Erasmus School of Health Policy & Management

Master Thesis

The relationship between the transition to empty nest and BMI: An empirical investigation into the self-reported BMI of parents after their last child has left the household.

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Abstract

The purpose of this paper is to investigate the influence of the transition to the empty nest on the Body Mass Index (BMI) of parents in the first year after the transition through the medium of fixed effects panel data analysis. Also, the moderating role of gender in this relationship is tested. A review of the relevant literature provides the basis for the theoretical foundations made throughout the analysis. The secondary dataset comprises data of the Netherlands during a period of 27 years for multiple economic data. The results suggest that there is a negative effect between making a transition to the empty nest and the parent's BMI. Additionally, there has been found that women experience a minor increase in their BMI in the first year after the transition, while men experience a decrease in their BMI.

Key words: Empty nest, BMI, stressful life event, parental transition

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1. Introduction

1.1 Research problem

In a family life cycle both the family and the individuals go through a series of life cycle stages, where individual development, family-acceptance and encouragement tasks are included (Lantz, 1993). Some of these life cycle stages will be positive, while others are considered negative. In the studies of Danish, Smyer, & Nowak (1980) and Baltes (1987) the age-graded normative life event is introduced. This phenomenon refers to a life event that is common to most people and predictable in nature due to coherence with age. One of the many examples of an age-graded life event is the transition to an empty nest (Lavee, McCubbin, & Olson, 1987). The majority of parents will experience this event when they are of middle-age. The empty nest indicates the empty house that a child leaves behind when he/she leaves and only the parent(s) stay behind. Children often leave the parental home because of studying or pursuing a career elsewhere (Bouchard, 2014). When children leave the household, this can cause stress on the parent(s). The main concerns of parents when they enter the empty nest phase are the safety, security and well-being of the child in the outside world (Mitchel & Lovegreen, 2009). Research has shown that mothers worry more than fathers (Mitchel & Lovegreen, 2009). A study examining gender differences in stress found that women significantly experience more chronic stress and minor daily stressors then men (Matud, 2004). Furthermore, women rated their life events more negative and less controllable than men. Elaborating on that, men and women tend to have different coping styles while dealing with this event. Men tend to deal with stress by problem-focused coping, while women have an emotional-focused approach. An emotional reaction to reduce the stress can be 'comfort eating', where sugar and fat-enriched foods are consumed to a larger extent than normally (Dallman et al., 2003; Dallman, Pecoraro, la Fleur, 2005). This behaviour can have substantial consequences for an individual and subsequently for the society.

Unfortunately, in existing research little attention has been devoted to the transition to the empty nest in comparison to other stages in the family life cycle, such as the transition to parenthood. The lack of interest in this topic and the possible difference between genders should be of great concern to researchers for at least two reasons. First, in recent decades the length of the post-parental period has expanded (Borland, 1982) and nearly half of the marriage is typically spent after the children have left home (Duvall & Miller, 1985). Second, the transition to the empty nest engenders complex emotions, both positive and negative, for parents and can therefore have a big influence on their well-being (Beaupré, Turcotte, Milan, 2006).

1.2 Research goal & Research question

This study aims to determine whether a change in BMI of parents occurs when their last child leaves the household. In order to address this research goal, the following research question has been constructed:

"What is the effect of the transition to an empty nest on the BMI of parents?"

In addition, this study will explore the potential role of gender in the relation between a transition to an empty nest and BMI.

''How does gender affect the relationship between the transition to an empty nest and the BMI?''

1.3 Relevance

As described above, the empty nest is a topic which has not been addressed much in prior research, while the importance of the effect of similar stressful life events on an individual's health has been expressed extensively. Piper & Jackson (2017) emphasize that health issues as a result of the empty nest is a serious issue that can have a substantial and negative impact on individuals. To the knowledge of the researcher, no panel data study has been conducted on the BMI of parents who made the transition to the empty nest and the possible interaction with gender. This underscores the need of filling up these gaps to extend the current theory on the relationship between the empty nest and BMI. Furthermore, A new study can potentially outline additional elements to facilitate further research.

1.4 Structure

This paper will advance in the following structure. First, the existing theoretical framework will be explored. More specifically, the concepts of the transition to the empty nest, the concept of stress, the interaction between stress and BMI and gender differences will be elaborated upon. Additionally, the hypotheses that result from the theoretical study will be formulated. Subsequently, the methods that are utilized to perform the research will be discussed. Consecutively, the outcomes of the regression analysis will be presented followed by a discussion of these results. Finally, a conclusion will be formulated regarding the main research question.

2. Theoretical framework

2.1 Empty nest

The empty nest is the phase of the family life cycle and the individual adult life cycle that occurs after the children grow up and leave the parental home (Bouchard, 2013; Harkins, 1970; Junge, & Maya, 1985; Lantz & Ahern 1994). When the child leaves it is a significant event for both parents and child (Mitchell & Lovegreen, 2009). For the child, this is a step forward in becoming independent from the parents. Young adults move out from the parental home to simply live independently or additionally to pursue educational or employment opportunities (Beaupré et al., 2006). This phenomenon can be described as a symbolic marker of adulthood (Mitchell & Lovegreen, 2009). Regarding the experience of the middle-aged parents (35-75 years old), some might experience this transition as a conflicted time, where the feeling of loving and letting go and the disruption of the day-to-day parental role is present. A majority of the adults believe that both men and women should leave the home when they are between 18 and 25 years old (Settersten, 1998). During this time of the life cycle, the development of personality and the expression of independence is important. Even though co-residence probabilities steeply decrease with children's age, this movement is hindered by another trend. Since the 1980's the average age for leaving home has increased in many western countries (Cherlin, Scabini, & Rossi, 1997). This is largely a result of financial problems for young adults (Beaupré et al., 2006; Mitchell & Lovegreen, 2009). The ability of support oneself economically is seen as a strong determinant of parental independence (Cherlin et al., 1997). Moreover, when they leave the childhood home their moves are not always permanent (Mitchell & Lovegreen, 2009). This results in an elongated transition period to the empty nest (Mitchell, 2006).

The departure of the child is influenced in certain ways. Studies show that women leave the parental home earlier than men (Beaupré et al., 2006; Cherlin et al., 1997; Chiuri & Del Boca, 2010; Settersten, 1998; White, 1994). This can be up to 2 to 3 years difference (Chiuri & Del Boca, 2010). Additionally, studies show that higher educated adolescents leave the parental home sooner than their less educated counterparts (Beaupré et al., 2006; Chiuri & Del Boca, 2010). Also, family characteristics influences the departure of the children. An adolescent growing up in a large family or living in a stepfamily will leave the parental home sooner (Beaupré et al., 2006). As well, having a mother who is unemployed during the adolescence phase of the offspring decreases the probability of a young adult moving out of the parental home. In contrast, the effect of having a father who is not in the paid labour force was not significant.

Children leaving the parental home and parents experiencing an empty nest is a form of event related to interpersonal losses (Schmidt, Murphy, Haq, Rubinow, & Danaceau, 2003). Since the parents have

devoted many years to the parenting role, they may be left with a major void in their daily lives (Raup, & Meyer, 1989). Therefore, it can be interpreted as a loss event, where separation from a valued person occurs (Finlay-Jones & Brown, 1981). The transition to an empty nest can be a positive experience for parents, an opportunity for reconnection and a time to rekindle interests (Dennerstein, Dudley, & Guthrie, 2002). More often however it is accompanied by negative changes, such as feelings of sadness, loss and fear or difficulty in redefining roles with negative effects such as depression, identity crisis, and marital conflict (Huerta, Mena, Malacara, & Leon, 1995). In addition, Piper & Jackson (2017) conclude that there is a substantial reduction in life satisfaction experienced by empty nesters when compared to pre-empty nesters. This experience is greatly influenced by the parental expectations regarding the appropriate timing of the child's departure (Harkins, 1978; Mitchell & Lovegreen, 2009). If the empty-nest period occurs too soon or too late according to the social lens of the parents, the more difficulties regarding coping with the event will be experienced.

In general, the reduction of life satisfaction is influenced by the perceived stress due to exposure to a stressful life event (Krause, 2004; Samaha & Hawi, 2016). Holmes & Rahe (1967) have created a list of 43 events which are considered as sources of stress, where the child's departure from parental home is positioned at 23rd place. The transition from pre-empty nester to empty nester can therefore be seen as a stressful live event. Also, Mitchell & Lovegreen (2009) and Badiani & De Sousa (2016) confirm this theory and point out that the transition to the empty nest can be seen as a potential life course stressor.

2.2 Stress

Baum (1990, p. 653) defined stress as *''a negative emotional experience accompanied by predictable biochemical, physiological, cognitive, and behavioural changes that are directed either toward altering the stressful event or accommodating to its effect''*. Stress will be perceived when an individual is confronted with a problem, and he/she believes that the problem is serious, and it does not have the necessary resources to cope with the problem (Lazarus, 1966). A stressor can be any phenomenon that triggers the stress system from the inside or outside the human body and they can be physical, chemical, biological, psychological or social oriented (Faraday, 2006). A child leaving the parental home and starting its journey to discover the life outside the nest is a stressor that triggers the stress system. Cohen, Kessler, & Gordon (1995) define three perspectives regarding stress. The first one is environmental stress, which emphasizes assessment of environmental situations or experiences that are related to substantial adaptive demands. The second is psychological (emotional) stress, which relates to people's subjective evaluations of their ability to cope with demands presented to them by certain situations and experiences. Finally, the biological stress perspective emphasizes the function of certain physiological systems in the body that are regulated by both physically and psychologically demanding conditions.

When stress occurs, the body will jump into fight-or-flight mode, where the sympathetic nervous system takes over (Gijsen, Jelicic, & Merckelbach, 2008; McEwen, 2008; Salleh, 2008). This leads to the secretion of stress hormones and an increase in heart rate, blood pressure, breathing and muscle tension. After a few minutes, the body relaxes and returns to its normal status. The critical factor associated with stress is its chronic effect over time, where the produced effects become cumulative (Salleh, 2008). Instead of discharging the stress, the body enters a second stage where the sympathetic nervous system declines and adrenaline secretion is reduced, but the secretion of the stress hormone corticosteroid continues above normal level. It is known that one of the functions of this hormone is to stimulates the increase of consumption of foods enriched in fat and sugar (Hewagalamulage, Lee, Clarke, & Henry, 2016).

Stressful life events have been associated with higher rates of physical and psychological health problems (Holmes & Masuda, 1974). As a response to stress or as a way of coping with stress, individuals may activate several health behaviours (Umberson, Liu & Reczek, 2008; McEwen, 2008), these can be unhealthy depending on the response (Baqutayan, 2015). The reaction to the stressful life event depends on the presence of provoking agents or vulnerability factors that contribute to one's ongoing stress (Badiani & De Sousa, 2016). Additionally, individual personality will be a dependent factor in choosing which strategy will be used (Bougea, Despoti, & Vasilopoulos, 2019). Stress coping can be achieved either by focusing on the problem or by focusing on the emotion. To minimize the perception of stress, parents may implement active coping efforts in response to a stressor (Anderson, 1988). These cognitive and behavioural problem-solving strategies serve to 1) strengthen or maintain the family resources which protect the family from harm or disruption, 2) reduce or eliminate stressor events and their related hardship, 3) to influence the environment by changing the social circumstances surrounding an event, and 4) to acquire additional resources outside the nuclear family.

Bougea et al. (2019) describes that the experience of the empty nest is not the same for all parents, given that for some it proved to be a highly stressful situation, while for others it was anticipated with pleasure. The parameters that make the transition to the empty nest a stressful event depends on factors that cannot be easily investigated, such as personality of the individual, psychosocial development, perception of the parental role and interactions of the family system. Moreover, Anderson (1988) addresses the status of the relationship. He indicates that the reduction in parental stress is related to the quality of parent-adolescent communication (for both mothers and fathers) and the degree of emotional attachment (for fathers) present in the family prior the transition.

2.3 Interaction between stress and BMI

Health behaviours are intentional or unintentional actions taken by individuals that affect health or mortality of the actor (Short & Mollborn, 2015; Parkerson et al., 1993). Health behaviours are dynamic and vary over the lifespan and over time (Short & Mollborn, 2015). Due to detrimental responsive behaviour to stress, life events can result in worsening of health behaviour (Baqutayan, 2015; Bucholz & Harrington, 2014; McEwen, 2008). An example of measurement of health behaviour is the Body Mass Index (BMI). Multiple studies utilize BMI as an indicator of the health behaviour of the individual (Short & Mollborn, 2015; Velicer, Rossi, Prochaska, & Diclemente, 1996; Prochaska, Spring, & Nigg, 2008). BMI is an international surrogate measure of excess weight relative to height and is calculated as $BMI = kg/(m)^2$ (Udo, Grilo, & McKee, 2014). A categorization goes as follows: underweight (BMI ≤ 18.0), normal ($18.0 \leq$ BMI ≤ 25.0), overweight ($25.0 \leq$ BMI ≤ 30.0) and obese (BMI ≥ 30.0).

Many studies documented the increase in BMI during a stressful period of time (Block, He, Zaslavsky, Ding, & Ayanian, 2009; Conway, Vickers, Ward, & Rahe, 1981; Harding et al., 2013; Rahe & Arthur, 1978; Roberts, Troop, Connan, Treasure, & Campbell, 2007; Wardle, Chida, Gibson, Whitaker, & Steptoe, 2011). Additionally, Barry & Petry (2008) found a positive association between the amount of stressful life events occurred in life and the BMI of individuals. In fact, many of the paths that lead from stress to an increase in weight are strategies of individuals to cope with the negative emotional aspects of stress (Tomiyama, 2019). Two mechanisms can be distinguished that underlie weight gain induced by stress. At first, the biomedical explanation would be that emotionally stressful experiences are associated with endocrine disorder (Stenstrom, Wikby, Hornquist, & Andersson, 1993). The Hypothalamic-Pituitary-Adrenal (HPA) axis is an important neuroendocrine component of the stress system and leads to the release of glucocorticoids in the blood circulation, which has some metabolic effects (De Vriendt, Moreno, & De Henauw, 2009). The critical factor associated with stress is its chronic effect over time, where the produced effects become cumulative (Salleh, 2008). Instead of discharging the stress, the body enters a second stage where the sympathetic nervous system declines and adrenaline secretion is reduced, but the secretion of the stress hormone corticosteroid continues above normal level. The excessive release of the component of the neuroendocrine system of the stress system due to physical or psychological stressors are involved in the food intake regulation system (De Vriendt et al., 2009). It is known that corticosteroid stimulates the increase of consumption of foods enriched in fat and sugar (Hewagalamulage et al., 2016). This result in eating more or eating differently, with most gravitating toward energy-dense and palatable foods during a stressful period (Adam & Epel 2007, Torres & Nowson 2007). This phenomenon, that is also been called 'comfort eating', can be an emotional reaction to reduce the activity in the chronic stress-response network (Dallman et al., 2003; Dallman, Pecoraro, la Fleur, 2005). Therefore, the BMI of an individual increases. Second, stress can disrupt activity patterns. This can be expressed through the decrease of physical activity or by the

increase of sedentary behaviour (Tomiyama, 2019). A survey of over 12,000 participants found that more stress was related to less frequent exercise (Ng & Jeffery 2003), and similarly, a longitudinal study of almost 1,400 women showed 3-year prospective relationships between higher perceived stress and lower leisure-time physical activity (Mouchacca, Abbott, & Ball 2013). Hypothetically, based on these studies above, one can say that parents experience an increase in BMI after the transition to the empty nest occurs.

2.4 Gender differences

The different experience of the transitional stage of the nest between men and women arises from the different roles and priorities, as well as ways of coping. Mitchell & Lovegreen (2009) state that the difficulties that goes accompanied with the empty nest are typically raised in relation to women. According to the social approach it is more 'natural' and suitable for women as mothers to be more clinging to the children in comparison to men as fathers (Bougea et al., 2019). However, some studies also support that men are more likely to suffer emotionally from the departure of the children (Bougea et al., 2019; Sheriff & Weatherall, 2009). According to Sheriff & Weatherall (2009) this is because of the regret of being an absent father as well as their inability to share their emotions with others. The fathers' satisfaction level about raising a successful child was negatively influenced by the levels of perceived stress (Bougea et al., 2019).

Men and women are differentially affected by stressors and make different use of their coping resources (Carmel, Anson, Levenson, Bonney, & Maoz, 1991). Men tend to deal with stress by problem-focused coping, which includes cognitive and behavioural attempts to modify or eliminate the stressful situation (Folkman & Lazarus, 1980). On the other hand, women focus on strategies that modify their emotional response, which involves attempts to regulate emotional responses elicited by the situation. A Canadian study from Mitchel and Lovegreen (2009) shows that women are more likely to experience health issues due to the transition to the empty nest than men. In general, motherhood is a major role for many midlife women (Raup & Myers, 1989). Many studies conclude that losing the parenting role can lead to an identity crisis and increasingly experienced stress in comparison to men (Crawford & Hooper, 1973; Hobdy et al., 2007; McLanahan & Adams, 1987) and therefore are more likely to experience a more significant health behaviour change. Evidence is found that a stressful life event is associated with a significant increase in BMI among women but not men (Laitinen, Ek, & Sovio, 2002; Sinha & Jastreboff, 2013; Udo et al., 2014). Furthermore, there is a stronger association between stress and comfort eating in women than men (Grunberg & Straub, 1992; Keski-Rahkonen et al., 2007; Pankevich & Bale, 2008; Zellner et al., 2006; Zellner, Saito, & Gonzalez, 2007). Stress significantly decreased eating by men, while women increased eating sweet and bland food (Grunberg & Straub, 1992). However, these increases were not statistically significant. Furthermore, I therefore hypothesize that

women will experience a greater increase in BMI during the transition to the empty nest in comparison to men.

3. Methods

3.1 Research design

The aim of this study is to investigate whether the transition to the empty nest increases the BMI of the parents and if the impact of this transition differs between men and women. To test the two hypotheses and to answer the research question, a quantitative research design is used. The study design is a prospective observational cohort study as households are followed over time. The panel structure enables assessment of bodyweight change in individuals after children have left the household within the last year. Thus, the investigated individuals are parents who made the transition to the empty nest since the previous annual wave. As a result, they have not yet been able to fully get used to their new situation. Using a panel dataset is very beneficial due to the large number of observations as it allows for numerous observations for various individuals over a long period of time.

3.2 Data collection

3.2.1 Collecting data

For the purpose of empirically testing the main hypothesis whether a link between the transition to the empty nest and an increase in BMI exists, a data-sample from the Netherlands for the time period of 1993 to 2020 is constructed. The data that is used for this study originates from the CentERdata. This datacentre collects economic data through the DNB Household Survey (DHS), with the goal to study the economic and psychological determinants of the saving behaviour of households (CentERdata, 2021).This data collection therefore contains relevant data on the variables of interest and control variables outlined in the next section. Since 1993, every year all members aged 16 and over of over 1500 households, participate in this project. The DNB Household Survey consists of five questionnaires, which are split up into datasets. The following datasets will be used in this study: 'Household', 'Income', 'Psychology' and 'Work'. The constructed data-sample consists of the variables height, weight, having children living in the household, sex, income status, labour force status, marital status, age and year of birth from 1993 to 2020. Since 2020 is the last year for which complete data is available of the DHS, this forms a natural ending to the time period.

3.2.2 Data transformation

In total, 31,892 respondents were included in the dataset, with 141,810 observations gathered. First, data transformations were done to filter out the relevant respondents. First, the relevant variables were

filtered out of the different DHS datasets and merged into one dataset. The initially constructed data set contained missing values for different values. For the variables with a non-changing nature such as height and gender, missing values could be filled using the non-missing observations of the same individual. The remaining observations with a missing value that could not be filled were removed from the dataset. Only respondents who have kids in their household (n=6,191) when they entered their first wave are relevant for this study, therefore respondents who are not having kids in their households (n=7,414) during their first wave will be dismissed from the dataset. Furthermore, only respondents that make the transition of the last child leaving the house are examined in the study (n=518). Moreover, only a maximum of one year after the transition is taken into the analysis, due to the assumption that the reaction to this transition will be the strongest within this year and the parents cannot get used to the new situation. Since the effect on the health behaviour of the parents is examined, other household members that filled in the questionnaire are excluded from the data sample. To secure this, only respondents between the age of 35 and 75 were included in the dataset, due to the possibility that most of the parents will experience this transition between these two ages. Respondents who reported gender inconsistencies were removed from the dataset. Outlier analysis was performed to filter out unrealistic observations which are likely the result of an input error. Lastly, since the fixed effects analysis will be used to analyse the data, at least two observations from one respondent is needed to receive a plausible result. Therefore, respondents who are having one observation will be excluded from the analysis. As a result of the data transformation, 138,573 observations and 34,368 respondents were lost. In total 3,237 observations and 524 respondents were included in the analysis.

3.3 Variables

Besides the main variables of interest, BMI and the empty nest status, the moderator variable sex and the control variables income status, labour force status, marital status, and age (Schüz, 2017; Piper & Jackson, 2017) are taken into account to control for the effects of these variables. To measure the effect of a transition to the empty nest on BMI the variables described above are operationalized below.

3.3.1 Dependent variables

Body Mass Index (BMI)

The dependent variable '*BMI*' is an interval variable. The respondents were asked to fill in their weight in kilograms and their height in centimetres. BMI is an international surrogate measure of excess weight relative to height and is calculated as $BMI = kg/(m)^2$ (Udo et al., 2014). BMI is calculated by dividing self-reported weight in kilograms by self-reported hight in centimetres squared.

3.3.2 Independent and control variables

Empty nest status

The main independent variable in this research is the transition from a status before the empty nest to the status of having an empty nest. To detect this transition, the variable whether the last child has left the house and the parents have entered the empty nest phase is measured.

To determine if the respondent has any kids living in the household, the respondents were asked how many children are part of the household. They could answer the following options: 0) none; 1) 1 child; 2) 2 children; 3) 3 children; 4) 4 children; 5) 5 children; 6) 6 children; 7) 7 children; 8) 8 children; and finally, 9) 9 children or more. To focus on the most important part of this information, having any child in the household or not, the variable was recoded to no (=0) and yes (=1). Due to excluding respondents who did not have children in the household when they entered the first wave, the nominal variable '*Empty nest*' could be created. When children were detected in the household, there was no empty nest (=0). If respondents filled in that there were no longer any children in the household, this was designated as a transition to the empty nest (=1).

Sex

As the literature review revealed a different reaction to stress between males and females, the nominal variable '*Sex*' is included in the analysis. Based on the questionnaire, the respondent had two choices: 1) male, and 2) female. Missing variables and respondents who reported their gender inconsistently were removed from the analysis.

Income status

This ordinal variable is chosen due to being subjective and being comparable over the years. The variable income is based on the question 'How well can you manage the total income of your household?'. The options that the respondents could choose were: 1) it is very hard; 2) it is hard; 3) it is neither hard not easy; 4) it is easy; and finally, 5) it is very easy. In consequence, three dummy variables have been created, which are hard; neither hard nor easy; and easy.

Labour force status

In the questionnaire respondents were asked what their primary occupation was, even if it is only for one or a few hours per week or for a short period of time. The respondents could answer with multiple

options with the answers “employed on a contractual basis”, “works in own business and free profession”, “freelance” & “self-employed” were recoded as having a paid job. The other options were recoded as unemployed.

Marital status

Marital status is a nominal variable. The respondents have six options, namely 1) married or registered partnership, having community of property (including separation from bed and table); 2) married or registered partnership, with a marriage settlement (including separation from bed and table); 3) divorced from spouse; 4) living together with partner (not married); 5) widowed; and finally, 6) never married. In consequence, dummy variables have been created, where option 1 and 2 are merged together into the group that is called ‘Married or registered partnership’. Options 3 till 6 remained the same as in the questionnaire since they are distinctly different.

Age

Age is operationalized as the age in years. In the questionnaire the respondent had to answer the question what their year of birth is. Age could consecutively be calculated by subtracting the year of birth from the year of the wave.

3.4 Directed Acyclic Graph

To determine which variables to include in the regression model, available independent variables (in the DHS dataset) and their possible causal inference pathways have been identified based on literature review and logical plausibility. A graphical representation of the underlying causal structures is presented by a directed acyclic graph (DAG) in Figure 1. Each arrow represents a possible causal effect. The interaction between gender and the possible differences between the BMI of a person when he/she has entered the empty nest phase is represented by the green arrow landing on the causal arrow between Empty nest status and BMI.

Confounding is bias that has been created by the common cause of exposure and outcome (VanderWeele, 2019). The factor that causes confounding is associated with both the exposure and the outcome. To remove this confounding, the variable should be adjusted for. Based on the DAG, the variable *‘Age’* is a confounder. Age has an influence on having made a transition to the empty nest and on the BMI.

Intermediate variables (mediators) are on a pathway between the exposure (Empty nest status) and the outcome (BMI) (Goossens, 2020). The only variables that can be detected as a mediator is income status. Making the transition to the empty nest can have a, both positive and negative, effect on managing on the total income of the household. One person less in the household will give less costs due to a reduction of food in the household, but it can also increase the costs by paying for more expensive education of the child. This mediator remains included in the analysis since we want to know capture the full effect of the exposure on the outcome.

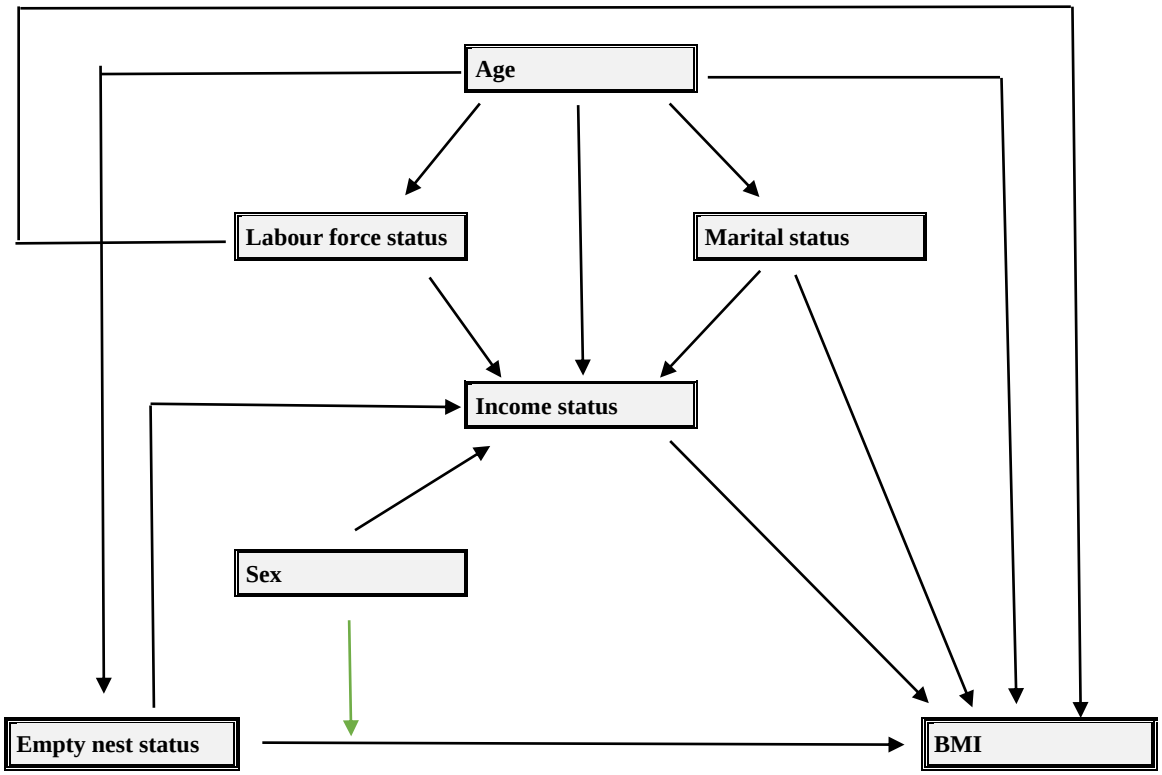

Figure 1. Directed Acyclic Graph (DAG)

3.5 Analytical strategy

Fixed effects regression model

Empty nest and BMI

The data has been analysed using STATA. Based on the assumption that a linear regression model would cause bias due to changes over time, the fixed-effects model is used to estimate effects of changes over time at an individual level (Gunasekara, Richardson, Carter, and Blakely, 2014). The outcomes have primarily been assessed in the form of a fixed effects regression model as this model focusses on

variations within individuals, instead of between different individuals and between different years. Consequently, there will be a reduction of room for omitted variables in the analysis. These are variables that are not observed in the dataset but do have an effect on the dependent variable (Bell & Jones, 2015). Also, robust editors were used to take care of correlations and heteroscedasticity in the observations.

To be able to quantify the interaction between the transition to the empty nest and a change in BMI, a multivariable regression formula will be used. The effect size reflects the strength and the sign of the direction of association between the independent and dependent variable. The following formula will be used:

$$\ddot{y}_{it} = \beta_{0t} + \beta_1 * \ddot{E}_{it} + \beta_2 * \ddot{S}_{it} + \beta_3 * \ddot{I}_{it} + \beta_5 * \ddot{L}_{it} + \beta_5 * \ddot{M}_{it} + \beta_6 * \ddot{A}_{it} + \ddot{e}_{it}$$

Where:

$\ddot{y}_{it} = y_{it} - \ddot{y}_t$	(BMI of an individual at a certain time)
$\ddot{E}_{it} = E_{it} - \ddot{E}_i$	(Empty nest status of an individual and at a certain time)
$\ddot{S}_{it} = S_{it} - \ddot{S}_i$	(Sex of an individual at a certain time)
$\ddot{I}_{it} = I_{it} - \ddot{I}_i$	(Income status of an individual at a certain time)
$\ddot{L}_{it} = L_{it} - \ddot{L}_i$	(Labour force status of an individual at a certain time)
$\ddot{M}_{it} = M_{it} - \ddot{M}_i$	(Marital status of an individual at a certain time)
$\ddot{A}_{it} = A_{it} - \ddot{A}_i$	(Age of an individual at a certain time)
$\ddot{e}_{it} = e_{it} - \ddot{e}_i$	(Error term of an individual at a certain time)

Interaction effect

To test whether an interaction effect between an increase in BMI and gender exist, a multivariable linear regression function will be tested that includes both an interaction term between gender and BMI as well as the individual variables gender and BMI. Here a distinction between subgroups will be presented. The second hypothesis will be supported by the coefficient for the interaction term. An interaction effect is added to the formula, where $\beta_7 * \ddot{E}_{it} * \ddot{S}_i$ is the additional gender effect for the transition to the empty nest of an individual. The following multivariable regression formula will be used:

$$\ddot{y}_{it} = \beta_{0t} + \beta_1 * \ddot{E}_{it} + \beta_2 * \ddot{S}_{it} + \beta_3 * \ddot{I}_{it} + \beta_5 * \ddot{L}_{it} + \beta_5 * \ddot{M}_{it} + \beta_6 * \ddot{A}_{it} + \beta_7 * \ddot{E}_{it} * \ddot{S}_i + \ddot{e}_{it}$$

3.6 Descriptive statistics

As mentioned before, panel data is obtained for a period of 1993 till 2020. After all data transformations the final sample consists of 2,642 observations, divided over 458 different respondents. The identification of the individuals who recently made the transition to the empty nest are presented below, in table 1. This table contains the number of observations per variable (N), the mean, the standard deviation, the minimum, and the maximum.

The mean of the dependent variable, *'BMI'*, is 26.11 with a standard deviation of 3.97. One can argue that the average of the BMI of the respondents is overweight. The scores vary between 14.36 as a minimum score and 42.91 as a maximum score. BMI is calculated by the variables height and weight. The mean of height is 174.91 centimetres with a standard deviation of 9.26. The scores vary between the minimum of 150 centimetres and the maximum of 200 centimetres. The variable weight has a mean of 80.16 kilograms with a standard deviation of 15.11. The minimum weight of the respondents is 45 kilograms, while 152 kilograms is the maximum.

For the independent variable about making the transition to the empty nest, 17 per cent of the observations were measured while the parents have made the transition to the empty nest, while the other 83 per cent contain observations where the transition did not occur yet. This is because there is no maximum of years set before the transition, and there is a maximum of one year after the transition. The scores for this independent variable could vary between 0 and 1. The minimal score is 0, while the maximum score is 1.

Looking at the moderator, *'Sex'*, 55 per cent of the observations were from male respondents and 45 per cent from female respondents. The scores could range between 1 (male) and 2 (female). Therefore, the minimal score is 1 and the maximums core is 2. The conclusion can be made that the respondents vary almost equally between males and females.

The scores of the variable '*Income status*' vary between 1 till 3, where 1 means that it hard for the respondent to manage on the total income of the household, 2 means that it is neither hard not easy and option 3 means that it is easy. Based on the table, 8 per cent of the respondents experience a hard time of managing on the total income of the household, while 43 per cent experiences it as neither hard not easy. The majority, which contains 49 per cent of the total respondents, has an easy time to manage the total income.

Furthermore, 63 per cent of the respondents are having a paid job, while 37 per cent of the respondents do not have a paid job. The scores do range from the minimum score of 1 and the maximum score of 2.

The variable '*Marital status*' is subdivided into five different groups. 89 per cent of the respondents is married or has a registered partnership, 4 per cent is divorced, 3 per cent lives together with his or her partner, 3 per cent is widowed and 1 per cent has never been married. Based on these statistics, there could be concluded that there is high change of most respondents being married or having a registered partnership.

Age ranges from 35 to 75 years, which are the ranges that were set for the analysis. The mean is 53 and the standard deviation is 7.74. There could be concluded that the average age of making the transition to the empty nest is 53 years based on the respondents in the dataset. Additionally, it shows that the range of 35 to 75 years is a good estimation of the possibility that most of the parents will experience this transition between these two ages.

Table 1. Descriptive statistics of dependent and explanatory variables

Variable	Obs.	Mean	Std. Dev.	Min	Max
Dependent variable					
BMI	2,642	26.11	3.97	14.36	42.91
Height	2,642	174.91	9.26	150	200
Weight	2,642	80.16	15.11	45	152
Independent variable					
Empty nest					
No	2,642	0.83	0.38	0	1
Yes	2,642	0.17	0.38	0	1
Control variables					
Sex					
Male	2,642	0.55	0.50	0	1
Female	2,642	0.45	0.50	0	1
Income status					
Hard	2,642	0.08	0.27	0	1
Neither hard nor easy	2,642	0.43	0.50	0	1
Easy	2,642	0.49	0.50	0	1
Labour force status					
No	2,642	0.37	0.48	0	1
Yes	2,642	0.63	0.48	0	1
Marital status					
Married or registered partnership	2,642	0.89	0.32	0	1
Divorced from spouse	2,642	0.04	0.20	0	1
Living together with partner (not married)	2,642	0.03	0.18	0	1
Widowed	2,642	0.03	0.16	0	1
Never married	2,642	0.01	0.12	0	1
Age	2,642	52.69	7.74	35	75
Year	2,642	2005.81	7.48	1993	2020

4. Results

In this section, first the results of the data analysis aimed at answering the main research question: *"What is the effect of the transition to an empty nest on the BMI of parents?"* will be presented. In addition, the potential role of gender in the relation between a transition to an empty nest and BMI will be addressed in an attempt to answer the sub-question: *''How does gender affect the relationship between the transition to an empty nest and the BMI?''*.

4.1 Transition to empty nest in relation to BMI

Table 2 presents results from the fixed effects regression model predicting changes in BMI of parents who make the transition to the empty nest. Two models are presented, where model 1 is the fixed effects regression model and model 2 is the fixed effects regression model where the results are controlled for other socio-economic variables.

The result of the first regression model show a significant positive relationship between the transition to an empty nest and BMI. The model estimates that parents who transition to an empty nest experience an increase in their BMI of 0.518 points. This result therefore supports the hypothesis that making the transition to the empty nest increases the BMI. The constant factor of 26.017 reflects the average BMI of the respondents.

Model 2 refers to the fixed effect linear regression model predicting changes in BMI of parents who make the transition to the empty nest with the control variables added. By way of contrast, when socioeconomic control variables income status, labour force status, marital status and age are added to the regression model, the effect is reversed. The results indicate that parents who entered the empty nest experience a decrease in their BMI of 0.036 points. However, this coefficient is not statistically significant.

The results further show that the control variables income status, labour force status and age all have a positive effect on BMI. From these variables only age has a highly significant effect. Notable is the fact that an income status of neither hard nor easy increases the BMI by 0.034 points in comparison to experiencing a hard time, while this effect decreases to an increase of 0.006 BMI-points when the income status is being experienced as easy. Looking at marital status the model shows that, relative to being married or having a registered partner, being divorced from spouse and being widowed has a negative effect on BMI, while living together with a partner, but not being married and never being married have a positive effect on BMI of respectively 0.166 and 1.316 points. However, only the result of never married is statistically significant. The coefficient of the constant in this model is 21.936.

Regarding the results of the fixed effect linear regression, the variable sex is not presented in the model due to the fact that this variable is omitted. Due to the fixed-effects regression model, any variables that are constant within every unit are redundant and will be omitted.

Using the fixed effects analysis, especially the R-squared that indicates the level of correctness of the model within the same respondents is the most interesting. In model 1, the R-squared within the different groups of respondents is 0.0218, which is the same as 2.18% of the variation in BMI is explained by a transition to the empty nest. This number shows that the model has a small explanatory power. In model 2, the R-squared within the respondents is 0.0781, which stands for 7.81% of the variation in BMI is explained by a transition to the empty nest controlled by sex, age, marital status, having a paid job and managing the total income of the household. This number shows that the model has a small explanatory power. Put in perspective, in comparison to model 1, model 2 has a three times as big explanatory power.

Table 2. Fixed effects linear regression models with and without controlling for socio-economic variables

Variable	Model 1 Fixed effects linear regression model	Model 2 Fixed effect linear regression model controlling for socio-economic variables
Empty nest	0.518*** (0.095)	-0.036 (0.112)
Income status		
Neither hard nor easy		0.034 (0.182)
Easy		0.006 (0.205)
Labour force status		0.149 (0.142)
Marital status		
Divorced from spouse		-0.364 (0.465)
Living together with partner (not married)		0.166 (0.531)
Widowed		-1.156 (0.635)
Never married		1.316* (0.627)
Age		0.078*** (0.015)
Constant	26.017*** (0.016)	21.936*** (0.814)
Observations	2642	2642
Groups	458	458
R-squared – Within	0.0218	0.0781

Legend: Robust standard errors in parentheses; * p<0.05; ** p<0.01; *** p<0.001

4.2 Moderator effect by gender

In this section, the possible moderating effect of gender on the relationship between transition to empty nest and BMI is examined. Based on 1,460 observations from 245 different male respondents and 1,182 observations from 213 different female respondents' multiple linear regression analysis were executed where the fixed effects method is used. An examination of whether the change in BMI due to the transition to the empty nest vary by gender is presented in table 3. Similar to the results above two

models are presented, where model 3 is the base fixed effects regression model and model 4 is the fixed effects regression model where the results are controlled for other socio-economic variables.

The results of model 3 show a significant positive effect from a transition into empty nest to BMI of 0.632 points. The interaction coefficients indicate a transition to the empty nest adds more extra weight to a woman than to a man. Men will have an addition of 0.421 BMI-points, while women will get an addition of 0.632 points. The interaction term is not statistically significant when p>0,05. These results therefore do not provide sufficient evidence of gender differences in the effect of the transition to the empty nest on a person's BMI.

Similar to the results of model 1 and 2, when the control variables are included in model 4 the coefficient of transition to empty nest decreases significantly. For woman however, still a positive effect of 0.092 transition to empty nest on BMI can be observed. This means that woman undergoing a transition to an empty nest experience a small increase in their BMI. The negative interaction coefficient of -0.247 shows that for men the transition to an empty nest leads to a decrease of 0.155 points in BMI, similar to the results of model 2. However, both coefficients are not statistically significant at a p-value<0.05. Therefore, there can be concluded that this result does not give statistically significant evidence of systematic gender differences in the effect of the transition to the empty nest and a person's BMI.

The results further show that for the variables labour force status, age and all the dummy variables of income status, an increase in BMI is detected. Similar to model 2, only the coefficient for age is significant. Also, income status of neither hard nor easy increases the BMI by 0.037 points in comparison to experiencing a hard time, while this effect decreases to an increase of 0.014 BMI-points when the income status is being experienced as easy. Having a paid job will increase the BMI by 0.111 points. Looking at marital status the model shows that, relative to being married or having a registered partner, being divorced from spouse and being widowed has a negative effect on BMI, while living together with a partner, but not being married and never being married have a positive effect on BMI.

Furthermore, the R-squared within the different groups of respondents of model 3 is 0.0227, which is the same as 2,77% of the variation in BMI is explained by a transition to the empty nest based on gender. This low percentage indicates that this model has very little explanatory power. For model 4, the R-squared within the different groups of respondents is 0.0793. Consequently, for men only, 7.93% of the variation in BMI is explained by the transition to the empty nest based on gender.

Table 3. Fixed effects linear regression models checked on moderation by gender

Variable	Model 3 Fixed effects regression model	Model 4 Fixed effect regression model controlling for socio-economic variables
Empty nest	0.632*** (0.165)	0.092 (0.163)
Income status		
Neither hard nor easy		0.037 (0.182)
Easy		0.014 (0.206)
Labour force status		0.111 (0.143)
Marital status		
Divorced from spouse		-0.348 (0.468)
Living together with partner (not married)		0.160 (0.537)
Widowed		-1.184 (0.625)
Never married		1.317* (0.639)
Age		0.078*** (0.015)
Interaction		
Transition to empty nest by male	-0.211 (0.197)	-0.247 (0.193)
Constant	26.017*** (0.017)	21.956*** (0.812)
Observations	2642	2642
Groups	458	458
R-squared – Within	0.0227	0.0793

Legend: Robust standard errors in parentheses; * p<0.05; ** p<0.01; *** p<0.001

4.3 Robustness test

To validate the robustness of the results presented above, multiple tests have been performed. First , the normality of BMI and age has been checked and it follows a normal distribution (appendix 2).

In table 4, the results are presented of the models 1a-e and 2. Similarly to the main analysis, model 1a consists of the main independent variable transition to empty nest and BMI. In model 1b, 1c and 1d one

by one socioeconomic variables are added separately to test the effect of each individual indicator on BMI. In model 1e, the moderator variable sex has been added to the analysis. Model 2 consists of all individual indicators together. Again, this analysis is performed using the fixed effects method by adding dummy variables for income status and marital status.

In model 1a, transition to empty nest has a positive and significant relationship with BMI. In addition, in model 1b, 1c and 1d making a transition to the empty nest still has a positive effect on BMI. This indicates that making a transition to the empty nest increases the persons BMI when controlling separately for income status, labour force status and marital status. Also, in all these models, the coefficients of empty nest are statistically significant. Remarkable is that when age is included in the analysis, such as in model 1e and 2, a noticeable reduction of the constant and the coefficient of the variable transition is shown, which results in a negative coefficient for the transition to the empty nest. This indicates that age is the influence that has a strong effect on the change in BMI when making the transition and not so much the transition by itself. Therefore, there can be concluded that the variable age is an unobserved heterogeneity in the models without age. It will therefore have to be included in the model.

Due to the big differences in coefficients between the model 1 and model 2, the unobserved heterogeneity in the fixed effect linear regression model 1 has a big effect. Controlling for these variables, confounding can be excluded. Therefore, it can be concluded that model 2 gives the full effect of the Empty nest status on BMI.

Table 4. Fixed effects analysis for Robustness test

Variable	Model 1a	Model 1b	Model 1c	Model 1d	Model 1e	Model 2
Empty nest	0.518***	0.520***	0.509***	0.522***	-0.038	-0.036
	(0.095)	(0.117)	(0.099)	(0.093)	(0.117)	(0.112)
Income status						
Neither hard nor…		-0.001				0.034
		(0.191)				(0.182)
Easy		-0.038				0.006
		(0.216)				(0.205)
Labour force status			-0.054			0.149
			(0.140)			(0.142)
Marital status						
Divorced…				-0.022		-0.364
				(0.485)		(0.465)
Living together…				0.503		0.166
				(0.616)		(0.531)
Widowed				-0.682		-1.156
				(0.635)		(0.635)
Never married				1.348*		1.316*
				(0.629)		(0.627)
Age					0.072***	0.078***
					(0.014)	(0.015)
Constant	26.017***	26.772***	26.051***	26.000***	22.314***	21.936***
	(0.017)	(0.181)	(0.094)	(0.041)	(0.726)	(0.814)
Observations	2642	2642	2642	2642	2642	2642
Groups	458	458	458	458	458	458
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
R-squared – Within	0.0218	0.0219	0.0219	0.0270	0.0686	0.0781

Legend: Standard errors in parentheses; * p<0.05; ** p<0.01; *** p<0.001

5. Discussion

In this section, the results presented above will be elaborated upon further and placed within the context of the existing body of literature. First, the results will be interpreted and their relevance discussed. Consecutively the strengths and weaknesses of this study will be reviewed.

5.1 Interpretation and relevance of results

In the first hypothesis, it is argued that there is a positive relationship between the transition to the empty nest and an increase in BMI. Based on literature, the assumption is that parents who make a transition to the empty nest, by means of the last child leaving the house, will experience this as a stressful life event and therefore will notice an increase of their BMI.

The results did not confirm the existing theory on the effect of the transition to the empty nest on a parent's BMI. When not taking into account age, marital status, income and having a paid job, the analysis did show that BMI will increase with 0.52 points when the parent has entered the empty nest within the first year. This result was significant. However, the robustness test shows that controlling for socio-economic factors is very important, especially the variable age. When this is done, the association is turned to a negative relationship, which means that within the first year of experiencing the empty nest, in general, the BMI will decrease by 0.04 points. However, this slightly decrease in BMI is not statistically significant.

An explanation could be that the stress that has been experienced during this transition was not expressed through the increase in BMI. In the theoretical framework, mechanisms that underlie weight gain induced by stress were highlighted. It could be that the association between stress and the endocrine disorder were not as substantial as is was expected during this life event. Also, it could be the case that the experienced stress did not disrupt the activity patterns in a negative way. The reduction of these two mechanisms can occur simultaneously or separately. A second explanation can be that the transition to the empty nest is not a substantial life course stressor in the lives of the parents. Although, the child leaving the household is a significant event for both parents and child (Mitchell & Lovegreen, 2009), since this transition is a normative life event parents can see this as something they have to undergo. As soon as they get a child, they are aware of the fact that this child will leave the household at some point in their lives. Over the years, they can get used to this idea. Third, Mitchell and Lovegreen (2009) also address the timing of the occurrence of the empty-nest period. If this transition takes place within the expected time period of the parents, the less difficulties regarding coping with the event will be experienced. There is a possibility that the vast majority of the parents in this study made the transition within the desired period of time.

The second hypothesis states that women will have a bigger increase in their BMI in comparison to men. As based on theory, there is a difference between men and women detected, however, not statistically significant. The results show that, when controlled for socio-economic factors, women will indeed experience an increase in their BMI by 0.09 points, while men will have a decrease of 0.16 points. These results therefore support the hypothesis that woman experience a more negative effect from a transition to an empty nest then men. However, both results were not statistically significant.

These results fit the current theory. Matud (2004) states that the differences between gender are due to the differences in the use of coping resources when stress is experienced. While men tend to deal with stress by focusing on the problem, women focus on strategies that modify their emotional response. Moreover, as described in the theoretical frame work, women are more likely to experience health issues due to the transition to the empty nest than men (Mitchell & Lovegreen, 2009). The results presented in the previous chapter give the same conclusion, however, men experience an decrease in BMI instead of an increase. The decrease in BMI among men can be explained by the theory of Udo et al. (2014), where is described that a stressful life event is associated with an increase in BMI among women but not among men. Additionally, it should be noted that the increase of BMI among women is very small.

To the knowledge of the researcher, this is the first panel data study that has been conducted on the BMI of parents who made the transition to the empty nest and the possible interaction with gender. To put it in a broader perspective, based on health policy and economics it is very important to keep people as much as can in a healthy state and to do this, it is crucial to know what affects health. It is widely known that an increased BMI (BMI $\geq$ 25.0 (Udo et al., 2014)) does not have a good influence on the functioning of a human body and is therefore more vulnerable to develop a disease or experience disabilities. By knowing what aspects have an influence on a persons' BMI and by anticipating on those causes, an individual and subsequently society will be enriched.

5.2 Strengths

First, the validity will be guaranteed by the consistency of the questioning in the DNB Household Survey. From 1993 until 2020 the exact same questions, used in this study, are asked to the individuals. The external validity is strengthened by the high respondence rate. Each year, around 1500 households answered the questionnaires. Moreover, the DHS dataset is relatively rich in terms of the wide variety of included variables.

Furthermore, a large advantage of the BMI measurement is the quick and easy calculations of a person's BMI, while BMI values based on self-reported height and weight give a very good indication of a person's health risks associated with variations in BMI, if corrected for biases associated with socio-

demographic characteristics of the survey respondents (Stommel & Schoenborn, 2009). These socio-demographic characteristics that were taken into account in this study are gender, age, marital status, and household income.

Longitudinal surveys are the best observational studies to limit the effect of bias and improve causal estimation, while remaining representative of the whole population (Gunasekara et al., 2014).

There are some advantages of using the fixed effects model in this study. First, an advantage of this model is that it only uses within-individual variation (Gunasekara et al., 2014). Second, using the fixed effects method eliminates confounding by all innumerable and unmeasurable influences if they do not vary over time (Kaufman, 2008). This makes this method attractive for studies where exposures are often heavily confounded by myriad contextual, behavioural, and attitudinal quantities that would be difficult to assess exhaustively. Furthermore, the impact of confounding bias by time-invariant factors can be reduced using a fixed effects approach, since each individual acts in their own control. Fourth, the fixed effects method is useful for investigating the varying levels of exposure. This study examines the differences in BMI between the pre-transition phase and post-transition phase. The change in exposure levels have been secured by only including respondents in the dataset who had at least two waves, where the first is in the pre-transition phase and the second is in the post-transition phase.

5.3 Limitations

First, the use of self-reported height and weight might have introduced some bias into the results. It appears common for individuals to underestimate their weight and overestimate their height (Shields, Gorber, & Tremblay, 2008). Furthermore, there are some reports suggesting systematic errors, such as women under-report more than men and self-reported BMI values tend to overestimate measured BMI values at the low end of the BMI scale and underestimate BMI values at the high end of the scale (Masheb & Grilo, 2001; Stommel & Schoenborn, 2009; Villanueva, 2001). It is striking that some respondents have registered the exact same weight during every wave. One can argue that this is not realistic and leads to an unchanged BMI. This phenomenon can be due to a lack of precision by the respondents when filling in the questionnaires. Moreover, a disadvantage of the chosen variable BMI can be that there is no data on an individual's fat percentages, which can result in an increase of the BMI while not the fat mass, but the amount muscles have increased (Stommel & Schoenborn, 2009). This socio-demographic predictor tends to obtain a closer approximation to the measured BMI. Also, the DHS dataset did not consist of data about the ethnicity of the individuals. Since the Netherlands being a multi-cultural society, individuals with different ethnographic backgrounds have participated in this study. However, this could not be checked. Therefore, differences in outcomes can be detected when another dataset from another part of the world has been used.

Second, the extent to which the change in the parental role disrupts the life of the parent and requires adjustment can influence his/her prosperity. The impact of the parental role change on his/ her prosperity may be reinforced by other stressful events taking place around the same period of time. Facing other stressful life events at the same time of the post-parental transition may influence the reaction on developing the empty nest. Since this is not taken into account during the analysis, this may have caused bias.

Third, the use of many different questionnaires brings the risk of not getting many respondents who have answered all these questionnaires. This has led to missing values. Missing values in of the variables paid job, marital status and income are detected. These missing values will be eliminated from the analysis when controlled for socio-economic variables, which led to losing observations and in some cases all the observations of a respondent. This results in a limited number of respondents in the final merged dataset.

Fourth, due to missing values of BMI, sex, age or transition, some years of a respondent has been eliminated from the dataset. This could lead to gaps between the years of one respondent. In the worst case, the missing year can be the first year that the respondent has made the transition. Automatically, the next year where the transition of the individual is detected will be marked as the transition year, even though that is not the case.

Fifth, based on the analysis that has been performed and the results, all the models have a limited explanatory power. Moreover, most of the coefficients were not statistically significant.

Lastly, using the fixed effects method also provides some limitations. Gunasekara et al. (2014) describes two limitations of this model that affects this study. First, the use of within-individual variation can lead to a lack of precision since this is a small part of the total. Second, Parameters for time-invariant variables are not estimated since they do not change over time. However, time-varying exposures of interest may interact with these time-invariant covariates.

6. Conclusion

The aim of this study was to investigate whether parents making a transition to the empty nest increases their BMI and if there is a difference in gender. The timeframe of the study is 1993 till 2020 and the sample consist of men and women between the age of 35 and 75 which go through the transition where the last child leaves the house. This study proposed the following research question:

"What is the effect of the transition to an empty nest on the BMI of parents?"

In addition, this study explored the potential role of gender in the relation between a transition to an empty nest and BMI. The following research question was formulated:

''How does gender affect the relationship between the transition to an empty nest and the BMI?''

To report upon the research questions, two hypotheses were formulated and tested using multiple regressions using the fixed effects design. The first component consists of only the dependent variable BMI and the independent variable Transition. The results show that there will be an increase in BMI by 0.501 points. However, when controlled for socio-economic factors and especially due to the influence of the variable age, results indicate a decrease in BMI after parents made the transition to the empty nest. However, this result is not statistically significant. The interpretation of the results is therefore quite ambiguous but nonetheless notable. This is a contribution to the existing theory since no other study has focused specifically on the relationship between the transition to the empty nest and a change in BMI of a parent.

The second hypothesis targeted the gender differences. The results show a difference between gender, where men have a decrease in BMI after the transition to the empty nest, while women indicate an increase. The conclusion can therefore be drawn that there are differences between men and woman in their reaction to a transition to an empty nest. However, these results are not statistically significant.

Based on this study, no hard conclusions can be drawn on the interaction between the transition to the empty nest and a parents BMI. However, the analysis shows that age is a confounder which substantially influences the results of a difference in BMI between the different stages. It is therefore an important factor for the increase in BMI. Therefore, based on this observation, further health policies can be formulated to reduce this increase in BMI with increasing age.

Although the results show that there is no statistically significant evidence that the transition to the empty nest causes an increase in BMI when controlling for socio-economic factors and when focusing

on gender differences, there remains room for further improvement of data and subsequently for analysis. A more elaborate dataset with more respondents can overcome the limitation of a limited dataset in this study and potentially increase the significance of the results. In addition, including respondents from other parts of the world in a study will provide even more new information on this subject.

Furthermore, interesting to know is which parameters influence the coping with the transition to the empty nest and how they do that. As described in the theoretical background, this depends on factors that cannot be easily investigated, such as personality of the individual, psychosocial development, perception of the parental role and interactions of the family system. When focusing on these aspects, knowledge about more personal matters is highlighted so that more appropriate interventions can be applied to overcome the difficulties associated with this transition. For example, this can be done through a qualitative study.

More empirical research can reveal more insights in the precise magnitude of BMI and the effects of the transition to the empty nest and can examine more characteristics of this transition.

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8. Appendix

Normal distributions check

Based on figure 2 and 3, one can argue that both the dependent variable BMI and the independent variable age have a normal distribution in the sample. This means that the sample gives a good representation of the real population. Figure 2 show that the average BMI of the sample is around 26. This means that the average of the respondents is being slightly overweight (Udo et al., 2014). Figure 3 shows that most people in the sample experience the transition to the empty nest when they are around 52 years old. Additionally, the ages 45 and 60 stand out in the distribution.

Figure 2. Normal distribution of the dependent variable BMI

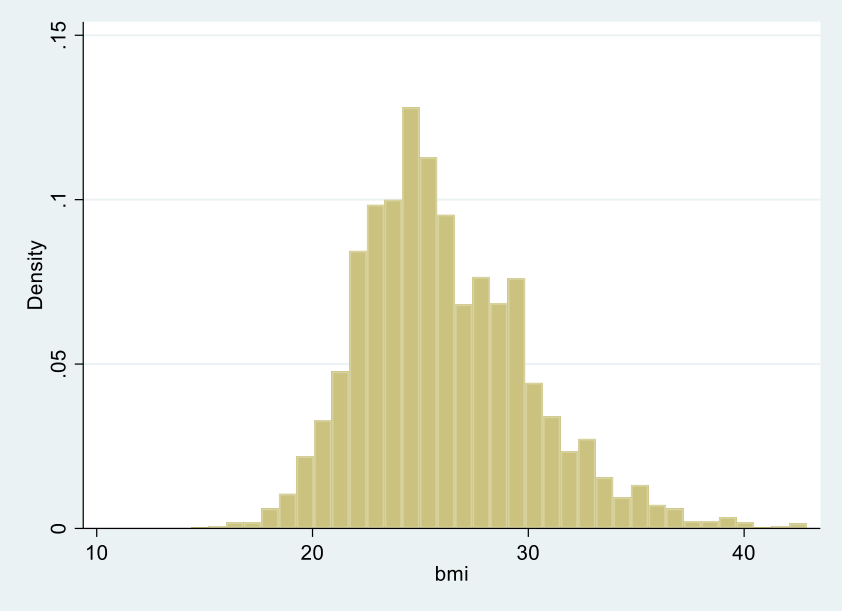

Figure 3. Normal distribution of the independent variable age.