Current Draft: April 2024

Relative Age, Self-Image, and Weight-Related Health Behaviors

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ABSTRACT

We provide novel evidence on the role of social comparisons in shaping weight-related perceptions, behaviors, and outcomes. We adopt an instrumental variables approach exploiting variation in relative age generated by school entry cutoff months throughout Europe, allowing us to compare students who are relatively older than their classmates to their same-age counterparts who are relatively younger than their classmates. First, we show that relative age influences how adolescents view their bodies. While relatively older students are more likely to describe themselves as the "right size" and state that they do not have any reason to diet, relatively younger students (i.e., those with older peers) are more likely to report that they should try and gain weight. Second, we find that relatively older students report higher levels of physical activity and consume more low-calorie foods, while relatively younger students consume more sweets and sodas. Finally, we show that relatively older students are more likely to be within their recommended BMI range, while relatively younger students are more likely to be overweight or obese. Overall, our results suggest that relatively older students base their weight-related expectations and behaviors on the behaviors and body types of their younger peers, while relatively younger students are comparing themselves to their older peers.

JEL Codes: I1; J13; D91
Keywords: social comparisons; health behaviors; weight

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1. Introduction

Over the last forty years, the global share of children and adolescents classified as overweight or obese increased by 350 percent, with over 400 million children and adolescents being overweight or obese (WHO 2024). This presents a significant challenge to global health.[1] Compared to healthy weight children, obese children are more likely to likely have elevated blood pressure (Hagman et al. 2019), display early signs of atherosclerosis (Tounian et al. 2001), and develop type 2 diabetes (Baranowski et al. 2006). Obese children are also more likely to be diagnosed with cancer (Furer et al. 2020) and to die by age 30 compared to their healthy weight counterparts (Lindberg et al. 2020). Today, most of the world's population now lives in countries where excess bodyweight kills more people than being underweight (WHO 2024).

Excess bodyweight is ultimately caused by caloric intake exceeding caloric expenditure, so policymakers have sought to discourage consumption of energy-dense food (Finkelstein et al. 2013; Cawley et al. 2019), encourage consumption of healthier foods (Bhattacharya et al. 2006; Millimet et al. 2010; Lundborg et al. 2022) and physical activity (Cawley et al. 2007; Cawley et al. 2013), and educate children about their weight status (Prina and Royer 2014; Churchill 2024). A common justification for these latter policies is that rising obesity rates have altered perceptions of what it means to be a "healthy weight." If children compare their bodyweight to an increasingly overweight reference group, they will be less likely to recognize when they are overweight or obese. There is empirical support for this hypothesis. In cross-sectional surveys, nearly 30 percent of children and parents misperceive the child's weight status (Maximova et al. 2008; Hernandez et al.

[1] Indeed, in 1997 the World Health Organization declared obesity a global epidemic (WHO 2000).

2010; Chen et al. 2014), and this misperception is a stronger predictor of childhood obesity than parental obesity (McKee et al. 2016; Rodrigues et al. 2020). Yet it is possible that the characteristics associated with this misperception are correlated with other traits and behaviors placing children at greater risk for excess bodyweight. As such, the importance of peer social comparisons in shaping self-image, weight-related health behaviors, and weight status remains an open question.

In this paper, we provide novel evidence on the relationship between peer social comparisons and a range of adolescent weight-related health behaviors and outcomes. To do so, we study the effects of being relatively older or younger within the classroom on body perceptions, caloric intake and expenditure, and body mass index (BMI). Key to our analysis is the fact that, while students' body image may be shaped by peers within their same classroom, adolescent BMI thresholds vary by age (in months) and sex. For example, imagine two boys within the same classroom who have a BMI of 21. The first boy is 13.75 years old while the second is 13.0 years old. Despite the fact that they have the same BMI, the relatively older boy is classified as normal weight, while the relatively younger boy is classified as overweight.

Our data are drawn from the 2002-2018 waves of the Health Behaviour in School-Aged Children (HBSC) study, a cross-national survey of students across Europe and North America. Because the HBSC data include each student's age (in months) at the time of the survey, we can identify students in the classroom who are relatively older/younger than their peers. However, because a student's relative age can be manipulated (e.g., parents choosing to delay enrolling their eligible child in school for a year) in a way that might be correlated with our outcomes of interest, we adopt an instrumental variables identification strategy exploiting differences between the student's birth month and the school entry cutoff month from 33 European countries (Allen and Barnsley 1993; Bedard and Dhuey 2006; Fumarco and Baert 2019).[2] The idea behind this strategy is that while a student's expected relative age generated by the school entry cutoff should reasonably predict her actual relative age, it will be otherwise unrelated to the determinants of her weight-related behaviors and outcomes.

We document several key findings. First, we show that relatively older adolescents (i.e., those with younger peers) have greater body satisfaction than their same-age peers who are relatively younger within their respective classrooms. Specifically, we find that a one standard deviation increase in relative age is associated with a 1.7-1.9 percentage point (3.0-3.4 percent) increase in the likelihood that adolescents described themselves as being "about the right size." Similarly, we show that relatively older students are more likely to report that they don't have any reason to diet, while relatively younger students (i.e., those with older peers) are more likely to report that they should try and gain weight. Second, we find that relatively older students are more likely to be physically active than their younger peers, while relatively younger students are less likely to report eating fruits and vegetables and more likely to consume sweets and sugar sweetened beverages. These diet differences imply that students who are one standard deviation younger than their classmates consume 1,382 more calories over the course of the year. Finally, we show that relatively older students are more likely to be within their recommended BMI range than their same-age peers who are relatively younger within their classroom. Overall, our results suggest that

[2] Twenty countries have a January cutoff, one country has a March cutoff, one country has an April cutoff, two countries have a July cutoff, seven countries have a September cutoff, and two countries have an October cutoff.

relatively older students base their weight-related expectations and behaviors on the behaviors and body types of their younger peers, while relatively younger students are comparing themselves to their older peers.

Our paper builds on an economics literature studying how peer social comparisons influence health behaviors and outcomes. These studies have found that unfavorable social comparisons are associated with worse self-reported physical and mental health, increases in risky health behaviors, and increased risk of death (Eibner and Evans 2005; Pham-Kanter 2009; Balsa et al. 2014; Braghieri et al. 2022). Specifically studying weight-based social comparisons, prior work has shown that women with relatively thinner peers are more likely to engage in disordered eating behaviors (Costa-Font and Jofre-Benet 2013; Arduini et al. 2019) and that relatively heavier adolescents experience greater behavioral problems (Huang et al. 2020).

We also add to literature specifically analyzing the effects of relative age on health behaviors outcomes. Leveraging variation in relative age generated by school entry cutoff dates, this work has shown that relatively younger adolescent girls (i.e., those with older peers) have elevated rates of substance use and risky sexual activity (Argys and Rees 2008; Black et al. 2011; Johansen 2021). Perhaps most relevant for our current study are two papers studying relative age effects using the HBSC data. Studying the effects of relative age on peer social networks, Fumarco and Baert (2020) showed that relatively younger students were more likely to electronically communicate with their friends than their relatively older peers but had fewer face-to-face relationships. Meanwhile, Fumarco et al. (2020) showed that relatively older students reported greater life satisfaction, had higher self-reported general health, reported fewer psychosomatic complaints and were less likely to be overweight than their relatively younger counterparts.

We build on this prior work in several important ways. First, we provide the first evidence that relative age influences how adolescents perceive their own bodies. Second, we offer new evidence that relative age is related to changes in nutrient intake and – consistent with a literature studying the effects of relative age on sports participation (Dhuey and Lipscomb 2008; Fumarco and Schultze 2020) – further evidence that relative age leads to different levels of physical activity. Third, we show the effects of relative age across the BMI distribution. Fourth, we are the first to show that the changes in BMI are driven by changes in bodyweight (which is relatively manipulable) and not by changes in height (which is not), increasing confidence in the mechanism driving our results. Finally, by separately examining responses for adolescent girls and boys, we provide novel evidence on how social comparisons separately influence these groups.

The rest of the paper proceeds as follows: Section 2 discusses the literature on how social comparisons affect economically meaningful outcomes, as well as the literature on the effects of relative age on educational and health outcomes. Section 3 describes the data and outlines our instrumental variables identification strategy. Section 4 presents the results, and Section 5 discusses and concludes.

2. Literature Review

2.1 Literature on Social Comparisons

Our paper contributes to an economics literature exploring the effects of various types of social comparisons on health outcomes. For example, several papers have studied the relationship between relative socioeconomic position – a type of social comparison – and risky health behaviors (Luttmer 2005; Pham-Kanter 2009; Mangyo and Park 2011). Eibner and Evans (2005) showed that individuals with less income than those in their reference group had worse self-reported health, higher body mass index, and increased risk of death. Similarly, Balsa et al. (2014) found that adolescent males in the AddHealth data in a relatively lower socioeconomic position than their peers were more likely to use alcohol, had heavier alcohol use, and were more likely to smoke. In another strand of literature, scholars have begun exploring the effects of social media use on social comparisons and mental health. Using both experimental (Allcott et al. 2019; Mosquera et al. 2019) and quasi-experimental methods (Braghieri et al. 2022), these papers have shown that social media use harms mental health, presumably by fostering unfavorable social comparisons.

We also add to a smaller literature documenting the relationship between relative bodyweight and economically meaningful health outcomes. For example, Costa-Font and Jofre-Benet (2013) showed that women with heavier peers were less likely to be anorexic, while Arduini et al. (2019) found that teen girls with relatively thinner peers were more likely to perceive themselves as heavier than their BMI and to engage in disordered eating behaviors. Using the AddHealth data, Brunello et al. (2020) showed that an increase in peers' average genetic predisposition to high BMI raised the probability that adolescents underestimated their weight and increased obesity among adolescent girls. There is also evidence that adolescents' relative position in the weight distribution can influence their self-esteem and other non-cognitive outcomes. Leveraging variation in relative body size induced by movements between MSAs, Huang et al. (2020) showed that adolescents who moved to thinner areas – and therefore became relatively heavier – experienced increased behavioral problems.

2.2 Literature on Relative Age

This paper also builds on a large body of evidence studying the effects of relative age on education, labor market, and health outcomes (Allen and Barnsley 1993; Bedard and Dhuey 2006; Evans et al. 2010; Page et al. 2019). One complication in this literature is that students who are relatively older than their peers are also older in the absolute sense. For example, if a 15.5-year-old performs better on an exam than her 15.0-year-old classmate, it is unclear whether this difference was because of a benefit to being a relatively older in the classroom or because the student was simply 0.5 years older at the time of the exam. Using a variety of identification strategies to disentangle these relative and absolute age effects, researchers have generally found large, positive effects of age at the time of the exam and smaller positive effects of starting school younger (Black et al. 2011; Cascio and Schanzenbach 2016; Peña 2017).

Examining the effects of relative age on risky health behaviors, Argys and Rees (2008) used data from the National Longitudinal Survey of Youth – 1997 and state-level variation in kindergarten starting dates to show that relatively younger adolescent girls (i.e., those with older peers) were more likely to use marijuana, drink alcohol, and smoke cigarettes. More recently, Johansen (2021) used Danish register data to show that being young-for-grade increased the probabilities that a girl had an abortion and experienced alcohol poisoning during adolescence.[3] Interestingly, neither paper found a relationship between relative age and adolescent boys' risky health behaviors.

[3] In line with these findings, Black et al. (2011) found that girls who started school when they were older were less likely to experience teen pregnancy.

There is also evidence that relative age can influence social networks and overall life satisfaction. Using Health Behaviour in School-Aged Children data and leveraging variation generated by school entry cutoff dates, Fumarco and Baert (2020) found that, after controlling for absolute age, relatively younger students were more likely to electronically communicate with their friends than their relatively older peers but had fewer face-to-face relationships. Similarly, Fumarco et al. (2020) showed that relatively older students reported greater life satisfaction and health, and in a contemporaneous working paper Fumarco et al. (2024) explore the relationship between relative age and eating behaviors.

3. Data Description and Empirical Approach

3.1 Data: Health Behaviour in School-Aged Children, 2002-2018

We obtain data on adolescent BMI and weight-related health behaviors from five waves of the Health Behaviour in School-Aged Children (HBSC) study. HBSC is a cross-national study of adolescents across Europe and North America conducted in collaboration with the World Health Organization. Data are collected from school-based surveys using a standard methodology to produce nationally representative estimates of 11-, 13-, and 15-year-old adolescents. While the surveys have been fielded every four years since 1983/84, only the 2001/02, 2005/06, 2009/10, 2013/14, and 2017/18 waves are publicly available.

For our purposes, these data offer a few key advantages. First, they include information on each student’s age (in months) at the time of the survey, allowing us to identify students in the classroom who are relatively older or younger. Second, these data include information on students from a wide range of absolute ages, allowing us to separately identify the effects of relative age and absolute age.[4] Finally, the cross-country nature of the data allow us to exploit additional variation in the school entry cutoff month, increasing confidence that the relative age effects we identify are not being driven by unobserved factors collinear with birth month.

Following the literature (Fumarco and Baert 2019; Fumarco et al. 2020), we calculate a student's relative age as the difference between age (in months) of the student and the oldest "regular" student within the same class. To identify regular students, we first find the modal year of birth for students born in the second academic quarter, given that these students are least likely to be in the "wrong" class due to retention or being "redshirted" (i.e., held back a year) by their parents. We then use this birth year and the relevant school entry cutoff month to identify older students (i.e., those that repeated a grade or were redshirted) and younger students (i.e., those that started school early). The remaining students are regular students (i.e., that are in the expected class).[5] If all students entered on time and did not repeat a grade, relative age would vary from -12 to 0 with a mean of -6. However, Figure 1 shows that the data are right skewed with an average relative age of -3.8, consistent with prior work showing that parents may strategically choose to delay enrolling their children in school (Allen and Barnsley 1993; Bedard and Dhuey 2006;

[4] This is more difficult if all students are surveyed at the same age because relative age is collinear with absolute age (i.e., the relatively older students in the classroom are also absolutely older than their peers). For example, the Programme for International Student Assessment (PISA) includes information on 15-year-olds' academic performance.

[5] Because this process requires classroom-specific information, we exclude observations without a classroom identifier. We also follow prior work exclude classes in the top and bottom 5% of the class size distribution, given concerns that these codes are not identifying unique classrooms. Our remaining classes range from 8 to 32 students, consistent with Fumarco and Baert (2019).

Evans et al. 2010; Page et al. 2019).[6] We report summary statistics for our explanatory variables of interest and our dependent variables in Table 1.[7]

3.2 Empirical Approach: Instrumental Variables

To study the relationship between relative age and weight-related health behaviors, one could estimate the following naïve ordinary least squares regression:

$$(1) \quad Y_{iact} = \alpha_0 + \alpha_1 \cdot \textit{RELATIVE AGE}_a + \alpha_2 \cdot \textit{AGE}_a + \alpha_3 \cdot X'_{iact} + \alpha_4 \cdot C_c + \alpha_5 \cdot T_t + \varepsilon_{iact}$$

where the dependent variable, Y, is the outcome of interest for adolescent *i* of age *a* from country *c* and survey year *t*. In this setting, the vector X includes individual-level demographic characteristics that might influence weight-related health behaviors, including indicators for month-of-birth, sex, whether the adolescent's mother is present in the household, whether the adolescent's father is present in the household, and socioeconomic status.[8] We also include country fixed effects, C, and survey wave fixed effects, T.

The independent variables of interest are (i) *RELATIVE AGE*, which captures the change in the outcome variable associated with being one month older than the typical peer, and (ii) *AGE*, which captures the change in the outcome variable associated with being one additional month older. One potential issue with this approach is that relative age can be manipulated in a way that may be correlated with factors affecting the outcomes of interest by parents timing conception to assure a particular season of birth, parents

[6] For Figure 1, we bin the endpoints at -12 and 12.
[7] We report additional summary statistics in Appendix Table 1.
[8] HBSC guidelines suggest that socioeconomic status be measured by adding the answers to four questions: (i) whether the respondent's family owns zero, one, or more than one car; (ii) whether the respondent sleeps in her own bedroom; (iii) whether the respondent has traveled for holidays in the prior twelve months never, once, or more than once; and (iv) whether the respondent's family owns zero, one, or more than one computer. The resulting sum is then divided into three levels (i.e., low, medium, and high socioeconomic status).

choosing to delay enrolling their eligible child in school for a year, or the child repeating a grade due to poor academic performance.

To address the potential endogeneity inherent in relative age, we follow the literature and leverage plausibly exogeneous variation generated by the country-specific school entry cutoff month using an instrumental variables approach (Datar 2006; Black et al. 2011; Peña and Duckworth 2018; Johansen 2021).[9] The idea behind this approach is that students born just after the school entry cutoff month will be nearly a year older than those born just before the cutoff, though they will both be part of the same academic class. For example, Figure 2 shows a clear negative relationship between students' birth months relative to the school entry cutoff and average relative age, with students born in the cutoff month having an average relative age of -1.4 while those born eleven months later had an average relative age of -7.3.

Given evidence that students born in the first and last few months of the academic year are more likely to be non-regular students (Bedard and Dhuey 2006; Sprietsma 2010), we follow Fumarco and Baert (2019) and disaggregate the instrument into twelve indicator variables corresponding to the months of the academic year (Angrist and Pishke 2008).[10] Because many of the endogeneity concerns related to relative age could also affect the absolute age of the adolescent, we also instrument for age with the average age of students from the same country, who were interviewed in the same survey wave, were in the same classroom, and were born during the same quarter of the academic year (Peña and Duckworth 2018; Fumarco and Baert 2019; Fumarco et al. 2020).

[9] Appendix Table 2 lists the country-specific school entry cutoff dates.
[10] Because we have significant variation in the school entry cutoff month, the months of the academic year do not overlap with the months of the calendar year.

Using these two instruments, we estimate our first stage regression relating the endogeneous variables (i.e., relative age and age) to our two instruments:

(2) $$\text{ENDOGENEOUS}_{iact} = \delta_0 + \delta_1 \cdot \textit{BIRTH MONTH RELATIVE TO CUTOFF}_{ic} + \delta_2 \cdot \textit{AVG AGE}_{iact} + \delta_3 \cdot X'_{iact} + \delta_4 \cdot C_c + \delta_5 \cdot T_t + \varepsilon_{iact}$$

where *BIRTH MONTH RELATIVE TO CUTOFF* is a series of twelve indicator variables denoting the position of the student's birth month based on that country's school entry cutoff and *AVG AGE* is the average age of the student's comparable peers. We then estimate the second stage equation:

(3) $$Y_{iact} = \beta_0 + \beta_1 \cdot \widehat{\textit{RELATIVE AGE}}_a + \beta_2 \cdot \widehat{\textit{AGE}}_a + \beta_3 \cdot X'_{iact} + \beta_4 \cdot C_c + \beta_5 \cdot T_t + \varepsilon_{iact}$$

where $\widehat{\textit{RELATIVE AGE}}$ and $\widehat{\textit{AGE}}$ indicate the predicted values of relative age and absolute age obtained from the first stage equations. Throughout the paper, we report these two-stage least squares (2SLS) estimates and cluster standard errors at the classroom level.[11]

4. Results

4.1 Effects on Self-Image

We begin by exploring the relationship between relative age and adolescent body image. The dependent variable in Table 2 is an indicator for whether the student reported that his or her body was "about the right size." Column 1 presents the sparse relationship between relative age and body satisfaction after controlling for absolute age. Column 2 then augments this specification with time-invariant country fixed effects, location-invariant survey year fixed effects, month-of-birth fixed effects, and individual-level demographic characteristics. Finally, column 3 utilizes the sample weights. Panel A reports ordinary

[11] Appendix Table 3 shows that our instrumental variables for relative age are generally unrelated to the righthand side demographic characteristics. The one unsurprising exception is that students born further from the school entry cutoff month are consistently younger in absolute age.

least squares estimates and Panel B reports two-stage least squares estimates. We report the estimates on absolute age and relative age within the classroom. For ease of interpretation, we have scaled the latter estimates to reflect a one standard deviation increase in relative age (approximately 5.3 months).

Across all three specifications, the ordinary least squares estimates in Panel A indicate that, as adolescents get older, they are less likely to report feeling that their bodies are "about the right size." However, we also find that students who are relatively older within their classrooms have higher levels of body satisfaction than their same-age counterparts who are relatively younger within their own classrooms. Specifically, we find that a one standard deviation increase in relative age is associated with a 0.7-0.8 percentage point increase in the likelihood that adolescents report being satisfied with their body sizes. Together these estimates suggest that while adolescents report lower levels of body satisfaction as they get older, being relatively older than one's classroom peers offers a measure of protection against this phenomenon.

Of course, relative age can be endogenously determined by parents opting to hold their children back a year, and the characteristics associated with this decision may also be correlated with household weight-based perceptions. To account for this possibility, we adopt the two-stage least squares specification, shown in equation (3), and Figure 3 shows a clear first-stage relationship between students' birth months relative to the school entry cutoff months and students' relative age. The two-stage least squares estimates in Panel B indicate that a one standard deviation increase in relative age is associated with a 1.7-1.9 percentage point increase in the likelihood that adolescents report feeling that their bodies are the right size – a 3.0-3.4 percent increase relative to the sample mean.[12] Conversely, the estimates imply that relatively younger students are less satisfied with their body sizes relative to their same-age counterparts who are relatively older within their classrooms. Across all columns, we reject the null hypotheses that the instruments are uncorrelated (LM statistic) or only weakly correlated (F statistic) with the endogenous variable. Meanwhile, we are unable to reject the null hypothesis that the instruments are exogeneous (J statistic).

Why might relatively older students be more likely to report that their bodies are about the right size? One explanation is that students' views on their ideal body sizes are influenced by the bodies of their classroom peers. If so, then relatively older students might base their views on their relatively younger peers' presumably smaller bodies. In this case, relatively older students may be more likely to view themselves as "too fat" in comparison to their younger peers. Similarly, relatively younger students might be more likely to view themselves as "too thin" in comparison to their older peers' bodies.

To test the broader ways in which relative age influences body image, in Figure 4 we present the reduced form relationship between birth month relative to the school entry cutoff month and the likelihood that adolescents described themselves as "too thin" (Panel A), "about the right size" (Panel B), and "too fat" (Panel C). Consistent with our hypothesis, we find that students born further from the school entry cutoff month are almost

[12] Students born near the school entry cutoff are less likely to be regular students (i.e., they are more likely to have started early, delayed schooling for a year, or repeated a grade), potentially violating our identification strategy's monotonicity assumption. While we have tried to minimize this possibility by disaggregating our instrument, in Appendix Table 4 we further address this possibility by dropping students born the month prior to the cutoff or during the cutoff month (column 1); during the two months prior to the cutoff, the cutoff month, and the month following the cutoff (column 2); and during the three months prior to the cutoff, the cutoff month, and the two months following the cutoff (column 3). We continue to find that relatively older students were more likely to report that they were "about the right size," though the results become less precise as we drop more students.

1-percentage point more likely to describe themselves as being "too skinny" compared to those born in the cutoff month. This pattern is consistent with relatively younger adolescents comparing themselves to their relatively older and larger peers. Perhaps surprisingly, we also find suggestive evidence that students born further from the cutoff month were more likely to describe themselves as "too fat," though the reduced form estimates are statistically insignificant. Table 3 reports the corresponding two-stage least squares estimates. We find that a one standard deviation increase in relative age is associated with a 1.1 percentage point (7.5 percent) increase in the likelihood that adolescents described themselves as "too skinny" (column 2) and a 0.9 percentage point (3.1 percent) increase in the likelihood that they described themselves as "too fat" (column 3).[13]

Prior work has found that concerns about body image and weight are more salient for adolescent girls and young women compared to their male counterparts (Costa-Font and Jofre-Benet 2013; Andruini et al. 2019; Carpenter and Churchill forthcoming), suggesting that the relationship between relative age and body image may be different for adolescent girls and adolescent boys. To test this possibility, Table 4 reports the results from separately examining adolescent girls (columns 1-3) and adolescent boys (columns 4-6). To account for the fact that adolescent girls are less likely to describe themselves as "too skinny" than adolescent boys (12 percent vs. 17.6 percent) and more likely to describe themselves as "too fat" (35.9 percent vs. 22.6 percent), Figure 5 shows the effects as

[13] We explored whether this relationship might vary based on regional attitudes towards body weight by separately estimating the two-stage least squares specification based on the United Nations Geoscheme for Europe. Appendix Figure 1 shows that the results are driven by Northern, Southern, and Western Europe; the results for Eastern Europe are never statistically significant.

percent changes relative to the respective sample means for each outcome. We find that a one standard deviation increase in relative age was associated with similar percent changes in how adolescent girls (darker triangles) and boys (lighter circles) described their bodies. The lack of a clear gendered relationship is consistent with Huang et al. (2020) who found that changes in relative body size generated by moving to relatively thinner or heavier areas were associated with similar behavioral changes for both adolescent girls and boys.[14]

To further explore how relative age may influence body image, we now examine changes in self-reported dieting behaviors, which offer insights into how adolescents view their current bodies relative to their preferred bodies. Figure 6 presents reduced form estimates showing no evidence of a relationship between birth month relative to the school entry cutoff month and the likelihood that adolescents reported being on a diet (Panel A). However, we do find that students born further from the school entry cutoff month are less likely to say that they did not have a reason to be on a diet (Panel B). Instead, we find that these students are more likely to report that they are not on a diet because they believe that they should gain weight (Panel C). We do not find any evidence that students born further from the cutoff month are more likely to report that they are not on a diet but should lose weight (Panel D).

Table 5 reports the corresponding two-stage least squares results examining relative age and dieting behaviors.[15] Consistent with the reduced form pattern, we do not find any

[14] We also explored heterogeneity by age category (i.e., whether the sampled student was intended to be representative of an 11-, 13-, or 15-year-old). Appendix Figure 2 shows that the reduction in the likelihood that adolescent described themselves as "too skinny" was largest for 11-year-old students (Panel A). We found a 2-4 percent increase in the likelihood that all ages described themselves as "about the right size," though the point estimates are largest for the younger students (Panel B).

[15] Appendix Figure 3 reports results separately by European region and Appendix Figure 4 reports results separately for each age category. The results are similar across subsamples.

evidence in column 1 that relatively older students are more likely to report that they are on a diet. Instead, column 2 shows that a one standard deviation increase in relative age is associated with a 1.3 percentage point (2.6 percent) increase in the likelihood that adolescents report that they have no reason to be on a diet. This is consistent with the prior results showing that relatively older students report greater body satisfaction. Meanwhile, column 3 shows that relatively younger students – who were also more likely to describe themselves as "too skinny" – are more likely to report that they are not on a diet because they should gain weight. Finally, column 4 does not reveal any evidence that relative age is related to changes in the likelihood that adolescents report that they should diet to lose weight. [16] We show similar changes for adolescent girls and boys in Figure 7.[17]

4.2 Effects on Weight Management Behaviors

The estimates in the prior section indicate that relatively older students are more likely to feel that their bodies are the "right size" and that they do not have any reason to diet, while relatively younger students are more likely to describe themselves as "too skinny" and report that they should gain weight. In this section, we explore whether these differences in perception are also found when we examine the relationship between relative age and weight-management activities. Consistent with prior evidence studying the relationship between relative age and sports participation (Dhuey and Lipscomb 2008; Fumarco and Schultze 2020), Table 6 indicates that relatively older students are more likely to be

[16] In a contemporaneous working paper, Fumarco et al. (2024) find evidence that relatively younger students are more likely to report being on a diet, while we do not find any evidence that these students are more likely to be on a diet. What might explain this difference? Fumarco et al. (2024) define being on a diet as "a dummy variable which equals one if the student is on a diet or is doing something else," suggesting that they have combined columns (1), (3), and (4), so that "being on a diet" is the complement to having no reason to be on a diet and includes individuals who report feeling that they should gain weight and lose weight.

[17] Appendix Table 5 reports these estimates separately for adolescent girls and boys.

physically active. Column 1 shows that students who are one standard deviation older in relative age report being physically active on 0.12 more days – a 3.0 percent increase relative to the sample mean. Likewise, column 2 shows that these relatively older students report 4.5 percent more instances of exercising outside of school, and column 3 shows that they report spending 3.9 percent more hours exercising outside of school.[18]

Next, we test the relationship between relative age and caloric intake. The dependent variables in Table 7 are the number of times per week the student reports consuming fruits, vegetables, sweets, and soda. Column 1 shows that students who are one standard deviation older in relative age report eating fruit 0.09 more times per week (1.7 percent increase). Similarly, column 2 shows that these relatively older students report eating vegetables 0.06 times more per week (1.2 percent increase). In contrast, columns 3 and 4 show that these students eat fewer calorie-dense foods. Column 3 indicates students who are one standard deviation older in relative age report eating sweets 0.05 fewer times per week (1.3 percent) and report drinking soda 0.8 fewer times per week (2.3 percent).[19,20]

Overall, Table 7 indicates that relatively older students are more likely than their same-age, relatively younger counterparts to consume nutritious, low-calorie items and less

[18] Appendix Table 6 shows that relatively older girls and boys are both more likely to participate in physical activity, though the results are larger for adolescent boys. Appendix Figure 5 shows similar changes across European regions. Appendix Figure 6 suggests that the increase in the number of days active for more than 60 minutes was larger for 13- and 15-year-olds than 11-year-olds (Panel A), though there were similar changes in the number of times all age groups reported exercising outside of school (Panel B).

[19] In Appendix Table 7 we show that the reduction in the number of times eating sweets is driven by adolescent girls, while the increase in fruit and vegetable consumption is driven by adolescent boys. Appendix Figure 7 shows similar changes in dietary intake across European regions. Appendix Figure 8 presents mixed evidence for the relationship between relative age and dietary intake for each age group. We find similar changes in fruit consumption (Panel A). However, while we find that relatively older 11-year-olds were less likely to consume sweets and sodas, this relationship appears to flip as students age (Panels C and D).

[20] A contemporaneous working paper finds that relatively older students were more likely to consume fruits and vegetables and less likely to consume sweets and sodas (Fumarco et al. 2024).

likely to consume calorie-dense items. It is worth noting that the measure used in this table (i.e., the number of times eating a category of food) is an imperfect proxy of caloric intake, given that students might consume multiple servings of the items in a single sitting. However, if we are willing to assume that students consume one serving each time they eat the item, we can use the estimates from Table 7 to estimate calorie differences throughout the year. Assuming that dessert has 300 calories per serving and a soda has 150 calories per serving, our estimates imply that students who are one standard deviation older in relative age will consume 26.6 fewer calories per week – a 1,381 calorie reduction over the course of the year.[21] There are 7,700 calories in a kilogram, so our estimates imply a 0.18 kilogram reduction in bodyweight attributable to these relatively older students' reduced consumption of sweets and sodas.

4.3 Effects on Body Mass Index

While we have shown that relative age affects how adolescents view their bodies and their weight-related health behaviors, we now explore the relationship between relative age and BMI. We determine each student's BMI using the 2007 World Health Organization's BMI reference charts that establish BMI-for-age (in months) thresholds for girls and boys. Students who are two or more standard deviations below their BMI-for-age cutoff are classified as "thin," students between two standard deviations below and one standard deviation above the cutoff are classified as "normal weight," students who are more than a standard deviation above the cutoff are classified as "overweight," and students who are more than two standard deviations above the cutoff are classified as "obese."

[21] $(0.051 \times 300) + (0.075 \times 150) = 26.55$

The descriptive trends in Figure 8 reveal an interesting pattern – students born further from the school entry cutoff month weigh less than those born closer to the cutoff month (Panel A), but they are more likely to be classified as overweight or obese (Panel B). This suggests that while these students born further from the cutoff weigh less in an absolute sense, it is not sufficiently less to keep them within the recommended region of their age-specific BMI recommendation. This possibility is supported by the reduced form evidence in Figure 9 showing that students born further from the school entry cutoff month have higher BMIs than students of the same age (in months) who were born closer to the school entry cutoff month.

Table 7 now explores the relationship between relative age and BMI using our two-stage least squares specification. Column 1 shows that a one standard deviation increase in relative age is associated with a 0.14-unit (0.7 percent) reduction in BMI.[22] While seemingly modest, it is worth noting that for the students in our data, the difference between the recommended BMI value and a BMI classifying that adolescent as overweight is 2.8 units. Indeed, in columns 2 and 3 we find that relatively older students are more likely to be classified as "thin" and "normal weight" than their same-age counterparts who are relatively younger within their classrooms. Instead, column 4 shows that a one standard deviation increase in relative age is associated with a 1.2 percentage point (6.6 percent) reduction in the likelihood that adolescents are classified as overweight. Finally, column 5 presents the first evidence that these relatively older students are 0.5 percentage points (12.5 percent) less likely to be obese. This latter finding is particularly important, given the

[22] Appendix Table 8 shows that this result is robust to dropping students born near the school entry cutoff. Appendix Figure 9 shows similar BMI changes in BMI for all European regions, and Appendix Figure 10 shows similar changes in BMI for 11-, 13-, and 15-year-old adolescents.

high health costs associated with adolescent obesity (Tounian et al. 2001; Baranowski et al. 2006; Hagman et al. 2019; Furer et al. 2020; Lindberg et al. 2020). Appendix Tables 9 and 10 report results for adolescent girls and adolescent boys, respectively. We find that relatively older girls are more likely to be classified as thin, while relatively older boys are more likely to be classified as normal weight.

In Table 8, we found that students with relatively younger peers (i.e., relatively older students) have lower BMIs, while students with older peers (i.e., relatively younger students) have higher BMIs. If these differences are due to students adopting the weight-related expectations and behaviors of their classmates, then these BMI differences should be driven by changes in bodyweight and not in height. The idea is that while weight is relatively modifiable by the student, height is not. Reassuringly, Figure 10 shows that a one standard deviation increase in relative age is associated with a statistically significant 0.9 percent reduction in bodyweight. In contrast, the relationship between relative age and height is incredibly small, precisely estimated, and statistically insignificant.[23]

5. Discussion and Conclusion

Over 400 million children and adolescents are classified as overweight or obese (WHO 2024), and public health officials and policymakers are increasingly concerned that rising obesity rates have altered perceptions of what it means for a child to be a "healthy weight." While there is a robust literature exploring the policy determinants of obesity (Cawley et al. 2007; Courtemanche 2009; Finkelstein et al. 2013; Fletcher et al. 2015; Cawley et al. 2019; Courtemanche et al. 2020), comparatively less is known about whether and how peer social comparisons influence bodyweight perceptions and drive changes in BMI. Using an

[23] We also report these results in Appendix Table 11.

instrumental variables identification strategy exploiting variation in relative age within the classroom generated by school entry cutoff months and data drawn from the 2002-2018 waves of the Health Behaviour in School-Aged Children (HBSC) study, we provide novel evidence on the relationship between relative age and weight-related health behaviors.

We show that relatively older students are more likely to have positive views of their body size, eat lower calorie food, and are more likely to be in their recommended BMI range than their same-age counterparts who are relatively younger within their respectively classrooms. Conversely, we show that relatively younger students are more likely to report that they should try and gain weight, eat more calorie-dense food items, and be classified as overweight or obese. Overall, our results suggest that relatively older students base their weight-related expectations and behaviors on the behaviors and body types of their younger peers, while relatively younger students are comparing themselves to their older peers.

This study is subject to some limitations. For one, as is common in this literature, our data on weight-related behaviors and outcomes are self-reported. While self-reported data are perhaps most appropriate when examining changes in self-image, they provide us with relatively coarse measures of physical activity and calorie intake. While there is no reason to believe that the propensity to under or overreport these measures should be correlated with relative age – particularly when we are exploiting school entry cutoff months throughout the year in a variety of countries – identifying ways to more accurately capture changes in physical activity and calorie intake remains an important area for future research. Additionally, prior work has shown that students born around the school entry cutoff data are more likely to be non-regular students (Bedard and Dhuey 2006), potentially violating our monotonicity assumption. To address this possibility, we have (i) followed the literature and disaggregated our instrumental variable (Fumarco and Baert 2019; Fumarco et al. 2020) and (ii) shown that our results are robust to excluding students born during these months from the sample. Yet it is possible that we have failed to fully resolve an underlying violation of the monotonicity assumption, limiting our ability to interpret our estimates as a local average treatment effect. Finally, because our sample is comprised entirely of adolescents, we can only speculate as to whether these social comparisons similarly influence weight-related behaviors among adults. Despite these limitations, this study provides the most comprehensive evidence on the role of peer social comparisons in driving weight-related health behaviors and outcomes.

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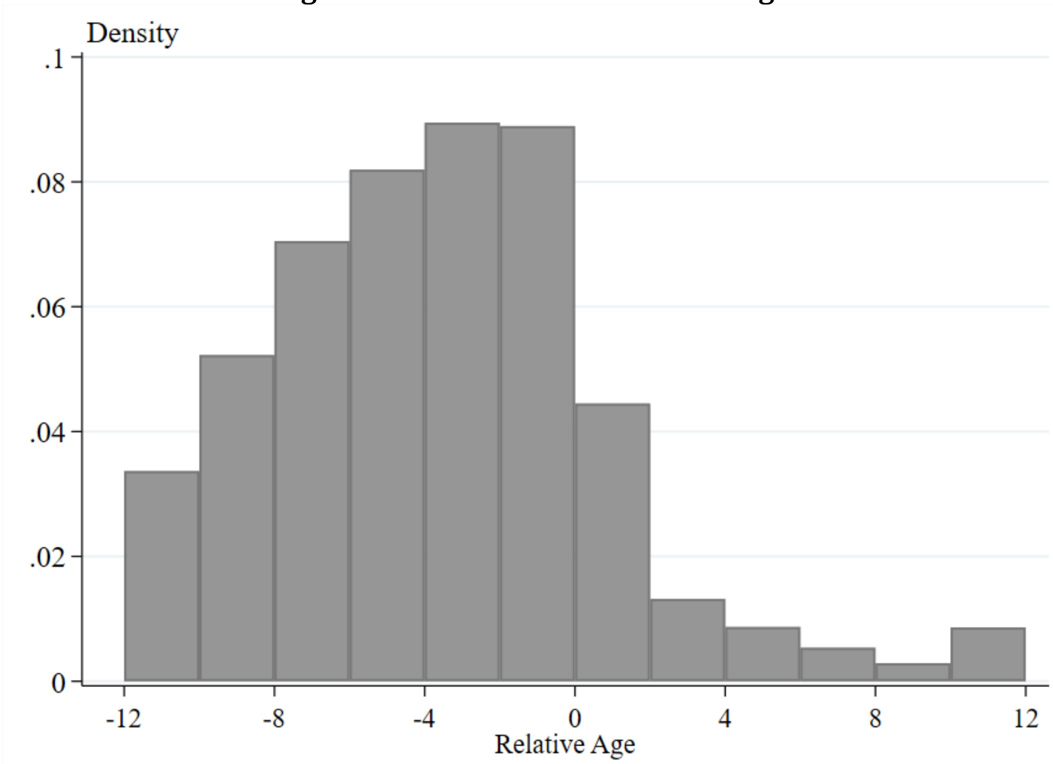
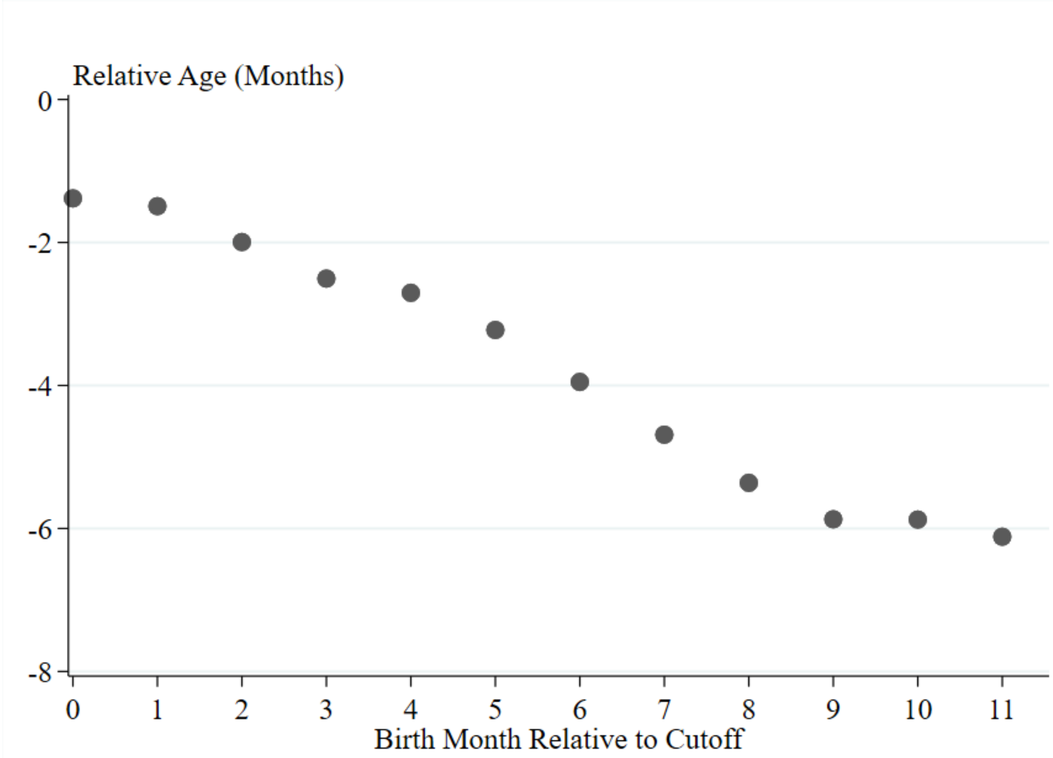
Figure 1: Distribution of Relative Age



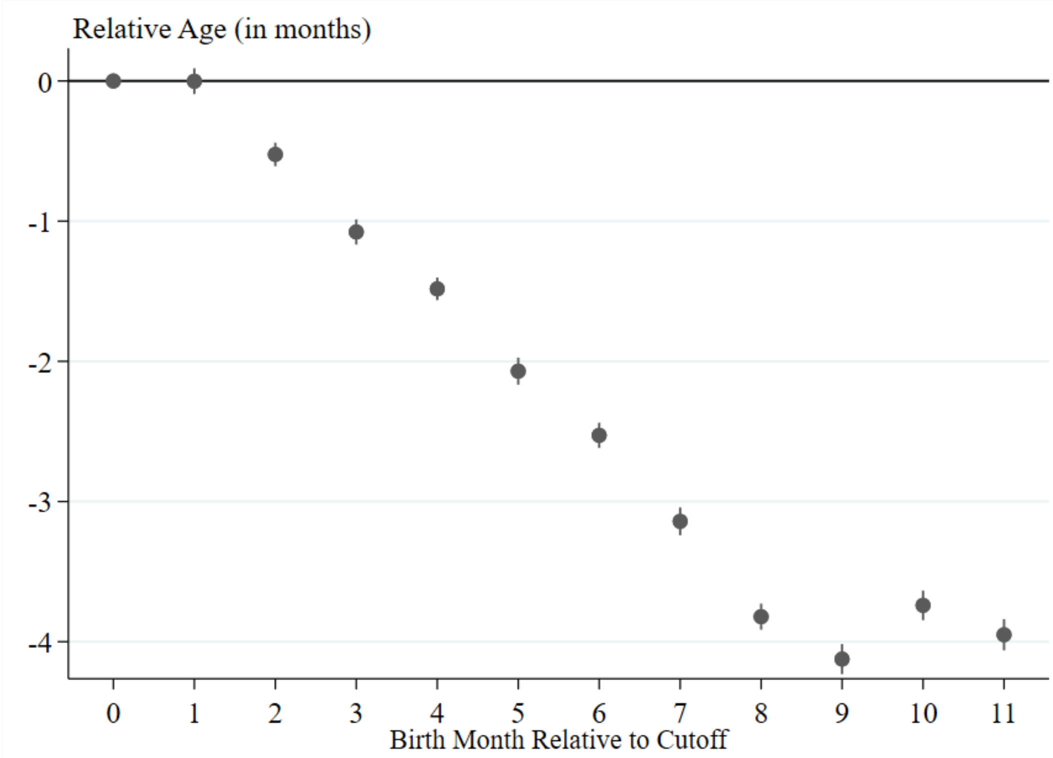
Source: Health Behaviors of School Aged Children, 2002-2018
Notes: The figure plots the average relative age (in months) for students based on their birth month relative to the school entry cutoff. The summary statistics utilize the sample weights.

Figure 2: Adolescents Born Further from the School Entry Cutoff Are Relatively Younger



Source: Health Behaviors of School Aged Children, 2002-2018
Notes: The figure plots the average relative age (in months) for students based on their birth month relative to the school entry cutoff. The summary statistics utilize the sample weights.

Figure 3: First-Stage Relationship Between Birth Month Relative to the School Entry Cutoff Month and Relative Age



Source: Health Behaviors of School Aged Children, 2002-2018
Notes: The dependent variable is the student's relative age. The estimates are obtained from the reduced form regression where the independent variables of interest are indicators for birth month relative to the school entry cutoff month. The circles plot the estimates, and the vertical lines denote the corresponding 95 percent confidence intervals. The regression includes the full set of controls from Table 2 column 3. The estimates utilize the sample weights. Standard errors are clustered at the classroom level.

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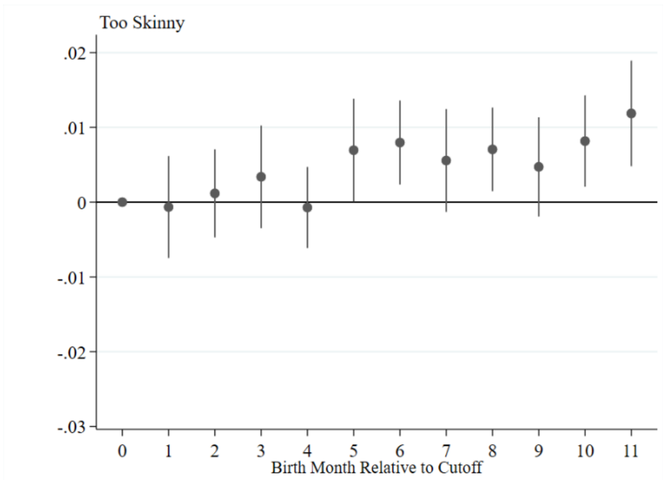
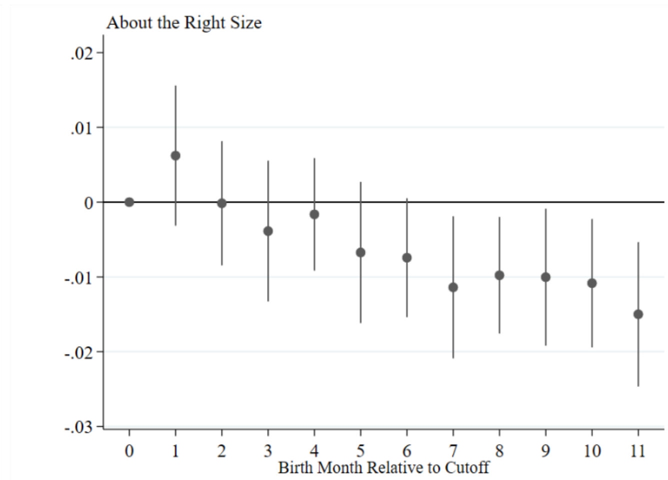
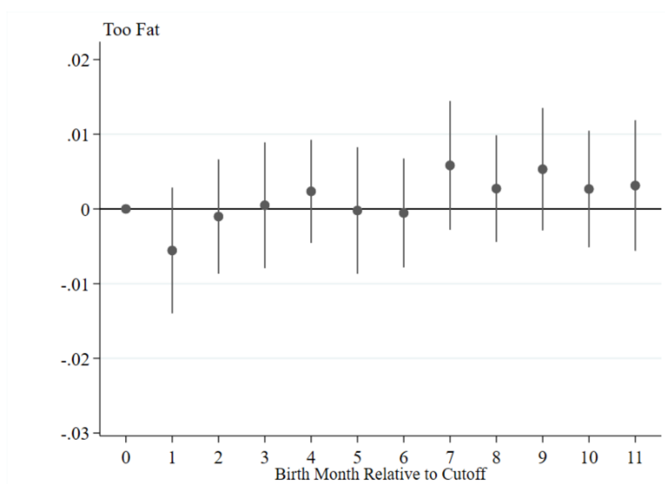
Figure 4: Reduced Form Relationship Between Relative Age and Body Image



(A)



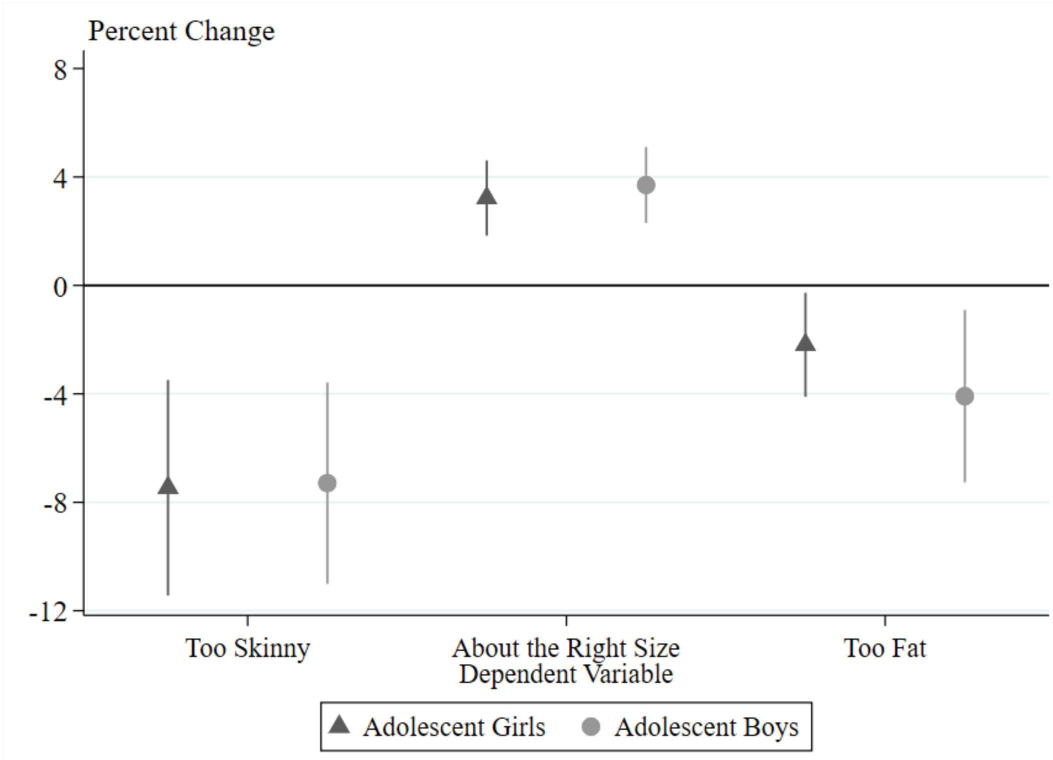
(B)



(C)

Source: Health Behaviors of School Aged Children, 2002-2018
Notes: The dependent variable in Panel A is an indicator for whether the adolescent described his or herself as "too skinny." The dependent variable in Panel B is an indicator for whether the adolescent described his or herself as "about the right size." The dependent variable in Panel C is an indicator for whether the adolescent described his or herself as "too fat." The estimates are obtained from the reduced form regression where the independent variables of interest are indicators for birth month relative to the school entry cutoff month. The circles plot the estimates, and the vertical lines denote the corresponding 95 percent confidence intervals. The regression includes the full set of controls from Table 2 column 3. The estimates utilize the sample weights. Standard errors are clustered at the classroom level.

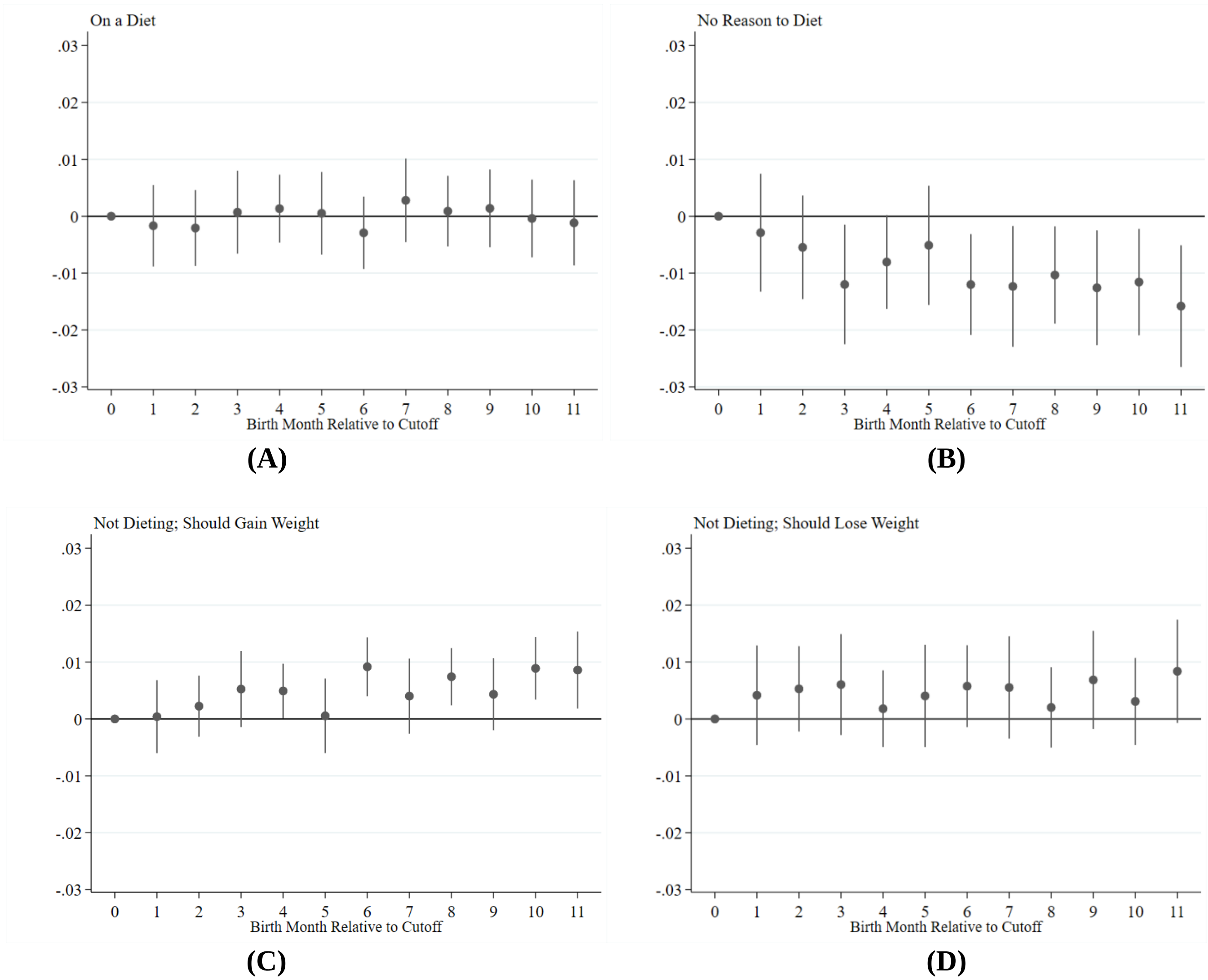
Figure 5: 2SLS Relationships Between Relative Age and Body Image, by Sex



Source: Health Behaviors of School Aged Children, 2002-2018

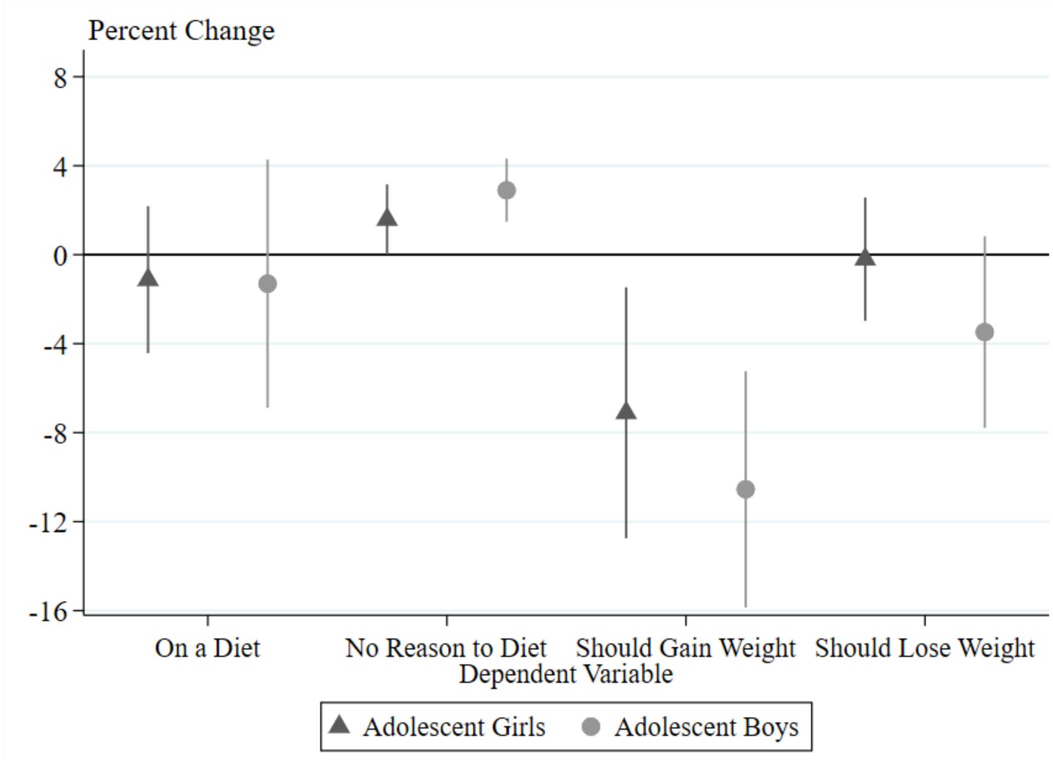
Notes: The figures plot the percent change relative to the sample mean associated with a one standard deviation increase in relative age. The dependent variables are listed on the horizontal axis and are indicators for whether the teen described his/her body as "too thin," "about the right size," or "too fat." The dark triangles plot the estimates for adolescent girls, while the lighter grey circles plot the estimates for adolescent boys. The vertical lines denote the corresponding 95 percent confidence intervals. The estimates are obtained using a two-stage least squares strategy where birth month relative to the school entry cutoff is an instrument for relative age and the average age of comparable classroom peers is used as an instrument for absolute age. All estimates use the full set of controls from Table 2 column 3. The estimates utilize the sample weights. Standard errors are clustered at the classroom level.

Figure 6: Reduced Form Relationship Between Relative Age and Dieting Behaviors



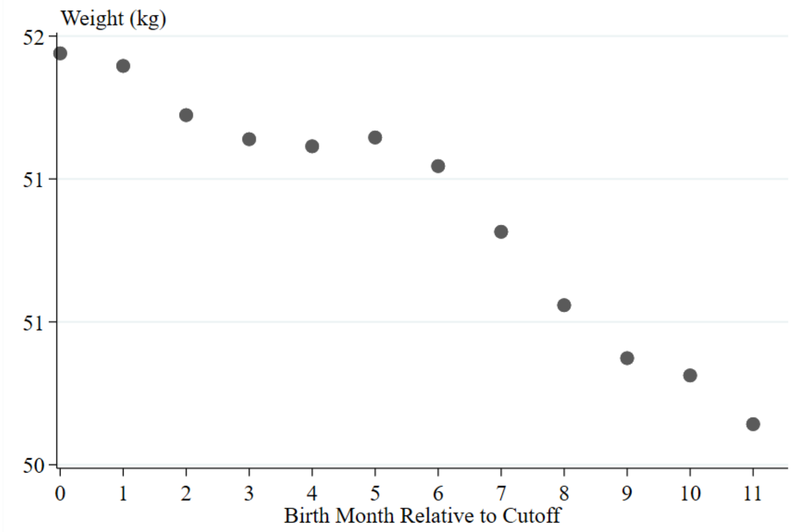
Source: Health Behaviors of School Aged Children, 2002-2018
Notes: The dependent variable in Panel A is an indicator for whether the adolescent reported being on a diet. The dependent variable in Panel B is an indicator for whether the adolescent reported having no reason to diet. The dependent variable in Panel C is an indicator for whether the adolescent reported not being on a diet but feeling that s/he should gain weight. The dependent variable in Panel D is an indicator for whether the adolescent reported not being on a diet but feeling that s/he should lose weight. The estimates are obtained from the reduced form regression where the independent variables of interest are indicators for birth month relative to the school entry cutoff month. The circles plot the estimates, and the vertical lines denote the corresponding 95 percent confidence intervals. The regression includes the full set of controls from Table 2 column 3. The estimates utilize the sample weights. Standard errors are clustered at the classroom level.

Figure 7: Relationships Between Relative Age, Body Image, and Dieting Behaviors

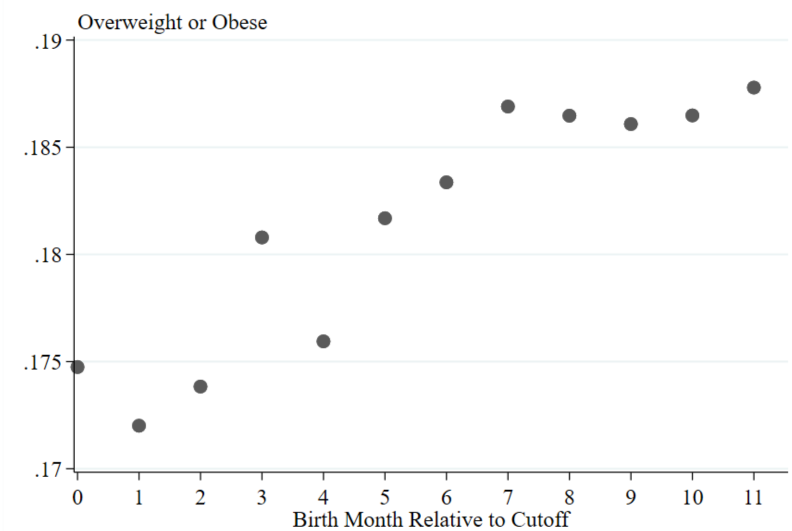


Source: Health Behaviors of School Aged Children, 2002-2018
Notes: The figures plot the percent change relative to the sample mean associated with a one standard deviation increase in relative age. The dependent variable is listed on the horizontal axis and includes indicators for whether the teen reported being on a diet, having no reason to diet, not being on a diet but should be on one to gain weight, or not being on a diet but should be on one to lose weight. The dark triangles plot the estimates for adolescent girls, while the lighter grey circles plot the estimates for adolescent boys. The vertical lines denote the corresponding 95 percent confidence intervals. The estimates are obtained using a two-stage least squares strategy where birth month relative to the school entry cutoff is an instrument for relative age and the average age of comparable classroom peers is used as an instrument for absolute age. All estimates use the full set of controls from Table 2 column 3. The estimates utilize the sample weights. Standard errors are clustered at the classroom level.

Figure 8: Adolescents Born Further from the School Entry Cutoff Weigh Less but Are More Likely to Be Overweight or Obese for Their Age



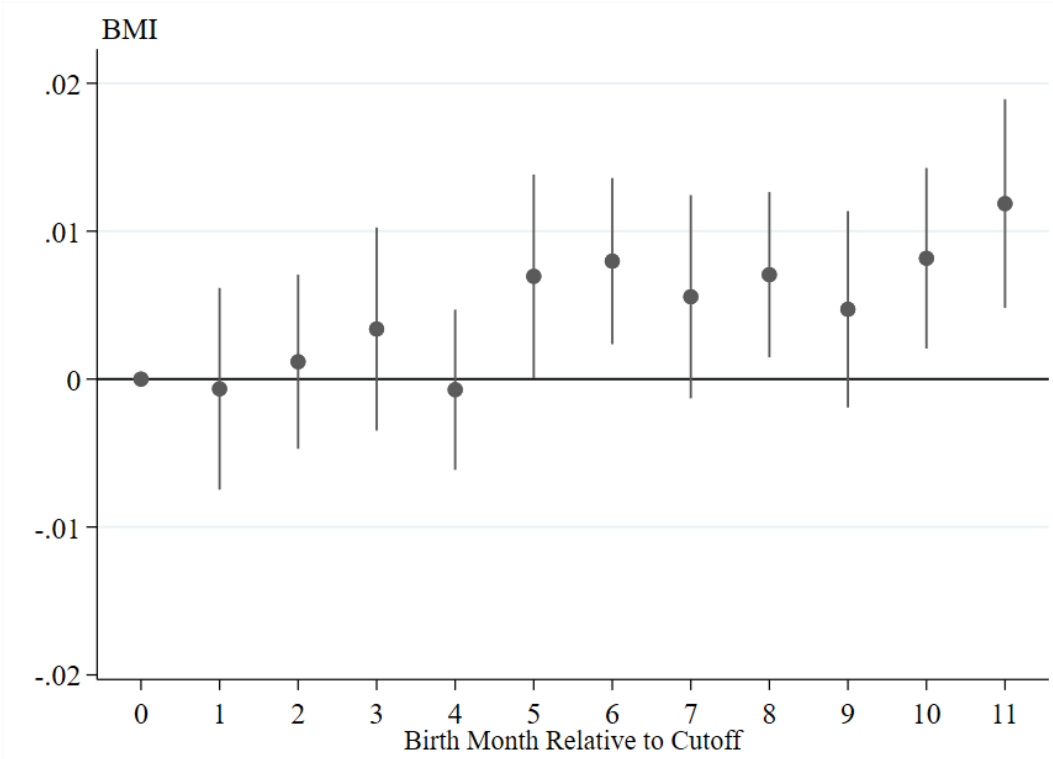
(A)



(B)

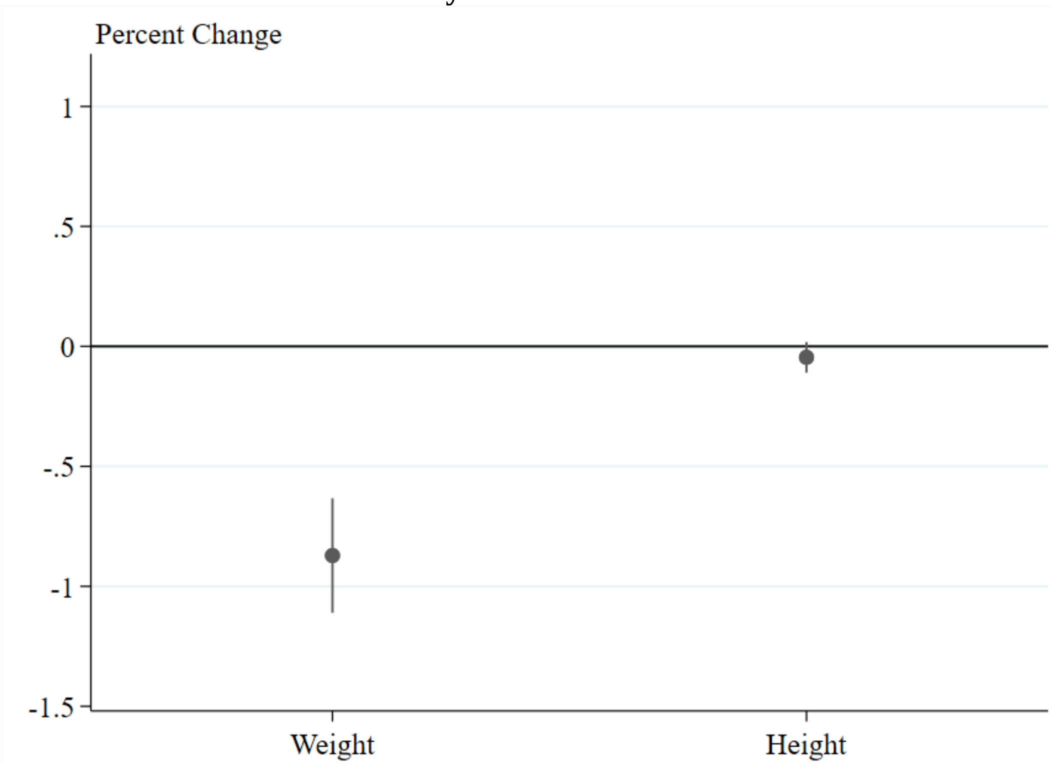
Source: Health Behaviors of School Aged Children, 2002-2018
Notes: Panel A plots the average weight (in kilograms) of students based on their birth month relative to the school entry cutoff. Panel B plots the share of students categorized as overweight or obese using their sex-specific BMI-for-age thresholds. The summary statistics utilize the sample weights.

Figure 9: Reduced Form Relationship Between Relative Age and BMI



Source: Health Behaviors of School Aged Children, 2002-2018
Notes: The dependent variable is the adolescent's body mass index. The estimates are obtained from the reduced form regression where the independent variables of interest are indicators for birth month relative to the school entry cutoff month. The circles plot the estimates, and the vertical lines denote the corresponding 95 percent confidence intervals. The regression includes the full set of controls from Table 2 column 3. The estimates utilize the sample weights. Standard errors are clustered at the classroom level.

Figure 10: Relatively Older Students Weigh Less Than Their Same-Age Counterparts Their Same-Age Counterparts Who Are Relatively Older Within Their Classrooms



Source: Health Behaviors of School Aged Children, 2002-2018
Notes: The figures plot the percent change relative to the sample mean associated with a one standard deviation increase in relative age. The dependent variable is listed on the horizontal axis, including the student's weight (in kilograms) and the student's height (in centimeters). The grey circles plot the estimates, and the vertical lines denote the corresponding 95 percent confidence intervals. The estimates are obtained using a two-stage least squares strategy where birth month relative to the school entry cutoff is an instrument for relative age and the average age of comparable classroom peers is used as an instrument for absolute age. All estimates use the full set of controls from Table 2 column 3. The corresponding estimates are reported in Appendix Table 10. The estimates utilize the sample weights. Standard errors are clustered at the classroom level.

Table 1: Summary Statistics

	Mean	Std. Dev.	Minimum	Maximum	Observations
Age Variables					
Relative Age	-3.812	5.328	-65	60	572,889
Absolute Age	13.549	1.644	9.833	17	572,889
Expected Relative Age	5.505	3.354	0	11	572,889
Average Classmate Age	13.550	1.625	9.063	17	572,889
Self-Description					
Right Size	0.558	0.497	0	1	554,546
Too Thin	0.147	0.354	0	1	554,546
Too Fat	0.294	0.456	0	1	554,546
Dieting Behaviors					
On a Diet	0.145	0.352	0	1	454,163
No Reason to Diet	0.561	0.496	0	1	454,163
Should Diet to Gain Weight	0.202	0.402	0	1	454,163
Should Diet to Lose Weight	0.091	0.288	0	1	454,163
Physical Activity					
No. Days Active for 60 Min	4.088	2.045	0	7	560,575
No. Times Exercising	3.321	2.330	0	7	465,717
No. Hours Exercising	2.520	2.223	0	7	358,910
Number of Times Eating					
Fruits	4.940	3.190	0	10	569,785
Vegetables	4.757	3.080	0	10	568,713
Sweets	3.940	3.086	0	10	568,815
Soda	3.238	3.238	0	10	569,084
Weight Outcomes					
BMI	19.389	3.407	5.951	79.861	476,401
Thin	0.047	0.211	0	1	476,401
Normal Weight	0.772	0.419	0	1	476,401
Overweight	0.181	0.385	0	1	476,401
Obese	0.040	0.196	0	1	476,401

Source: Health Behaviours of School-Aged Children, 2002-2018
Note: The summary statistics utilize the sample weights.

Table 2: Relatively Older Students Report Greater Body Satisfaction Than Their Same-Age Counterparts Who Are Relatively Younger Within Their Classrooms

	(1)	(2)	(3)
Panel A: Ordinary Least Squares			
Age	-0.020***	-0.020***	-0.020***
	(0.000)	(0.000)	(0.000)
1 SD ↑ Relative Age	0.007***	0.008***	0.007***
	(0.001)	(0.001)	(0.001)
Panel B: Two-Stage Least Squares			
Age	-0.021***	-0.021***	-0.021***
	(0.001)	(0.000)	(0.000)
1 SD ↑ Relative Age	0.017***	0.019***	0.019***
	(0.002)	(0.003)	(0.003)
2SLS Tests			
LM Statistic	11,952.094	7,794.736	7,548.652
	[0.000]	[0.000]	[0.000]
F-Statistic	1,600.748	1,103.455	1,074.915
J-Statistic	4.373	7.982	6.694
	[0.929]	[0.631]	[0.754]
Full Set of Covariates?		Y	Y
Sample Weights			Y
Mean	0.558	0.558	0.558
Observations	554,546	554,546	554,546

Source: Health Behaviours of School-Aged Children, 2002-2018

Note: The dependent variable is an indicator for whether the student reported being "about the right size." The independent variable of interest indicates the student's relative age in the classroom in months. Column 1 presents results from a sparse specification only controlling for absolute age. Column 2 includes the adolescent's absolute age as a covariate. Column 3 includes time-invariant country-specific fixed effects, location-invariant survey wave-specific fixed effects, month-of-birth fixed effects, an indicator for whether the student is a girl or a boy, an indicator for whether the student's mother is present in the household, an indicator for whether the student's father is present in the household, and indicators for whether the student is from the bottom third, middle third, or top third of the socioeconomic status distribution. The estimates are obtained using a two-stage least squares strategy where birth month relative to the school entry cutoff is an instrument for relative age and the average age of comparable classroom peers is used as an instrument for absolute age. Columns 1 and 2 do not utilize the sample weights, while column 3 utilizes the sample weights. Standard errors, shown in parentheses, are clustered at the classroom level.

*** p < 0.01, ** p < 0.05, * p < 0.10

Table 3: Relatively Older Students Are Less Likely to Describe Themselves as "Too Thin" and "Too Fat" Compared to Their Same-Age Counterparts Who Are Relatively Younger Within Their Classrooms

	(1)	(2)	(3)
Self-Description →	Too Thin	Right Size	Too Fat
Age	0.002***	-0.021***	0.019***
	(0.000)	(0.000)	(0.000)
1 SD ↑ Relative Age	-0.011***	0.019***	-0.009***
	(0.002)	(0.003)	(0.003)
Mean	0.147	0.558	0.294
Observations	554,546	554,546	554,546
2SLS Tests			
LM Statistic	7,548.652	7,548.652	7,548.652
	[0.000]	[0.000]	[0.000]
F-Statistic	1,074.915	1,074.915	1,074.915
J-Statistic	14.133	6.694	6.453
	[0.167]	[0.754]	[0.776]

Source: Health Behaviours of School-Aged Children, 2002-2018

Note: The dependent variable in column 1 is an indicator for whether the student described his/her body as "too thin," in column 2 for whether the student described his/her body as being "about the right size," and in column 3 for whether the student described his/her body as being "too fat." The estimates are obtained using a two-stage least squares strategy where birth month relative to the school entry cutoff is an instrument for relative age and the average age of comparable classroom peers is used as an instrument for absolute age. All columns use the full set of controls from Table 2 column 3. The estimates utilize the sample weights. Standard errors, shown in parentheses, are clustered at the classroom level.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Table 4: Relatively Older Students Are Less Likely to Describe Themselves as "Too Thin" and "Too Fat" Compared to Their Same-Age Counterparts Who Are Relatively Younger Within Their Classrooms

	(1)	(2)	(3)	(4)	(5)	(6)
	Adolescent Girls			Adolescent Boys		
Self-Description →	Too Thin	Right Size	Too Fat	Too Thin	Right Size	Too Fat
Age	-0.009***	-0.028***	0.037***	0.013***	-0.013***	-0.000
	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
1 SD ↑ Relative Age	-0.009***	0.017***	-0.008**	-0.013***	0.022***	-0.009**
	(0.002)	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)
Mean	0.120	0.522	0.359	0.176	0.597	0.226
Observations	284,746	284,746	284,746	269,800	269,800	269,800
2SLS Tests						
LM Statistic	6,212.364	6,212.364	6,212.364	6,212.364	6,212.364	6,212.364
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
F-Statistic	855.274	855.274	855.274	667.816	667.816	667.816
J-Statistic	7.953	4.956	8.022	6.694	6.694	6.453
	[0.633]	[0.894]	[0.627]	[0.038]	[0.046]	[0.762]

Source: Health Behaviours of School-Aged Children, 2002-2018

Note: The dependent variable in column 1 is an indicator for whether the student described his/her body as "too thin," in column 2 for whether the student described his/her body as being "about the right size," and in column 3 for whether the student described his/her body as being "too fat." The estimates are obtained using a two-stage least squares strategy where birth month relative to the school entry cutoff is an instrument for relative age and the average age of comparable classroom peers is used as an instrument for absolute age. All columns use the full set of controls from Table 2 column 3. The estimates utilize the sample weights. Standard errors, shown in parentheses, are clustered at the classroom level.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Table 5: Relatively Younger Students Are More Likely to Want to Gain Weight Than Their Same-Age Counterparts Who Are Relatively Older Within Their Classrooms

	(1)	(2)	(3)	(4)
Outcome →	Currently on a Diet	No Reason to Diet	Not Dieting Because Should Gain Weight	Not Dieting but Should Lose Weight
Age	0.010***	-0.024***	0.005***	0.008***
	(0.000)	(0.001)	(0.000)	(0.000)
1 SD ↑ Relative Age	-0.002	0.013***	-0.008***	-0.003
	(0.002)	(0.003)	(0.002)	(0.002)
Mean	0.145	0.561	0.202	0.091
Observations	454,163	454,163	454,163	454,163
2SLS Tests				
LM Statistic	5,887.03	5,887.03	5,887.03	5,887.03
	[0.000]	[0.000]	[0.000]	[0.000]
F-Statistic	850.319	850.319	850.319	850.319
J-Statistic	5.050	6.113	12.961	4.707
	[0.888]	[0.806]	[0.226]	[0.910]

Source: Health Behaviours of School-Aged Children, 2002-2018

Note: The dependent variable in column 1 is an indicator for whether the student reported currently being on a diet, in column 2 for whether the student reported not having any reason to diet, in column 3 for whether the student reported that while s/he isn't on a diet s/he should diet to gain weight, and in column 4 for whether the student reported that while s/he isn't on a diet s/he should diet to lose weight. The estimates are obtained using a two-stage least squares strategy where birth month relative to the school entry cutoff is an instrument for relative age and the average age of comparable classroom peers is used as an instrument for absolute age. All columns use the full set of controls from Table 2 column 3. The estimates utilize the sample weights. Standard errors, shown in parentheses, are clustered at the classroom level.

*** p < 0.01, ** p < 0.05, * p < 0.10

Table 6: Relatively Older Students Are More Physically Active Than Their Same-Age Counterparts Who Are Relatively Younger Within Their Classrooms

	(1)	(2)	(3)
Outcome →	Number of Days Last Week Physically Active for ≥ 60 Minutes	Number of Times Exercising Outside of School	Number of Hours Exercising Outside of School
Age	-0.164***	-0.170***	0.028***
	(0.002)	(0.003)	(0.003)
1 SD ↑ Relative Age	0.121***	0.150***	0.098***
	(0.011)	(0.014)	(0.014)
Mean	4.088	3.321	2.520
Observations	560,575	465,717	358,910
2SLS Tests			
LM Statistic	7,637.85	6,941.715	5,382.08
	[0.000]	[0.000]	[0.000]
F-Statistic	3,286.805	2,924.342	2,423.808
J-Statistic	8.435	10.243	13.918
	[0.586]	[0.419]	[0.177]

Source: Health Behaviours of School-Aged Children, 2002-2018

Note: The dependent variable in column 1 is the number of days the student reports being physically active for at least 60 minutes. The dependent variable in column 2 is the number of times the student reports exercising outside of school where s/he gets out of breath or sweats. The dependent variable in column 3 is the number of hours a week that the student reports exercising where s/he gets out of breath or sweats. The estimates are obtained using a two-stage least squares strategy where birth month relative to the school entry cutoff is an instrument for relative age and the average age of comparable classroom peers is used as an instrument for absolute age. All columns use the full set of controls from Table 2 column 3. The estimates utilize the sample weights. Standard errors, shown in parentheses, are clustered at the classroom level.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Table 7: Relatively Younger Students Consume Fewer Low-Calorie Items and More Calorie-Dense Items Than Their Same-Age Counterparts Who Are Relatively Older Within Their Classrooms

	(1)	(2)	(3)	(4)
Times Per Week Eating →	Fruits	Vegetables	Sweets	Soda
Age	-0.211***	-0.057***	0.138***	0.145***
	(0.003)	(0.003)	(0.003)	(0.004)
1 SD ↑ Relative Age	0.085***	0.056**	-0.051**	-0.075***
	(0.018)	(0.017)	(0.017)	(0.019)
Mean	4.940	4.757	3.940	3.238
Observations	569,785	568,713	568,815	569,084
2SLS Tests				
LM Statistic	7,644.706	7,637.627	7,641.883	7,644.472
	[0.000]	[0.000]	[0.000]	[0.000]
F-Statistic	1,098.825	1,096.539	1,097.638	1,098.025
J-Statistic	9.510	8.091	10.656	14.879
	[0.484]	[0.620]	[0.385]	[0.137]

Source: Health Behaviours of School-Aged Children, 2002-2018

Note: The dependent variable in column 1 is the number of times per week the student reports eating fruits, in column 2 the number of times per week the student reports eating vegetables, in column 3 the number of times per week the student reports eating sweets, and in column 4 the number of times per week the student reports drinking sodas. The estimates are obtained using a two-stage least squares strategy where birth month relative to the school entry cutoff is an instrument for relative age and the average age of comparable classroom peers is used as an instrument for absolute age. All columns use the full set of controls from Table 2 column 3. The estimates utilize the sample weights. Standard errors, shown in parentheses, are clustered at the classroom level.

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

Table 8: Relatively Younger Students Are More Likely to Be Overweight or Obese Than Their Same-Age Counterparts Who Are Relatively Older Within Their Classrooms

	(1)	(2)	(3)	(4)	(5)
		WHO BMI Category			
Outcome →	BMI	Thin	Normal Weight	Overweight	Obese
Age	0.703***	-0.008***	0.021***	-0.013***	-0.005***
	(0.003)	(0.000)	(0.000)	(0.000)	(0.000)
1 SD ↑ Relative Age	-0.135***	0.004**	0.008***	-0.012***	-0.005***
	(0.020)	(0.001)	(0.003)	(0.002)	(0.001)
Mean	19.389	0.047	0.772	0.181	0.040
Observations	476,401	476,401	476,401	476,401	476,401
2SLS Tests					
LM Statistic	6,982.511	6,982.511	6,982.511	6,982.511	6,982.511
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
F-Statistic	937.662	937.662	937.662	937.662	937.662
J-Statistic	8.920	13.844	15.452	8.358	12.688
	[0.540]	[0.180]	[0.116]	[0.594]	[0.242]

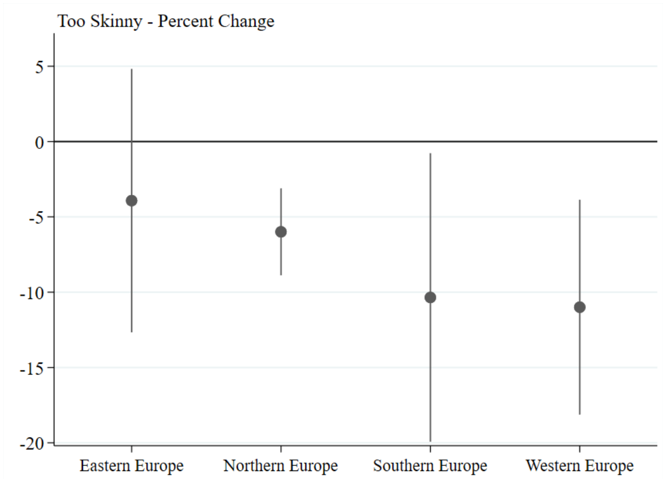
Source: Health Behaviours of School-Aged Children, 2002-2018

Note: The dependent variable in column 1 is the adolescent's body mass index. The dependent variable in column 2 is an indicator for whether the adolescent is classified as "thin," in column 3 for whether the adolescent is classified as "normal weight," in column 4 for whether the adolescent is classified as "overweight," and in column 5 for whether the adolescent is classified as "obese." The estimates are obtained using a two-stage least squares strategy where birth month relative to the school entry cutoff is an instrument for relative age and the average age of comparable classroom peers is used as an instrument for absolute age. All columns use the full set of controls from Table 2 column 3. The estimates utilize the sample weights. Standard errors, shown in parentheses, are clustered at the classroom level.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Appendix

Appendix Figure 1: Relationship Between Relative Age and Body Image, by Region of Europe



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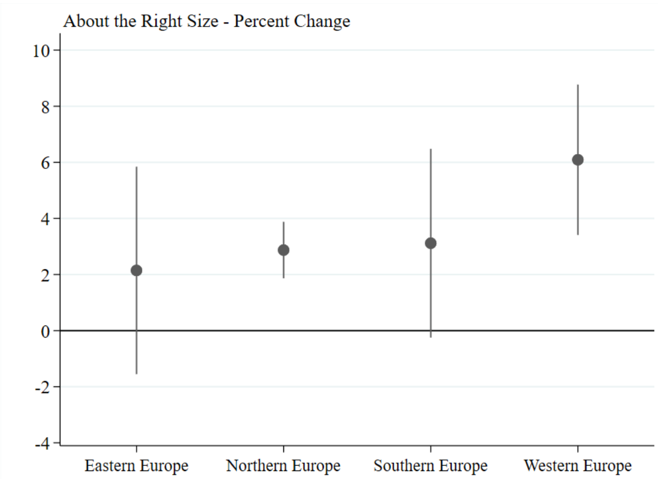
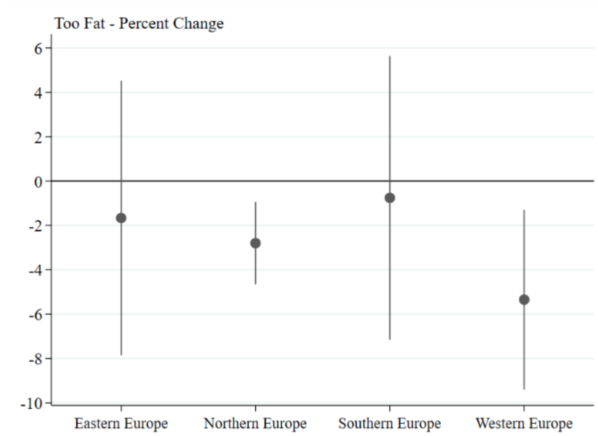


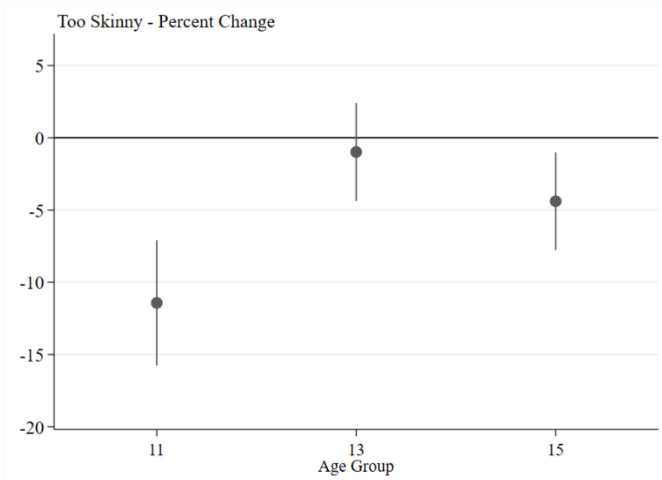
(B)



(C)

Source: Health Behaviors of School Aged Children, 2002-2018
Notes: The figures plot the percent change relative to the sample mean associated with a one standard deviation increase in relative age. The dependent variable in Panel A is an indicator for whether the adolescent described his or herself as "too skinny." The dependent variable in Panel B is an indicator for whether the adolescent described his or herself as "about the right size." The dependent variable in Panel C is an indicator for whether the adolescent described his or herself as "too fat." Observations are limited to the region of Europe indicated on the horizontal axis. The circles plot the estimates, and the vertical lines denote the corresponding 95 percent confidence intervals. The estimates are obtained using a two-stage least squares strategy where birth month relative to the school entry cutoff is an instrument for relative age and the average age of comparable classroom peers is used as an instrument for absolute age. All estimates use the full set of controls from Table 2 column 3. The estimates utilize the sample weights. Standard errors are clustered at the classroom level.

Appendix Figure 2: Relationship Between Relative Age and Body Image, by Age Group



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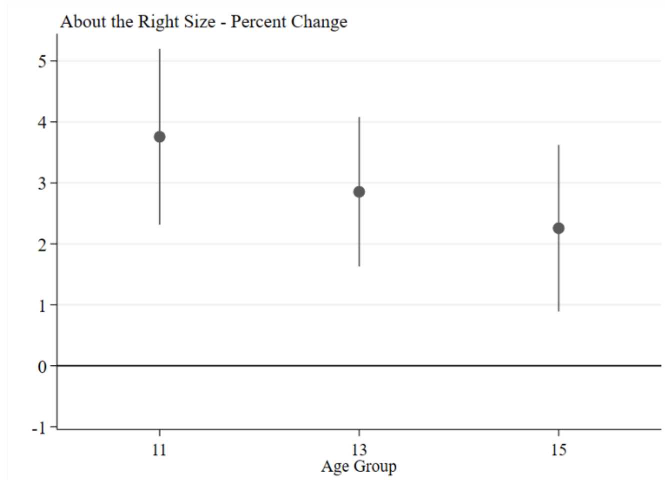

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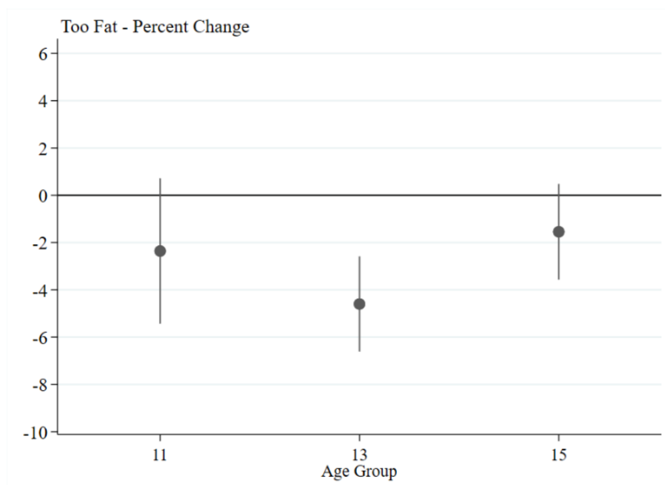
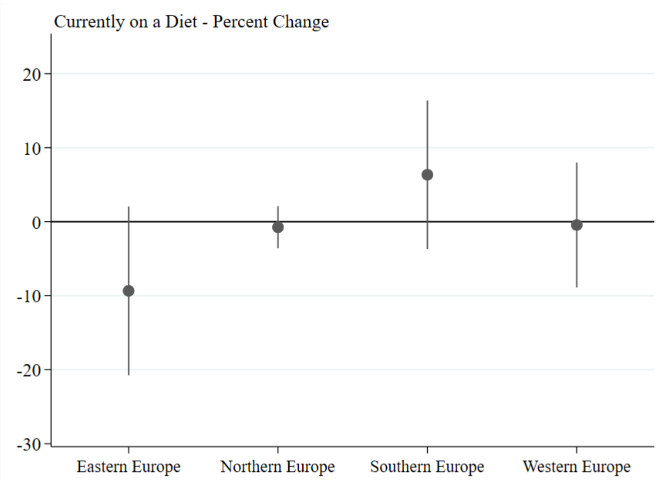


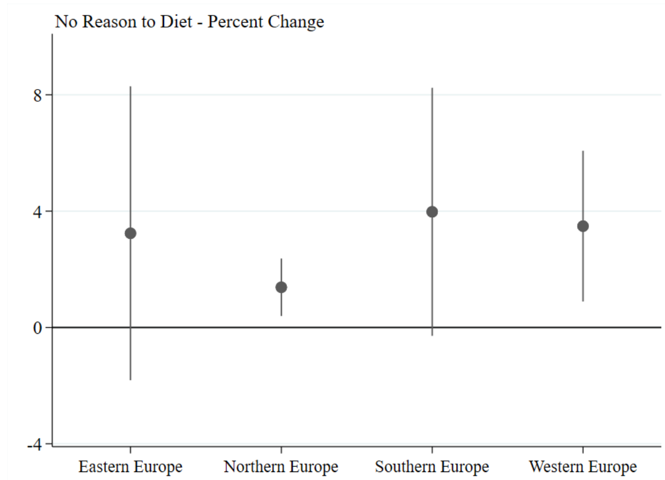
(C)

Source: Health Behaviors of School Aged Children, 2002-2018
Notes: The figures plot the percent change relative to the sample mean associated with a one standard deviation increase in relative age. The dependent variable in Panel A is an indicator for whether the adolescent described his or herself as "too skinny." The dependent variable in Panel B is an indicator for whether the adolescent described his or herself as "about the right size." The dependent variable in Panel C is an indicator for whether the adolescent described his or herself as "too fat." Observations are limited to the age category indicated on the horizontal axis. The circles plot the estimates, and the vertical lines denote the corresponding 95 percent confidence intervals. The estimates are obtained using a two-stage least squares strategy where birth month relative to the school entry cutoff is an instrument for relative age and the average age of comparable classroom peers is used as an instrument for absolute age. All estimates use the full set of controls from Table 2 column 3. The estimates utilize the sample weights. Standard errors are clustered at the classroom level.

Appendix Figure 3: Relationship Between Relative Age and Dieting Behaviors, by Region of Europe

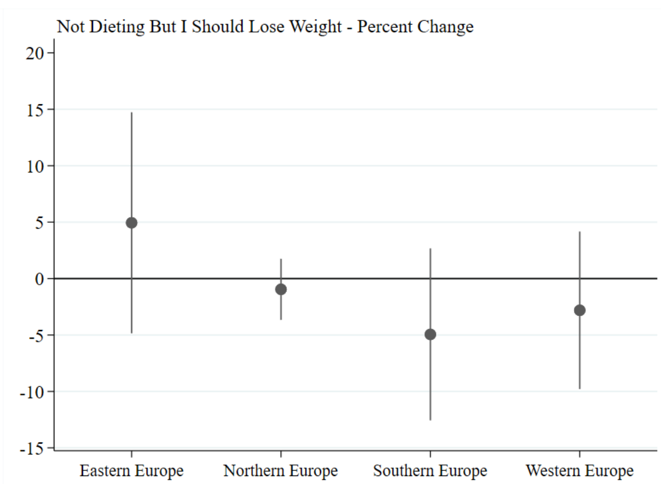


(A)



(B)

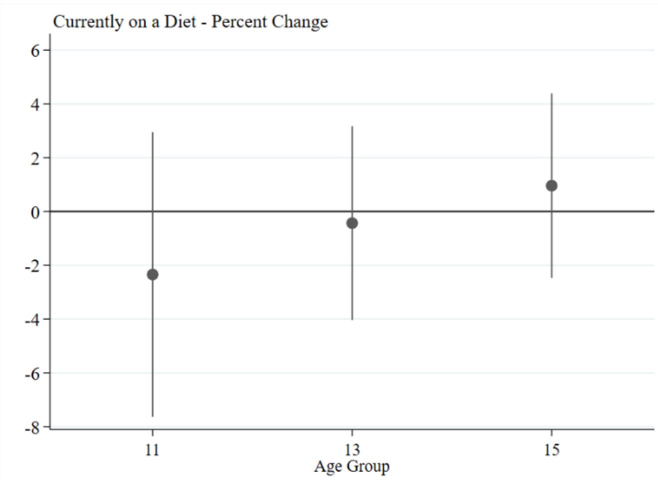
(C)



(D)

Source: Health Behaviors of School Aged Children, 2002-2018
Notes: The figures plot the percent change relative to the sample mean associated with a one standard deviation increase in relative age. The dependent variable in Panel A is an indicator for whether the adolescent reported being on a diet. The dependent variable in Panel B is an indicator for whether the adolescent reported having no reason to diet. The dependent variable in Panel C is an indicator for whether the adolescent reported not being on a diet but feeling that s/he should gain weight. The dependent variable in Panel D is an indicator for whether the adolescent reported not being on a diet but feeling that s/he should lose weight. Observations are limited to the region of Europe indicated on the horizontal axis. The circles plot the estimates, and the vertical lines denote the corresponding 95 percent confidence intervals. The estimates are obtained using a two-stage least squares strategy where birth month relative to the school entry cutoff is an instrument for relative age and the average age of comparable classroom peers is used as an instrument for absolute age. All estimates use the full set of controls from Table 2 column 3. The estimates utilize the sample weights. Standard errors are clustered at the classroom level.

Appendix Figure 4: Relationship Between Relative Age and Dieting Behaviors, by Age Group



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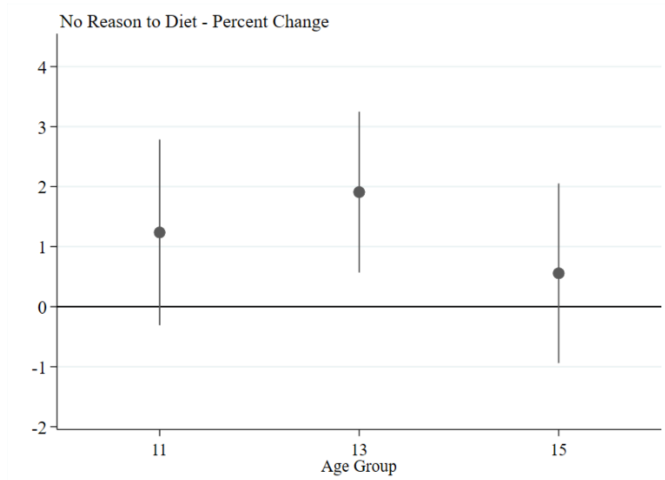

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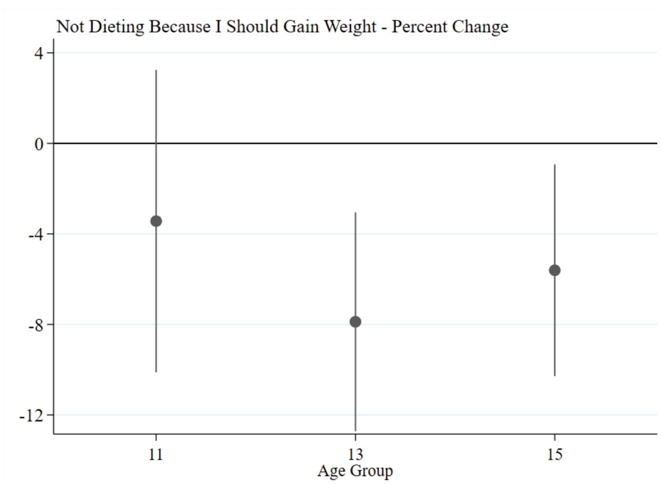

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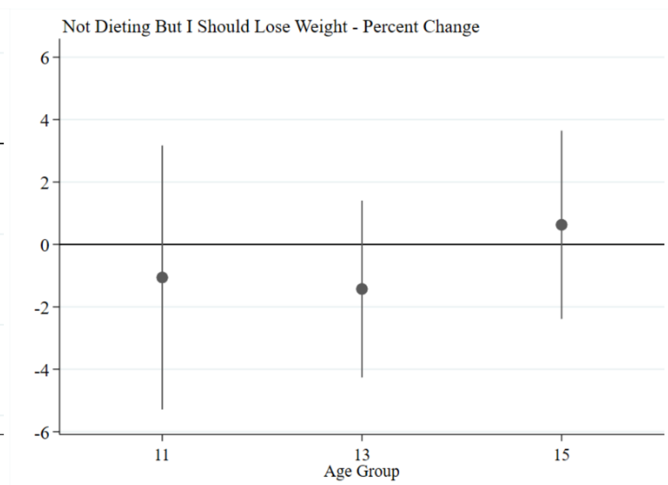
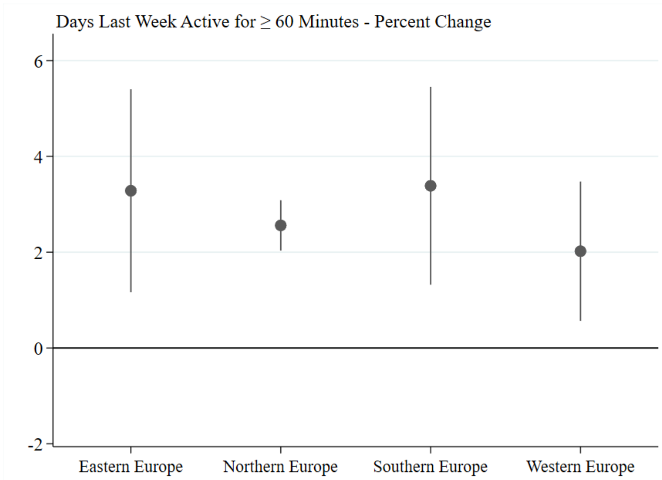


(D)

Source: Health Behaviors of School Aged Children, 2002-2018
Notes: The figures plot the percent change relative to the sample mean associated with a one standard deviation increase in relative age. The dependent variable in Panel A is an indicator for whether the adolescent reported being on a diet. The dependent variable in Panel B is an indicator for whether the adolescent reported having no reason to diet. The dependent variable in Panel C is an indicator for whether the adolescent reported not being on a diet but feeling that s/he should gain weight. The dependent variable in Panel D is an indicator for whether the adolescent reported not being on a diet but feeling that s/he should lose weight. Observations are limited to the age category indicated on the horizontal axis. The circles plot the estimates, and the vertical lines denote the corresponding 95 percent confidence intervals. The estimates are obtained using a two-stage least squares strategy where birth month relative to the school entry cutoff is an instrument for relative age and the average age of comparable classroom peers is used as an instrument for absolute age. All estimates use the full set of controls from Table 2 column 3. The estimates utilize the sample weights. Standard errors are clustered at the classroom level.

Appendix Figure 5: Relationship Between Relative Age and Physical Activity, by Region of Europe



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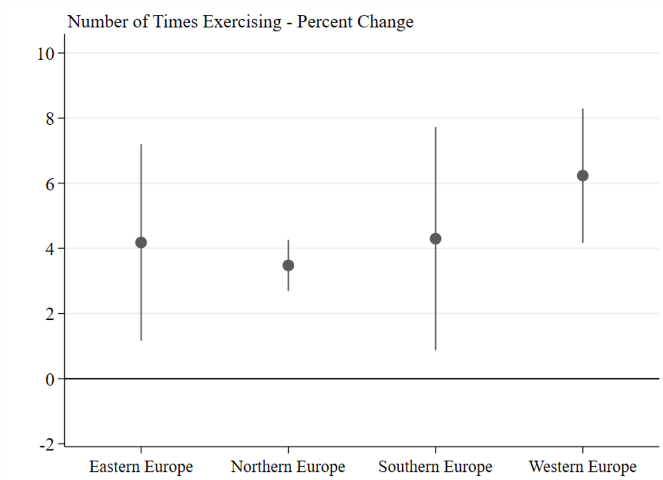

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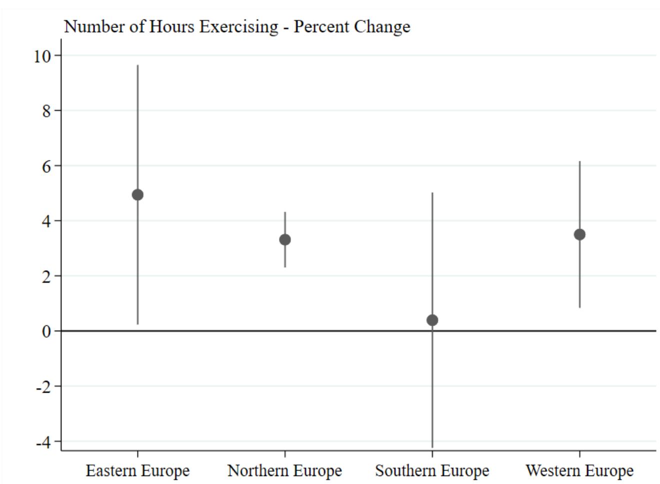
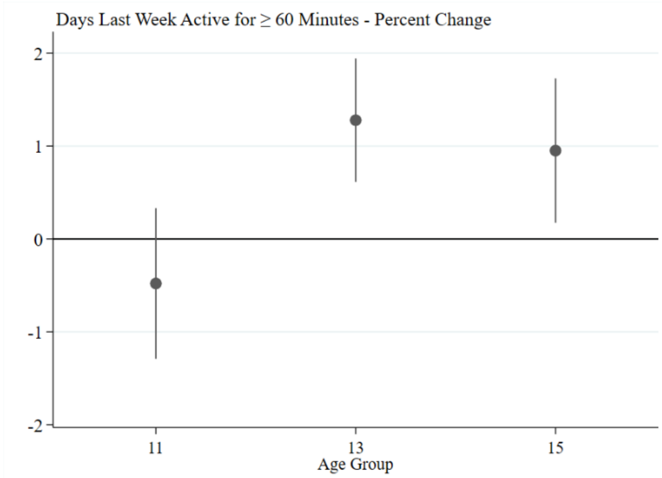


(C)

Source: Health Behaviors of School Aged Children, 2002-2018
Notes: The figures plot the percent change relative to the sample mean associated with a one standard deviation increase in relative age. The dependent variable in Panel A is the number of days that the adolescent reported being active for at least 60 minutes during the past week. The dependent variable in Panel B is the number of times the adolescent reported exercising outside of school during the past week. The dependent variable in Panel C is the number of hours the adolescent reported exercising outside of school during the past week. Observations are limited to the region of Europe indicated on the horizontal axis. The circles plot the estimates, and the vertical lines denote the corresponding 95 percent confidence intervals. The estimates are obtained using a two-stage least squares strategy where birth month relative to the school entry cutoff is an instrument for relative age and the average age of comparable classroom peers is used as an instrument for absolute age. All estimates use the full set of controls from Table 2 column 3. The estimates utilize the sample weights. Standard errors are clustered at the classroom level.

Appendix Figure 6: Relationship Between Relative Age and Physical Activity, by Age Group



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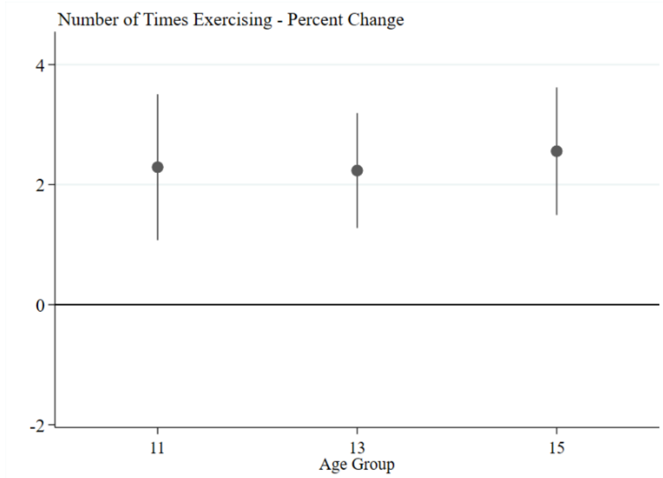
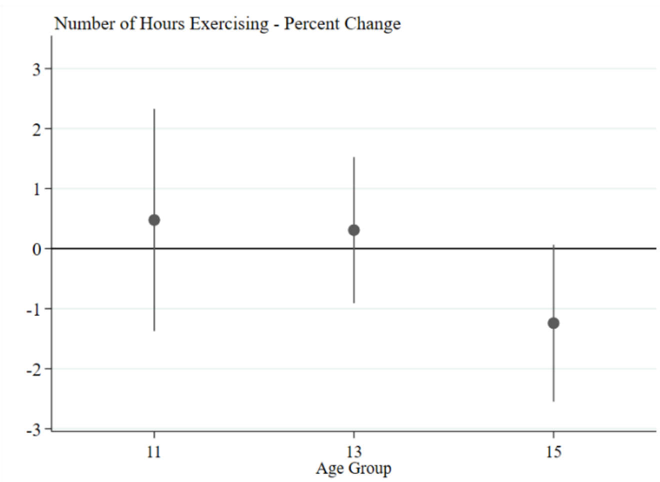


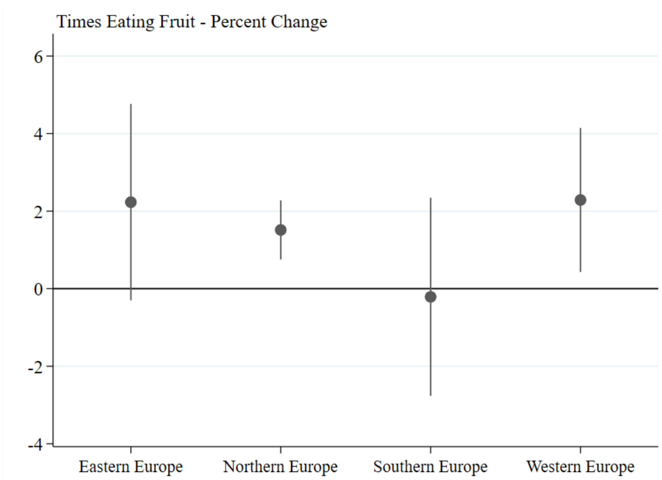
(B)



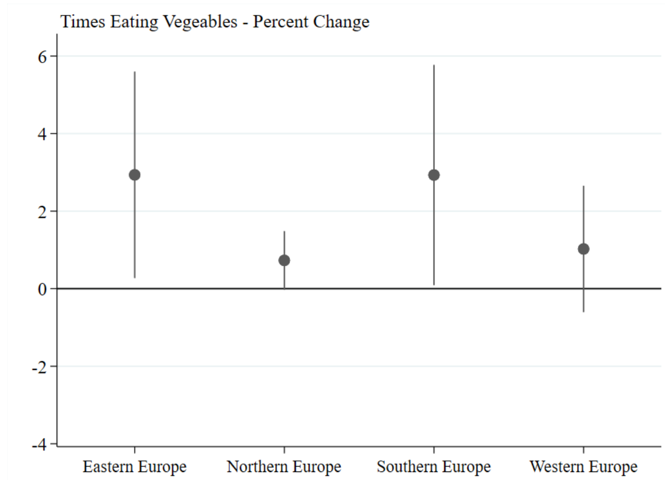
(C)

Source: Health Behaviors of School Aged Children, 2002-2018
Notes: The figures plot the percent change relative to the sample mean associated with a one standard deviation increase in relative age. The dependent variable in Panel A is the number of days that the adolescent reported being active for at least 60 minutes during the past week. The dependent variable in Panel B is the number of times the adolescent reported exercising outside of school during the past week. The dependent variable in Panel C is the number of hours the adolescent reported exercising outside of school during the past week. Observations are limited to the age category indicated on the horizontal axis. The circles plot the estimates, and the vertical lines denote the corresponding 95 percent confidence intervals. The estimates are obtained using a two-stage least squares strategy where birth month relative to the school entry cutoff is an instrument for relative age and the average age of comparable classroom peers is used as an instrument for absolute age. All estimates use the full set of controls from Table 2 column 3. The estimates utilize the sample weights. Standard errors are clustered at the classroom level.

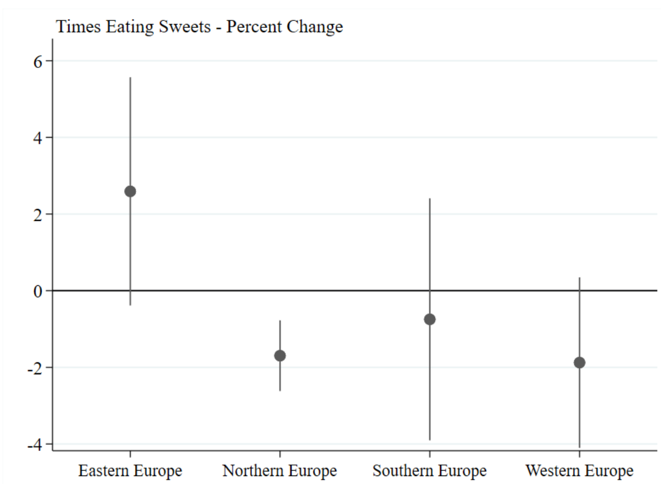
Appendix Figure 7: Relationship Between Relative Age and Nutritional Intake, by Region of Europe



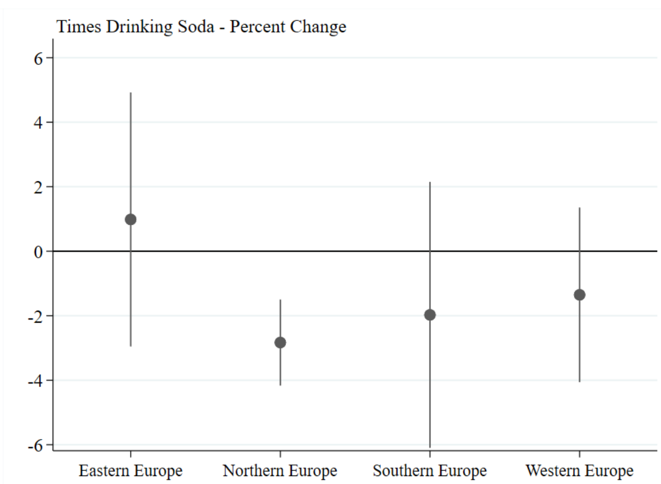
(A)



(B)



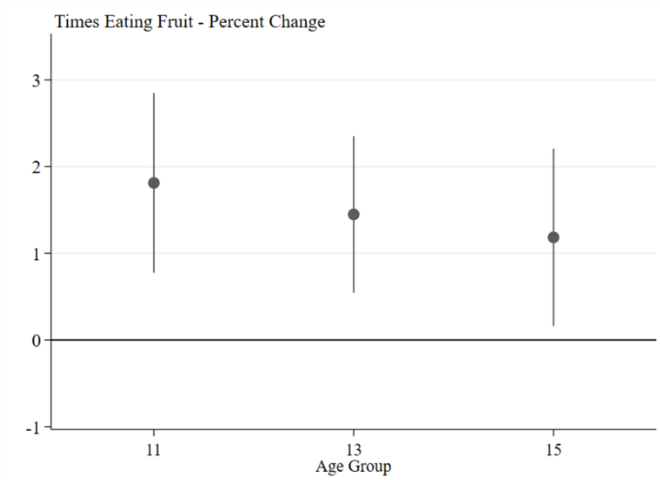
(C)



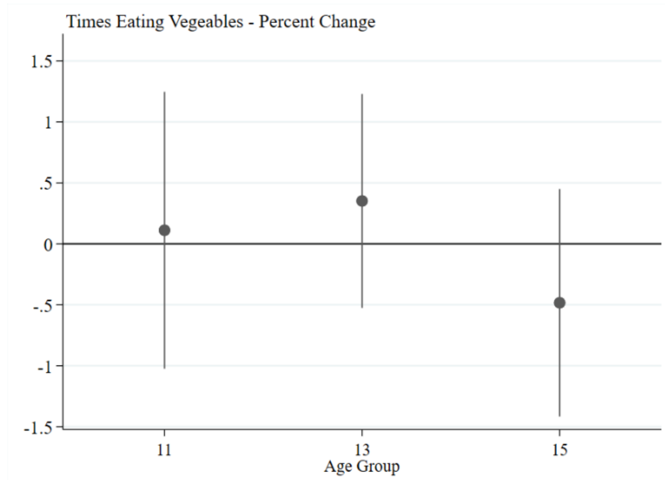
(D)

Source: Health Behaviors of School Aged Children, 2002-2018
Notes: The figures plot the percent change relative to the sample mean associated with a one standard deviation increase in relative age. The dependent variable in Panel A is the number of times the adolescent reported consuming fruit each week. The dependent variable in Panel B is the number of times the adolescent reported consuming vegetables each week. The dependent variable in Panel C is the number of times the adolescent reported consuming sweets each week. The dependent variable in Panel D is the number of times the adolescent reported consuming soda each week. Observations are limited to the region of Europe indicated on the horizontal axis. The circles plot the estimates, and the vertical lines denote the corresponding 95 percent confidence intervals. The estimates are obtained using a two-stage least squares strategy where birth month relative to the school entry cutoff is an instrument for relative age and the average age of comparable classroom peers is used as an instrument for absolute age. All estimates use the full set of controls from Table 2 column 3. The estimates utilize the sample weights. Standard errors are clustered at the classroom level.

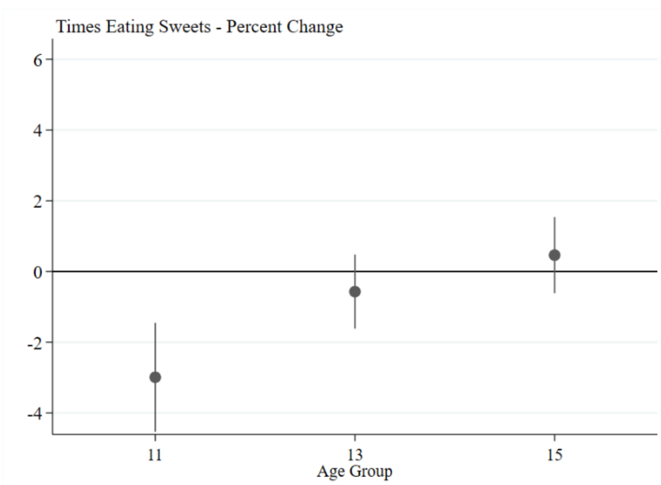
Appendix Figure 8: Relationship Between Relative Age and Nutritional Intake, by Age Group



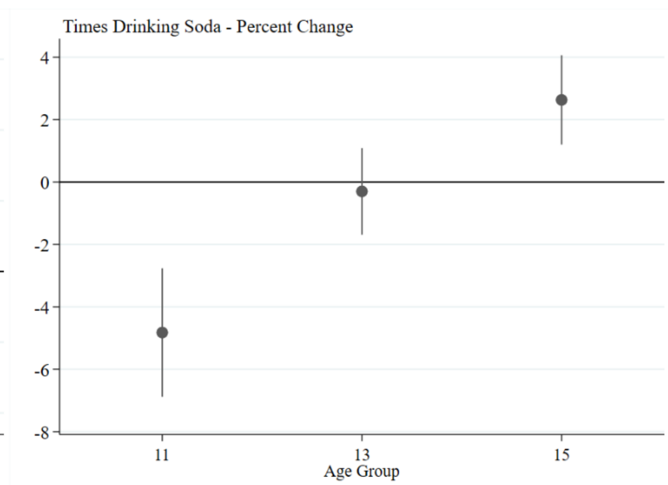
(A)



(B)



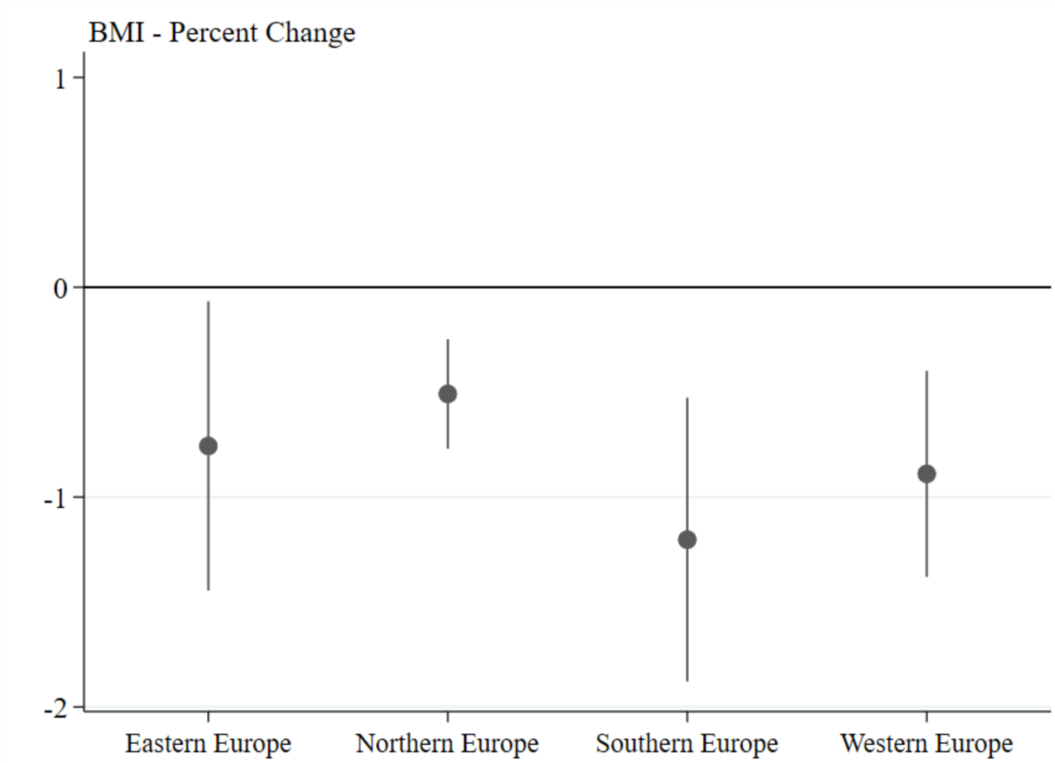
(C)



(D)

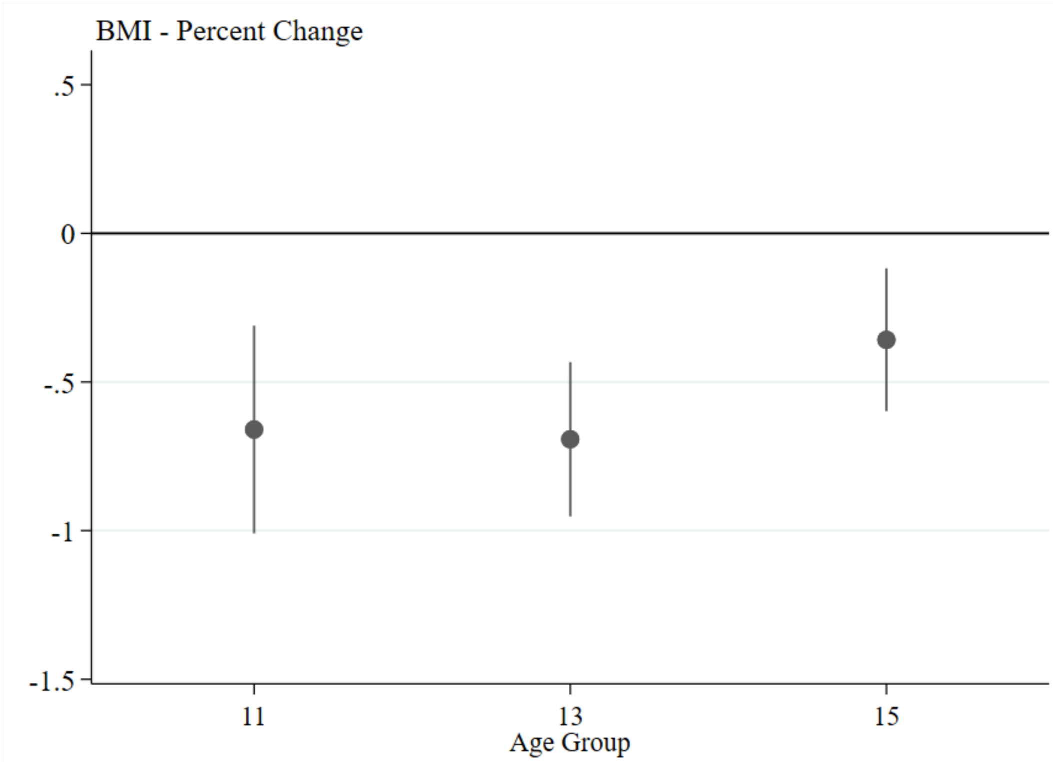
Source: Health Behaviors of School Aged Children, 2002-2018
Notes: The figures plot the percent change relative to the sample mean associated with a one standard deviation increase in relative age. The dependent variable in Panel A is the number of times the adolescent reported consuming fruit each week. The dependent variable in Panel B is the number of times the adolescent reported consuming vegetables each week. The dependent variable in Panel C is the number of times the adolescent reported consuming sweets each week. The dependent variable in Panel D is the number of times the adolescent reported consuming soda each week. Observations are limited to the age category indicated on the horizontal axis. The circles plot the estimates, and the vertical lines denote the corresponding 95 percent confidence intervals. The estimates are obtained using a two-stage least squares strategy where birth month relative to the school entry cutoff is an instrument for relative age and the average age of comparable classroom peers is used as an instrument for absolute age. All estimates use the full set of controls from Table 2 column 3. The estimates utilize the sample weights. Standard errors are clustered at the classroom level.

Appendix Figure 9: Relationship Between Relative Age and BMI, by Region of Europe



Source: Health Behaviors of School Aged Children, 2002-2018
Notes: The figures plot the percent change relative to the sample mean associated with a one standard deviation increase in relative age. The dependent variable is the adolescent's body mass index. Observations are limited to the region of Europe indicated on the horizontal axis. The circles plot the estimates, and the vertical lines denote the corresponding 95 percent confidence intervals. The estimates are obtained using a two-stage least squares strategy where birth month relative to the school entry cutoff is an instrument for relative age and the average age of comparable classroom peers is used as an instrument for absolute age. All estimates use the full set of controls from Table 2 column 3. The estimates utilize the sample weights. Standard errors are clustered at the classroom level.

Appendix Figure 10: Relationship Between Relative Age and BMI, by Age Group



Source: Health Behaviors of School Aged Children, 2002-2018
Notes: The figures plot the percent change relative to the sample mean associated with a one standard deviation increase in relative age. The dependent variable is the adolescent's body mass index. Observations are limited to the age category indicated on the horizontal axis. The circles plot the estimates, and the vertical lines denote the corresponding 95 percent confidence intervals. The estimates are obtained using a two-stage least squares strategy where birth month relative to the school entry cutoff is an instrument for relative age and the average age of comparable classroom peers is used as an instrument for absolute age. All estimates use the full set of controls from Table 2 column 3. The estimates utilize the sample weights. Standard errors are clustered at the classroom level.

Appendix Table 1: Summary Statistics of Explanatory Variables

	(1)	(2)	(3)	(4)	(5)
	Mean	Std. Dev.	Minimum	Maximum	Observations
Weight	50.975	13.093	19	150	505,980
Height	161.614	11.828	120	256	503,290
Girl	0.511	0.500	0	1	572,889
Mom at Home	0.946	0.225	0	1	572,889
Dad at Home	0.790	0.407	0	1	572,889
Low Socioeconomic Status	0.272	0.445	0	1	572,889
Middle Socioeconomic Status	0.364	0.481	0	1	572,889
High Socioeconomic Status	0.364	0.481	0	1	572,889

Source: Health Behaviours of School-Aged Children, 2002-2018

Note: The summary statistics utilize the sample weights.

Appendix Table 2: School Entry Cutoff Dates

Country	Cutoff
Austria	September 1st
Belgium, Flanders	January 1st
Belgium, Wallonia	January 1st
Bulgaria	January 1st
Croatia	April 1st
Czech Republic	September 1st
Denmark	January 1st
England	September 1st
Estonia	October 1st
Finland	January 1st
France	January 1st
Greece	January 1st
Greenland	January 1st
Hungary	July 1st
Iceland	January 1st
Ireland	January 1st
Italy	January 1st
Latvia	January 1st
Lithuania	January 1st
Luxembourg	September 1st
Macedonia	January 1st
Malta	January 1st
Netherlands	October 1st
Norway	January 1st
Poland	September 1st
Scotland	March 1st
Slovakia	September 1st
Slovenia	January 1st
Spain	January 1st
Sweden	January 1st
Switzerland	July 1st
Ukraine	January 1st
Wales	September 1st

Source: Fumarco and Baert (2019)

Appendix Table 3: Relationship Between the Instrumental Variables and the Righthand Side Demographic Characteristics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Outcome →	Age	Girl	Mom at Home	Dad at Home	Low SES	Middle SES	High SES
Birth Month Relative to the School Entry Cutoff							
0	-	-	-	-	-	-	-
1	0.006	-0.001	-0.001	-0.007*	-0.003	0.006	-0.003
	(0.016)	(0.005)	(0.002)	(0.004)	(0.004)	(0.005)	(0.004)
2	-0.057***	0.002	-0.001	0.002	-0.002	0.005	-0.004
	(0.014)	(0.004)	(0.002)	(0.003)	(0.004)	(0.004)	(0.004)
3	-0.103***	-0.001	-0.002	-0.003	-0.004	0.002	0.002
	(0.017)	(0.005)	(0.002)	(0.004)	(0.004)	(0.005)	(0.004)
4	-0.086***	0.002	-0.004**	-0.002	-0.002	0.001	0.002
	(0.014)	(0.004)	(0.002)	(0.003)	(0.003)	(0.004)	(0.004)
5	-0.136***	0.000	-0.002	-0.002	0.003	0.007	-0.010**
	(0.017)	(0.005)	(0.002)	(0.004)	(0.004)	(0.005)	(0.004)
6	-0.150***	0.003	-0.002	0.001	0.005	-0.002	-0.003
	(0.014)	(0.004)	(0.002)	(0.003)	(0.003)	(0.004)	(0.004)
7	-0.206***	0.011**	-0.001	0.002	-0.002	0.005	-0.003
	(0.017)	(0.005)	(0.002)	(0.004)	(0.004)	(0.005)	(0.004)
8	-0.250***	0.007*	-0.002	0.002	-0.001	0.004	-0.003
	(0.014)	(0.004)	(0.002)	(0.003)	(0.003)	(0.004)	(0.004)
9	-0.304***	0.003	-0.000	-0.001	-0.003	0.009*	-0.006
	(0.017)	(0.005)	(0.002)	(0.003)	(0.004)	(0.005)	(0.004)
10	-0.260***	0.003	-0.002	-0.003	0.006	0.006	-0.011***
	(0.015)	(0.004)	(0.002)	(0.004)	(0.004)	(0.004)	(0.004)
11	-0.298***	0.002	-0.003	-0.007*	0.003	0.001	-0.004
	(0.017)	(0.005)	(0.002)	(0.004)	(0.004)	(0.005)	(0.004)
Country FE?	Y	Y	Y	Y	Y	Y	Y
Survey Wave FE?	Y	Y	Y	Y	Y	Y	Y
Birth Month FE?	Y	Y	Y	Y	Y	Y	Y
Observations	572,889	572,889	572,889	572,889	572,889	572,889	572,889

Source: Health Behaviours of School-Aged Children, 2002-2018

Note: The dependent variable in column 1 is the student's age, in column 2 an indicator for whether the student is a girl, in column 3 for whether the student's mother is at home, in column 4 for whether the student's father is at home, in column 5 for whether the student is classified as low socioeconomic status, in column 6 for whether the student is classified as middle socioeconomic status, and in column 7 for whether the student is classified as high socioeconomic status. The estimates report reduced form results where the independent variables of interest indicate the student's birth month relative to the school entry cutoff month. The regressions include country fixed effects, survey wave fixed effects, and month-of-birth fixed effects. The estimates utilize the sample weights. Standard errors, shown in parentheses, are clustered at the classroom level.

*** p < 0.01, ** p < 0.05, * p < 0.10

Appendix Table 4: The Relationship Between Relative Age and Body Image is Robust to Dropping Students Born Around the School Entry Cutoff Month

	(1)	(2)	(3)
Months Excluded Around the Cutoff →	+/- 1 Month	+/- 2 Months	+/- 3 Months
Age	-0.020***	-0.020***	-0.020***
	(0.001)	(0.001)	(0.001)
1 SD ↑ Relative Age	0.018***	0.012**	0.014*
	(0.003)	(0.004)	(0.006)
Mean	0.559	0.559	0.559
Observations	468,838	384,865	294,099
2SLS Tests			
LM Statistic	6,776.372	4,683.88	3,336.85
	[0.000]	[0.000]	[0.000]
F-Statistic	1,154.384	1,347.288	1,190.749
J-Statistic	6.73	2.69	2.863
	[0.566]	[0.847]	[0.581]

Source: Health Behaviours of School-Aged Children, 2002-2018

Note: The dependent variable is an indicator for whether the student reported feeling that his or her body is about the right size. The estimates are obtained using a two-stage least squares strategy where birth month relative to the school entry cutoff is an instrument for relative age and the average age of comparable classroom peers is used as an instrument for absolute age. All columns use the full set of controls from Table 2 column 3. Column 1 drops students born the month prior to the school entry cutoff and the month of the school entry cutoff. Column 2 drops students born two months prior to the cutoff month, the cutoff month, or the month following the cutoff. Column 3 drops students born three months prior to the cutoff month, during the cutoff month, or the two months following the cutoff months. The estimates utilize the sample weights. Standard errors, shown in parentheses, are clustered at the classroom level.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Appendix Table 5: Relationship Between Relative Age and Dieting Behaviors, by Sex

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Adolescent Girls				Adolescent Boys			
Outcome →	Currently on a Diet	No Reason to Diet	Should Diet to Gain Weight	Should Diet to Lose Weight	Currently on a Diet	No Reason to Diet	Should Diet to Gain Weight	Should Diet to Lose Weight
Age	0.027***	-0.043***	-0.003***	0.019***	-0.007***	-0.004***	0.014***	-0.003***
	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)
1 SD ↑ Relative Age	-0.002	0.008**	-0.005**	0.000	-0.001	0.018***	-0.012***	-0.005
	(0.003)	(0.004)	(0.002)	(0.003)	(0.003)	(0.005)	(0.003)	(0.003)
Mean	0.187	0.494	0.074	0.245	0.102	0.632	0.109	0.157
Observations	232,845	232,845	232,845	232,845	221,318	221,318	221,318	221,318
2SLS Tests								
LM Statistic	4,934.459	4,934.459	4,934.459	4,934.459	4,130.484	4,130.484	4,130.484	4,130.484
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
F-Statistic	695.482	695.482	695.482	695.482	528.501	528.501	528.501	528.501
J-Statistic	4.075	3.525	6.741	2.026	8.067	8.728	23.349	8.114
	[0.944]	[0.966]	[0.750]	[0.996]	[0.622]	[0.558]	[0.010]	[0.618]

Source: Health Behaviours of School-Aged Children, 2002-2018

Note: The dependent variable in columns 1 and 5 is an indicator for whether the student reported currently being on a diet, in columns 2 and 6 for whether the student reported not having any reason to diet, in columns 3 and 7 for whether the student reported that while s/he isn’t on a diet s/he should diet to gain weight, and in columns 4 and 8 for whether the student reported that while s/he isn’t on a diet s/he should diet to lose weight. Columns 1-4 examine adolescent girls, and columns 5-8 examine adolescent boys. The estimates are obtained using a two-stage least squares strategy where birth month relative to the school entry cutoff is an instrument for relative age and the average age of comparable classroom peers is used as an instrument for absolute age. All columns use the full set of controls from Table 2 column 3. The estimates utilize the sample weights. Standard errors, shown in parentheses, are clustered at the classroom level.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Appendix Table 6: Relationship Between Relative Age and Physical Activity, by Sex

	(1)	(2)	(3)	(4)	(5)	(6)
	Adolescent Girls			Adolescent Boys		
Outcome →	Number of Days Last Week Physically Active for at Least 60 Minutes	Number of Times Exercising Outside of School	Number of Hours Exercising Outside of School	Number of Days Last Week Physically Active for at Least 60 Minutes	Number of Times Exercising Outside of School	Number of Hours Exercising Outside of School
Age	-0.203***	-0.215***	-0.003	-0.123***	-0.121***	0.061***
	(0.003)	(0.003)	(0.004)	(0.003)	(0.004)	(0.004)
1 SD ↑ Relative Age	0.090***	0.114***	0.070***	0.162***	0.198***	0.137***
	(0.014)	(0.017)	(0.017)	(0.017)	(0.021)	(0.023)
Mean	3.812	2.912	2.182	4.377	3.750	2.875
Observations	287,282	238,968	184,461	273,293	226,749	174,449
2SLS Tests						
LM Statistic	6,273.211	5,710.256	4,529.251	5,374.713	4,799.668	3,698.646
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
F-Statistic	867.783	827.377	689.220	683.971	630.333	497.180
J-Statistic	3.822	3.898	8.911	14.084	12.145	9.81
	[0.955]	[0.952]	[0.541]	[0.169]	[0.275]	[0.457]

Source: Health Behaviours of School-Aged Children, 2002-2018

Note: The dependent variable in column 1 is the number of days the student reported being physically active for at least 60 minutes. The dependent variable in column 2 is the number of times the student reported exercising outside of school where s/he gets out of breath or sweats. The dependent variable in column 3 is the number of hours a week that the student reported exercising where s/he gets out of breath or sweats. The estimates are obtained using a two-stage least squares strategy where birth month relative to the school entry cutoff is an instrument for relative age and the average age of comparable classroom peers is used as an instrument for absolute age. All columns use the full set of controls from Table 2 column 3. The estimates utilize the sample weights. Standard errors, shown in parentheses, are clustered at the classroom level.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Appendix Table 7: Relationship Between Relative Age and Food Consumption, by Sex

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Adolescent Girls				Adolescent Boys			
Times Eaten →	Fruits	Vegetables	Sweets	Soda	Fruits	Vegetables	Sweets	Soda
Age	-0.188***	-0.043***	0.151***	0.093***	-0.235***	-0.072***	0.125***	0.200***
	(0.005)	(0.004)	(0.004)	(0.005)	(0.004)	(0.004)	(0.004)	(0.005)
1 SD ↑ Relative Age	0.043*	0.029	-0.068***	-0.058**	0.138***	0.089***	-0.030	-0.094***
	(0.023)	(0.022)	(0.022)	(0.024)	(0.027)	(0.026)	(0.026)	(0.028)
Mean	5.191	5.001	3.998	2.897	4.676	4.500	3.880	3.597
Observations	292,404	291,974	292,037	292,122	277,381	276,739	276,778	276,962
2SLS Tests								
LM Statistic	6,295.321	6,290.176	6,293.145	6,292.503	5,369.449	5,361.231	5,364.719	5,370.848
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
F-Statistic	874.54	872.95	873.821	873.379	683.256	681.694	682.356	683.225
J-Statistic	18.076	13.197	5.177	13.376	7.486	8.706	10.496	9.058
	[0.054]	[0.213]	[0.879]	[0.203]	[0.679]	[0.560]	[0.398]	[0.527]

Note: The dependent variable in columns 1 and 5 is the number of times a week the student reported eating fruits, in columns 2 and 6 the number of times per week the student reported eating vegetables, in columns 3 and 6 is the number of times per week the student reported eating sweets, and in columns 4 and 8 the number of times per week the student reported drinking sodas. Columns 1-4 examine adolescent girls, and columns 5-8 examine adolescent boys. The estimates are obtained using a two-stage least squares strategy where birth month relative to the school entry cutoff is an instrument for relative age and the average age of comparable classroom peers is used as an instrument for absolute age. All columns use the full set of controls from Table 2 column 3. The estimates utilize the sample weights. Standard errors, shown in parentheses, are clustered at the classroom level.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Appendix Table 8: The Relationship Between Relative Age and BMI is Robust to Dropping Students Born Around the School Entry Cutoff Month

	(1)	(2)	(3)
Months Excluded Around the Cutoff →	+/- 1 Month	+/- 2 Months	+/- 3 Months
Age	0.702***	0.703***	0.701***
	(0.004)	(0.004)	(0.004)
1 SD ↑ Relative Age	-0.126***	-0.120***	-0.144***
	(0.023)	(0.029)	(0.044)
Mean	19.395	19.399	19.408
Observations	403,080	331,469	253,443
2SLS Tests			
LM Statistic	6,190.314	4,107.564	2,661.519
	[0.000]	[0.000]	[0.000]
F-Statistic	995.775	1,195.291	1,038.124
J-Statistic	9.703	8.758	6.281
	[0.287]	[0.188]	[0.179]

Source: Health Behaviours of School-Aged Children, 2002-2018

Note: The dependent variable is the adolescent's BMI. The estimates are obtained using a two-stage least squares strategy where birth month relative to the school entry cutoff is an instrument for relative age and the average age of comparable classroom peers is used as an instrument for absolute age. All columns use the full set of controls from Table 2 column 3. Column 1 drops students born the month prior to the school entry cutoff and the month of the school entry cutoff. Column 2 drops students born two months prior to the cutoff month, the cutoff month, or the month following the cutoff. Column 3 drops students born three months prior to the cutoff month, during the cutoff month, or the two months following the cutoff months. The estimates utilize the sample weights. Standard errors, shown in parentheses, are clustered at the classroom level.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Appendix Table 9: Relationship Between Relative Age and Adolescent Girls' BMI

	(1)	(2)	(3)	(4)	(5)
		WHO BMI Category			
Outcome →	BMI	Thin	Normal Weight	Overweight	Overweight
Age	0.689***	-0.011***	0.023***	-0.012***	-0.003***
	(0.005)	(0.000)	(0.001)	(0.000)	(0.000)
1 SD ↑ Relative Age	-0.106***	0.007***	0.001	-0.008***	-0.003**
	(0.026)	(0.002)	(0.003)	(0.003)	(0.001)
Mean	19.198	0.049	0.815	0.136	0.025
Observations	242,456	242,456	242,456	242,456	242,456
2SLS Tests					
LM Statistic	5,568.34	5,568.34	5,568.34	5,568.34	5,568.34
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
F-Statistic	730.910	730.910	730.910	730.910	730.910
J-Statistic	4.002	8.74	6.613	5.036	4.703
	[0.947]	[0.557]	[0.761]	[0.889]	[0.910]

Source: Health Behaviours of School-Aged Children, 2002-2018

Note: The sample is adolescent girls. The dependent variable in column 1 is the adolescent's body mass index. The dependent variable in column 2 is an indicator for whether the adolescent is classified as "thin," in column 3 for whether the adolescent is classified as "normal weight," in column 4 for whether the adolescent is classified as "overweight," and in column 5 for whether the adolescent is classified as "obese." The estimates are obtained using a two-stage least squares strategy where birth month relative to the school entry cutoff is an instrument for relative age and the average age of comparable classroom peers is used as an instrument for absolute age. All columns use the full set of controls from Table 2 column 3. The estimates utilize the sample weights. Standard errors, shown in parentheses, are clustered at the classroom level.

*** p < 0.01, ** p < 0.05, * p < 0.10

Appendix Table 10: Relationship Between Relative Age and Adolescent Boys' BMI

	(1)	(2)	(3)	(4)	(5)
		WHO BMI Category			
Outcome →	BMI	Thin	Normal Weight	Overweight	Overweight
Age	0.717***	-0.006***	0.020***	-0.014***	-0.008***
	(0.005)	(0.000)	(0.001)	(0.001)	(0.000)
1 SD ↑ Relative Age	-0.167***	0.002	0.015***	-0.016***	-0.007***
	(0.032)	(0.002)	(0.004)	(0.004)	(0.002)
Mean	19.587	0.044	0.729	0.227	0.055
Observations	233,945	233,945	233,945	233,945	233,945
2SLS Tests					
LM Statistic	4,790.84	4,790.84	4,790.84	4,790.84	4,790.84
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
F-Statistic	573.859	573.859	573.859	573.859	573.859
J-Statistic	15.517	19.488	16.816	14.791	17.409
	[0.114]	[0.034]	[0.079]	[0.140]	[0.066]

Source: Health Behaviours of School-Aged Children, 2002-2018

Note: The sample is adolescent boys. The dependent variable in column 1 is the adolescent's body mass index. The dependent variable in column 2 is an indicator for whether the adolescent is classified as "thin," in column 3 for whether the adolescent is classified as "normal weight," in column 4 for whether the adolescent is classified as "overweight," and in column 5 for whether the adolescent is classified as "obese." The estimates are obtained using a two-stage least squares strategy where birth month relative to the school entry cutoff is an instrument for relative age and the average age of comparable classroom peers is used as an instrument for absolute age. All columns use the full set of controls from Table 2 column 3. The estimates utilize the sample weights. Standard errors, shown in parentheses, are clustered at the classroom level.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Appendix Table 11: Relationships Between Relative Age, Weight, and Height

	(1)	(2)
Outcome →	Weight (kg)	Height (cm)
Age	4.947***	4.929***
	(0.011)	(0.010)
1 SD ↑ Relative Age	-0.444***	-0.074
	(0.062)	(0.053)
Mean	50.975	161.614
Observations	505,980	503,290
2SLS Tests		
LM Statistic	7,243.345	7,252.798
	[0.000]	[0.000]
F-Statistic	988.268	988.491
J-Statistic	15.486	19.232
	[0.115]	[0.037]

Source: Health Behaviours of School-Aged Children, 2002-2018
Note: The dependent variable in column 1 is the adolescent's weight (in kilograms) and in column 2 the adolescent's height (in centimeters). The estimates are obtained using a two-stage least squares strategy where birth month relative to the school entry cutoff is an instrument for relative age and the average age of comparable classroom peers is used as an instrument for absolute age. All columns use the full set of controls from Table 2 column 3. The estimates utilize the sample weights. Standard errors, shown in parentheses, are clustered at the classroom level.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$