohol/income puzzle implied by Auld (2005). However, accounting for the magnitude of the fluctuation, which is lower or higher than the prior year, it contradicts the puzzle, as lower disposable income increases the tendency to participate in excessive alcohol consumption.

Moreover, decreases in income lowers the tendency to smoke and the number of cigarettes consumed and is considered to have a more significant effect than being a present-oriented individual. The conclusion made by Charitonidi et al. (2016) does, therefore, not hold for the income aspect for the Dutch population. Binkley (2010) stated that low-income consumers are considered to make less healthy choices because they face lower costs in terms of forgone future utility. This statement is partly in line with this study. Low-income individuals, ergo present-oriented individuals, make less healthy choices when looking at their attitudes towards smoking initiation and consumption. However, they tend to be less vulnerable to excessive alcohol consumption.

Additionally, Becker and Murphy (1988) stated that present-oriented individuals are potentially more addicted to harmful goods than future-oriented individuals. This aligns with

the results for smoking, but excessive alcohol consumption seems more related to future-oriented individuals. However, for both present and future-oriented individuals, it holds that if the disposable income decreases compared to the year prior, both types find relief in alcohol. Becker and Murphy (1988) also indicated price as a significant predictor in the participation of unhealthy behaviours. Time-fixed effects were included to account for these price changes, which shows findings in line with Chaloupka et al. (2019) and Keeler et al. (2020). However, caution is needed as the Dutch government applied more legislation to make unhealthy behaviours less attractive.

In conclusion, Headey, Muffels, and Wooden (2004) suggested that economic circumstances, formalised by income and wealth, influenced life satisfaction. This study suggests that the affective state, formalised by disposable income, influenced the consumer's choice to participate in unhealthy behaviours. So, life satisfaction is inherently associated with the initiation and consumption of smoking and excessive amounts of alcohol. In other words, economic drivers are relevant when studying individuals' unhealthy behaviors.

There is a vast array of research done in the area of human behaviours and their affective state. This study shed light on how the affective mind influences the tendency to participate in excessive alcohol consumption and smoking. The results imply that individuals from strongly urbanised municipalities are most vulnerable to changes in affective state and will participate even more in excessive alcohol consumption if present-oriented. In addition, it shows a contradiction in the alcohol/income puzzle; whether an individual is present-or future-oriented, the tendency to participate in excessive alcohol consumption increases if their disposable income is lower compared to the year prior. This study argues that more individual- and locational-specific guidance is needed to decrease the affective state's influence on unhealthy behaviour, as current legislation only considers macro-level considerations. It is arbitrary to be in favour of legalising illicit drugs while not fully understanding how to tackle problems occurring from addiction. In doing so, the economic loss from these behaviours can be overturned and potentially contribute to the Dutch economy by reducing health expenditures.

Limitations

As mentioned, some models used in this study depict coefficients of independent variables that are statistically significantly not different from zero. This paper aimed to study the effects of income fluctuations on the affective state and whether it plays a vital role in risky health choices. A potential explanation can be provided by Oakes and Andrade (2017), who imply that income is an imperfect measure of SES. Many individuals are unwilling to reveal their income, and those that do may misstate it. Moreover, it is highly volatile and fluctuates considerably over a year, let alone the life course.
Furthermore, the results stemming from this study are subject to methodological limitations, which restrict the extent to which they can be applied to a broader population. For further research, it is recommended to replicate these findings using more diverse and representative samples and explore variations in data collection methods. It could be beneficial to assess a younger sample, as middle-aged (30-67) were overrepresented, and to add middle-class incomes. In addition, qualitative research on a smaller population could offer a more in-depth assessment of how income fluctuations influence affective states and unhealthy behaviours.

Lastly, a final suggestion for further research on the influence of the affective state on unhealthy behaviours could be to add other proxies for unhealthy behaviours. Interesting would be to research the

association with illicit drugs. To be more precise, marijuana, as the Netherlands is testing whether legalisation could be beneficial for the country as a whole.

Conclusion

In what extent does the affective state, formalised by fluctuations in disposable income, contribute to the participation in unhealthy behaviours, and;

Do present-oriented individuals interpret fluctuations in income on the participation in unhealthy behaviours differently than future-oriented individuals?

This research discusses the association between the affective state and the tendency to participate in unhealthy behaviours in Dutch individuals. This is done from an economic perspective in which income is used as a proxy for an individual's affective state and the unhealthy behaviours formalised by smoking and excessive alcohol consumption. In order to do so, panel data from the DHS was assessed, and a multilinear regression model was used, which included the time-and locational fixed effect formalised by dummy-and factor variables.

Income fluctuations do contribute to participating in unhealthy behaviours by altering an individual's perception of their affective state. Based on a quantitative analysis of unhealthy behaviours in response to income fluctuations, it can be concluded that Dutch individuals are vulnerable to participating more in unhealthy behaviours as a decrease in income occurs. Moreover, as income increases, smoking rates decrease while the tendency to consume excessive alcohol increases.

There is a general effect, but is there a difference between present- and future-oriented individuals? Yes, there is, although it must be treated with caution as the models used represent underfitting. Present-oriented individuals tend to be more addicted to smoking. They will be less affected by fluctuations in income, while the same holds for future-oriented individuals when looking at excessive alcohol consumption. When the model accounts for the magnitude of the change, both types show an increased tendency to participate in excessive alcohol consumption.

This study shed light on how to target vulnerable individuals that perceive fluctuations in income more heavily by participating more in unhealthy behaviours. Macroeconomic legislation to discourage unhealthy behaviours is considered the first-best solution. However, individuals vulnerable to an addiction still tend to participate in these behaviours while neglecting other vital health choices. This is still a fascinating area of research as further research can assess this problem by using available European data or even data about the prevalence rate of marijuana, as the Dutch government insists on legalising marijuana, and its addictive nature.

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Appendix

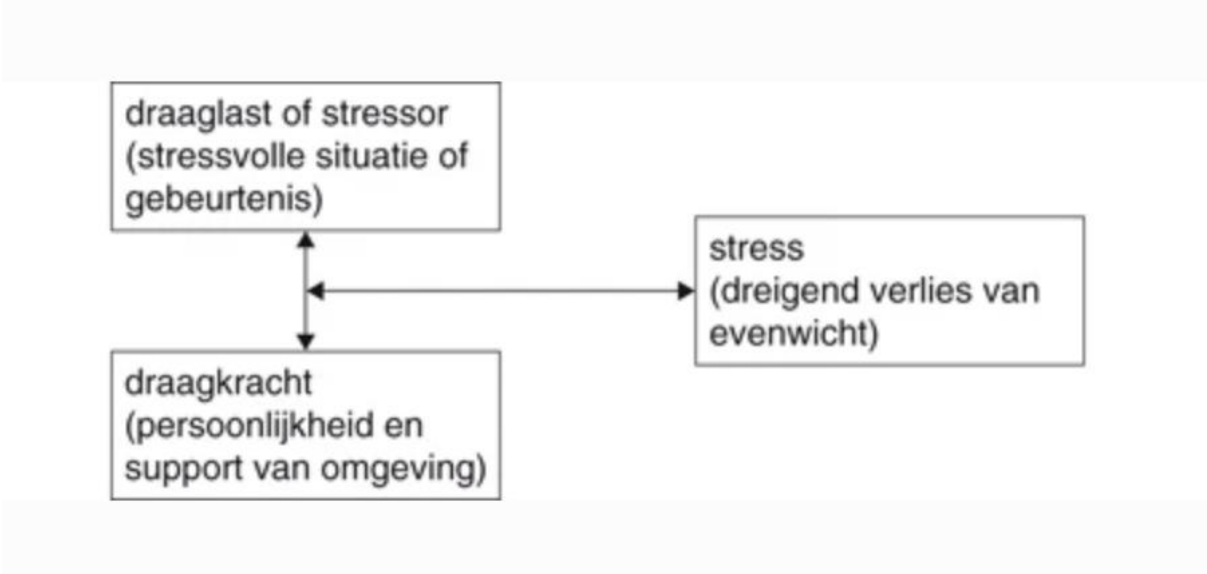


Figure 1: Stress in relation to workload (; stressor) and load bearing.
Resource: Van der Ploeg, J. (2013).

Table 1: Question selection, obtained from the DHS database.

Questionnaire / Dataset	*Question*
Household Information (HHI)	GEBJAAR Geboortejaar van de respondent; Year of birth GESLACHT Geslacht van de respondent; Gender OPLMET Hoogste opleiding met diploma; Highest obtained diploma BEZIGHEI Belangrijkste bezigheid van de respondent; Most important occupation AANTALKI Aantal kinderen in het huishouden; Number of kids STED Stedelijkheid woonplaats; Grade of Urbanisation PROV Provincie van de woongemeente
Work and pension (WRK)	BURGST Wat is uw burgerlijke staat?; Marital status BET Verricht u betaald werk, ook al is het maar voor één of enkele uren per week of voor een korte periode?; Whether the respondent works, even if it is only for one or a couple of hours per week or for a short period in time

Accommodation (HSE)	WO1 Bent u huurder, onderhuurder of eigenaar van uw huidige woning? Als u in meer dan één woning woont, wilt u dan de belangrijkste nemen.; Whether the respondent is a tenant, subtenant or houseowner WO48 Rusten er op deze woning een of meer hypotheken?; If the respondent is an owner, do they have one or several mortgages on the house? WO49 Hoeveel hypotheken rusten er op deze woning?; How many mortgages are included in the mortgage debt? WO89 Als u meer dan twee woningen hebt, houdt u dan bij de volgende vragen de voor u belangrijkste tweede woning in gedachte. De overige woningen kunt u later in een andere vragenlijst opgeven bij 'onroerende goederen'; Whether a respondent has a second house or not.
Income (INC)	GEZ1 Hoe lang bent u?; The length of a respondent (in centimetres) GEZ2 Hoeveel weegt u zonder kleren en schoenen?; The weight of a respondent (in kilograms) without him/her wearing clothes and shoes GEZ7 Rookt u (wel eens) sigaretten?; Whether a respondent (from time to time) smokes cigarettes GEZ8 Hoeveel sigaretten rookt u per dag?; How many cigarettes does a respondent smokes? GEZ9 Drinkt u gemiddeld meer dan vier glazen alcoholische dranken per dag?; Whether a respondent drinks, on average, more than four glasses of alcohol a day?
Wealth (WTH)	None
Psychological concepts (PSY)	None
Aggregated income	Net income = btot – ib + alik + beurs + studlen + otoel + ftoel + erf + hs + hg + min(0,winst) + min(alim,0) + rente + og.
Aggregated wealth	None

Table 2: Operationalisation of the binary variables *work* and *pension*.

Answer	Statement DHS	Meaning	*Work Value*	*Pension Value*
1	Verricht betaald werk in loondienst	If a person works on payroll	=1	=0
2	Werkt of is meewerkend in gezins- of familiebedrijf	Work at family company	=1	=0
3	Zelfstandig beroepsbeoefenaar	Works at own company	=1	=0
4	Zoekt werk na verlies werkkring	In search of a job after being let go by former employer	=0	=0

5	Zoekt voor het eerst naar werk	First time entering job market	=0	=0
6	Gaat naar school of studeert	Still goes to school or university	=0	=0
7	Verzorgt de huishouden	Does the chores in household	=0	=0
8	Is met pensioen (vervroegd, AOW of VUT)	Enjoys old age payment	=0 if BET==2, otherwise 1	=1 if BET==2
9	Arbeidsongeschikt	Not able to work	=0	=0
10	Verricht onbetaald werk met behoud van uitkering	Unpaid work	=0	=0
11	Verricht vrijwilligerswerk	Voluntary work	=0	=0
12	Doet iets anders	Doing something else (?)	=0	=0

Table 3a: Frequency gender and unhealthy behaviours

gender	Current smoker	Abuses alcohol
Woman	1420	212
Male	2799	1170
Total	4219	1382

Table 3b: Frequency Age and unhealthy behaviours

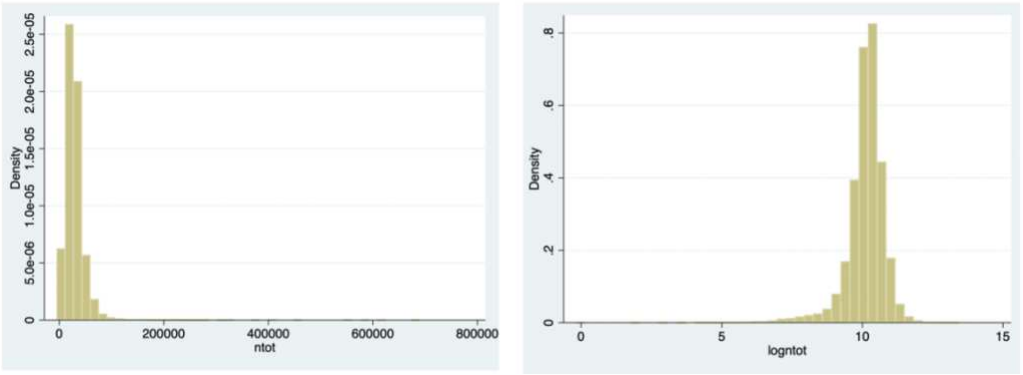
age_group	Current smoker	Abuses alcohol
Young	165	47
Middle-aged	3390	987
Old	664	348
Total	4219	1382

Table 3c: Frequency Education and unhealthy behaviours

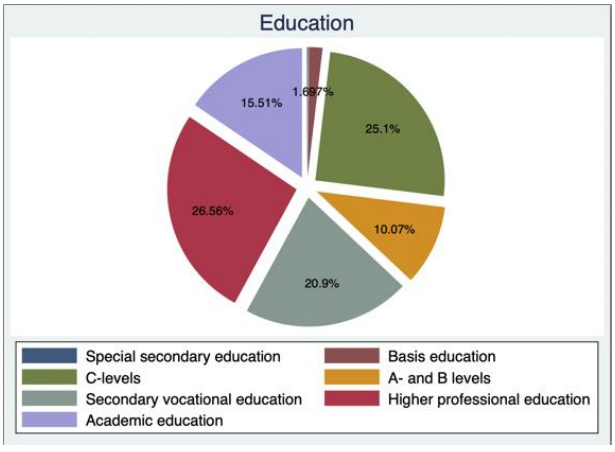
Education	Current Smoker	Alcohol Abuser
Primair	109	58
Secundair	2599	703
Tertiair	1511	621
Total	4219	1382

Table 4: Division of respondents their home province and grade of urbanisation

	Grade of urbanisation					
Provinces	Very Urban	Urban	Moderate Urban	Few Urban	Not Urban	Total
Groningen	286	6	47	232	274	845
Friesland	3	134	234	267	495	1133
Drenthe	0	2	173	252	300	727
Overijssel	2	695	200	271	227	1395
Flevoland	0	7	266	133	0	406
Gelderland	6	798	791	637	520	2752
Utrecht	256	250	502	360	42	1410
Noord-Holland	1234	1252	577	366	276	3705
Zuid-Holland	1857	1096	542	551	280	4326
Zeeland	0	80	123	213	303	719
Noord-Brabant	9	1168	1127	1076	439	3819
Limburg	3	501	388	420	416	1728
Total	3656	5989	4970	4778	3572	22965



Graph 1 a & b: Distribution of disposable income (a) and log income with outliers (b).



Graph 2: Pie chart education

Table 5: Reg. Tendency of Unhealthy Behaviours without control variables

	(1) Smoke	(2) Cig. consumption	(3) Alcohol abuse	(1) Current Smoker
Log disp. Inc.	-.033***	-.48***	.015***	-.443***
	(.005)	(.062)	(.003)	(.121)
inc_change	-.018***	-.213***	.007**	.048
	(.006)	(.077)	(.004)	(.148)
2002bn.year				
2003	0	-.112	.007	-.596
	(.02)	(.264)	(.013)	(.437)
2004	-.033*	-.641**	-.011	-1.029**
	(.019)	(.25)	(.012)	(.425)
2005	-.027	-.576**	-.02*	-1**
	(.019)	(.246)	(.012)	(.415)
2006	-.032*	-.554**	-.014	-.711*
	(.019)	(.247)	(.012)	(.42)
2007	-.016	-.436*	-.013	-1.078**
	(.02)	(.256)	(.012)	(.428)
2008	-.048**	-.827***	-.005	-1.089**
	(.02)	(.258)	(.013)	(.446)
2009	-.039*	-.747***	-.007	-1.159***
	(.02)	(.26)	(.013)	(.445)
2010	-.044**	-.779***	-.009	-1.011**
	(.02)	(.258)	(.013)	(.445)
2011	-.07***	-1.104***	-.003	-1.05**
	(.02)	(.26)	(.013)	(.467)
2012	-.091***	-1.453***	-.024*	-1.543***
	(.02)	(.263)	(.013)	(.487)
2013	-.084***	-1.392***	-.031**	-1.763***
	(.02)	(.263)	(.013)	(.481)
2014	-.083***	-1.43***	-.038***	-2.011***
	(.02)	(.259)	(.013)	(.472)
2015	-.098***	-1.603***	-.036***	-1.935***
	(.019)	(.247)	(.012)	(.454)
2016	-.099***	-1.631***	-.038***	-2.116***
	(.019)	(.245)	(.012)	(.451)
2017	-.11***	-1.779***	-.049***	-2.205***
	(.019)	(.244)	(.012)	(.455)
2018	-.108***	-1.801***	-.045***	-2.526***
	(.019)	(.247)	(.012)	(.463)
2019	-.15***	-2.236***	-.047***	-2.21***
	(.021)	(.269)	(.013)	(.576)
2020	-.13***	-2.059***	-.039***	-2.621***
	(.019)	(.241)	(.012)	(.464)
2021	-.137***	-2.084***	-.05***	-2.221***
	(.019)	(.243)	(.012)	(.48)
2022	-.132***	-2.016***	-.05***	-2.113***
	(.019)	(.25)	(.012)	(.492)
1bn. Strong Urban				
2. Urban	-.075***	-.994***	-.03***	-.366
	(.01)	(.124)	(.006)	(.225)
3. Mod. urban	-.082***	-1.057***	-.032***	-.36
	(.01)	(.132)	(.006)	(.244)
4. Few urban	-.119***	-1.627***	-.034***	-1.222***
	(.01)	(.133)	(.007)	(.265)
5. No urban	-.14***	-1.886***	-.048***	-1.266***
	(.011)	(.144)	(.007)	(.293)
NH	-.006	-.187	.015**	-.923***

	(.01)	(.132)	(.006)	(.263)
ZH	-.036***	-.536***	-.001	-.811***
	(.01)	(.131)	(.006)	(.263)
FR	0	-.027	-.012	-.181
	(.014)	(.187)	(.009)	(.38)
GR	-.008	-.404*	-.04***	-1.361***
	(.016)	(.211)	(.01)	(.415)
LI	-.063***	-.818***	-.002	-.387
	(.012)	(.156)	(.008)	(.371)
NB	.001	-.066	-.004	-.558**
	(.01)	(.124)	(.006)	(.247)
OV	.039***	.334*	.004	-.666**
	(.013)	(.171)	(.008)	(.314)
UT	-.029**	-.463***	-.002	-.895***
	(.013)	(.172)	(.008)	(.347)
ZE	.058***	.499**	-.012	-.806**
	(.017)	(.224)	(.011)	(.403)
_cons	.69***	9.723***	-.035	14.008***
	(.055)	(.709)	(.035)	(.604)
Observations	18761	18761	18761	4219
R-squared	.03	.035	.014	.067
Adj R^2	.028	.033	.012	.057

Standard errors are in parentheses
**** p<.01, ** p<.05, * p<.1*

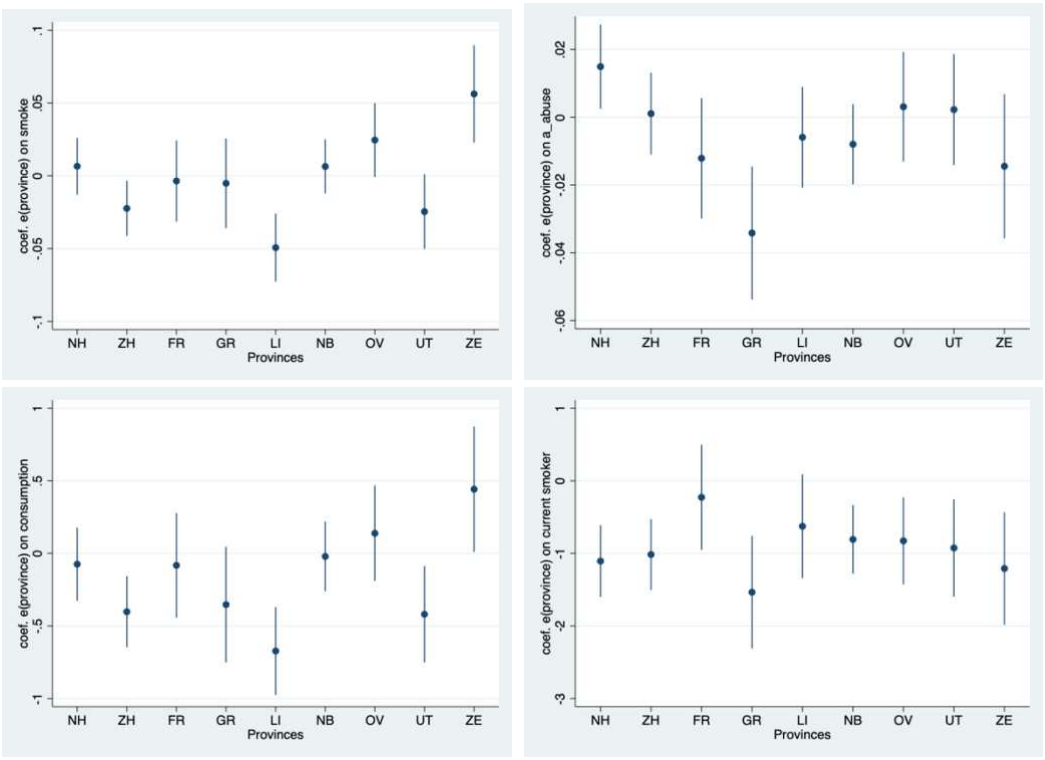
Table 6: Reg. Tendency of Unhealthy Behaviours based on Ind. Time-orientation.

	(1) Smoke	(2) Cig. consumption	(3) Alcohol abuse	(3) Current smoker
present_or	.004	.085	-.009***	.121
	(.006)	(.073)	(.004)	(.143)
inc_change	-.008	-.103	.007**	-.041
	(.006)	(.073)	(.004)	(.142)
1bn. Young				
2. Middle-aged	.052***	.912***	-.002	1.317***
	(.014)	(.18)	(.009)	(.327)
3. Old	-.063***	-.448**	-.016*	1.736***
	(.014)	(.186)	(.009)	(.356)
Gender	-.001	-.008	.047***	-.04
	(.006)	(.077)	(.004)	(.144)
Marital Status	-.049***	-.722***	-.023***	-.675***
	(.006)	(.077)	(.004)	(.144)
1bn. Primair				
2. Secundair	.023	.252	-.037***	-.375
	(.016)	(.208)	(.01)	(.403)
3. Tertiair	-.025	-.409*	-.034***	-.906**
	(.016)	(.21)	(.01)	(.408)
Owner	-.076***	-.97***	.007	-.157
	(.008)	(.104)	(.005)	(.208)
Mortgage	.006	-.105	-.011*	-.886***
	(.009)	(.12)	(.006)	(.262)
# mort	-.007	-.006	0	.383***
	(.005)	(.06)	(.003)	(.129)
2002bn.year				
2003	.019	.237	.005	-.057
	(.018)	(.236)	(.011)	(.383)
2004	-.015	-.345	-.01	-.622
	(.018)	(.232)	(.011)	(.39)
2005	-.008	-.239	-.023**	-.487

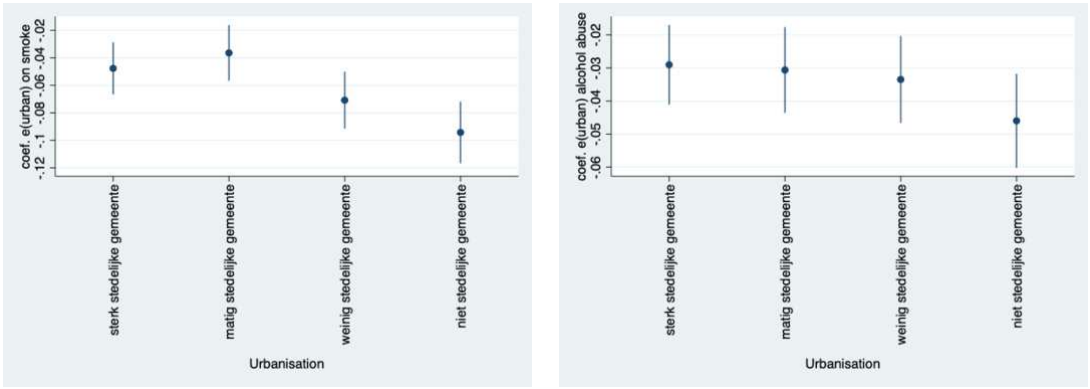
	(.018)	(.227)	(.011)	(.38)
2006	-.01	-.265	-.014	-.544
	(.018)	(.228)	(.011)	(.385)
2007	.004	-.099	-.01	-.617
	(.018)	(.23)	(.011)	(.383)
2008	-.029	-.513**	-.01	-.638
	(.018)	(.232)	(.011)	(.401)
2009	-.02	-.481**	-.015	-.988**
	(.018)	(.237)	(.012)	(.406)
2010	-.017	-.382*	-.012	-.615
	(.018)	(.231)	(.011)	(.397)
2011	-.038**	-.669***	-.008	-.75*
	(.018)	(.233)	(.011)	(.413)
2012	-.052***	-.904***	-.024**	-1.162***
	(.018)	(.232)	(.011)	(.419)
2013	-.038**	-.795***	-.031***	-1.519***
	(.018)	(.233)	(.011)	(.416)
2014	-.043**	-.884***	-.034***	-1.652***
	(.018)	(.228)	(.011)	(.406)
2015	-.061***	-1.097***	-.036***	-1.632***
	(.017)	(.22)	(.011)	(.401)
2016	-.06***	-1.129***	-.038***	-1.898***
	(.017)	(.218)	(.011)	(.397)
2017	-.066***	-1.21***	-.045***	-2.019***
	(.017)	(.216)	(.01)	(.39)
2018	-.079***	-1.34***	-.045***	-1.906***
	(.017)	(.22)	(.011)	(.408)
2019	-.09***	-1.49***	-.047***	-2.12***
	(.018)	(.236)	(.011)	(.474)
2020	-.092***	-1.512***	-.039***	-2.125***
	(.017)	(.215)	(.01)	(.409)
2021	-.097***	-1.578***	-.048***	-2.12***
	(.017)	(.218)	(.011)	(.421)
2022	-.091***	-1.464***	-.047***	-1.841***
	(.017)	(.221)	(.011)	(.427)
1bn. Strong Urban				
2. Urban	-.049***	-.629***	-.022***	-.123
	(.009)	(.113)	(.005)	(.207)
3. Mod. urban	-.05***	-.619***	-.021***	.092
	(.009)	(.122)	(.006)	(.23)
4. Few urban	-.079***	-1.122***	-.023***	-1.081***
	(.01)	(.124)	(.006)	(.246)
5. No urban	-.108***	-1.447***	-.036***	-.87***
	(.01)	(.134)	(.006)	(.269)
NH	-.006	-.199*	.016***	-.902***
	(.009)	(.119)	(.006)	(.238)
ZH	-.038***	-.596***	-.001	-.829***
	(.009)	(.118)	(.006)	(.236)
FR	.002	.074	-.012	.499
	(.013)	(.166)	(.008)	(.33)
GR	-.007	-.328*	-.041***	-1.011***
	(.015)	(.189)	(.009)	(.374)
LI	-.039***	-.539***	.002	-.609*
	(.011)	(.141)	(.007)	(.32)
NB	.006	.004	-.011**	-.507**
	(.009)	(.112)	(.005)	(.219)
OV	.035***	.259*	.004	-.738***
	(.012)	(.154)	(.007)	(.28)
UT	-.037***	-.538***	-.005	-.795**
	(.012)	(.153)	(.007)	(.312)
ZE	.06***	.497**	-.016*	-.916***

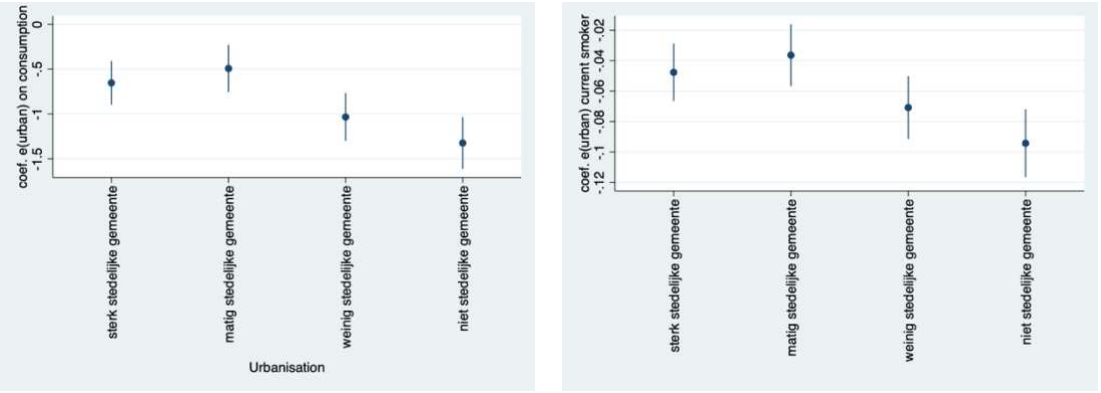
	(.015)	(.199)	(.01)	(.354)
_cons	.368***	4.824***	.135***	14.008***
	(.025)	(.33)	(.016)	(.604)
Observations	22965	22965	22965	4219
R-squared	.064	.068	.021	.067
Adj R^2	.062	.066	.019	.057

Standard errors are in parentheses
**** p<.01, ** p<.05, * p<.1*



Graph 3 a, b, c & d: Different provinces' attitudes towards unhealthy behaviour. (a) the prevalence rate of smoking, (b) the effect on the tendency to become an excessive drinker, (c) and (d) the effect on number of cigarettes consumed for the whole sample and for current smokers. Note: Drenthe equals zero.





Graph 4 a, b, c & d: Urbanisation grade effect (a) the prevalence rate of smoking, (b) the effect on the tendency to become an excessive drinker, (c) and (d) the effect on number of cigarettes consumed for the whole sample and for current smokers. Note: very urban is the base.