Rising obesity rates have generated serious policy concern and public interest. Along with other factors contributing to weight gain, dietary and physical activity behaviours are considered the main determinants of individual body weight. In order to tackle the increasing obesity problem and change individual behaviour, effective policy interventions need to be developed which target specific groups within the population. Economic frameworks that have been designed to model individual choices can be applied to improve the understanding of how individual characteristics and socio-economic factors affect weight-related behaviours and body weight.

### Aims

This thesis analysed:

- whether average BMI and socio-economic characteristics differ across combinations of weight-related behaviours;
- how diet and physical activity behaviours, as well as their determinants, can be adapted to explain BMI on average;
- how determinants of BMI impact differently across a conditional BMI distribution; and
- to what degree a change in BMI over time can be explained by changing influences.

### Methods

Based on economic frameworks by Grossman (1972), Becker (1965) and Cawley (2004), basic concepts and influences were identified to derive a behavioural model explaining diet and physical activity behaviours and their effect on individual body weight. Given that determinants of health-related choices are characterised by a complex relationship between lifestyle factors and various influences from the physical, social and economic environment, the underlying assumption regarded diet and physical activity as elements of the health production function based on Grossman's model of the demand for health. Accordingly, diet and physical activity were considered as investments in a healthy lifestyle providing an output of healthy time that again could be used for household production and consumption. As suggested by Grossman, human capital was measured by educational qualifications that were assumed to improve individual health production directly and affect other influences, such as socio-economic characteristics, on dietary and activity choices mediating BMI as health outcome. Socio-economic factors and different time inputs were included according to frameworks by Becker and Cawley. Rather than assuming that individuals rationally decide to be obese, this approach assumes that individuals engage in specific behaviours without fully anticipating or even disregarding their consequences on body weight.

The estimated models considered the following equations for diet (D), physical activity (A) and BMI:

1. \( D_i = \beta X_i + \epsilon_D \)
2. \( A_i = \beta X_i + \epsilon_A \)
3. \( BMI_i = \beta_0 + \beta_1 D_i + \beta_2 A_i + \epsilon_{BMI} \)

where the vector \( X \) includes demographic, household, lifestyle and socio-economic characteristics affecting the health-related behaviours or BMI directly. For identification, exclusion restrictions were applied.

Effects of individual characteristics on diet and physical activity were estimated via instrumental variables and sample selection models. BMI was introduced as health outcome in a simultaneous estimation model where diet, physical activity and BMI were jointly estimated via a three-stage least squares (3SLS) model capturing the complex intercorrelation between the behaviours and their impact on body weight, and vice versa. Finally, differences in BMI distribution over time were decomposed using a quantile regression model to identify causes for the observed gap in BMI and to assess whether influences of BMI are constant or vary in their effect across the BMI distribution and over time.

### Results

Although traditional weight management measures promote a reduction in caloric intake and the energy balance framework suggests a promotion of a healthy diet and a sufficiently active lifestyle, the results suggest that physical activity is the predominant behaviour regarding the influence on individual BMI (compared to individual diet measured by quality proxies rather than the overall caloric intake).

The analysis of socio-economic factors influencing both weight-related behaviours, and BMI, confirmed two principles of the underlying economic theory: health production and time allocation. Higher levels of general education are associated with a healthier diet, a higher uptake of physical activity and a lower BMI. The findings suggest that especially individuals with lower educational qualifications and in more deprived areas have to be targeted by interventions to promote a generally healthier lifestyle.

Rather than applying a mean-based one-size-fits-all approach, policies aimed at reducing population weight should be more specifically targeted across the BMI distribution with a special focus on the higher end of the distribution. Decomposing the change in BMI over time for different quantities of the BMI distribution revealed that the change is decreasingly attributable to observed variations in the included characteristics when moving along the BMI distribution (see Figure 1).

![Figure 1: Decomposition of differences in BMI distributions using quantile regression.](image)

### Conclusions

While previous economic research did not consider the combined effect of dietary and physical activity behaviours on body weight, this work investigated the relationship between weight-related behaviours and individual BMI on average and across the conditional BMI distribution to identify areas for policy interventions. Current guidelines promoting a healthy nutrition and a sufficiently active lifestyle aim to improve individual behaviours separately in order to improve individual health in general. However, for weight-related interventions to be more effective, they need to be specifically targeted across socio-economic determinants of both body weight and associated behaviours. Further attention has to be paid to the promotion of a healthy lifestyle across different weight groups within the population.

### Dissemination

