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DISCUSSION PAPER SERIES

IZA DP No. 15297

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ABSTRACT

The Effect of Higher Education on Women's Obesity and Smoking: Evidence from College Openings in Turkey

This paper analyzes the relationship between higher education and body weight and smoking behavior among women in Turkey. We exploit the largely exogenous and substantial increase in the openings of universities throughout Turkey. Based on the spatial and temporal variability of university openings, we construct college accessibility measures at the level of the city of residence when the woman turned 17 years of age to serve as instruments for college enrollment. The college accessibility measures have a substantial 5 percentage-point (about 80%) impact on the probability of college enrollment, and we show they also impact lower levels of schooling, likely through expectations. Using the college accessibility measures as instruments for college enrollment, we find that a one percentage point increase in the probability of college enrollment reduces BMI by about 0.21% and the probability of being classified as obese by 0.44 percentage points. Regarding smoking, we find that a similar increase in the probability of college enrollment increases the probability of being a current smoker by 0.73 to 1.1 percentage points. Both results contrast with previous findings for Turkey and other countries, likely denoting heterogeneities in the level of schooling considered (primary or secondary versus tertiary) and in the level of economic development of these countries.

JEL Classification: I12, I21, I23, I26, C26

Keywords: health, tertiary education, women, body mass index, obesity, smoking, Turkey

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1. Introduction

It is well documented that better education is associated with better health and longer lives. This can be explained using the productive efficiency argument (Grossman, 1972) where education increases knowledge which in turn enables individuals to produce better health output by increasing the efficiency of fixed inputs. Alternatively, it can be explained with an allocative efficiency argument (Rosenzweig and Schultz, 1982; Grossman, 2006) where more education leads to better allocation of inputs resulting in better health. Other explanations include varying discount rates and risk aversion, which affect both education and the health of individuals (Fuchs, 1982). Education may also enable individuals to have larger social networks that provide financial and psychological support, which may affect health (Cutler and Lleras-Muney, 2006). Empirically, this relationship has been investigated extensively considering various measures of health, such as mortality, self-rated health, physical limitations, health-risk factors such as tobacco use, alcohol consumption, and obesity. The empirical evidence, by and large, indicates that there is a strong relationship between education and health, regardless of the measure of health/health behavior, time period, or countries studied (see Grossman, 2006 for a review).

To attribute causality in the estimation of this relationship, the difficulty consists of dealing with the endogeneity of educational attainment. Popular methods include instrumental variables and regression discontinuity designs using natural experiments to instrument for education. Most of these studies use data from developed nations (e.g., Lleras-Muney, 2005; Davies et al., 2016) with some exceptions (e.g., Dursun et al., 2018; Baltagi et al., 2019). Moreover, most of these studies look at primary or secondary education with few exceptions that look at higher (tertiary) education (e.g., Currie and Moretti, 2003; Kamhöfer et al., 2019; Bratti et al., 2022).

Evidence on the effect of education on smoking and body weight, which are among the leading preventable causes of serious health-related issues and death around the world, is mixed. Using compulsory schooling law changes as an instrument for schooling, Davies et al. (2016), Li and Powdthavee (2015), Silles (2015), Clark and Royer (2013), Kemptner et al. (2011), and Baltagi et al. (2019) find that there is no significant effect of education on smoking. In contrast, other studies like Etilé and Jones (2011) and Jürges et al. (2011) find a beneficial effect of schooling on smoking. Other studies exploiting different institutional changes as instruments for schooling also find that an increase in schooling reduces smoking (see Grimard and Parent, 2007; De Walque, 2007; Kenkel et al., 2006; Kamhöfer et al., 2019), while Bratti et al. (2022) find that higher education increases smoking. The causal evidence regarding the effect of education on body weight problems is also mixed: Brunello et al. (2013), Reinhold and Jürges (2010), Baltagi et al. (2019), and Kenkel et.al. (2006) find no statistical evidence of an effect, while James (2015), Bratti et al. (2022), and Kamhöfer et al. (2019) find that schooling reduces the probability of being obese. Furthermore, Kemptner et al. (2011) find that there is a beneficial effect of education on obesity only for men, but not for women. Grabner (2009) shows that additional years of schooling reduce BMI and the probability of obesity, and that this effect is stronger for women than for men.

Moreover, the effect of education on body weight and smoking might be heterogeneous depending on the level of schooling, the level of development of the country, and gender. The effect of education on smoking and obesity is non-linear, with this effect likely being higher at higher levels of schooling (Cutler and Lleras-Muney, 2012). Also, Cutler and Lleras-Muney (2012) show that the effect of schooling on health and health behavior appears to vary by the level of development of a country: the effect of education on smoking is negative for rich countries and positive for many middle-income countries. Furthermore, the causal effect of schooling on health outcomes likely varies by gender, given that there is a documented stronger relationship for men than for women (e.g., Galama et al., 2018).

In this study, we estimate the causal effect of higher education on women's weight-related variables and the probability of being a current smoker for a developing country, Turkey. To deal with the endogeneity of college enrollment, we use plausibly exogenous variation brought about by the high number of university openings that occurred throughout Turkey between 1976 and 2002. Based on this universities expansion, we create two instruments that measure college accessibility at the time a woman turned 17 years of age, which we refer to as college proximity and college availability. These instruments follow in the spirit of Card (1993) and Currie and Moretti (2003), respectively. Indeed, our instruments seem to be more powerful in the context of Turkey given the more conservative nature of societal norms towards women. Also, relative to prior literature using similar instruments (e.g., Card, 1993; Currie and Moretti, 2003), we have the advantage of being able to determine the exact city of residence of women at the age of 17, which results in more accurately measured instruments.

This study offers several contributions. First, we study the effect of schooling on weight-related variables and smoking in the context of a developing country, Turkey. Second, we document the effect of higher education (college enrollment). Most studies in the literature focus on developed countries and on primary or secondary education. Third, the instrument we use in the estimation of the effect of education or college enrollment on health represents a refinement relative to prior literature since we have information on the city of residence of women when they were 17 years old (the time of the college attendance decision). Previous literature (e.g., Card, 1993; Currie and

Moretti, 2003; Bratti et al., 2022) did not have this information and were forced to assume away endogenous migration. We provide information about the potential consequences of this limitation in the context of Turkey. Fourth, another advantage of our data is that the weight and height employed in measuring weight-related variables (e.g., BMI) are measured rather than reported, potentially avoiding reporting errors and their consequences (Engstrom et al.,2003; Gorber et al., 2007). in one of our key set of outcomes. Lastly, we show that, while the expansion of universities strongly affected college enrollment by women living in cities with a university when they were 17 years old, their enrollment in high school and middle school was also positively impacted. This implies that some women increased their schooling probably due to the possibility of being able to attend college, which has implications for higher education policies.

We find that the availability of a college in a woman's city of residence when she is 17 years old increases her probability of college attendance by about 5 percentage points, approximately 80% relative to the college attendance rate of women who live in cities without universities. We also find that the college accessibility measures we employ as instruments are not weak predictors of college enrollment. Using an instrumental variable strategy, we find evidence that a 1 percentage point increase in the probability of college attendance decreases a woman's BMI by 0.21 percent. The same increase in the probability of college enrollment decreases a woman's probability of being obese by about 0.44 percentage points. Both of these effects are statistically significant, while we find statistically insignificant effects of college enrollment on a woman's probability of being normal-weight, overweight, or underweight. These estimates suggest that higher education has a causal beneficial effect on women's BMI and obesity in the context of a developing country. Moreover, our instrumental variables estimates imply that a 1 percentage point increase in a woman's probability of college enrollment increases her probability of being a current smoker by 0.73 to 1.1

percentage points. This finding stands in contrast with existing evidence on the effect of higher education on smoking for developed countries (e.g., Grimard and Parent, 2007; De Walque, 2007; Kenkel et al., 2006; Kamhöfer et al., 2019). An exception is Bratti et al. (2022), which finds that higher education increases women's probability of smoking in Italy. Indeed, our estimates are consistent with the four-stage tobacco epidemic model proposed by Lopez et al. (1994), as well as the evidence on the effect of education on smoking for developing countries pointed out in Cutler and Lleras-Muney (2012), Lleras-Muney (2022), and the empirical findings in Bratti et al. (2022) for Italy.

The remainder of the paper is structured as follows. Section 2 provides an overview of higher education in Turkey. Section 3 describes the data used in the paper. Section 4 discusses the identification strategy and estimation methodology. Section 5 presents evidence about the effect of the college accessibility measures on education and college enrollment. Section 6 shows the results for weight-related variables and smoking, and section 7 concludes.

2. Higher Education in Turkey

Education at all levels in Turkey is mainly provided in public schools free of charge, with some exceptions in the form of private schools. The Ministry of National Education (MONE) administers the primary and secondary education while the Council of Higher Education (COHE), established in 1981, regulates and monitors the higher education system. All levels of education in Turkey have gone through major reforms since the 1990s. Compulsory education consisted of 5 years until 1997, followed by non-compulsory three years of middle school and three years of high school.[1]

[1] Exceptions are some high schools offering four years of vocational education, or some general high schools offering one-year foreign language preparation, but these comprise a small share among Turkey's high schools.

Compulsory schooling was increased to 8 years in 1997 (for a detailed discussion see e.g. Dursun et al., 2018; and Baltagi et al., 2019). High school education increased from 3 to 4 years in 2005. In 2012, compulsory schooling was increased to 12 years. Students in Turkey are required to take a highly competitive nationwide university entrance exam following their graduation from high school.[2] The university system is largely dominated by public universities in which students obtain college education free of charge. Private universities currently exist mainly in a few metropolitan cities while public universities now exist all over Turkey.

Most children in Turkey start primary school at age 6 and complete middle school at age 14. Those who continue their education typically complete high school at age 17. Students take the university entrance exam towards the end of their last grade in high school. Because of the excess demand for higher education, those students who are not admitted to a college typically prepare for the entrance exam for another year or more after graduating from high school. For this reason, between 1980 and 2002, high school seniors and high school graduates comprised, on average, around 35 and 45 percent of new university admissions, respectively (Cetinsaya, 2014).[3] Hence, the typical entry age to college is 18, and the typical graduation age is 22-24 in Turkey (OECD, 2017).

We employ the rapid increase in the opening of universities in Turkey over time as a source of plausible exogenous variation in the individual woman's decision to attend college. The first modern university in the Republic of Turkey was established in Istanbul in 1933. The number of universities increased at a slow pace reaching a total of 9 universities in 5 different cities by 1970. After 1975, multiple universities were established in several cities by the national government,

[2] The centralized university entrance exam has been used since 1974 by the establishment of the Measuring, Selection, and Placement Center (ÖSYM).

[3] Those who are already enrolled in a program and those who have graduated from a program comprise, on average, around 15 and 3 percent of new university admissions, respectively.

with the choice of their location driven by political considerations of the ruling party at the time (see Kaynar and Parlak, 2005). For instance, 5 new universities were established in 1975 in cities that did not already have a university. Right after the military coup in 1982, the new government established 8 new universities. By 1985, there were 28 universities, of which 13 were in the three largest cities, Istanbul, Ankara, and Izmir. This means that by 1985, only 18 out of 81 provinces had a university. Meanwhile, the first private university was established in Ankara in 1985.

In 1992, the government took an unprecedented step by founding 23 public universities in 21 provinces that did not previously have a university (COHE, Higher Education Statistics). The choice of the province where a new university was established was largely politically motivated and driven by members of parliament (Arap, 2010; Caner et al., 2019). Between 1992 and 2006, 2 more public universities were established while the number of private universities increased to 24. However, these private universities primarily operated in Istanbul, Ankara, and Izmir (COHE, Higher Education Statistics). The last expansionary wave of universities took place between 2006 and 2008. The government introduced a higher education policy aimed at establishing at least one university for each city. Between 2006 and 2008, 40 additional public universities opened, resulting in at least one university operating in each province. In recent years, some private universities were established outside of the three biggest metropolitan areas of Istanbul, Ankara, and Izmir, but most of the private universities are still located in those three cities. In our empirical analysis below, we consider the expansion of universities up to 2002 because of concerns explained in section 3.

Figure 1 shows the number of private and public universities in Turkey by year, up to 2002. The number of public universities increased gradually until 1982 and increased dramatically in 1992. In contrast, the number of private universities increased only gradually after 1994. Despite the opening of new universities in Turkey, there has always been a gap between the number of college applications and admissions. Figure 2 shows the college applications (a measure of demand) and admissions (a measure of supply) by year between 1980 and 2002. The figure indicates that the demand for higher education increased over the years. The number of admissions suggests that the supply of higher education has also increased during the period under consideration, consistent with the rapid expansion of university openings. Figure 2 also shows that there has consistently been excess demand for higher education in Turkey.

3. Data

We use the Turkey Demographic and Health Survey (TDHS) for the years 2008, 2013, and 2018. The TDHS is conducted every 5 years since 1968 by Hacettepe University Institute of Population Studies as part of the Demographic and Health Survey (DHS). The TDHS focuses primarily on women aged 15-49. Some waves of the TDHS survey all women, while other waves provide information on women who have married at least once. Specifically, TDHS 2008 focuses on ever-married women and has a sample size of 7,405, while TDHS 2013 and TDHS 2018 focus on all women and have a sample size of 9,746 and 7,345, respectively. The TDHS collects detailed data on women's demographic, socio-economic, migration, and health-related information.

Important for our identification strategy, the TDHS provides the migration history of women, which allows us to identify the city in which a woman lived at the age of 17, when we assume the college attendance decision is made. Having this information is critical because we employ the availability of colleges when the woman is 17 as a source of exogenous variation for education and for enrolling in college. Previous studies using college proximity as an instrument for education (e.g., Card, 1993, Bratti et al., 2022, and Currie and Moretti, 2003) were forced to use the current county or municipality of residence as the place in which the individual lived at the age of college attendance decision. Other Turkish datasets lack this crucial information, such as the Turkey Health Survey (THS) which has been used by previous studies investigating the effect of other levels of schooling on health (e.g. Dursun et al., 2018; Tansel and Karaoglan, 2019).

Another key advantage of the TDHS is that it reports the measured weight and height information of individuals unlike most of the other surveys used in the literature which contain self-reported weight and height information (e.g. Cutler and Lleras-Muney, 2010; Dursun et al., 2018; Bratti et al., 2022). Individuals' tendency to over-report their height while under-reporting their weight can result in substantial inaccuracies in calculating BMI and identifying obese individuals (Engstrom et al.,2003). Particularly, these inaccuracies are more prevalent among women (Gorber et al., 2007). The measured weight and height in the TDHS help us sidestep the concern of dealing with errors of measurement in a key outcome variable.

We restrict our attention to women born between 1959 and 1985 which means our analysis sample includes women aged at least 22-49 at the time of the surveys. In other words, women in our sample reached the age of 17 between 1976 and 2002. The reason we do not consider women born after 1985 is due to the compulsory schooling law of 1997, which increased compulsory schooling from 5 to 8 years in Turkey. We are concerned that this policy change may have a spillover effect on the level of education beyond that compulsory schooling level, that is, that it might have induced some people to complete high school and enroll in college, and that this could confound the effect of the expansion of universities. Women born after 1985 are more likely to be affected by the compulsory schooling law change in 1997. In addition to this restriction, we dropped 256 observations for which we were not able to identify the city of residency when they were 17 because of missing information on their migration history.[4] Furthermore, information on smoking status and BMI is missing for 11 and 1619 observations, respectively.[5] Hence, the final samples consist of 16,121 women to analyze effects on smoking and 14,511 women to analyze effects on BMI-related measures.

Information on the numbers and the year of establishment of universities are obtained from the Council of Higher Education (COHE). Furthermore, the population data comes from the 1975, 1980, 1985, 1990, and 2000 Censuses and the 2007 Address Based Population Registration System (ABPRS). Population figures for the intercensal years were interpolated.[6]

Table 1 shows the descriptive statistics for those who lived in a city with a college when they were 17 (College Proximity=1) and those who lived in a city without a college at the age of 17 (College Proximity=0). The table shows two samples, one for the BMI-related outcomes, and one for the smoking outcomes, since their sample sizes differ due to missing observations, as explained before. In both samples, on average, women who lived in a city with a college at age 17 attain higher levels of education. In the corresponding samples, women who lived in a city with a college at age 17 have lower BMI and obesity rate, but have a higher smoking rate, relative to women who lived in a city without a college at the age of 17.

4. Methodology

[4] The city of residence at the age of 17 is not identified for 256 observations because of the following reasons: 199 women lived abroad at age 17; 29 women moved at least once after they were 17, but information on their childhood city or the city they moved from is missing; 12 women moved at least once at or before 17, but information on the city they moved to is missing. Lastly, 16 women moved to another city, but the year they moved is missing.

[5] Information on BMI was missing for various reasons, such as not being at home at the time of measuring and refusing to have their height or weight measured.

[6] There were 67 provinces before 1990, and 14 districts became provinces between 1990 and 2000. Since the census provides population data for provinces, people who lived in these 14 new provinces are counted in the cities from which new provinces are detached in pre-1990 censuses. Because of that, we assign women who reached the age of 17 before 1990 to the province they lived in before their district was detached, to avoid mismeasurement in obtaining the college availability measure.

4.1. Identification and the Instruments Employed

Our identification strategy closely follows Card (1993) and Currie and Moretti (2003). Card (1993) uses college proximity as an instrument for years of schooling to estimate the causal effect of education on earnings. The idea is that the availability of a nearby college reduces the cost of college because of the possibility of staying with parents and avoid the cost of accommodation. Alternatively, Currie and Moretti (2003) used different college availability measures as instruments to estimate the effect of mothers' schooling on infant health. They construct measures for the availability of 2-year and 4-year colleges as the number of corresponding colleges per 1000 persons aged 18-22 in the county where a woman lived when she was 17.

Like Card (1993), our first instrument (IV1) is a binary indicator for the availability of a university in a woman's city of residence when she was 17 years old. In Turkey, students typically finish high school and decide on college attendance at age 17.[7] Following Card (1993), we call this dummy variable "college proximity" in our analyses. This instrument relies on two sources of variation for identification: variation in the city of residence at age 17 and variation in the year a woman reaches the age of 17. Figure 3 shows how the number of cities in Turkey with at least one university grew over time. The figure shows dramatic growth, with substantial jumps in the number of cities around 1975 and 1992. Moreover, Figure 4 shows the spatial distribution of the provinces with cities with at least one university for various years. As would be expected, the first provinces with cities with at least one university correspond to those provinces with the largest Turkish cities. Even at the

[7] As mentioned before, retaking the university entrance exam is common among youth who do not gain admission to college right after high school graduation, resulting in a typical college entry age of 18. We hesitate to construct the instrument based on the residence city at age 18 since we consider that the relevant college-attendance choice happens upon high school graduation. Alternatively, by making the decision age 17, we avoid potential problems with endogenous mobility between ages 17 and 18 to attend college (i.e., students from a city without a university moving to another city with a university right after finishing high school and attributing that—erroneously—to the effect of a university opening). While we define the availability of a college in the woman's city of residence at age 17 in constructing the instrument, we tried an instrument based on the college availability in the city of residence at age 18 as a robustness check. The results are quite similar.

level of province, it is not until after the early 1990s that a considerable number of Turkish provinces had a city with at least one university. Together, Figures 3 and 4 suggest that there is a substantial amount of variation in the college proximity variable by the year in which a woman reaches the age of 17 and her city of residence.

Our first instrument of college proximity (IV1) does not account for the differences in the number of college-age children and in the number of universities available in the city of residence when a woman turns 17 years old. For example, Istanbul, Ankara, and Izmir are the three most populated cities in Turkey and the first universities were established in these cities. In our sample, women who lived in these cities always had access to college in their city. Furthermore, there is more than one public university in these cities for most of the period considered. Additionally, most of the private universities are established in these cities. Thus, the effect of a new university would be different for those who live in these three cities than those living in relatively smaller cities. In order to account for these aspects, we follow Currie and Moretti (2003) and construct a second instrument (IV2), "college availability", as the number of universities in the woman's residence city when she was 17 years old divided by the number of people between the ages of 18 and 24. This measure is expressed in units per 100,000 persons. The variation in this instrument across regions and years is considerable. Figure 5 shows the number of colleges per 100,000 persons aged 18-24 by year and by NUTS1 regions (averaged over years).[8] Moreover, Figure 6 shows the spatial variation of college availability at the province level for selected years. These figures show that the number of universities per 100,000 persons varies substantially across regions, years, and residence

[8] NUTS1 is the first level of NUTS (Nomenclature of territorial units for statistics) regional division, which is a hierarchical system for dividing the economic territory of the EU and the candidate states into territorial units to harmonize the collection and development of the European statistics and socio-economic analyses of the regions (Eurostat, 2020).

cities in which a woman reaches the age of 17, supporting the identification power of this second instrument.

In principle, our two instruments for educational attainment are likely more relevant in the case of Turkey than in the U.S. or other developed countries, especially for women. Living in a city without a university not only increases the cost of higher education by increasing the costs related to accommodation, but it also increases non-negligible psychic costs. Moving out of parental housing before marriage is very unlikely for women in Turkey. Psychic costs are high: it used to be very common that parents would not allow their daughters to go to college in another city in accordance with the traditional and conservative views of people on gender roles (e.g., Caner et al., 2019). This is relatively more prevalent in eastern regions of Turkey, which is mostly characterized by lower levels of education and college availability. Once a college is available in the city of residence, parents are less likely to oppose their daughters' higher education decisions. Thus, if women can attend college in their hometown, they are able to live at home avoiding both accommodation and psychic costs. Hence our instruments likely lower the overall cost of higher education substantially, thereby increasing the level of schooling by women.

One drawback of the instruments used in Card (1993), Currie and Moretti (2003), and Bratti et al. (2022) is that their data has no information on the region of residence when the decision to attend college is being made (age 17 in the first two studies and age 19 in the last study). All three studies were forced to use the region of residence in a different time period in the definition of the instrument, thereby making an assumption that the individual did not endogenously change residence between age 17 (19) and when the residence information is available. If this assumption about mobility is not satisfied, it could jeopardize the validity of the instrument (Currie and Moretti, 2003). Therefore, having access to the exact location where a woman resided at the time of deciding about college enrollment is critical. Fortunately, the TDHS data includes information on the city of birth, the city in which the woman lived most of her life until 12 years old, and the region of residence at the time of the interview. Furthermore, women in the TDHS are asked about their detailed migration history, such as the number of migrations, the reason for migration, the city from which they migrated, and the year they migrated. We use this information to determine the exact city of residence in which a woman lived when she was 17 years old, thereby improving the measurement of our instruments. Table 2 shows the proportion of women who have migrated at least once at or after the age of 17 and the proportion of movers who report having migrated for educational purposes. Table 2 indicates that around 32% of women in the larger "smoking sample" have migrated at least once between age 17 and the time of the survey. Furthermore, around 13% of movers reported changing residence city for educational purposes. This implies that assuming that the residence city at the time of the survey is the same as the residence city at age 17 could be misleading and would likely bias the resulting estimates, at least in the context of Turkey.

We finish this section with a brief discussion about the assumptions needed for identification in the instrumental variables approach we use. The first assumption is that of conditional independence of the college accessibility instruments from the (potential) outcomes we analyze—body weight variables and smoking. This assumption is justified given that the decision to open new universities in Turkey stemmed largely from political reasons and not in relation to the outcomes of individual women. The second assumption is that the college accessibility instruments impact the outcomes only through increases in schooling and not independently of those increases. This assumption is required to be satisfied conditional on the variables we include such as individual-level covariates (see below) and regional cohort-specific indicators. Once those factors are controlled for, thereby holding constant several of the political motivations behind the locational choice of new universities, we find it hard to think of other unobserved factors that could mediate an effect of the instruments independently of schooling.

A third assumption is monotonicity: no woman living in a city with a university would have a higher probability of attending college had the woman been living in a city with no university accessible. This assumption appears mild in light of the fact that the college attendance decision is heavily influenced by both pecuniary and psychic costs, both of which would be lower for a woman living in a city with access to a university. The last assumption is that the college accessibility instruments have a non-zero effect on the probability of college enrollment by women. This assumption is verifiable, and we show in section 5 that college accessibility indeed had a substantial effect on the probability of college enrollment. In sum, we believe that the method's assumptions are likely satisfied in our setting.

4.2. Estimation Strategy

We use the following model to estimate the effect of education on health outcomes/ behaviors:

$$H_i = \beta_0 + \beta_1 S_i + \boldsymbol{X}_i' \boldsymbol{\theta} + u_i \tag{1}$$

where H_i is a measure of health outcomes/behaviors such as BMI, obesity, and current smoker. S_i represents the measure of schooling, which is an indicator variable for whether a woman attended college. $\boldsymbol{X}_i$ is a vector of control variables such as age, age-squared, a dummy for being married, and a dummy variable for the survey year. There are substantial regional differences in the level of development, population, economic activity, and consumption habits. Thus, educational participation, socioeconomic status, gender roles, and autonomy of women differ significantly across regions (for a detailed discussion see Smits and Gündüz-Hoşgör, 2006). Therefore, we include indicators for 12 NUTS1 regions in the regressions. Furthermore, in some of our specifications, we include interactions of the NUTS1 region indicators with year-of-birth indicators to flexibly control for regional cohort-specific factors.

Schooling in equation (1) may be endogenous for several reasons. First, there might be reverse causality between health outcomes/behaviors and schooling. For example, currently obese individuals could have experienced adverse health conditions growing up which in turn result in less schooling. Second, there is also a possibility of a third variable affecting both health outcomes/behaviors and schooling, such as time preferences (e.g., the discount rate). For example, women with higher discount rates might attain less schooling and also invest less in their health or engage in health-damaging behavior (e.g. Cutler, Lleras-Muney, and Vogl 2008; Fuchs, 1982).

Due to the likely endogeneity of schooling in equation (1), we employ the identification strategy previously described that takes advantage of supply-side changes in higher education in Turkey given by the dramatic increase in university openings in the country. Our instruments reflect the college proximity and college availability in the city of residence of women when they turned 17 years of age. Thus, we estimate the following equation as the first-stage regression:

$$S_i = \alpha_0 + \alpha_1 Z_i + \boldsymbol{X_i'}\boldsymbol{\Gamma} + \varepsilon_\mathrm{i} \qquad (2)$$

where S_i is defined as before and $\boldsymbol{X_i}$ includes the same control variables as in equation (1). Z_i represents either college proximity (IV1) or college availability (IV2). Predicted values of S_i are then used in equation (1) to obtain the causal effects of college attendance on the health outcomes/behaviors we consider. As is well-known, these two-stage estimates using instruments are to be interpreted as the "local average treatment effect" (LATE) for the latent subpopulation of women who change their college enrollment status due to a change in the value of the instrument. Below, we present an informal characterization of this latent subpopulation. All regressions are estimated using the sampling weights provided by the TDHS. Furthermore, all standard errors are clustered at the birth year and region of residence at age 17.

5. The Effect of College Accessibility on Schooling

We start by presenting some suggestive graphical evidence. Figure 7 shows unconditional evidence of how the availability of colleges relates to the college attendance rate of women by birth cohort for women who lived in cities with and without a university. It shows that college attendance rates exhibit an increasing trend both for women living in cities with and without universities. Our estimation strategy includes region by birth year indicators to control for these trends. Importantly, Figure 7 shows that, almost uniformly, for each birth cohort the college attendance rate is higher for women living in cities with a university than women living in cities without a university.

We now present estimates of the effect of our two college accessibility instruments on women's schooling attainment using equation (2). These estimates serve as the first stage in our instrumental variables estimation. Furthermore, the effect of college accessibility on schooling attainment by itself could have significant policy implications. If having a college available in the city of residence when a woman makes a college decision increases the woman's probability of attending college, construction of colleges in regions lagging in terms of women's college attendance could be an effective policy for nations striving to empower women. Moreover, this could be even more relevant for nations with traditionally strong conservative views on women.

Table 3 shows the effect of college accessibility—defined as either college proximity or college availability measure—on college attendance, using the slightly larger "smoking sample" (results are very similar using the "BMI sample"). The first column of Table 3 indicates that the probability of attending college is 5 percentage points higher if there is a college available in the woman's residence city when she was 17 years of age. The second column of Table 3 shows the effect of the number of colleges per 100,000 persons aged 18-24 in the residence city of a woman when she was 17 years of age (college availability) on schooling. It is found that an increase of one college available per 100,000 persons increases the probability of college education by 4 percentage points. Both effects are statistically significant and represent an increase of 83% and 67%, respectively, relative to the college attendance rate of women living in cities with no universities. In columns (3) and (4), we additionally control for NUTS1 region by birth year indicators. The third column of Table 3 indicates that the probability of college attendance is slightly reduced to 4 percentage points higher for women with a college available in their city of residence at age 17 when adding these controls. The fourth column of Table 3 shows that the additional controls slightly increase the effect of the college availability measure on college attendance to 5 percentage points.

In sum, Table 3 indicates that both college accessibility measures have a substantial impact on the probability of attending college. Relative to the mean college attendance rate of women without a college in their city of residence by age 17 (0.06), the impact of the instruments on college attendance is between 67% and 83%. The corresponding F-statistics of the excluded instruments, a statistical measure of the potential weakness of the instruments are reported in Table 4 and Table 5 for each of the estimation samples. Both instruments are found not to be weak.

Next, we present an additional investigation of the impact of the college proximity instrument on the schooling attainment of women in Turkey that helps us understand this impact and thus the subpopulation for which the IV results apply. The exercise is in the spirit of Angrist and Imbens (1995), who show that, in a setting with a binary instrument (e.g., college proximity) and a treatment with variable intensity (e.g., years of schooling) the IV estimates identify a weighted average of treatment effects for individuals whose treatment intensity is affected by the instrument (the "compliers") and the weights are proportional to the unconditional quantile treatment effects of the instrument on the treatment.[9] Our implementation loosely follows Amin et al. (2020) by creating indicator variables for at least having completed each of the observed values of years of schooling. Then, we estimate the effect of the college proximity instrument on these indicator variables using an inverse probability weighing approach with weights given by $\left(\frac{Z}{PS}+\frac{1-Z}{1-PS}\right)$ where Z is college proximity and PS is the propensity score obtained from a logistic regression of Z on all covariates. By using this approach, we estimate the effect of college proximity on the distribution of years of schooling controlling for covariates.

Figure 8 presents the percentage effect of the instrument on attaining at least a given level of schooling, controlling for observable factors. It shows that, unconditionally, the college proximity binary instrument starts having a small but statistically significant percentage effect at 6 years of schooling, which increases monotonically for the rest of the schooling levels. For instance, college proximity increases by 55%, 63% and 88% the probability of attaining at least 8, 11, and 12 years of schooling. Therefore, the most potent effect of college proximity occurs, not surprisingly, on the

[9] More formally, the weights defined in Angrist and Imbens (1995) are proportional to the difference between the distribution of the (potential) treatment intensities in the absence of the IV and the distribution of the (potential) treatment intensities under receipt of the IV at a given level of the treatment. The result in Angrist and Imbens (1995) can also be written in such a way that the weights are defined in terms of the difference in quantiles of those distributions.

probability of college attendance (years of schooling 12 and beyond). Interestingly, college proximity (the presence of a college in a woman's city of residence) has spillover effects by also increasing the probability of attaining lower schooling levels, as early as six years of schooling. These spillovers suggest that having a college in the city of residence also increases the schooling level of women beyond the obvious effect on college enrollment.[10]

6. The Effect of Schooling on Health Outcomes and Behaviors

We showed in the previous section that women's college attendance is substantially affected by our college accessibility measures. Using these plausibly exogenous college accessibility measures as instrumental variables for college attendance, we estimate the causal effect of higher education on weight-related outcomes and smoking. In the remainder of this section, we first show graphical evidence on the reduced-form effect of college proximity on health outcomes and behaviors. Then, we show ordinary least squares (OLS) and instrumental variables (IV) estimates of schooling on the body weight and smoking behavior of women.

6.1. BMI/ Obesity

The relationship between college proximity and BMI and obesity is presented in Figures 9(a) and 9(b), respectively. The figures show this relationship by year of birth, along with a linear fit obtained by regressing the average BMI /obesity rate on birth year. The figures show a lower average BMI and obesity rate for younger cohorts. They also show that the average BMI and obesity rate

[10] In the next sections, we focus on the causal effect of college enrollment on the outcomes of interest for the reasons motivated in the Introduction, among them that our instruments have the most potent impact on higher education. However, we have investigated the causal effect of attaining at least middle school and high school education. As expected, the instruments are weaker (especially for middle school) and the effects of these schooling levels on the outcomes of interest are consistent with but milder and some not statistically significant relative to the effects reported in the next sections. These other results are available upon request.

is higher for women who did not have a college available in their city of residence at age 17. Together with the evidence of a positive effect of college proximity on college attendance in Figure 7, they suggest that the accessibility of college affects BMI and obesity rate through its effect on college attendance.

Following this graphical evidence on the reduced-form relationship between the college accessibility measures and the body weight outcomes, we formally estimate the effect of schooling on BMI and obesity using OLS (which likely represents an association) and IV methods. For the IV estimates, we use both college accessibility measures: college proximity (denoted as IV1) and college availability (denoted as IV2). All regressions control for age and age square, a dummy for being married at the time of interview. Interview year dummy variables and dummies for 12 NUTS1 regions of residence at age 17 are also included in the regressions. Furthermore, in order to control for unobserved regional differences across birth cohorts, we include region-specific birth cohort indicators in some specifications. Since the effect of schooling on health outcomes and behaviors might not be linear (e.g., Cutler and Lleras-Muney, 2006 and 2010), we estimate the effect of college attendance on different weight-related variables: the logarithm of BMI, the probabilities of being obese, overweight, normal-weight, and underweight.[11]

Table 4 presents the estimated effects of college attendance on weight-related variables. Column 1 of Table 4 shows the OLS estimates. The results indicate that a woman who attained at least some college education has a 10 percent lower BMI, as compared to a woman who did not enroll in college. Moreover, a one percentage point increase in the probability of college attendance is associated with a decrease in the propensity to be obese by 0.18 percentage points, and the propensity

[11] We define dummy variables for being obese ($BMI \geq 30\ kg/m^2$), being overweight ($30\ kg/m^2 > BMI \geq 25\ kg/m^2$), being normal-weighted ($25\ kg/m^2 > BMI \geq 18.5\ kg/m^2$), being underweight ($18.5\ kg/m^2 > BMI$).

to be in the normal weight range by 0.21 percentage points. These estimates are statistically significant. There is also a negative association between college attendance and the probability of being overweight and a positive association with the probability of being underweight, but these two estimates are small and not statistically significant. These OLS estimates are likely to suffer from the endogeneity of college attendance, nonetheless, the results indicate a favorable association between schooling and weight health problems for women, consistent with findings elsewhere (e.g., Dursun et al., 2018; Baltagi et al.,2019; Braga and Bratti, 2013, Grabner, 2009).

To address the endogeneity of college attendance, we employ instrumental variables in college proximity (IV1 in columns 2 and 5) and college availability (IV2 in columns 3 and 6). The IV estimates in columns 2 and 3 of the lower panel present first-stage estimates in the weight-related analysis sample, showing that the two college accessibility measures have a substantial effect on college attendance. The corresponding F-statistics on the excluded instruments for the college proximity and the college availability are 39.75 and 38.94, respectively. Since both F-statistics are considerably greater than 10, the rule of thumb proposed by Staiger and Stock (1997) is met and indicates that both instruments are not weak.

Column 2 in Table 4 shows the IV estimates using college proximity (IV1) as an instrument for college attendance. We find that a one percentage point increase in the probability of college attendance decreases the woman's BMI by 0.27 percent and the probability of being obese by 0.63 percentage points, which are statistically significant at the 1% level. Furthermore, IV1 estimates in column 2 show that one percentage point increase in the probability of college attendance increases the probability of being overweight, being in the normal-weight range, and underweight by 0.23, 0.34, and 0.06 percentage points, respectively. However, these estimates are not statistically significant. Using college availability (IV2) as an instrument for college attendance, column 3 shows that the results are in line with the estimates in column 2, with only somewhat smaller effects of college attendance. These estimates indicate that a one percentage point increase in college attendance decreases women's BMI by 0.23 percent and the probability of being obese by 0.46 percentage points. The same increase in college attendance increases the probability of being normal-weight by a marginally statistically significant 0.39 percentage points, while the estimates on the probability of being over-or under-weight are statistically insignificant.

Regional differences across birth cohorts in outcomes could render the previously described estimates biased (Mazumder, 2008). To address this possibility, columns 4-6 of Table 4 estimate the same coefficients including region-specific birth cohort indicators. Controlling for region-specific birth cohort indicators result in slightly lower F-statistics on the excluded instruments in the first stage for both college accessibility measures, but they remain considerably above the rule-of-thumb of 10. While the OLS estimates in column 4 are unchanged relative to those in column 1, the IV estimates change slightly when including region-specific birth cohort indicators. Indeed, the IV estimates that include region-specific birth cohort indicators remain within one standard deviation of those that do not.[12] These estimates indicate that a one percentage point increase in college attendance decreases women's BMI by 0.23% (IV1) and 0.21% (IV2), and the probability of being obese by 0.57 (IV1) and 0.44 (IV2) percentage points. Using IV2, there is a marginally statistically significant effect of 0.41 percentage points on the probability of being normal weight.

In sum, the IV estimates in Table 4 show evidence that college attendance by women in Turkey—specifically those who were induced to enroll in college due to the availability of a college in their

[12] Huebener (2018) finds that including maternal education in their analysis reduces the effect on the probability of children being overweight and on smoking. We checked our results including a variable indicating whether the mother of the respondent has primary school education as another control variable. The estimated coefficients and their statistical significance changed only slightly. We did not include this variable in our baseline regressions since it is missing for some observations.

city of residence at age 17—reduces substantially their BMI. Moreover, this beneficial effect of higher education is mainly driven by a substantial reduction in the probability of being obese and a marginally statistically significant increase in the probability of being in the normal-weight range. The results also show that the IV estimates of the impact of schooling on weight-related outcomes are higher than the OLS estimates. This likely stems from correcting endogeneity, but it can also be a consequence of the margin of incidence of the instrumental variables used, which selects women that attend college only because of the presence of one in their city of residence at age 17 (i.e., the "compliers").

Our results on weight-related variables can be related to others in the literature, although most of these studies concentrate on middle school attainment. Dursun et al. (2018) found that an increase in middle school completion exogenously determined by the compulsory schooling change in 1997 increases Turkish women's probability of being in the normal weight range but reduces the probability of being overweight or underweight. However, they find a very small and statistically insignificant effect of schooling on women's probability of being obese. Dursun et al. (2018)'s estimates are based on the Turkey Health Survey in which the weight and height of women are self-reported. Using the same compulsory schooling change in Turkey and some of the same data as in this paper, Baltagi et al. (2019) found that middle school education reduces Turkish women's probability of being overweight and increases the probability of being obese using both measured- and self-reported height and weight information. However, their estimated coefficients are not statistically significant. Similarly, several other studies reporting IV estimates based on exogenous changes in schooling at lower levels of education in developed countries largely fail to show a significant causal effect of education on women's weight-related variables (e.g. Kenkel et al. 2006; Kemptner et al. 2011; Brunello et al., 2013).[13] In light of this, a likely explanation for why our results differ from those in prior literature is the argument advanced by Cutler and Lleras-Muney (2006, 2010) that the effects of education on obesity are higher at higher levels of education. Consistent with this explanation and our results, Bratti et al. (2022) finds that, in Italy, schooling significantly reduced obesity when instrumenting schooling by college proximity, while there is no significant effect when instrumenting schooling using a compulsory schooling law with incidence at lower schooling levels. Likewise, for the case of Turkey, our results herein contrast with the results in Baltagi et al. (2019) using the same dataset but employing instrumental variables that have incidence at lower schooling levels (middle school).

6.2. Smoking

Smoking is considered one of the leading preventable causes of premature deaths in the world (WHO, 2009). While the prevalence of smoking is higher among men than women, depending on the stage of the smoking pandemic, the prevalence of smoking in women in some countries is on the rise. This might be because of the changes in the social norms and traditions as well as women's increased liberation and economic prosperity (Samet and Yoon, 2010). Smoking behavior is likely to be determined by knowledge, income, wealth, cigarette taxes and prices, and peers among other factors (Galama et al., 2018; Lleras-Muney, 2022). Among these factors, knowledge of the harmful effects of smoking, income, wealth, and social groups are likely to be affected by schooling. Hence, schooling could affect starting or quitting smoking behavior of individuals through altering these characteristics. For instance, Jensen and Lleras-Muney (2012) find that schooling affects smoking

[13] On the other hand, Braga and Bratti (2013) find that IV estimates show a significant impact of women's schooling on their probability of being obese using the Italian compulsory schooling reform which increased compulsory schooling from 5 to 8 years.

through changes in peer network and income, while they could not find any direct effect of knowledge of harmful effects of smoking, time preference, and attitudes toward risk. Moreover, the effect of schooling on smoking may differ across time and countries. For example, in their international comparison based on women aged 15-49 and using OLS, Cutler and Lleras-Muney (2012) find that the effect of schooling on smoking is negative for richer countries, but the effect is very small for the poorest countries. More interestingly, they find that the impact of education on smoking is positive for many middle-income countries. It is thus important to examine the effect of schooling on women's smoking in our context.

Before presenting regression estimates of the impact of schooling on women's smoking, we present graphical unconditional evidence. Figure 10 shows that the rate of current smokers by birth cohort for women who lived in a city with a college at age 17 is higher than that for women who were 17 and resided in a city without a college. Also, the rate of current smokers is increasing with women's birth year in both groups defined by whether they lived in a city with a college at age 17.

Table 5 presents the OLS and IV estimates of the effects of schooling on the smoking behavior of women in Turkey, along with the corresponding first stage estimates and the F statistics on the excluded instruments in the first stage. The smoking behavior of women is defined as a dummy variable which takes a value of 1 if a woman is a current smoker at the time of the interview, and 0 otherwise. We include the same control variables in all regressions as in Table 4. The OLS estimates in column 1 of Table 5 indicates that college attendance is associated with a marginally statistically significant 3 percentage point increase in the woman's probability of being a current smoker. This finding is in line with the previous OLS evidence on the smoking behavior of women in Turkey (e.g., Dursun et al., 2018; Baltagi et al., 2019) and in middle-income countries (Cutler and Lleras-Muney, 2012). However, it is at odds with findings for developed countries that schooling decreases the probability of smoking for women (e.g., Kenkel et al., 2006; Jürges et al. 2011; Etilé and Jones, 2011).

The first stage estimates in this analysis indicate again that the college accessibility measures significantly increase the probability of women's college attendance, with very similar magnitudes as those obtained in the analysis for weight-related variables. The F-statistics on the excluded instruments in the first stage in all specifications in Table 5 are substantially greater than the 10 rule-of-thumb. We take this as evidence that the college proximity (IV1) and the college availability (IV2) instruments are not weak.

Using college proximity as an instrument (IV1) for college attendance, the IV estimate in column 2 of Table 5 indicates that a one percentage point increase in college attendance increases women's probability of being a current smoker by a statistically significant 1.12 percentage points. This represents an increase of 4.9% relative to the rate among women who did not attend college. Using college availability as an instrument (IV2), we find that a one percentage point increase in the probability of college attendance increases the probability of being a current smoker by 0.57 percentage points (a 2.5% increase), which is statistically significant at a 5% level. Regional differences in smoking trends across birth cohorts are controlled by including region-specific birth year cohort indicators in columns 5 and 6. These results show that a one percentage point increase in college attendance increases women's probability of being a current smoker by 1.1 and 0.73 percentage points, respectively. Thus, only the estimates using IV2 increase somewhat by adding these controls, although the estimates remain within one standard deviation of each other.

We find evidence that college enrollment raises women's probability of being a current smoker in Turkey. Instrumenting schooling using the compulsory schooling law change that increased compulsory schooling from 5 to 8 years in Turkey, both Dursun et al. (2018) and Baltagi et al. (2019) found that a one percentage point increase in middle school completion increases women's probability of ever smoking in Turkey by 0.09 and 0.14 to 0.52 percentage points, respectively. However, the estimated coefficients in both of those previous studies were statistically insignificant. In contrast, our estimates based on an exogenous variation at the higher college education level for the same country are statistically significant. This can be interpreted as evidence that the impact of increasing tertiary education on women's smoking behavior is stronger relative to increasing middle school education in Turkey.

In the context of developed countries, existing studies on the impact of schooling on the probability of smoking mostly make use of compulsory schooling changes as an instrument for schooling. Among these, some papers provide estimates of the effect of schooling on smoking separately for women (e.g., Silles, 2015; Etilé and Jones, 2011; Jürges et al., 2011; Kemptner et al., 2011; Kenkel et al. 2006; Dilmaghani, 2021). The IV estimates in these studies are mostly not statistically significant, except for Kenkel et al. (2006), Etilé and Jones (2011), and Jürges et al. (2011). These studies, using instruments affecting high school education, find that men's and women's years of schooling *reduce* the probability of smoking in the US, France,[14] and Germany, respectively. Recently, in the case of Italy, Bratti et al. (2022) show that schooling increases women's probability of smoking using college proximity as an instrument for years of schooling. For developing countries, Parinduri (2017) uses the change in the school term length in Indonesia as an instrument and

[14] Etilé and Jones (2011) uses a set of instruments based on a series of reforms affecting compulsory elementary and secondary schooling in France.

finds that schooling has no statistically significant effect on smoking. While, Huang (2015) finds that schooling reduces smoking using China's 1986 compulsory schooling law as an instrument. However, these two studies do not estimate the impact of schooling on smoking separately for women.

The contradicting evidence on the effect of schooling on women's smoking in Turkey in this paper and existing studies for developed countries could reflect the different stages of smoking transition in developed and developing countries. Lopez et al. (1994) propose a four-stage model for the tobacco epidemic in which the prevalence of smoking is low among women compared to men in the early stage. Trailing behind for several decades, smoking prevalence among women increases in the second stage of the epidemic (Lopez et al., 1994, Janssen, 2020). Smoking prevalence among women increases with the improvements in women's political liberation and labor force participation, and the evolution of cultural and social norms (Solomon, 2020). The recent increase in women's labor force participation in developing countries makes cigarettes more affordable and smoking by women is seen as a symbol of independence in confronting social norms (Mackay and Amos, 2003, Galama et al., 2018). Young women, particularly those with higher socioeconomic status, are predicted to be the first group to take up smoking, which is like the smoking patterns of men in the earlier stages of the tobacco epidemic (Pampel, 2006). Depending on the development level, nations go through the stages of the tobacco epidemic at different times (Solomon, 2020). In light of these considerations, our results are consistent with the notion that the rise in college education of women in Turkey has increased their labor force participation, income, liberation, and social circle, which in turn may have increased their probability of smoking. Interestingly, Bratti et al. (2022) find that the effect of schooling on smoking is not statistically significant for the younger cohort in Italy, but that there is a significantly positive effect for older cohorts, which also appears consistent with the described four-stage tobacco epidemic model. Our finding also provides additional causal evidence to Cutler and Lleras-Muney's (2012) conclusion based on OLS estimates that the impact of education on smoking is positive for middle-income countries.

7. Conclusions

We estimated the impact of woman's college enrollment in Turkey on two leading causes of health-related issues, weight problems and smoking, using exogenous variation in college accessibility in the resident city of a woman when she was 17 years old. Most of the existing studies on the effect of education on health and health behaviors mostly focus on developed countries and use compulsory schooling law changes that affected secondary education as an instrument for education. Thus, the exogenous variation in college accessibility enables us to estimate this relationship at the higher end of the education distribution and for a developing country. Additionally, and specific to our instruments, our data allows us to determine the resident city of a woman when she was 17 years old, sidestepping a drawback of studies that use college accessibility as an instrument for schooling and are forced to assume that endogenous mobility is not a factor (e.g. Card, 1993; Currie and Moretti, 2003; Bratti et al., 2022). Moreover, our data contains measured height and weight of the respondents which enables us to avoid potential measurement errors from self-reported height and weight.

We start by analyzing the effect of our college accessibility measures on the college attendance of women. Our college accessibility measures stem from the relatively recent and substantial increase in the opening of universities throughout Turkish cities. We find that having a college in the city of residence at age 17 (the first measure) and one additional college per 100,000 persons in the city of residence at age 17 (the second measure) increases women's probability of attending college by about 5 percentage points. These results are consistent with the findings of Caner et al. (2019) in the context of Turkey and of Currie and Moretti (2003) in the context of the U.S.

Having documented the substantial effect of the college accessibility measures on women's schooling; we estimated the impact of schooling on body weight variables and smoking behavior of women. We find that women's tertiary schooling improves women's body weight. Attending college reduces log-BMI and the probability of being obese. These statistically significant IV estimates indicate that a 1 percentage point increase in the probability of college attendance decreases the woman's BMI by 0.23 percent. It also reduces the probability of being obese by about 0.57 percentage points. Our results contrast with previous studies for Turkey that did not find a statistically significant effect of schooling on body weight using exogenous changes in middle school levels of education, even when using the same data source as in Baltagi et al. (2019). This contrast in results suggests that the effect of education on body weight is stronger at higher levels of education (e.g., Kamhöfer et al., 2019, Jürges et al., 2011), which is consistent with the arguments pointed out by Cutler and Lleras-Muney (2010), the findings in Bratti et al. (2022) for the case of Italy, and the conjecture advanced in Baltagi et al. (2019) for the case of Turkey.

We also estimated the impact of female tertiary education on the probability of being a current smoker. When accounting for the endogeneity of college attendance using our college availability measures, the IV estimates indicate that a 1 percentage point increase in the probability of college attendance increases a woman's probability of smoking by 1.1 percentage points using the college proximity IV and by 0.73 percentage points using the college availability IV. These detrimental effects of education on smoking in Turkey are interesting in that most of the existing studies for developed countries find a negative relationship, which is statistically significant in some studies (e.g., Etilé and Jones, 2011; Jürges et al., 2011) and not statistically significant in others (e.g. Silles,2015; Kemptner et al., 2011; Kenkel et al. 2006; Dilmaghani, 2021). The finding of a detrimental effect of higher education on smoking in the context of a developing country is consistent with the paradigm of the four-stage tobacco epidemic (Lopez et al.,1994; Solomon, 2020) in which prevalence of smoking among women lags behind men for several decades and increases rapidly, driven by women with higher socioeconomic status. It is also consistent with related findings and arguments by Cutler and Lleras-Muney (2012) for middle-income countries and Bratti et al.(2022) for Italy.

In sum, we document heterogenous effects of increased enrollment in higher education by women in a developing country on body weight and smoking behavior. While the literature has traditionally focused on the positive health spillovers of education, our results caution about possible heterogeneities and tradeoffs. Heterogeneity in the effect of schooling on health may arise relative to the level of education considered, as in our finding of statistically significant effects from college attendance on women's body weight and the statistically insignificant effect from additional middle school attainment in Baltagi et al. (2019) for the same country. Heterogeneity may also arise relative to the particular health outcome or behavior considered and the state of economic development of the country under study. This is because we document that, while college attendance improves the bodyweight of women, the probability of being a current smoker is increased. And the detrimental effect of smoking appears at odds with the existing literature for developed nations. More research should document additional heterogeneities in the effect of schooling on health across levels of education, different health outcomes, and countries, and on exploring potentially negative spillovers of education.

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Figures and Tables

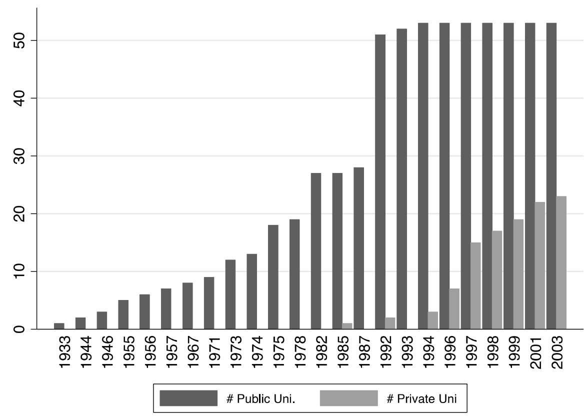

Figure 1: Number of Public-Private Universities
Authors' illustration based on Higher Education Statistics of Council of Higher Education (COHE)

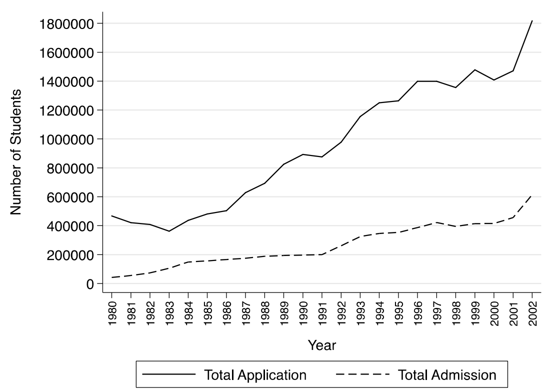

Figure 2: Number of College Applications and Admissions
Authors' illustration based on Higher Education Statistics of Council of Higher Education (COHE)

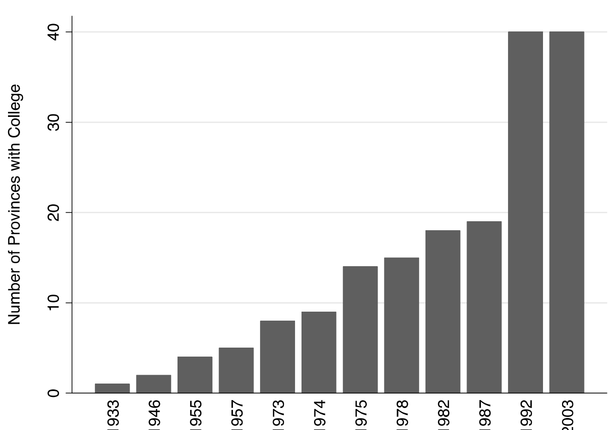

Figure 3: Number of Turkish Provinces with at least One College, by Year
Authors' illustration based on Higher Education Statistics of Council of Higher Education (COHE)

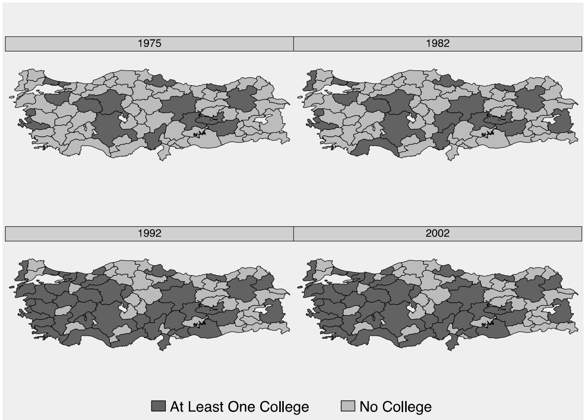

Figure 4: Spatial Distribution of Turkish Provinces With at Least One College
Authors' illustration based on Higher Education Statistics of Council of Higher Education (COHE)

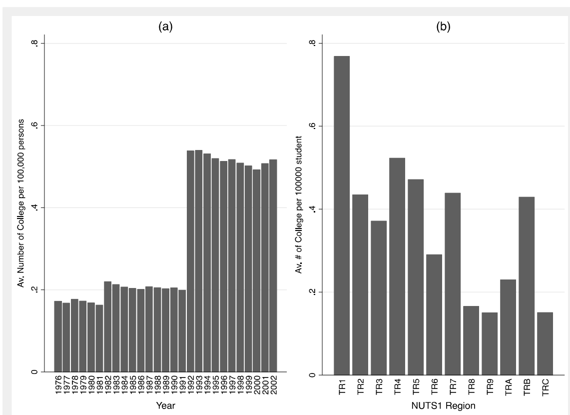

Figure 5: Number of Colleges per 100,000 persons by Year and Region
Authors' illustration based on Higher Education Statistics of Council of Higher Education (COHE). (a) shows the average number of colleges per 100,000 persons aged 18-24 by year. (b) shows the average number of colleges per 100,000 persons aged 18-24 by 12 NUTS1 regions between 1975-2002. Number of universities include both public and private colleges.

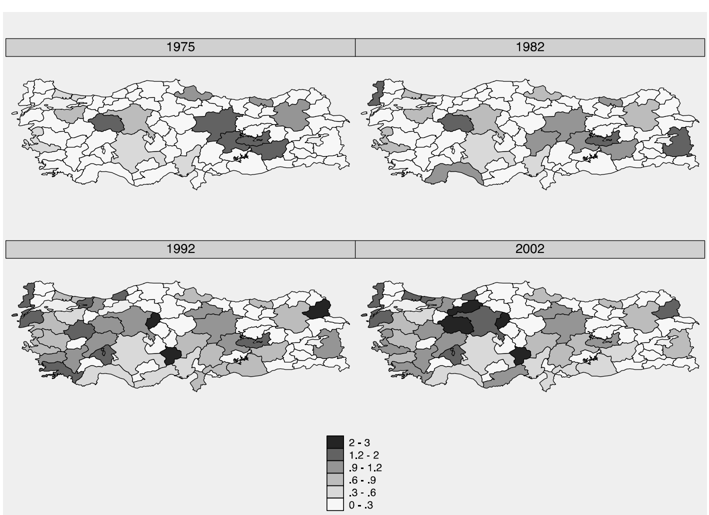

Figure 6: Spatial Distributions Number of Colleges per 100,000 persons
Authors' illustration based on Higher Education Statistics of Council of Higher Education (COHE).

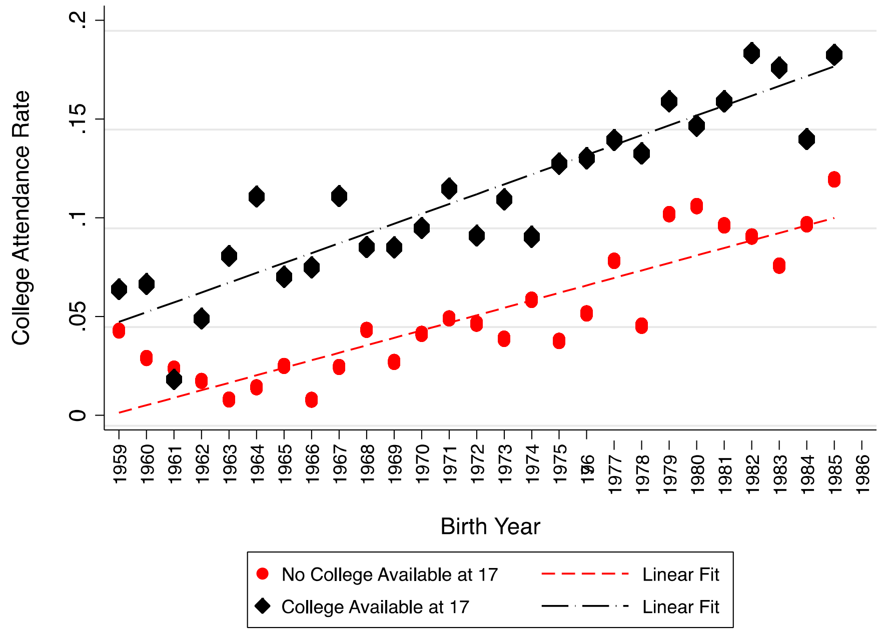

Figure 7: College Attendance Rate

Authors' illustration based on the 2008,2013, and 2018 TDHS data. The graph shows college attendance rates by birth cohort for those lived in a city with college when they were 17 years old and those lived in a city without a college when they were 17 years old. Linear fits obtained by regressing the average college attendance on birth year.

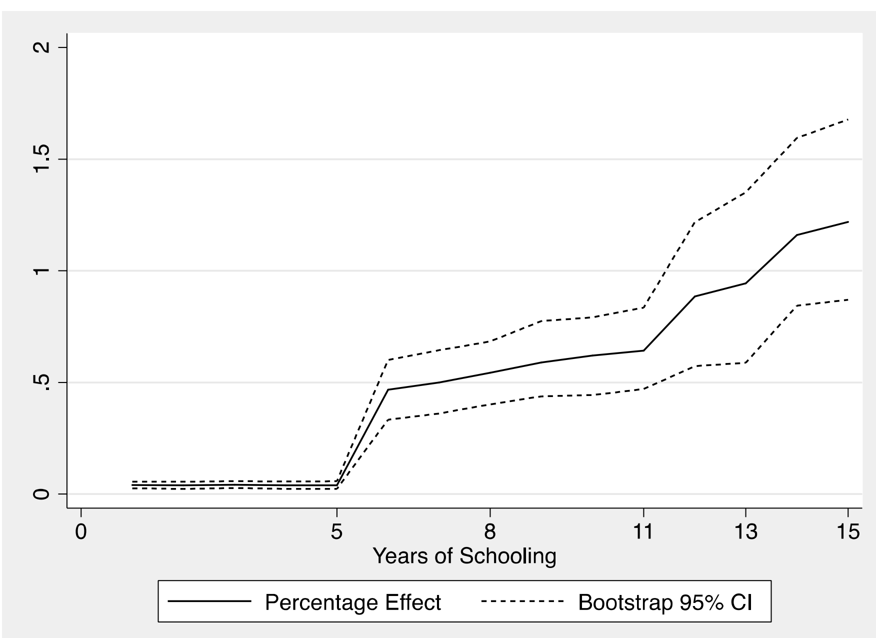

Figure 8: Percentage Effect of College Proximity on the Distribution of Years of Schooling

Authors' calculations based on the 2008, 2013, and 2018 TDHS data. The figure shows the percentage effects of college proximity on indicator variables for at least having completed each of the observed values of years of schooling, controlling for covariates using an inverse probability weighing approach with weights given by $\left(\frac{Z}{PS}+\frac{1-Z}{1-PS}\right)$ where Z is college proximity and PS is the propensity score obtained from a logistic regression of Z on covariates.

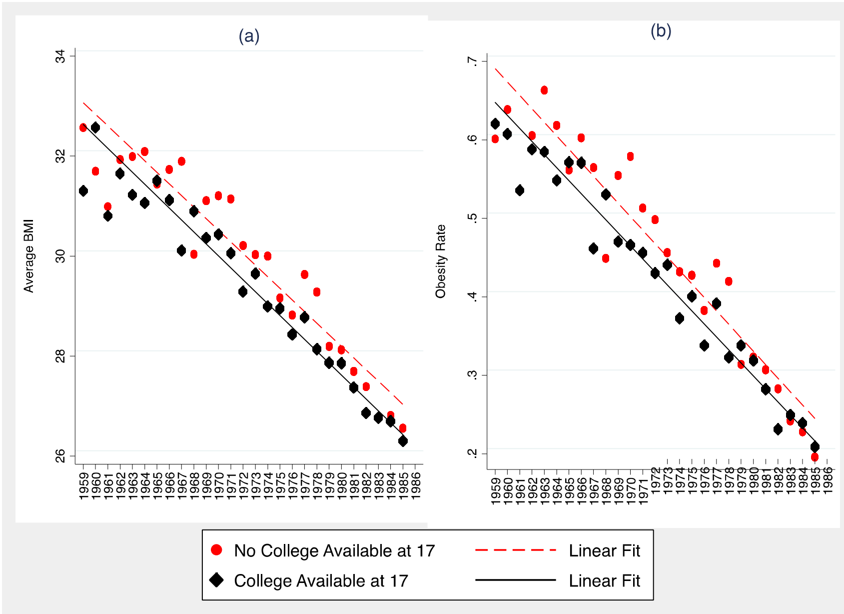

Figure 9: Average BMI and Obesity Rate

Authors' illustration based on the 2008,2013, and 2018 TDHS data. (a) shows average BMI by birth cohort for those lived in a city with college when they were 17 years old and those lived in a city without a college when they were 17 years old. Linear fits obtained by regressing the average BMI on birth year. (b) shows obesity rates by birth cohort for those lived in a city with college when they were 17 years old and those lived in a city without a college when they were 17 years old. Linear fits obtained by regressing the average obesity rate on birth year.

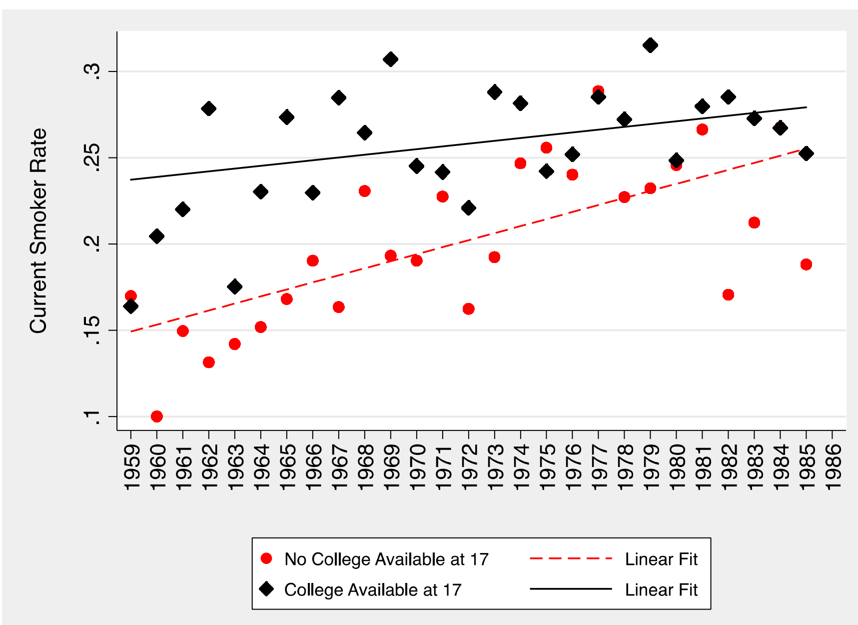

Figure 10: Smoking Rate

Authors' illustration based on the 2008,2013, and 2018 TDHS data. Figure shows rate of current smokers by birth cohort for those lived in a city with college when they were 17 years old and those lived in a city without a college when they were 17 years old. Linear fits obtained by regressing the smoker rate on birth year.

Table 1: Summary Statistics

Variables	All	College Proximity=0	College Proximity=1
		BMI Sample	
Age*	**37.35**	**39.27**	**36.02**
	(6.81)	(6.62)	(6.63)
Years of Education*	**5.96**	**4.99**	**6.62**
	(4.11)	(3.76)	(4.21)
At least Middle School*	**0.28**	**0.19**	**0.34**
	(0.45)	(0.39)	(0.47)
At least High School *	**0.21**	**0.14**	**0.26**
	(0.41)	(0.34)	(0.44)
College Attendance*	**0.09**	**0.05**	**0.12**
	(0.29)	(0.22)	(0.33)
BMI*	**29.09**	**29.87**	**28.56**
	(5.75)	(5.81)	(5.65)
Obese*	**0.40**	**0.46**	**0.36**
	(0.49)	(0.50)	(0.48)
Overweight	**0.34**	**0.33**	**0.34**
	(0.47)	(0.47)	(0.48)
Normal-Weight*	**0.25**	**0.21**	**0.28**
	(0.43)	(0.41)	(0.45)
Underweight*	**0.01**	**0.004**	**0.01**
	(0.09)	(0.06)	(0.10)
Married	**0.92**	**0.92**	**0.92**
	(0.27)	(0.27)	(0.28)
N	14511	5931	8580
		Smoking Sample	
Age*	**37.37**	**39.26**	**36.07**
	(6.80)	(6.59)	(6.64)
Years of Education*	**6.06**	**5.08**	**6.73**
	(4.17)	(3.83)	(4.27)
At least Middle School*	**0.29**	**0.20**	**0.35**
	(0.45)	(0.40)	(0.48)
At least High School*	**0.22**	**0.15**	**0.27**
	(0.41)	(0.35)	(0.44)
College Attendance*	**0.10**	**0.06**	**0.13**
	(0.30)	(0.23)	(0.34)
Smoking*	**0.24**	**0.20**	**0.26**
	(0.43)	(0.40)	(0.44)
Married	**0.92**	**0.92**	**0.91**
	(0.28)	(0.27)	(0.28)
N	16121	6572	9549

Notes: College Proximity=1 if there is a college in woman's resident city when she was 17 years old, and 0 otherwise. Standard errors are in parentheses. * indicates that the differences of means between College Proximity=1 and College Proximity=0 are significant based on a t-test.

Table 2: Migration at or after Age 17

	Migrated for Education	Not Migrated for Education	Total
Migrated	659 (12.8%)	4,490 (87.2%)	5,149 (31.9%)
Not Migrated	0 (0 %)	10,972 (100%)	10,972 (68.1%)
Total	659 (4.1 %)	15,462 (95.9%)	16,121 (100%)

Notes: Migrated indicates number of women who migrated to another city at or after age of 17. Percentages are shown in parentheses. The sample employed is the "smoking sample."

Table 3: The Effect of College Availability on College Attendance

	(1) **College Proximity**	(2) **College Availability**	(3) **College Proximity**	(4) **College Availability**
College Enrollment	0.05***	0.04***	0.04***	0.05***
	(0.01)	(0.01)	(0.01)	(0.01)
Region*Birth Year Indicators	NO	NO	YES	YES

Notes: Number of observations is 16,123. Standard errors clustered by region of residence at age 17 and birth cohort are in parentheses *** p<0.01, ** p<0.05, * p<0.1. All regressions include age, age square, a dummy for married, **12 NUTS1 region of residence at age 17 dummies** and year dummies. Columns (3)-(4) additionally include interactions of **12 NUTS1 regions of residence at age 17** and birth year indicators.
College Proximity =1 if there is a college in woman's resident city when she was 17 years old, and 0 otherwise.
College Availability is the number of colleges per 100,000 persons in woman's resident city when she was 17 years old

Table 4: The Effect of College Attendance on Body Weight

Variables	(1) OLS	(2) IV1	(3) IV2	(4) OLS	(5) IV1	(6) IV2
log (BMI)	**-0.10***	**-0.27***	**-0.23***	**-0.10***	**-0.23**	**-0.21***
	(0.01)	**(0.09)**	**(0.08)**	**(0.01)**	**(0.09)**	**(0.08)**
Obese	**-0.18***	**-0.63***	**-0.46**	**-0.18***	**-0.57**	**-0.44**
	(0.01)	**(0.24)**	**(0.20)**	**(0.01)**	**(0.23)**	**(0.19)**
Overweight	**-0.02**	**0.23**	**0.01**	**-0.02**	**0.21**	**-0.01**
	(0.02)	**(0.22)**	**(0.21)**	**(0.02)**	**(0.24)**	**(0.23)**
Normal Weight	**0.21***	**0.34**	**0.39***	**0.21***	**0.30**	**0.41***
	(0.02)	**(0.22)**	**(0.23)**	**(0.02)**	**(0.23)**	**(0.22)**
Underweight	**-0.001**	**0.06**	**0.06**	**-0.001**	**0.06**	**0.04**
	(0.001)	**(0.04)**	**(0.04)**	**(0.001)**	**(0.05)**	**(0.04)**
Region*Birth Year Indicators	**NO**	**NO**	**NO**	**YES**	**YES**	**YES**
			First Stage Estimates			
Instrument	_	**0.04***	**0.05***	_	**0.05***	**0.05***
		(0.01)	**(0.01)**		**(0.01)**	**(0.01)**
1st Stage F-stat		**39.75**	**38.94**		**34.02**	**37.36**

Notes: Number of observations: 14,511. Standard errors clustered by region of residence at age 17 and birth cohort are in parentheses *** p<0.01, ** p<0.05, * p<0.1. All regressions include age, age square, a dummy for married, **12 NUTS1 region of residence at age 17 dummies** and year dummies. Columns (4)-(6) additionally include interactions of **12 NUTS1 regions of residence at age 17** and birth year indicators.

IV1: **College Proximity** (1 if there is a college in woman's resident city when she was 17 years old, and 0 otherwise.).

IV2: College Availability (number of colleges per 100,000 persons in woman's resident city when she was 17 years old).

Table 5: The Effect of College Attendance on Smoking

Variables	(1) OLS	(2) IV1	(3) IV2	(4) OLS	(5) IV1	(6) IV2
Current Smoker	**0.03*** (0.02)**	**1.12*** (0.26)**	**0.57** (0.23)**	**0.03 (0.02)**	**1.10*** (0.28)**	**0.73*** (0.25)**
Region*Birth Year Indicators	**NO**	**NO**	**NO**	**YES**	**YES**	**YES**
First Stage Estimates						
Instrument	**_**	**0.05*** (0.01)**	**0.04*** (0.01)**	**_**	**0.04*** (0.01)**	**0.05*** (0.01)**
1st Stage F-stat		**40.58**	**37.98**		**31.77**	**34.27**

Notes: Number of observations: 16,121. Standard errors clustered by region of residence at age 17 and birth cohort are in parentheses *** p<0.01, ** p<0.05, * p<0.1. All regressions include age, age square, a dummy for married, **12 NUTS1 region of residence at age 17 dummies** and birth year dummies. Columns (4)-(6) additionally include interactions of **12 NUTS1 regions of residence at age 17** and birth year indicators.
IV1: **College Proximity** (1 if there is a college in woman's resident city when she was 17 years old, and 0 otherwise.).
IV2: College Availability (number of colleges per 100,000 persons in woman's resident city when she was 17 years old).