ERF Working Papers Series

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ECONOMIC RESEARCH FORUM
منتدى البحوث الاقتصادية

Working Paper No. 1703
January 2024

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This paper received financial support from the Turkish Research Council (TÜBİTAK), Project 122K095. Abdullah Tirgil would like to extend his gratitude to the Turkish Academy of Sciences for their valuable nonfinancial support. The usual disclaimer holds. We thank Ceyda Vatansever and Ümit Acar for their research assistance.

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First published in 2024 by
The Economic Research Forum (ERF)
21 Al-Sad Al-Aaly Street
Dokki, Giza
Egypt
www.erf.org.eg

Abstract

This paper investigates the causal relationship between education and mental health in Turkey. We rely on the quasi-experimental setting created by the 1997 compulsory education reform that raised the compulsory years of schooling from five to eight years. Using regression discontinuity design, we use the birth year to indicate reform exposure and identify the causal effects of longer years of schooling on mental health. Our results demonstrate a sizable negative impact of education on the mental health scale. We present evidence that the reform had a more adverse effect on men's mental health. There is also heterogeneity by the place of residence, as the longer school years led people who live in urban areas to experience worse mental health outcomes. By investigating possible mechanisms, we show that those with at least a middle school education did not invest more in their health than those without a middle school diploma. We explain the evidence for the adverse effects of education on mental health, especially experienced by those who face higher competition in the labor market, by the lack of an increase in household income despite the longer years in school.

Keywords: mental health, MHI-5, regression discontinuity design, compulsory schooling law, education policy, Turkey
JEL Classifications: I12, I26, I28

ملخص

تبحث هذه الورقة في العلاقة السببية بين التعليم والصحة العقلية في تركيا. ونحن نعتمد على الوضع شبه التجريبي الذي أوجده إصلاح التعليم الإلزامي في عام 1997 والذي رفع سنوات الدراسة الإلزامية من خمس إلى ثماني سنوات. باستخدام تصميم التوقف عن الانحدار، نستخدم سنة الولادة للإشارة إلى التعرض للإصلاح وتحديد الآثار السببية لسنوات الدراسة الأطول على الصحة العقلية. تظهر نتائجنا تأثيرًا سلبيًا كبيرًا للتعليم على مقياس الصحة العقلية. نقدم أدلة على أن الإصلاح كان له تأثير سلبي أكثر على الصحة العقلية للرجال. هناك أيضًا عدم تجانس حسب مكان الإقامة، حيث دفعت سنوات الدراسة الأطول الأشخاص الذين يعيشون في المناطق الحضرية إلى تجربة نتائج أسوأ للصحة العقلية. من خلال التحقيق في الآليات الممكنة، نظهر أن أولئك الذين حصلوا على الأقل على تعليم إعدادي لم يستثمروا في صحتهم أكثر من أولئك الذين لم يحصلوا على شهادة المدرسة الإعدادية. نشرح الأدلة على الآثار السلبية للتعليم على الصحة العقلية، خاصة من قبل أولئك الذين يواجهون منافسة أعلى في سوق العمل، بسبب عدم وجود زيادة في دخل الأسرة على الرغم من السنوات الأطول في المدرسة.

1. Introduction

Mental health-related problems pose a significant burden globally, as there are 280 million people who have depression across the world (WHO, 2023). Although it is not straightforward to demonstrate a causal relationship, depression is documented to be less common among the more educated (Silva et al., 2016; Tirgil and Aygün, 2021), and the negative association between education and depression is more prevalent among those who come from disadvantaged backgrounds (Bauldry, 2015). Moreover, educated individuals are more likely to seek treatment for depression than their less educated counterparts (Evans-Lacko et al., 2018). However, our knowledge about the best education policy applications to support the mental health of individuals in developing countries is limited.

This study investigates the causal relationship between education and mental health in Turkey. In particular, we explore the effect of the 1997 compulsory schooling reform, which raised the compulsory years of schooling from five to eight years, on mental health. The reform effectively increased the likelihood of completing at least middle school by more than 20 percentage points. There were also some spillover effects, and the probability of staying in school increased by 22 percentage points. We use the quasi-experimental setting of the reform to analyze the impact of an additional three years of schooling on mental health. To explain the possible mechanisms, we also investigate a broad list of variables. Our heterogeneity analysis reports results by gender and place of residence.

We use the waves of the Turkish Statistical Institute (TurkStat)'s Turkey Health Survey (THS) 2008, 2010, and 2012. We measure the mental health outcome using the Mental Health Index (MHI-5) scale. MHI-5 is an index that combines different behavioral patterns that can be observed as symptoms of depression. When used in a primary care setting, MHI-5 has proven to be an effective tool in accurately identifying depression and anxiety (Means-Christensen et al., 2005). The THS waves we used in this study collected information suitable for generating MHI-5 scores.

Our results demonstrate a negative effect of longer years of schooling on the mental health scale. Middle school completion leads to a half standard deviation decrease in MHI-5 score, indicating worsening mental health. Our heterogeneity analysis presents evidence that men's mental health scale fell more than women's with the reform. While women reported an increase in propensity to experience chronic depression, men's tendency to experience mental problems other than depression increased. There is also heterogeneity by the place of residence, as the longer school years led people who live in urban areas to experience worse mental health outcomes. We further report that the reform affected the likelihood of staying in school longer than the mandated years. Our findings suggest that this spillover effect in continuing higher education may have played a key role in worsening mental health in our setting. The adverse impact on mental health is mainly visible for men and urban residents for whom the probability of not working and staying in school increased significantly, along with an income loss.

Using the health production function framework (Grossman, 1972), we test possible mechanisms to explain the relationship between education and mental health. First, we show that the more educated did not have different health behaviors: they were neither more likely to receive professional psychology help nor develop a healthier lifestyle than those without a middle school diploma. Second, even though we did not directly test the differences in productivity in health production, our results imply that those affected by the reform were not more productive in producing mental or physical health despite working in less challenging environments. Third, we comment on the existence of other mechanisms through which education can affect health. We find that household income per capita and the probability of marriage decreased significantly.

Economists often use compulsory schooling reforms to identify a causal relationship between education and health. Most of these studies provide evidence from developed countries and focus on physical health outcomes. Among the ones with a mental health outcome similar to ours, Avendano et al. (2020) used the 1972 reform in Britain that raised the school-leaving age from 15 to 16 and reported no improvements in mental health. They found increased depression and anxiety due to the reform with one of the three datasets they used. Janke et al. (2020) again used data from Britain and reported that the reform did not affect mental illnesses using chronic mental conditions as their outcome variable. Courtin et al. (2019) reported increased depression symptoms among women but improved cognitive skills among men due to the reform that extended compulsory schooling by two years in France. Dahmann and Schnitzlein (2019) reported no effect of the reform that increased compulsory education by one year in Germany on the Mental Component Summary scores.

Ours is among the few studies investigating the causal relationship between education and mental health in a developing country context. Evidence from Zimbabwe (Kondirolli and Sunder, 2022) and China (Jiang et al., 2020) demonstrates the positive effects of education on mental health. In contrast to their findings, however, our results suggest a negative impact of education. In the Zimbabwe and China studies, improvements in mental health were more sizable among women and rural residents, whereas we report worsening mental health among men and urban residents. One of the main reasons for this difference might be because, in the case of Turkey, there were no improvements in the labor market opportunities and earned income among men (Aydemir and Kırdar, 2017) in contrast to what was observed in China. Our finding with the income variable also aligns with this: middle school completion leads to statistically significant per capita household income reductions as affected individuals replace school with employment.

Previously, Dursun et al. (2018) used the same setting as ours to test the effect of schooling on physical health in Turkey. They found that the reform did not have any impact on the reported health of women. There were also no behavioral changes such as smoking, fruit and vegetable consumption, or getting flu vaccination among women. Among men, the Body Mass Index and prevalence of obesity and overweight increased. Other studies reported improvements in healthcare utilization among women. More specifically, healthcare utilization during the first trimester of pregnancy and the use of contraceptives increased, according to Dinçer et al. (2017), and the health of the infants born to mothers affected by the compulsory schooling reform improved (Güneş, 2015).

Using the Turkish Life Satisfaction Survey, Dursun and Cesur (2016) measured the reform's effect on life satisfaction. They found that the reform increased the ratio of women who are satisfied with their lives, whereas negative but insignificant results were reported for men. Our paper differs from theirs by deriving results on a mental health score effective in detecting depression if used in a clinical setting. By using a health survey, we also test the existence of an effect on mental health behavior and chronic depression outcomes of increased educational attainment. Our paper mainly differs from Dursun and Cesur (2016) by testing the hypothesis to relate education and health in a health production function framework. In contrast, they comment more on the behavioral aspects of the relationship.

Our paper contributes to the literature investigating the nature and direction of a relationship between education and mental health by providing evidence for a younger age cohort than the previous studies. As a result of the timing of the compulsory schooling reforms, which were primarily implemented in the first half of the 20th century, evidence from the developed countries focuses on a relatively older sample of individuals.[1] The mean age of the adults in our study is 25, which enables us to focus on individuals at the child-bearing age and in the labor market. Hence, the policy implications are different from those of an older sample. Our study also contributes to the literature on the mental health effects of education with its results. We present an example of a developing country where education does not improve mental health, and compulsory schooling reforms may lead to undesirable health outcomes when they cannot yield financial returns.

2. Background

2.1 Compulsory Schooling Reform in Turkey

Before the 1997 compulsory schooling intervention, the Turkish education system had three subsections: primary, middle, and high school. The primary school comprised a mandatory five years of training. After primary school, students could either drop out or continue their education in middle school for another three years, followed by another (optional) three years in high school.

On August 16, 1997, the Turkish government passed Law no. 4306 to extend compulsory education from five to eight years, which immediately went into effect for the 1997-1998 school year. Hence, those who completed the fifth grade in the 1996-1997 school year had the option to discontinue their education; however, those who completed the fourth grade in the 1996-1997 school year were obliged to stay in school until the eight-year mandatory education had been completed. Since the children were supposed to begin school when they turned 72 months old, compulsory schooling reform affected individuals born in January 1987 or later. The reform combined primary school with middle school, and a basic education diploma was given after completing the eighth grade. Throughout the paper, we refer to obtaining the basic education diploma as completing at least middle school because completing eight years of schooling corresponded to a middle school degree in the prior system.

The reform was very effective in increasing the completion rate of eighth grade and improving schooling in rural areas, and it had spillover effects, increasing high school graduation rates (Kırdar et al., 2015). However, despite increasing middle and high school completion rates, the reform generated low wage returns, especially for men (Aydemir and Kırdar, 2017). They

[1] For example the compulsory schooling reforms in England were put into effect in 1947 and 1972, and in France in 1959. Even the reforms in Zimbabwe and China were implemented in 1980 and 1986, respectively leaving the cohort in Turkey the youngest to be affected by such a reform.

explain the low wage returns of the reform in their study by the fact that the wage-schooling locus is flat for the affected grades and the lack of a sheepskin effect.

3. Data

We use the 2008, 2010, and 2012 waves of Turkey's Health Surveys (THS) conducted by the Turkish Statistical Institute (TurkStat) to examine the impact of longer years of mandatory schooling on individuals' mental health scores. Our datasets are repeated cross-sectional surveys representative at the national level.

We constructed our primary dependent variable using a five-variable mental health index (MHI-5) per the Short Form Health Survey (SF-36) guidelines (Ware et al., 1993). The mental health component of SF-36 consists of five screening questions to detect depression symptoms, which can be used to calculate an MHI-5 scale. MHI-5 scale obtained in this way produces results that are highly correlated with other questionnaires used for evaluating mental health (Berwick et al. 1991; Rumpf et al. 2001; Yamazaki et al. 2005).

MHI-5 combines information based on the answers to five questions about feelings in the last four weeks. The survey questions are framed as follows: "In the last four weeks, how often have you felt (i) very nervous, (ii) brokenhearted and depressed, (iii) calm and quiet, (iv) melancholic (thought nothing could cheer you up), and (v) happy?" The answers in our data are a five-point Likert-type ranging from 1 = Always to 5 = Never.[2] While calculating the MHI-5 scale, responses to (iii) calm and quiet and (v) happy are reverse scored (i.e., 1= Never to 5 = Always) because they refer to positive feelings. By adding answers to these five questions, we obtained a score that ranges between 0 and 25. We then converted the obtained score to a scale that ranges between 0 and 100 with simple linear transformation, as suggested by the guideline by Ware et al. (1993).

A score of 100 means no depressive symptoms, as the depressive symptoms are experienced more frequently, a lower MHI-5 scale is recorded, and a 0 score indicates the worst mental health. We treated responses such as "I do not know" and "I do not want to answer" as missing and handled the missing values as Ware et al. (1993) suggested: If a respondent has filled in values for more than half (at least three) of the five questions, we imputed the missing values by taking the average score of the filled frequencies. However, we dropped the observation if a

[2] The original MHI-5 is a six-point Likert-type questionnaire. THS offers one less answer option than the original, leaving out the option “a good bit of the time.” We believe this will not affect our analysis because we have rescaled the scores to fit the 0-100 range.

respondent did not respond to more than three feeling questions. As a robustness check, we show in Appendix Table B1 that the existence of three or more missing variables in this category is not affected by the respondent's education.

Even though MHI-5 has proved itself to be an effective tool for detecting depressive symptoms, there is not a universally accepted formal cut point to diagnose mental health problems using the MHI-5 scale. Researchers have reported various cutpoints using data from individual countries (Kelly et al., 2008). However, the results depend on numerous factors, such as the population from which data was collected, the criteria used to define mental disorders, and the chosen method for comparison. As a result, we prefer to use the 0-100 scale as our outcome variable.

In our additional analysis, we refer to the survey data regarding chronic mental health conditions categorized as chronic depression and chronic mental conditions other than depression in the last 12 months. We also include variables for mental health care use. These are doctor-prescribed antidepressants and medicines for tension and unrest in the last two weeks and visits to the psychologist or psychotherapist visits during the previous 12 months.

For our analysis to explain the possible mechanisms, we incorporated various questions regarding physical health. These include a question about overall health, which we use as a binary variable with 0: medium, bad, or very bad; 1: good or very good. We also included two binary variables showing that the respondent experienced a health problem that lasted or was expected to last more than six months, and their daily activities were limited due to their health in the last six months. Finally, we use a binary variable indicating that the respondent felt any physical pain in the previous four weeks.

We used physical activity and fruit or vegetable consumption variables to test the lifestyle effects of education. These include dummy variables if the individual engaged in heavy or medium physical activity or walked for at least 10 minutes in the last seven days. We also included numeric variables ranging from 0: never to 5: two or more times a day for fruit, vegetable, salad, and fruit juice consumption.

For our analysis to explain the possible economic mechanisms, we constructed employment status variables using the survey questions regarding the economic activities in the last seven days. We group individuals as employed if they worked for at least one hour, as unemployed if they did not work but looked for a job, and as in school if they did not work and were at school during this time.[3]

The income information in the THS waves is for monthly household income and is given in 10 different categories. We assigned the most frequent category of household income variable in each wave to the missing observations. We constructed the income variable as a continuous variable using the midpoint of each range, except for the first and last categories, for which we used the upper and lower limits, respectively. We then created a per capita income variable by dividing the household income by the number of household members. The variable is deflated using 2003 prices to account for inflation throughout the survey years.

Finally, we use the work environment and social asset questions to test the impact of education on social well-being. The work environment questions refer to facing heavy workload and time pressure in the workplace and having difficult working conditions, i.e., lifting heavy objects, working in a physically challenging environment, or completing monotone tasks at work. Additionally, we include the existence of at least one close person to trust in the case of a severe personal problem for measuring the social asset.

3.1. Descriptive Statistics

Table 1 presents the summary statistics for the variables we use in our regression analyses. We provide these descriptive statistics for our largest bandwidth of nine years around the cutoff. The mean MHI-5 scale (our primary dependent variable) was about 64, ranging from 0 to 100. 72% indicated they had at least a middle school diploma. 1.4% reported that chronic depression occurred in the last 12 months. 1.5% stated that other chronic mental problems happened during the previous 12 months. Regarding the use of mental healthcare services, just over 1% of those in the sample indicated that they used an antidepressant prescribed by a doctor in the last two weeks, and just under 1% stated that they used medicine for tension and unrest prescribed by a doctor during the previous two weeks, and just above 3% agreed that they visited a psychologist/psychotherapist in the last 12 months.

Self-assessment of overall health was positive, as over 80% of the sample agreed they had good or very good health. About 19% of the people in the survey indicated they had continuing health problems, about 17% reported health problems limiting daily life, and 27% indicated physical pain in the last four weeks.

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[3] In the survey, school participation information is collected as a reason of not working, hence does not coexist with employment.

Engagement in heavy physical activity was rare, with 11% of the sample indicating they had done so in the last seven days, and approximately a quarter of the sample agreed that they had had medium physical activity in the previous seven days. Over 50% of the sample reported a ten-minute walk in the last seven days. The mean score for fruit consumption is 3.254, 3.535 for vegetable or salad consumption, and 2.105 for fruit or vegetable juice consumption.

Analysis of the work environment and social assets showed that approximately 96% of the surveyed individuals indicated they had someone to trust when there was a severe problem they had to face. Just under 7% of those surveyed reported having difficult working conditions and under pressure in the workplace.

More than half of the respondents aged 18 or above (53%) reported being married, and 1.3% were divorced. 43% indicated that they were employed, 6.3% were unemployed, and 15.3% stated they were in school. The sample's mean per capita household income was 1,294TL, ranging from 175TL to 2,700TL (in 2003 prices) per month.

4. Empirical Strategy

The compulsory education law plays a crucial role in our econometric model, given the quasi-experimental environment it creates. We take advantage of the discontinuity of reform exposure by year of birth to examine the causal impact of education on individuals' mental health scores. Our identifying assumption is that there are no systematic differences between the treated and untreated cohorts. Thus, the birth year can serve as an instrument in predicting one's likelihood of having at least a middle school education.

We conduct two types of regression analysis using the THS datasets. The first one establishes a direct relationship between the birth year criterion and mental health, which serves as a reduced-form analysis:

$$Y_i = \alpha_0 + \alpha_1 D_i + \alpha_2 D_i f(x_i) + X'\theta + u_i \qquad (1)$$

Y_i is the dependent variable related to mental health, D_i is the policy dummy variable (1 for those born in 1987 and later, 0 for others), x_i is the running variable (the birth year, which is set to zero at the cutoff value of 1987), $f(x_i)$ is a linear function of the running variable to control for the temporal trend in mental health on both sides of the cutoff, and X are control variables (a continuous age variable and dummy variables for female, urban residence, NUTS1 region, and survey year). In this case, α_1 is the coefficient of interest for measuring the impact of the policy on mental health.

Equation 1 represents the model used in the sharp regression discontinuity design. However, the sharp regression discontinuity model is more suitable for cases with a clear jump in treatment from one side of the threshold to the other. For this, it is necessary that everyone affected by the policy complies. Considering the non-compliers in the case of compulsory education reform, we estimate the effect of education on mental health using a fuzzy regression discontinuity design. In this setting, the two-stage least squares (2SLS) method considers the birth year an exogenous instrument (Hahn et al., 2001). For this method, we use Equation 2 in the first stage and Equation 3 in the second stage:

$$s_i = \beta_0 + \beta_1 D_i + \beta_2 f(x_i) + \beta_3 D_i f(x_i) + X'\Delta + \varepsilon_i \quad (2)$$

$$Y_i = \gamma_0 + \gamma_1 \hat{s_i} + \gamma_2 f(x_i) + \gamma_3 D_i f(x_i) + X'\zeta + \eta_i \quad (3)$$

In Equation 2, s_i is a dummy variable representing having at least middle school education, and we use the birth year being 1987 and later (D_i) as an instrument in predicting education. Then, we use these predicted values ($\hat{s_i}$) in Equation (3) to measure the impact of education on mental health. Therefore, the γ_1 coefficient represents how having a middle school education or higher affects mental health.

Even though the reform made eight years of schooling mandatory for those born in 1987, there could be some non-compliance cases within this group if some started school at an age older than the required age. Similarly, some individuals could start school early and would be affected by the reform even though they were born in 1986. In Panel B of Figure 1, such cases could be seen by the middle school completion rates, which are distinctively lower or higher than the remaining observations on the immediate right and left side of the cutoff, respectively. To eliminate these late- or early-starters influencing our results, we followed Kırdar et al. (2018) and conducted a "donut hole" analysis by eliminating 1986 and 1987 birth years from the sample. The donut hole analysis is our preferred strategy because we cannot control the potential variations in school-starting age by birth month. After all, THS lacks month of birth information. We present results without the donut hole for our primary outcome variable as a robustness check in Appendix Table B3.

In our setting, exposure to the reform depends on the birth year; therefore, the observations with the same birth year are not independent. To prevent this from affecting the precision of our estimations, we cluster the standard errors. However, since the number of birth years is as low as 17 in our largest bandwidth with the donut hole, we use wild-cluster bootstrapping (Cameron et al., 2008), which is valid even if the number of clusters is small (Canay et al., 2021).

Since the THS lacks month of birth information and we have limited data points of the running variable for the nonparametric analysis, we prefer parametric bandwidths in the outcomes in our main text. We begin with a nine-year bandwidth to the left and right of the cutoff and narrow the bandwidth to four years step-by-step to test the consistency of estimates with different bandwidths.[4] We also provide results using a nonparametric bandwidth for the primary outcome variable to complement our parametric bandwidth estimations in Appendix Table B4.

4.1. Tests for the Appropriateness of the Identification Strategy

It has been demonstrated in previous studies that the 1997 education reform created an environment suitable for a regression discontinuity design specification (Aydemir and Kırdar, 2017; Erten and Keskin, 2018). We also ran various tests of the identification assumptions related to using the regression discontinuity design in our setting. First, using a histogram of the running variable, which is discrete because we lack month of birth information in the THS, we demonstrate no manipulation or clustering in the birth year around the cutoff (Appendix Figure A1). Second, in Appendix Figure A2, we show no statistically significant jump at the cutoff for the control variables, validating the use of the regression discontinuity design in our setup. Third, we use alternative cutoffs dating back to five to ten years before the actual reform in our placebo analysis and show that there exist no jumps of the dependent variable at these alternative cutoffs except for one of the placebo treatments in Appendix Table A1. To avoid the contamination of a later reform that further expanded compulsory schooling by affecting those born in 1998 or later, we limit our placebo analysis to the pre-reform dates and exclude the post-reform period.

5. Results

5.1 Main Results

The first set of graphical analyses in Figure 1 aims to show the effects of the birth year criterion (i.e., being treated by the 1997 education policy) on middle school completion and the MHI-5 scale. The jump in the fraction of individuals with a middle school diploma at the birth year criterion can be seen in Panel A (with a donut hole excluding 1986-1987 birth years) and Panel

[4] The compulsory schooling law changed once again in 2012, increasing the mandatory years of schooling from 8 to 12. In order to omit the cohort affected by the 2012 reform, we cut our largest bandwidth at 9 years at both sides of the cutoff.

B (without the donut hole) in Figure 1. As seen in Panel B, the two points corresponding to the 1986 and 1987 birth years are closer. Hence, the model with the donut hole is our preferred model. In the bottom half of Figure 1 (Panels C and D), the downward jump in the MHI-5 scale stands out for those affected by the 1997 education policy, indicating worse mental health outcomes than those who were not.

Figure 2 displays the heterogeneous effects of the birth year on middle school completion by sex and place of residency. As the discontinuous jumps at the birth year cutoff can be seen in these figures, the 1997 education policy was highly effective for all four groups we studied. The increase in middle school completion was higher in relative terms for women and rural residents. The reform increased the percentage of men with a middle school diploma by 27 percent at the cutoff (from 75 percent on the left to 95 percent on the right with a 20 percentage points increase) and for women by 52 percent (from 54 percent on the left-hand side of the cutoff to 82 percent on the right-hand side with a 28 percentage points increase). The percentage of urban residents with a middle school diploma increased by 35 percent at the cutoff (from 68 percent on the left-hand side of the cutoff to 92 percent on the right-hand side with a 24 percentage points increase). The ratio of rural residents with a middle school diploma increased by 52 percent at the cutoff (from 48 percent on the left-hand side of the cutoff to 74 percent on the right-hand side with a 26 percentage points increase).

Finally, we examine graphically the heterogeneous effects of the birth year on mental health outcomes by sex and place of residence. In all the groups we study, there is a fall in the MHI-5 score at the birth year cutoff, but we do not observe a statistically significant drop for the rural residents in Panel D.

Table 2 presents the results obtained from the regression analysis. Panel A shows the OLS estimates of at least middle school variable on the MHI-5 scale, where a statistically significant and positive correlation was found between more years of schooling and the mental health outcome across various bandwidths around the 1987 birth year cutoff, as seen in columns 2-5. However, the OLS regression estimates would be biased because they cannot account for some unobservable factors that might affect education and the MHI-5 scale. Therefore, we rely on the regression discontinuity design estimates in Panels B and C to measure the unbiased impact of at least a middle school degree on mental health.

Panel B of Table 2 shows the effect of the birth year criterion on at least middle school completion and the MHI-5 scale. Accordingly, the 1997 education reform increased the probability of middle school completion, where the effect is robust and consistent across various bandwidths. The treated individuals (born in 1987 and above) are more likely to complete middle school by about 24 percentage points than those in the control group (born in 1986 or earlier). Panel B also provides the coefficient estimates of the birth year criterion on the MHI-5 scale obtained by estimating Equation (1). These reduced-form results indicate significant and adverse effects of treatment and mental health outcomes. The MHI-5 scale decreases by one by treatment, as seen in the second column.

Panel C of Table 2 provides the 2SLS estimates of the middle school completion instrumented via treatment status according to the birth year. The coefficients in this panel provide the impact of being treated, i.e., completing at least middle school. The table also presents the first-stage regression results estimated via Equation 2 and F-statistics. Our first-stage regression estimates are large and precisely estimated across various bandwidths. Also, F-statistics are robust, showing that our instrument strongly correlates with the endogenous middle school completion variable.

The evidence on the effect of middle school completion on the MHI-5 scale in Table 2 suggests that middle school completion reduces the mental health score, meaning worsening mental health conditions. For example, at a nine-year bandwidth around the cutoff, the MHI-5 scale falls by 4.4 due to completing middle school, corresponding to one-third of the standard deviation in the MHI-5 scale, which is statistically significant at 1 percent. As the bandwidth gets narrower from nine to six years on both sides of the cutoff, we observe an increase in the magnitudes of the coefficients.

In Table 3, we examine the effects of middle school completion on chronic depression and mental healthcare use variables. The table reveals a link between education and chronic depression, but the statistical significance of this estimate varies across the bandwidths and vanishes in the narrowest bandwidth. There is evidence showing the occurrence of chronic mental problems other than depression increases by five percentage points with middle school completion. The table reveals no significant evidence of education on the use of antidepressants or medicine for unrest or tension. We find a positive effect on the visits to psychologists/psychotherapists in the last 12 months; however, this is not robustly measured across the bandwidths.

These results suggest that there is a statistically significant negative effect of middle school completion on mental health outcomes. In the next section, we aim to explain the underlying mechanisms in this relation.

5.2 Possible Mechanisms

In this section, we explore various channels that might explain our findings that suggest significant and negative effects of longer years of schooling on mental health outcomes. Using the model specified in Equation (3), we estimate γ_1, where middle school completion is instrumented via treatment status according to the birth year of the respondents. We use each possible mechanism variable as the dependent variable in separate regressions.

We start by testing whether education generates significant changes in health inputs. We focus on the health-improving behavior that could be linked to better mental health outcomes (Buttery et al., 2015). Lifestyle risk factors such as physical exercise and fruit and vegetable consumption may play a vital role in mental health (Parletta et al., 2013; Kondirolli and Sunder, 2022). As the results in Table 4 demonstrate, these factors do not appear to be changing much by middle school graduation. A statistically significant decline in engaging in heavy physical activities, as seen in column 1, is likely to result from the changes in work arrangements because the survey questionnaire does not distinguish between physical activity for recreation and work. This outcome should be interpreted with caution as the bootstrapped p-value reported in column 1 is more than 0.5. Completing middle school has no statistically significant effect on medium or light physical activity (columns 3-4) or fruit, vegetable, and juice consumption (columns 5-7).

Next, we test whether education improves physical health because physical and mental health are interwind (Ohrnberger et al., 2017). For this, we focus on the outcomes in Table 5 and do not find any statistically significant evidence of the impact of middle school completion on overall health, experiencing continuing health problems, or physical pain.

In Table 6, we focus on the possible mediating roles of the socioeconomic effects of longer years of schooling in explaining our findings. For the analyses presented in this table, we limit our sample to those 18 years old or older due to the existence of spillover effects for high school graduation (Kırdar et al., 2015). The table reveals that the incidence of being married decreases significantly with middle school completion. For the largest bandwidth, the decline in marriage probability is as big as 74 percentage points. There is also a sizeable negative effect on the likelihood of being employed, which is not statistically significant at the conventional levels across the bandwidths. Those who finished middle school are significantly more likely to be in school by 25 percentage points in the largest bandwidth we used. They also have lower household income per capita, albeit statistically insignificant for the narrowest bandwidth. At the nine-year age bandwidth, household income decreases by 144 TL in real terms. In this table, we also report no impact on the probability of being divorced (column 3) and unemployed (column 6), the latter having small, negative, and insignificant coefficients.

Finally, to test whether education can affect mental health through other channels, we provide the instrumental variable estimates on the effects of middle school completion on work environment and social assets in Table 7. Our findings indicate that education is essential in reducing time pressure or heavy workloads (columns 2-3) at work. This result is consistent with the decrease in child labor due to the 1997 reform (Dayıoğlu and Kırdar, 2022) since children who work are condemned to exploitation in difficult working conditions. There is also a small and negative impact of middle school completion on having someone to trust during a severe problem, which is not statistically significant.

5.3 Heterogeneous Effects

5.3.1 Heterogeneity by Gender

In this section, we examine the effects of middle school completion on mental health by gender and rural or urban residency.

We find suggestive evidence that middle school completion negatively affects men's mental health. MHI-5 scores drop by 6.3 to 9.9 points (Table 8). The effect is sizeable and statistically significant within all the bandwidths we use. The incidence of chronic mental health problems also increases with education for men, as seen in Table 9. For the bandwidth in the range of nine years on either side of the cutoff, completing middle school increases the fraction of men who report chronic mental health problems other than depression by eight percentage points. The same table reveals women also experience a decline in their MHI-5 scale; however, the magnitude of the impact is smaller for women. The coefficients range between -3 and -5 across bandwidths. The incidence of chronic depression increases for women by 3.3 percentage points at the largest bandwidth. There is also suggestive evidence that women are more likely to see a psychologist or psychotherapist as a result of completing at least middle school by five percentage points albeit lacking strong statistical significance. The online Appendix illustrates the effect of middle school completion on the explanatory mechanisms by gender.

5.3.1 Heterogeneity by Place of Residence

Next, we examine heterogeneity in the impact of middle school completion by place of residence (Table 8 Panel B). The reduction in the MHI-5 scale is higher among urban residents, with a statistically significant 4.9-point decline, than among rural residents, for whom a negative but insignificant coefficient is recorded by the size of 3.2 in Column 2. Middle school completion increases the tendency for chronic mental problems by three percentage points among the urban residents without any significant effects in the rural area. (Table 9 Panel B, Columns 2 and 3).

As the heterogeneity analyses suggest, adverse mental health effects were more evident for men and urban residents who replaced employment with schooling. As these groups had higher middle school completion rates before the reform, they responded to the increased competition arising from the increasing supply of middle-school graduates in the labor market by staying in school longer and facing a mental burden. The fact that there were no financial returns to schooling is also likely to be an essential factor in mediating these results.

6. Robustness Checks

We run various alternative specifications to show the robustness of our findings. First, as a robustness check, we rerun the reduced form and 2SLS regressions using the survey weights and show the results in Table B2. The weighted model's results are consistent with the unweighted model.

Next, we present results without the donut hole in Table B3. Compared with the reduced form regressions in Table 2, the reform becomes less effective in middle school completion once we include those born in 1986 and 1987 in our regressions. While the reform increases the middle school completion rate by 24 percentage points (Table 2, Column 2), the impact falls to 19.5 percentage points without the donut hole (Table B3, Column 2). The existence of noncompliers in the 1986-1987 birth year groups is more problematic in our case because we cannot control the seasonality in school starting age due to not observing the month of birth in THS. However, the impact of middle school completion as measured without the donut hole in Appendix Table B3 is consistent with our preferred model, with the coefficients becoming slightly smaller in magnitude but still being precisely estimated.

We also provide results using a nonparametric bandwidth for the primary outcome variable to complement our parametric bandwidth estimations. The negative effect of middle school completion on MHI-5 score persists. While the impact for men becomes considerably higher in magnitude, the nonparametric bandwidth analysis reveals no significant effect on the MHI-5 scale for women. The results in Table B4 indicate a similar impact to our parametric bandwidth estimates for the urban residents. Using the same context, Akyol and Kırdar (2022) raise issues in nonparametric approaches due to noncompliers around the cutoff and the discreteness of the running variable. Therefore, following their approach, we present the nonparametric results as complementary to our findings using the parametric method in Appendix Table B4.

7. Discussion and Conclusion

This study examines the impact of education on mental health outcomes in Turkey. We do so by exploiting the exogenous shock in education stemming from the 1997 education policy, which mandated individuals born after 1986 to finish middle school, leading to eight years of compulsory schooling compared to five years before.

We contribute to the evidence on the impact of extending the years of mandatory schooling by using three waves of nationally representative and extensive household health surveys from a developing country. We offer new evidence on the shorter-term effects of education on mental health by focusing on a younger age cohort than the ones previously studied.

Our OLS regressions report a positive correlation between mental health and middle school completion. However, when we take into account the endogeneity of education, our results suggest that longer years of education lead to worsening mental health. These results corroborate the findings of Avendano et al. (2020), Janke et al. (2020), and Courtin et al. (2019), who suggested that mental health returns to education are negative or negligible. Our results imply that education causes deterioration in mental health likely to be driven by male and urban subsamples. We discuss the relative roles of possible underlying mechanisms in this section.

An interesting outcome of the reform in Turkey arises from the fact that a negative impact of the reform on income was observed. This result is likely to emerge from the fact that men were less likely to be employed, and the reform in Turkey could not generate any financial returns (Aydemir and Kırdar, 2017). Lack of financial returns to the extra years of education, combined with the increased likelihood of staying in school, is the most likely mechanism to drive our results. Even though non-financial aspects of work improve with education as the likelihood of work in physically challenging jobs decreases, this does not seem to effectively overwrite the negative impact of a loss in income.

We find that education decreases the probability of being married. While there is an association between marital status and mental health, marital satisfaction or quality of marriage is an essential factor in determining mental health (Kiecolt-Glaser et al., 2001; Kendler and Gardner, 2014). Previously, the reform in Turkey was shown to change marriage sorting patterns by decreasing the age gap between spouses and increasing the number of marriages where women's consent was taken (Akyol and Kırdar, 2022). We also outlined that education does not affect the availability of someone to trust when a serious problem occurs despite the fall in marriage rates. Hence, it is difficult to bring a decrease in marriage out as the explanatory mechanism for our findings on mental health.

Prior studies have noted the importance of physical activity in improving mental health outcomes (Orstad et al., 2020; De Vries et al., 2013; Kvam et al., 2016; Sjösten and Kivelä, 2006). Of interest here is that education decreases heavy physical activity, according to our results. As a result, more years of schooling through reduced exercise has contributed to the decline in mental well-being. Besides, we do not find any effects on medium activity or walking.

Policies for improving educational attainment in developing countries have great significance. The compulsory education reform in Turkey also led to substantial improvements, such as declining child labor or teen marriage rates. But most of these effects were observed through keeping children in school longer (Dayıoğlu and Kırdar, 2022; Kırdar et al., 2018). Our results have important policy implications by suggesting that failing to improve the efficiency of education may negatively impact mental health in the shorter term, and the working-age population’s mental health should be monitored in the labor markets following the factors that increase the degree of competition in the labor markets.

Tables

Table 1: Descriptive Statistics

Variables	Mean	S.D.	Min.	Max.	Obs.
MHI-5 Scale	63.535	13.454	0	100	17,932
At least Middle School	0.717	0.450	0	1	17,932
Chronic Depression and Mental Healthcare Use					
Chronic Depression (last 12 months)	0.014	0.119	0	1	17,916
Other Chronic Mental Problems (last 12 months)	0.015	0.121	0	1	17,925
Antidepressant Use (last 2 weeks)	0.011	0.102	0	1	17,924
Medicine Use for Tension &Unrest (last 2 weeks)	0.006	0.077	0	1	17,921
Psychologist/psychotherapist (last 12 months)	0.032	0.177	0	1	17,893
Health Status, and Physical Pain					
Health Status (1: Good or Very Good)	0.854	0.353	0	1	17,926
Continuing Health Problem (for at least 6 months)	0.185	0.388	0	1	17,918
Health Problem Limiting Daily Life (for at least 6 months)	0.167	0.373	0	1	17,873
Physical Pain (last 4 weeks)	0.270	0.444	0	1	17,912
Health Inputs: Life Style					
Heavy Practice (last 7 days)	0.112	0.316	0	1	17,512
Medium Practice (last 7 days)	0.237	0.425	0	1	17,263
Ten-Minute Walk (last 7 days)	0.617	0.486	0	1	17,270
Fruit Consumption*	3.254	1.189	0	5	17,903
Vegetable or Salad Consumption*	3.535	1.044	0	5	17,911
Fruit or Vegetable Juice Consumption*	2.105	1.423	0	5	17,852
Demographic and Economic Status (Age 18 and Above)					
Married	0.526	0.499	0	1	14,778
Divorced	0.013	0.112	0	1	14,778
Employed	0.430	0.495	0	1	14,778
In School	0.153	0.360	0	1	14,776
Unemployed	0.063	0.243	0	1	14,776
Per capita Household Income (TL)	1294.185	772.550	175	2700.5	14,778
Work Environment and Social Assets					
Work Place: Difficult Working Conditions	0.067	0.250	0	1	17,913
Work Place: Under Pressure	0.067	0.250	0	1	17,906
Having Someone to Trust with a Serious Problem	0.958	0.200	0	1	17,833

*Frequency measured by 0: never to 5:two or more times a day

Notes: The data come from 2008, 2010, and 2012 of Turkey Health Survey (THS) of TurkStat. The sample is restricted to the widest bandwidth used in the study: 9 years above and below the cut off (birth year=1987) (except for the donut hole for birth years 1986 and 1987).

Table 2: Regression Results of the Main Dependent Variable

(1)	(2)	(3)	(4)	(5)
	-9<=Age Gap<=9	-8<=Age Gap<=8	-7<=Age Gap<=7	-6<=Age Gap<=6
A) OLS Results				
MHI-5 scale	3.014***	3.017***	3.165***	2.946***
	[0.289]	[0.322]	[0.333]	[0.349]
Bootstrapped p-value	0.0000	0.0000	0.0000	0.0000
B) Reduced Form Results				
At least middle school	0.243***	0.238***	0.234***	0.232***
	[0.013]	[0.014]	[0.014]	[0.015]
Bootstrapped p-value	0.0000	0.0000	0.0000	0.0060
MHI-5 scale	-1.067***	-1.357***	-1.432***	-1.597***
	[0.285]	[0.292]	[0.363]	[0.490]
Bootstrapped p-value	0.0200	0.0000	0.0040	0.0180
C) 2SLS Results				
MHI-5 scale	-4.396***	-5.696***	-6.115***	-6.885***
	[1.161]	[1.174]	[1.394]	[1.920]
Bootstrapped p-value	0.0140	0.0000	0.0030	0.0130
First-stage regression	0.243***	0.238***	0.234***	0.232***
	[0.013]	[0.018]	[0.014]	[0.016]
F-statistics	367.226	305.228	281.179	224.697
Observations	17,932	16,105	13,956	11,733

Notes: The data come from 2008, 2010, and 2012 of Turkey Health Survey (THS) of TurkStat. The sample is restricted to various bandwidths around the cut off (birth year=1987) as given in columns 2-5 (except for the donut hole for birth years 1986 and 1987). The dependent variable is given in column 1. In Panel A, OLS coefficients of at least middle school variables are reported. In Panel B, reduced form coefficients of the treatment according to the birth year criteria are reported. In panel C, 2SLS regression results, where middle school completion is instrumented via treatment status in terms of birth year are reported. Each cell comes from a separate regression. All regressions include a control for the survey year dummy, age and split linear polynomials around the cutoff in the running variable (birth year) and additional controls. These controls include a dummy for respondent's sex, and urban residence also dummy variables for the 12 NUTS1-level regions. Clustering is done at the birth year. p values for the wild-cluster bootstrapped standard errors are presented. Statistically significant: *** 1 percent level; ** 5 percent level, * 10 percent level.

Table 3: The Effect of Middle School Completion on Chronic Depression and Mental Healthcare Use

(1)	(2)	(3)	(4)	(5)	(6)
	Chronic Depression	Other Chronic Mental Problems	Antidepressant Use	Medicine Use for Tension and Unrest	Psychologist/ psychotherapist
-9<=Age Gap<=9	0.022*	0.030**	0.008	0.004	0.019
	[0.012]	[0.012]	[0.013]	[0.011]	[0.017]
Bootstrapped p-value	0.1301	0.0821	0.6226	0.7918	0.3644
Observations	17,916	17,925	17,924	17,921	17,893
-8<=Age Gap<=8	0.027**	0.045***	0.010	-0.004	0.040***
	[0.013]	[0.011]	[0.014]	[0.011]	[0.014]
Bootstrapped p-value	0.0190	0.0100	0.5566	0.7738	0.0080
Observations	16,090	16,098	16,098	16,097	16,066
-7<=Age Gap<=7	0.033**	0.053***	0.009	-0.006	0.044***
	[0.014]	[0.011]	[0.016]	[0.012]	[0.015]
Bootstrapped p-value	0.0060	0.0010	0.6727	0.6697	0.0881
Observations	13,942	13,951	13,952	13,950	13,921
-6<=Age Gap<=6	0.015	0.053***	0.002	0.000	0.019
	[0.010]	[0.013]	[0.019]	[0.010]	[0.014]
Bootstrapped p-value	0.1001	0.0030	0.9259	0.9830	0.4494
Observations	11,720	11,728	11,730	11,729	11,704

Notes: The data come from 2008, 2010, and 2012 of Turkey Health Survey (THS) of TurkStat. The sample is restricted to various bandwidths around the cut off (birth year=1987) as given in column 1 (except for the donut hole for birth years 1986 and 1987). The dependent variable is given in columns 2-6. Each cell comes from a separate 2SLS regression, where middle school completion is instrumented via treatment status in terms of birth year. All regressions include a control for the survey year dummy, age and split linear polynomials around the cutoff in the running variable (birth year) and additional controls. These controls include a dummy for respondent's sex, and urban residence also dummy variables for the 12 NUTS1-level regions. Clustering is done at the birth year. p values for the wild-cluster bootstrapped standard errors are presented. Statistically significant: *** 1 percent level; ** 5 percent level, * 10 percent level.

Table 4: The Effect of Middle School Completion on Health Inputs: Lifestyle

(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Heavy practice	Medium practice	Ten-minute walk	Fruit consumption	Vegetable consumption	Juice consumption
-9<=Age Gap<=9	-0.116***	0.011	0.061	-0.162	-0.068	-0.147
	[0.042]	[0.056]	[0.040]	[0.171]	[0.092]	[0.146]
Bootstrapped p-value	0.1191	0.8098	0.2222	0.4144	0.5335	0.3994
Observations	17,512	17,263	17,270	17,903	17,911	17,852
-8<=Age Gap<=8	-0.118**	0.000	0.005	-0.122	-0.045	-0.013
	[0.051]	[0.068]	[0.025]	[0.197]	[0.102]	[0.135]
Bootstrapped p-value	0.1942	0.9980	0.8468	0.6156	0.7017	0.9139
Observations	15,727	15,514	15,508	16,079	16,085	16,033
-7<=Age Gap<=7	-0.135*	0.022	0.021	-0.060	-0.018	-0.038
	[0.076]	[0.079]	[0.033]	[0.181]	[0.122]	[0.147]
Bootstrapped p-value	0.3243	0.7988	0.5956	0.7878	0.8609	0.8258
Observations	13,627	13,449	13,435	13,936	13,939	13,891
-6<=Age Gap<=6	-0.273***	0.070	0.027	0.046	0.020	0.000
	[0.033]	[0.079]	[0.031]	[0.181]	[0.142]	[0.155]
Bootstrapped p-value	0.0220	0.5325	0.4635	0.8238	0.9259	0.9990
Observations	11,460	11,296	11,281	11,713	11,718	11,677

Notes: The data come from 2008, 2010, and 2012 of Turkey Health Survey (THS) of TurkStat. The sample is restricted to various bandwidths around the cut off (birth year=1987) as given in column 1 (except for the donut hole for birth years 1986 and 1987). The dependent variable is given in columns 2-7. Each cell comes from a separate 2SLS regression, where middle school completion is instrumented via treatment status in terms of birth year. All regressions include a control for the survey year dummy, age and split linear polynomials around the cutoff in the running variable (birth year) and additional controls. These controls include a dummy for respondent's sex, and urban residence also dummy variables for the 12 NUTS1-level regions. Clustering is done at the birth year. p values for the wild-cluster bootstrapped standard errors are presented. Statistically significant: *** 1 percent level; ** 5 percent level, * 10 percent level.

Table 5: The Effect of Middle School Completion on Health Status and Physical Pain

(1)	(2)	(3)	(4)	(5)
	Health Status-Binary (1: Good or Very Good, 0: Others)	Continuing Health Problem (for at least 6 months)	Health Problem Limiting Daily Life (for at least 6 months)	Physical Pain (last 4 weeks)
-9<=Age Gap<=9	-0.079*	0.097*	0.080	0.052
	[0.043]	[0.059]	[0.081]	[0.045]
Bootstrapped p-value	0.1782	0.2242	0.5315	0.3624
Observations	17,926	17,918	17,873	17,912
-8<=Age Gap<=8	-0.080	0.113	0.119	0.065
	[0.049]	[0.071]	[0.099]	[0.055]
Bootstrapped p-value	0.2913	0.2903	0.4304	0.3714
Observations	16,101	16,091	16,049	16,086
-7<=Age Gap<=7	-0.050	0.043	0.039	0.042
	[0.044]	[0.063]	[0.078]	[0.068]
Bootstrapped p-value	0.4855	0.6637	0.7127	0.7177
Observations	13,953	13,942	13,912	13,938
-6<=Age Gap<=6	-0.040	0.019	0.050	-0.016
	[0.047]	[0.063]	[0.084]	[0.027]
Bootstrapped p-value	0.5996	0.8078	0.6637	0.6837
Observations	11,730	11,720	11,693	11,716

Notes: The data come from 2008, 2010, and 2012 of Turkey Health Survey (THS) of TurkStat. The sample is restricted to various bandwidths around the cut off (birth year=1987) as given in column 1 (except for the donut hole for birth years 1986 and 1987). The dependent variable is given in columns 2-5. Each cell comes from a separate 2SLS regression, where middle school completion is instrumented via treatment status in terms of birth year. All regressions include a control for the survey year dummy, age and split linear polynomials around the cutoff in the running variable (birth year) and additional controls. These controls include a dummy for respondent's sex, and urban residence also dummy variables for the 12 NUTS1-level regions. Clustering is done at the birth year. p values for the wild-cluster bootstrapped standard errors are presented. Statistically significant: *** 1 percent level; ** 5 percent level, * 10 percent level.

Table 6: The Effect of Middle School Completion on Demographic and Economic Status - Ages 18 and Above

(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Married	Divorced	Employed	In School	Unemployed	Income-TL (per capita)
-9<=Age Gap<=9	-0.736***	0.002	-0.174**	0.251***	-0.026	-144.025***
	[0.099]	[0.011]	[0.081]	[0.067]	[0.027]	[39.505]
Bootstrapped p-value	0.0010	0.9059	0.1211	0.0090	0.3534	0.0000
Observations	14,778	14,778	14,778	14,776	14,776	14,778
-8<=Age Gap<=8	-0.652***	0.010	-0.162*	0.239***	-0.030	-134.553***
	[0.096]	[0.011]	[0.093]	[0.073]	[0.029]	[43.910]
Bootstrapped p-value	0.0010	0.4494	0.2092	0.0110	0.3303	0.0020
Observations	13,543	13,543	13,543	13,541	13,541	13,543
-7<=Age Gap<=7	-0.544***	0.006	-0.136	0.205***	-0.022	-110.563***
	[0.053]	[0.011]	[0.103]	[0.072]	[0.030]	[40.189]
Bootstrapped p-value	0.0000	0.6667	0.3674	0.0220	0.5035	0.0000
Observations	12,357	12,357	12,357	12,355	12,355	12,357
-6<=Age Gap<=6	-0.493***	0.010	-0.080	0.219***	-0.036	-84.935**
	[0.053]	[0.011]	[0.101]	[0.081]	[0.037]	[42.744]
Bootstrapped p-value	0.0000	0.4454	0.5916	0.0571	0.4054	0.0551
Observations	10,448	10,448	10,448	10,446	10,446	10,448

Notes: The data come from 2008, 2010, and 2012 of Turkey Health Survey (THS) of TurkStat. The sample is restricted to 18-year-old or above and various bandwidths around the cut off (birth year=1987) as given in column 1 (except for the donut hole for birth years 1986 and 1987). The dependent variable is given in columns 2-7. Each cell comes from a separate 2SLS regression, where middle school completion is instrumented via treatment status in terms of birth year. All regressions include a control for the survey year dummy, age and split linear polynomials around the cutoff in the running variable (birth year) and additional controls. These controls include a dummy for respondent's sex, and urban residence also dummy variables for the 12 NUTS1-level regions. Income variable is inflation adjusted household income divided by the household size. Clustering is done at the birth year. p values for the wild-cluster bootstrapped standard errors are presented. Statistically significant: *** 1 percent level; ** 5 percent level, * 10 percent level.

Table 7: The Effect of Middle School Completion on Work Environment and Social Assets

(1)	(2)	(3)	(4)
	Difficult Working Conditions	Time Pressure/ Heavy Work Load	Someone to Trust with a Serious Problem
-9<=Age Gap<=9	-0.064***	-0.115***	-0.016
	[0.024]	[0.040]	[0.019]
Bootstrapped p-value	0.0050	0.0040	0.4444
Observations	17,913	17,906	17,833
-8<=Age Gap<=8	-0.064**	-0.117***	-0.023
	[0.025]	[0.045]	[0.019]
Bootstrapped p-value	0.0030	0.0000	0.3343
Observations	16,088	16,081	16,012
-7<=Age Gap<=7	-0.052*	-0.119**	-0.021
	[0.027]	[0.052]	[0.019]
Bootstrapped p-value	0.0210	0.0040	0.3654
Observations	13,942	13,939	13,877
-6<=Age Gap<=6	-0.051	-0.125**	-0.020
	[0.041]	[0.060]	[0.020]
Bootstrapped p-value	0.5035	0.0030	0.3724
Observations	11,720	11,717	11,665

Notes: The data come from 2008, 2010, and 2012 of Turkey Health Survey (THS) of TurkStat. The sample is restricted to various bandwidths around the cut off (birth year=1987) as given in column 1 (except for the donut hole for birth years 1986 and 1987). The dependent variable is given in columns 2-4. Each cell comes from a separate 2SLS regression, where middle school completion is instrumented via treatment status in terms of birth year. All regressions include a control for the survey year dummy, age and split linear polynomials around the cutoff in the running variable (birth year) and additional controls. These controls include a dummy for respondent's sex, and urban residence also dummy variables for the 12 NUTS1-level regions. Clustering is done at the birth year. p values for the wild-cluster bootstrapped standard errors are presented. Statistically significant: *** 1 percent level; ** 5 percent level, * 10 percent level.

Table 8: Heterogeneous Effect of Middle School Completion on the MHI-5 Scale by Gender and Urban/Rural Residence

(1)	(2)	(3)	(4)	(5)
	-9<=Age Gap<=9	-8<=Age Gap<=8	-7<=Age Gap<=7	-6<=Age Gap<=6
A) Heterogenous Effects by Gender				
		MEN		
MHI-5 scale	-6.336***	-8.486***	-7.542***	-9.939***
	[2.095]	[1.983]	[1.951]	[2.741]
Bootstrapped p-value	0.0250	0.0060	0.0090	0.0030
Observations	7,939	7,103	6,116	5,147
		WOMEN		
MHI-5 scale	-3.333***	-4.167***	-5.121***	-5.068**
	[1.284]	[1.310]	[1.477]	[2.302]
Bootstrapped p-value	0.0280	0.0120	0.0040	0.1602
Observations	9,993	9,002	7,840	6,586
B) Heterogenous Effects by Urban/Rural Residence				
		URBAN		
MHI-5 scale	-4.900***	-6.568***	-7.415***	-8.205***
	[1.047]	[0.759]	[0.860]	[1.206]
Bootstrapped p-value	0.0350	0.0010	0.0030	0.0200
Observations	13,724	12,318	10,717	8,985
		RURAL		
MHI-5 scale	-3.170	-3.391	-2.994	-3.456
	[2.863]	[3.195]	[3.798]	[4.780]
Bootstrapped p-value	0.4094	0.4064	0.5445	0.5415
Observations	4,208	3,787	3,239	2,748

Notes: The data come from 2008, 2010, and 2012 of Turkey Health Survey (THS) of TurkStat. The sample is restricted to various bandwidths around the cut off (birth year=1987) as given in columns 2-5 (except for the donut hole for birth years 1986 and 1987). The dependent variable is given in column 1. Each cell comes from a separate 2SLS regression, where middle school completion is instrumented via treatment status in terms of birth year. All regressions include a control for the survey year dummy, age and split linear polynomials around the cutoff in the running variable (birth year) and dummy variables for the 12 NUTS1-level regions. The controls also include a dummy for respondent's urban residence in Panel A and for sex in Panel B. The main dependent MHI-5 scale is distributed as follows for the largest bandwidth: Men: 64.7 (Mean) 13.2 (S.D.), 7,939 (Obs.); Women:62.7 (Mean), 13.6 (S.D.), 9,993 (Obs.); Urban:63.7 (Mean), 13.4 (S.D.), 13,724 (Obs.); Rural: 63.1 (Mean), 13.6 (S.D.), 4,208 (Obs.). Clustering is done at the birth year. p values for the wild-cluster bootstrapped standard errors are presented. Statistically significant: *** 1 percent level; ** 5 percent level, * 10 percent level.

Table 9: Heterogeneous Effect of Middle School Completion on Chronic Depression by Gender

(1)	(2)	(3)	(4)	(5)	(6)
	Chronic Depression	Other Chronic Mental Problems	Antidepressant Use	Medicine Use for Tension and Unrest	Psychologist/ psychotherapist
A) Men					
-9<=Age Gap<=9	0.002	0.080***	0.004	0.034*	-0.004
	[0.018]	[0.024]	[0.013]	[0.018]	[0.026]
Bootstrapped p-value	0.8959	0.0350	0.8108	0.1992	0.9089
Observations	7,934	7,938	7,935	7,933	7,928
-8<=Age Gap<=8	0.002	0.112***	0.011	0.037*	0.014
	[0.022]	[0.016]	[0.010]	[0.019]	[0.029]
Bootstrapped p-value	0.9499	0.0020	0.3473	0.2442	0.6877
Observations	7,098	7,102	7,099	7,098	7,092
-7<=Age Gap<=7	0.024	0.104***	0.012	0.039*	0.000
	[0.021]	[0.013]	[0.013]	[0.020]	[0.034]
Bootstrapped p-value	0.3193	0.0030	0.4364	0.2763	0.9940
Observations	6,111	6,115	6,112	6,111	6,106
-6<=Age Gap<=6	0.005	0.107***	-0.001	0.036	-0.042
	[0.018]	[0.018]	[0.012]	[0.024]	[0.031]
Bootstrapped p-value	0.7648	0.0030	0.9459	0.4565	0.4474
Observations	5,142	5,146	5,144	5,144	5,139
B) Women					
-9<=Age Gap<=9	0.033***	0.000	0.012	-0.014	0.034
	[0.012]	[0.018]	[0.021]	[0.018]	[0.028]
Bootstrapped p-value	0.0330	0.9810	0.6737	0.4925	0.4324
Observations	9,982	9,987	9,989	9,988	9,965
-8<=Age Gap<=8	0.042***	0.007	0.011	-0.027	0.057**
	[0.011]	[0.019]	[0.022]	[0.018]	[0.028]
Bootstrapped p-value	0.0000	0.7828	0.6807	0.2272	0.1411
Observations	8,992	8,996	8,999	8,999	8,974
-7<=Age Gap<=7	0.037***	0.02	0.009	-0.033*	0.072**

	[0.012]	[0.022]	[0.026]	[0.020]	[0.029]
Bootstrapped p-value	0.0010	0.5055	0.8378	0.1401	0.1391
Observations	7,831	7,836	7,840	7,839	7,815
-6<=Age Gap<=6	0.021***	0.019	0.005	-0.021	0.055*
	[0.008]	[0.024]	[0.028]	[0.018]	[0.030]
Bootstrapped p-value	0.0100	0.5355	0.9009	0.2873	0.4765
Observations	6,578	6,582	6,586	6,585	6,565

Notes: The data come from 2008, 2010, and 2012 of Turkey Health Survey (THS) of TurkStat. The sample is restricted to various bandwidths around the cut off (birth year=1987) as given in column 1 (except for the donut hole for birth years 1986 and 1987). The dependent variable is given in columns 2-6. Each cell comes from a separate 2SLS regression, where middle school completion is instrumented via treatment status in terms of birth year. All regressions include a control for the survey year dummy, age and split linear polynomials around the cutoff in the running variable (birth year) and additional controls. These controls include a dummy for respondent's urban residence and dummy variables for the 12 NUTS1-level regions. Clustering is done at the birth year. p values for the wild-cluster bootstrapped standard errors are presented.. Statistically significant: *** 1 percent level; ** 5 percent level, * 10 percent level.

Table 10: Heterogeneous Effect of Middle School Completion on Chronic Depression by Urban/Rural Status

(1)	(2)	(3)	(4)	(5)	(6)
	Chronic Depression	Other Chronic Mental Problems	Antidepressant Use	Medicine Use for Tension and Unrest	Psychologist/ psychotherapist
A) Urban					
-9<=Age Gap<=9	0.028**	0.029*	0.009	0.005	0.029
	[0.012]	[0.017]	[0.022]	[0.015]	[0.029]
Bootstrapped p-value	0.0160	0.2613	0.7608	0.7758	0.5155
Observations	13,715	13,718	13,717	13,716	13,691
-8<=Age Gap<=8	0.030**	0.049***	0.009	-0.001	0.056**
	[0.014]	[0.012]	[0.025]	[0.017]	[0.027]
Bootstrapped p-value	0.0521	0.0420	0.7628	0.9439	0.1592
Observations	12,309	12,312	12,312	12,313	12,285
-7<=Age Gap<=7	0.044***	0.051***	0.017	0.002	0.061**
	[0.016]	[0.014]	[0.025]	[0.018]	[0.028]
Bootstrapped p-value	0.0020	0.0671	0.6567	0.9319	0.2062
Observations	10,708	10,712	10,714	10,714	10,688
-6<=Age Gap<=6	0.025**	0.061***	0.015	0.012	0.052*
	[0.012]	[0.014]	[0.026]	[0.014]	[0.031]
Bootstrapped p-value	0.0340	0.0711	0.7337	0.5015	0.4494
Observations	8,977	8,980	8,983	8,983	8,961
B) Rural					
-9<=Age Gap<=9	0.006	0.034	0.008	0.003	-0.005
	[0.019]	[0.036]	[0.015]	[0.015]	[0.037]
Bootstrapped p-value	0.7467	0.4054	0.6336	0.8679	0.9089
Observations	4,201	4,207	4,207	4,205	4,202

-8<=Age Gap<=8	0.016	0.033	0.013	-0.007	0.000
	[0.016]	[0.041]	[0.020]	[0.013]	[0.043]
Bootstrapped p-value	0.2533	0.4925	0.6276	0.7027	0.9990
Observations	3,781	3,786	3,786	3,784	3,781
-7<=Age Gap<=7	0.007	0.056	-0.011	-0.022	0.004
	[0.016]	[0.047]	[0.013]	[0.014]	[0.053]
Bootstrapped p-value	0.6306	0.3684	0.5556	0.3624	0.9630
Observations	3,234	3,239	3,238	3,236	3,233
-6<=Age Gap<=6	-0.011	0.026	-0.033***	-0.029*	-0.066
	[0.024]	[0.052]	[0.011]	[0.015]	[0.044]
Bootstrapped p-value	0.7367	0.6897	0.1271	0.3003	0.3854
Observations	2,743	2,748	2,747	2,746	2,743

Notes: The data come from 2008, 2010, and 2012 of Turkey Health Survey (THS) of TurkStat. The sample is restricted to various bandwidths around the cut off (birth year=1987) as given in column 1 (except for the donut hole for birth years 1986 and 1987). The dependent variable is given in columns 2-6. Each cell comes from a separate 2SLS regression, where middle school completion is instrumented via treatment status in terms of birth year. All regressions include a control for the survey year dummy, age and split linear polynomials around the cutoff in the running variable (birth year) and additional controls. These controls include a dummy for respondent's sex, and dummy variables for the 12 NUTS1-level regions. Clustering is done at the birth year. p values for the wild-cluster bootstrapped standard errors are presented. Statistically significant: *** 1 percent level; ** 5 percent level, * 10 percent level.

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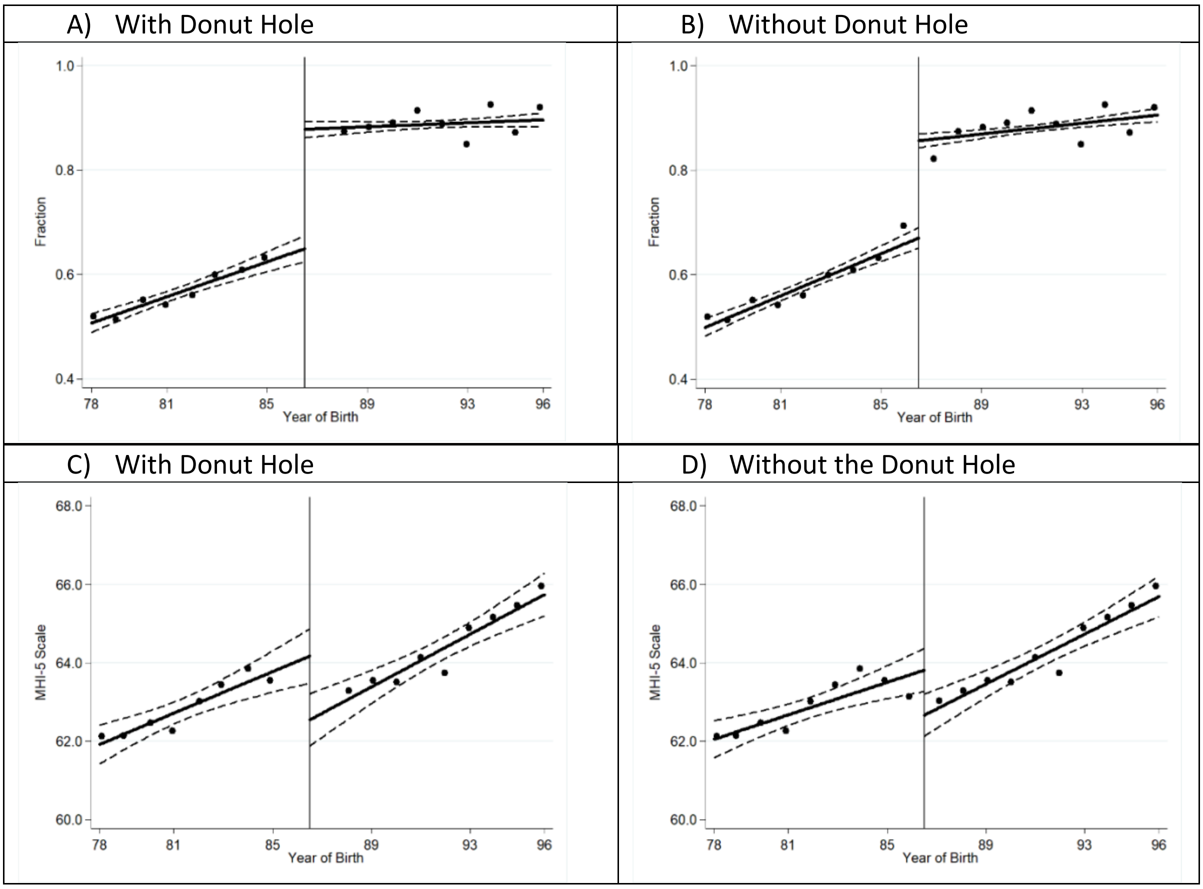
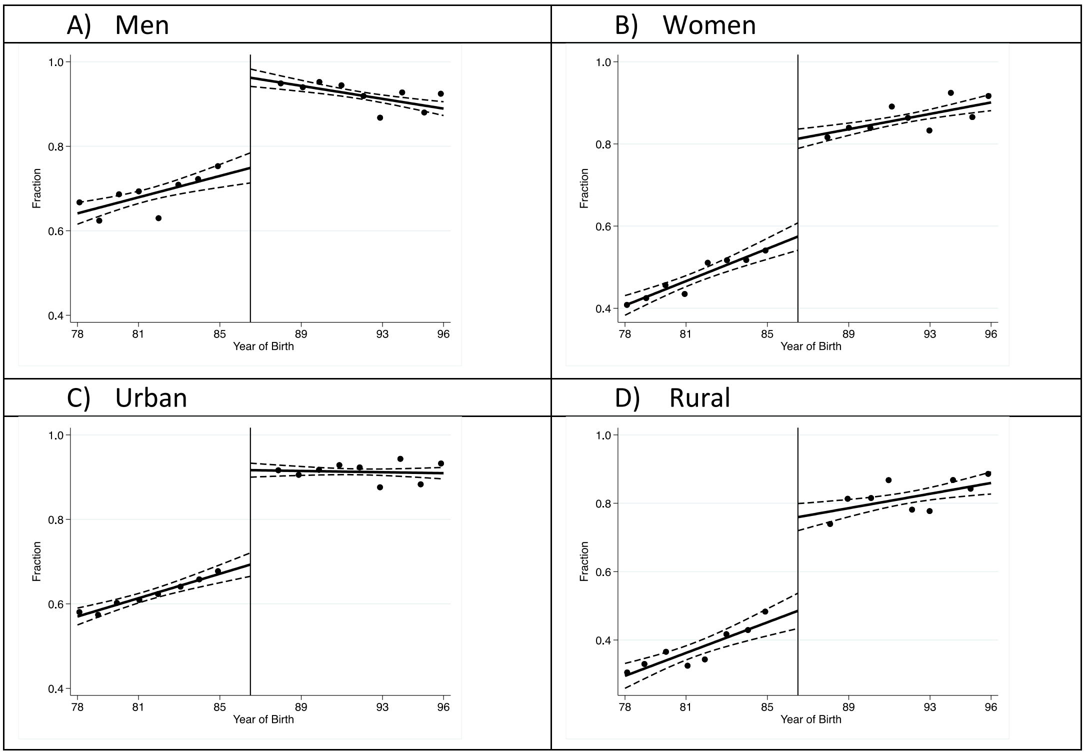
Figures

Figure 1: The Effect of Birth Year on Middle School Completion and MHI-5 Scale



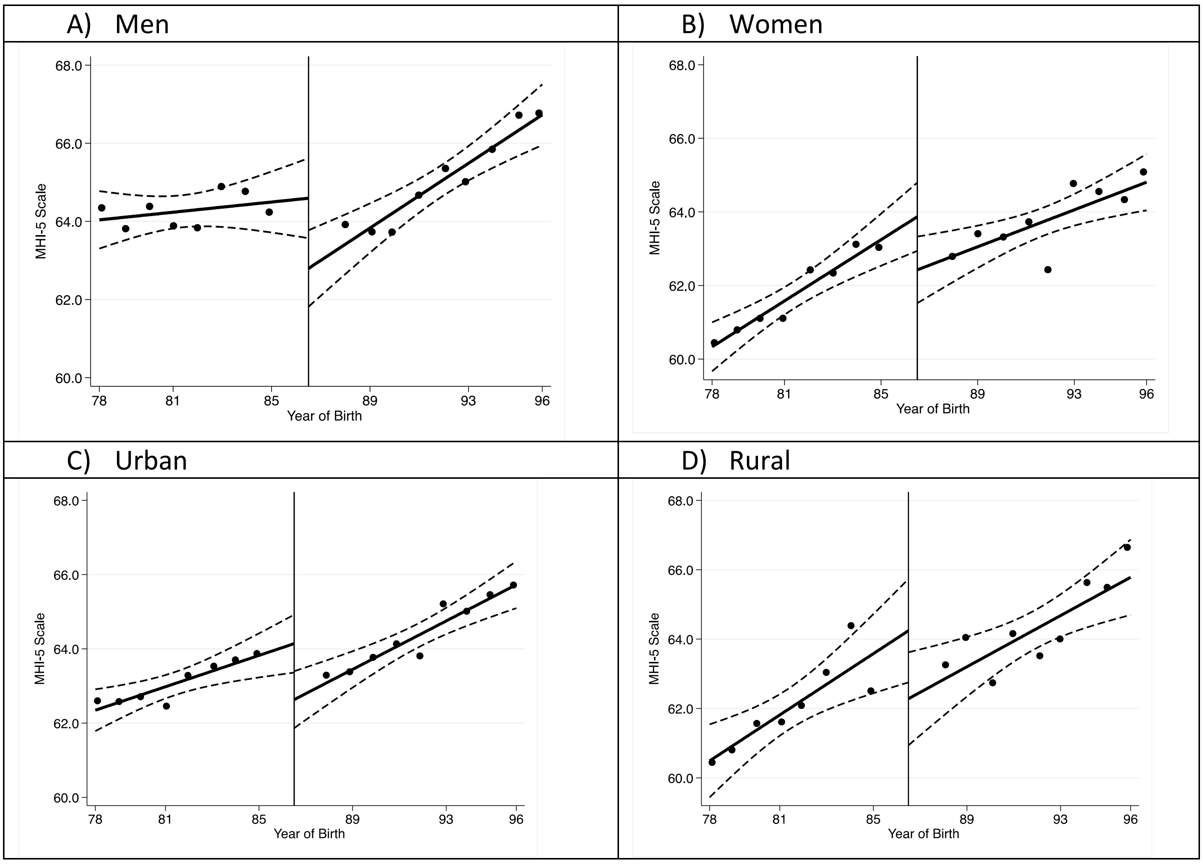
Notes: The dependent variable is at least middle school completion in Panels A and B and a mental health scale ranging from 0-worst mental health (continuously experiencing negative and never experiencing positive symptoms) to 100-perfect mental health (never experiencing negative and continuously experiencing positive symptoms) in Panels C, and D. Linear fits on each side of the birth year cutoff, and confidence intervals at the 95% level are provided.

Figure 2: The Effect of Birth Year on Middle School Completion - Heterogeneous Effects



Notes: The dependent variable is at least middle school completion. Linear fits on each side of the birth year cutoff and confidence intervals at the 95% level are provided.

Figure 3: The Effect of Birth Year on MHI-5 Score - Heterogeneous Effects



Notes: The dependent variable is the mental health scale ranging from 0-worst mental health (continuously experiencing negative and never experiencing positive symptoms) to 100-perfect mental health (never experiencing negative and continuously experiencing positive symptoms). Linear fits on each side of the birth year cutoff and confidence intervals at the 95% level are provided.

Appendix Tables and Figures

APPENDIX A– Checks of the Identifying Assumptions

Table A1: The Effect of Placebo Reforms on Middle School Completion and MHI-5 Scale

(1)	(2)	(3)	(4)
	At least middle school	MHI-5 scale	Observations
Cut off:1977	0.022	-0.120	13,315
	[0.015]	[0.479]	
Cut off:1978	-0.011	-0.626	13,247
	[0.017]	[0.426]	
Cut off:1979	-0.034**	-0.819**	13,180
	[0.015]	[0.367]	
Cut off:1980	-0.007	-0.165	12,929
	[0.014]	[0.398]	
Cut off:1981	-0.015	0.138	11,789
	[0.015]	[0.457]	

Notes: The data come from 2008, 2010, and 2012 of Turkey Health Survey (THS) of TurkStat. The sample is restricted to 5 year bandwidth around the cut off as given in columns 1. Reduced form coefficients of the treatment according to the birth year criteria are reported. Each cell comes from a separate regression. All regressions include a control for the survey year dummy, age and split linear polynomials around the cutoff in the running variable (birth year) and additional controls. These controls include a dummy for respondent's sex, and urban residence also dummy variables for the 12 NUTS1-level regions. Clustering is done at the level of birth year and NUTS1-level region. Statistically significant: *** 1 percent level; ** 5 percent level, * 10 percent level.

Figure A1:Histogram of the Running Variable

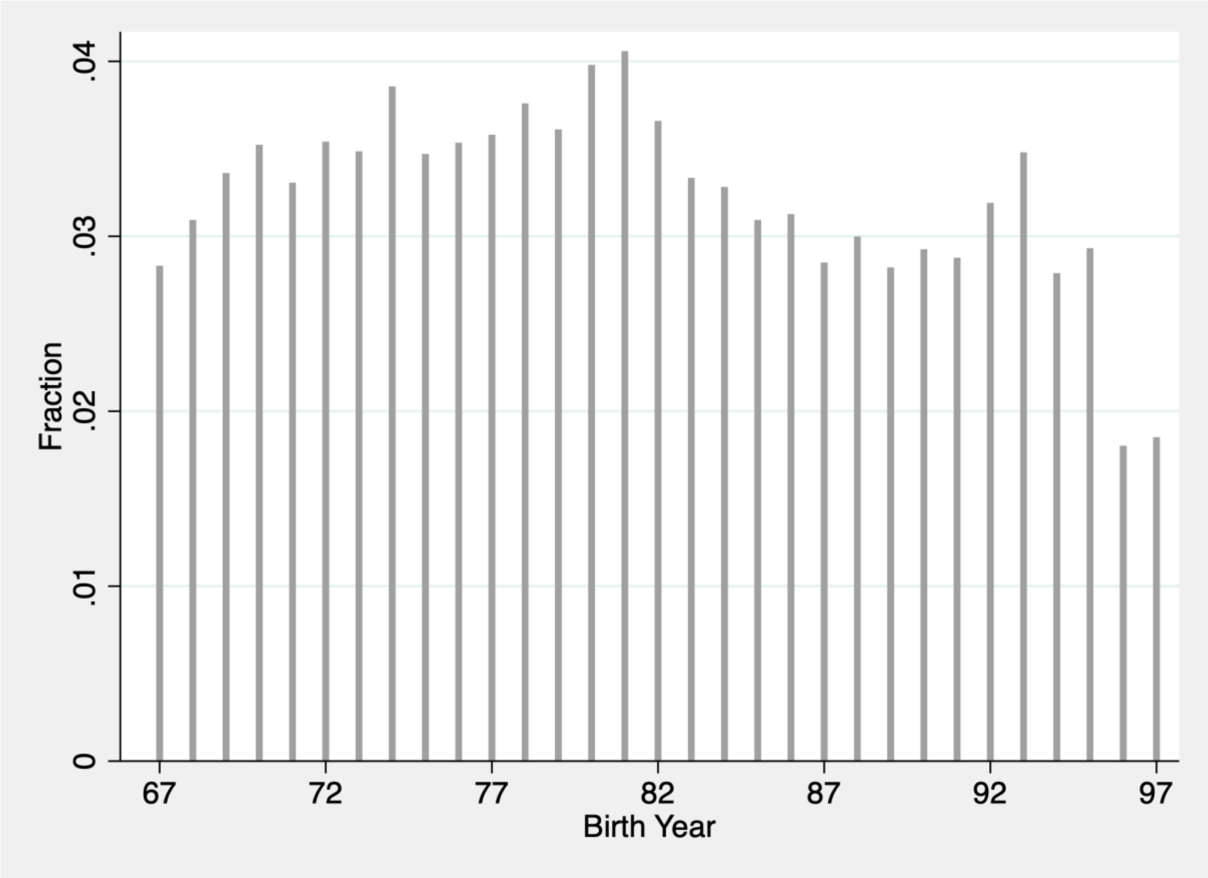
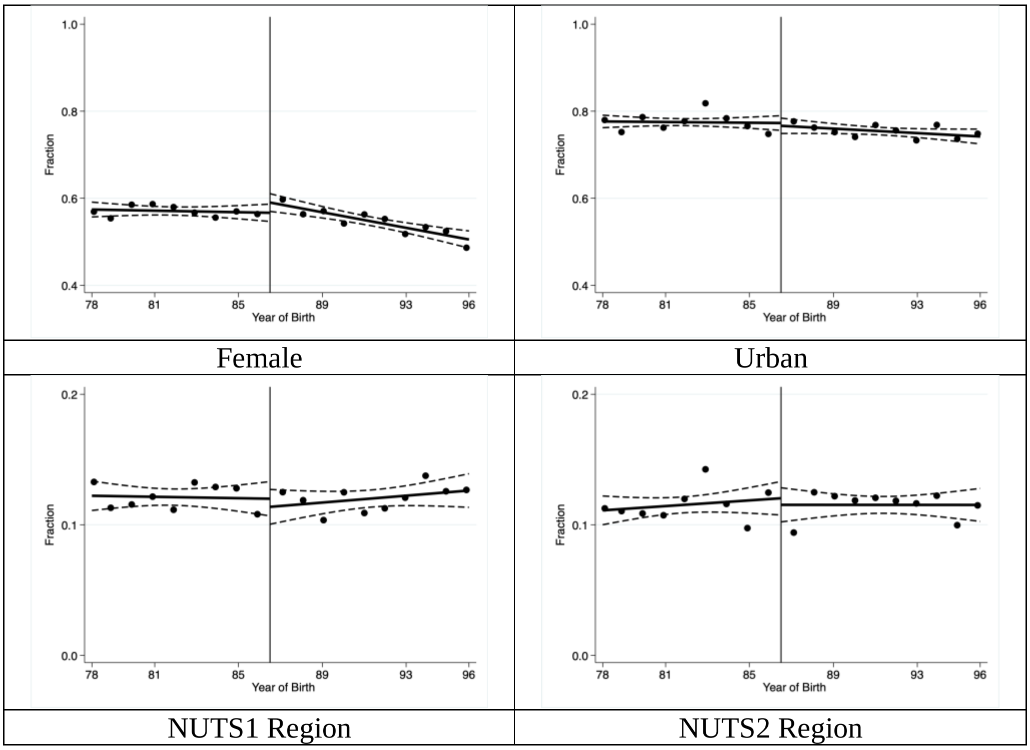
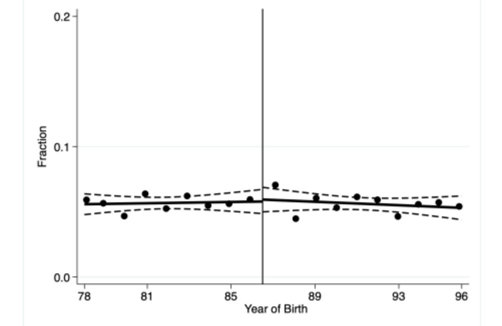
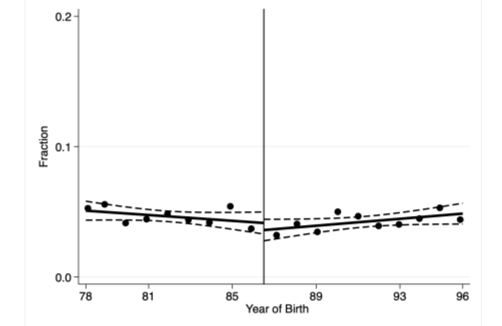


Figure A2: Continuity of the Control Variables

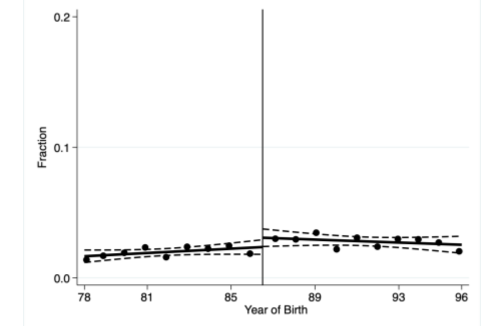




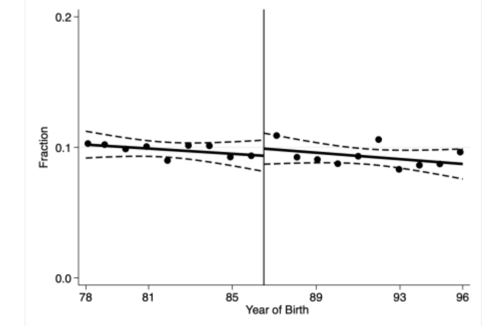
NUTS3 Region



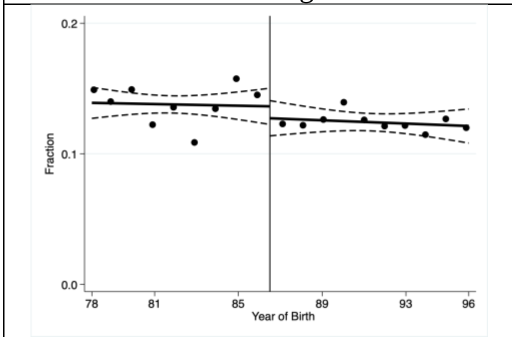
NUTS4 Region



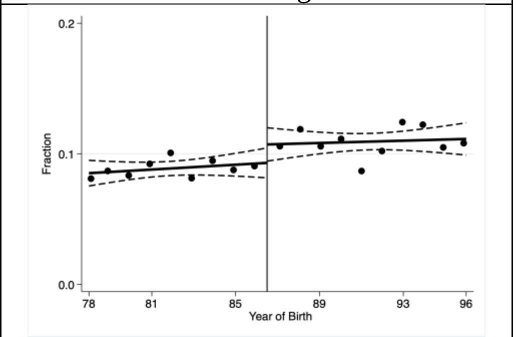
NUTS5 Region



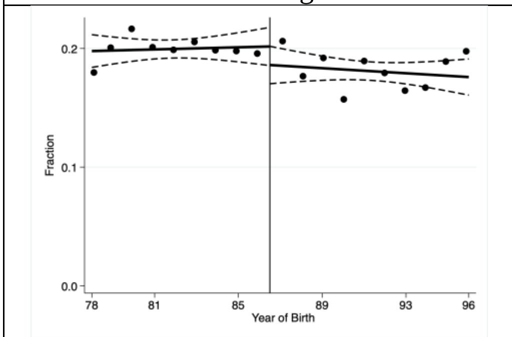
NUTS6 Region



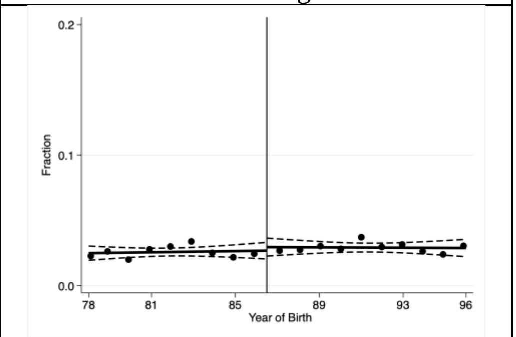
NUTS7 Region



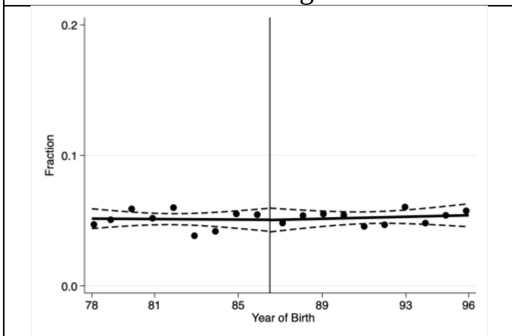
NUTS8 Region



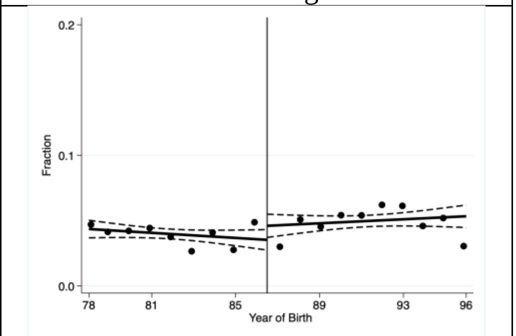
NUTS9 Region



NUTS10 Region



NUTS11 Region



NUTS12 Region

APPENDIX B– Robustness Checks

Table B1: The Effect of Middle School Completion on Missing MHI-5 Scale Variable

(1)	(2)	(3)	(4)	(5)
	-9<=Age Gap<=9	-8<=Age Gap<=8	-7<=Age Gap<=7	-6<=Age Gap<=6
MHI-5 Scale Missing	-0.007	-0.005	-0.003	0.001
	[0.008]	[0.009]	[0.009]	[0.009]
Bootstrapped p-value	0.4404	0.6637	0.7628	0.9560
Observations	18,028	16,193	14,035	11,797

Notes: The data come from 2008, 2010, and 2012 of Turkey Health Survey (THS) of TurkStat. The sample is restricted to various bandwidths around the cut off (birth year=1987) as given in columns 2-5 (except for the donut hole for birth years 1986 and 1987). The dependent variable is a binary variable indicating that the MHI-5 Scale variable could not be constructed due to missing, unknown or unanswered variables for at least 3 of the 5 feeling questions. Each cell comes from a separate 2SLS regression, where middle school completion is instrumented via treatment status in terms of birth year. All regressions include a control for the survey year dummy, age and split linear polynomials around the cutoff in the running variable (birth year) and dummy variables for the 12 NUTS1-level regions. The controls also include a dummy for respondent's urban residence and sex. Clustering is done at the level of birth year. p values for the wild-cluster bootstrapped standard errors are presented. Statistically significant: *** 1 percent level; ** 5 percent level, * 10 percent level.

Table B2: The Effect of Birth Year Criterion on Middle School Completion and MHI-5 Scale-Weighted Results

(1)	(2)	(3)	(4)	(5)
	-9<=Age Gap<=9	-8<=Age Gap<=8	-7<=Age Gap<=7	-6<=Age Gap<=6
A) Reduced form				
At least middle school	0.249***	0.247***	0.235***	0.233***
	[0.018]	[0.019]	[0.018]	[0.019]
Bootstrapped p-value	0.0000	0.0000	0.0000	0.0060
MHI-5 scale	-1.098***	-1.499***	-1.459***	-1.595**
	[0.362]	[0.334]	[0.393]	[0.508]
Bootstrapped p-value	0.0310	0.0010	0.0070	0.0320
Observations	17,932	16,105	13,956	11,733
B) 2sls				
MHI-5 scale	-4.406***	-6.074***	-6.201***	-6.830***
	[1.411]	[1.230]	[1.460]	[1.923]
Bootstrapped p-value	0.0280	0.0000	0.0060	0.0160
Observations	17,932	16,105	13,956	11,733

Notes: The data come from 2008, 2010, and 2012 of Turkey Health Survey (THS) of TurkStat. The sample is restricted to various bandwidths around the cut off (birth year=1987) as given in columns 2-5 (except for the donut hole for birth years 1986 and 1987). The dependent variable is given in column 1. Each cell comes from a separate weighted- regression, using the survey's weights. All regressions include a control for the survey year dummy, age and split linear polynomials around the cutoff in the running variable (birth year) and additional controls. These controls include a dummy for respondent's sex, and urban residence also dummy variables for the 12 NUTS1-level regions. Clustering is done at the level of birth year. p values for the wild-cluster bootstrapped standard errors are presented. Statistically significant: *** 1 percent level; ** 5 percent level, * 10 percent level.

Table B3: The Effect of Birth Year Criterion on Middle School Completion and MHI-Scale- Without the Donut Hole

(1)	(2)	(3)	(4)	(5)
	-9<=Age Gap<=9	-8<=Age Gap<=8	-7<=Age Gap<=7	-6<=Age Gap<=6
A) Reduced form				
At least middle school	0.195***	0.189***	0.176***	0.168***
	[0.029]	[0.031]	[0.030]	[0.032]
Bootstrapped p-value	0.0010	0.0000	0.0010	0.0050
MHI-5 scale	-0.820**	-1.027***	-0.946**	-0.950**
	[0.292]	[0.311]	[0.322]	[0.367]
Bootstrapped p-value	0.0250	0.0040	0.0060	0.0160
Observations	19,895	18,068	15,919	13,696
B) 2sls				
MHI-5 scale	-4.198***	-5.429***	-5.379***	-5.664***
	[1.405]	[1.406]	[1.532]	[1.816]
Bootstrapped p-value	0.0160	0.0020	0.0060	0.0080
Observations	19,895	18,068	15,919	13,696

Notes: The data come from 2008, 2010, and 2012 of Turkey Health Survey (THS) of TurkStat. The sample is restricted to various bandwidths around the cut off (birth year=1987) as given in columns 2-7. The dependent variable is given in column 1. Each cell comes from a separate weighted- regression, using the survey's weights. All regressions include a control for the survey year dummy, age and split linear polynomials around the cutoff in the running variable (birth year) and additional controls. These controls include a dummy for respondent's sex, and urban residence also dummy variables for the 12 NUTS1-level regions. Clustering is done at the level of birth year. p values for the wild-cluster bootstrapped standard errors are presented. Statistically significant: *** 1 percent level; ** 5 percent level, * 10 percent level.

Table B4: Nonparametric RDD Results for the Main Outcome Variable

(1)	(2)	(3)	(4)	(5)	(6)
	WHOLE SAMPLE	**MALE**	**FEMALE**	**URBAN**	**RURAL**
A) At Least Middle School					
Conventional	0.175***	0.146***	0.201***	0.163***	0.219***
	(0.027)	(0.025)	(0.031)	(0.027)	(0.035)
Bias-corrected	0.143***	0.120***	0.164***	0.131***	0.169***
	(0.027)	(0.025)	(0.031)	(0.027)	(0.035)
Robust	0.143***	0.120***	0.164***	0.131***	0.169***
	(0.024)	(0.023)	(0.026)	(0.023)	(0.026)
Observations	56,811	25,710	31,101	40,851	15,960
BW loc. poly. left of cutoff	11.24	13.32	11.11	11.55	22.555
BW loc. poly. right of cutoff	10	10	10	10	10
BW bias left of cutoff	20.56	24	19.87	21.10	19.34
BW bias left of cutoff	9.935	10	9.623	9.063	10
B) MHI-5 Total Scale					
Conventional	-4.106***	-10.405***	-0.643	-5.466**	1.081
	(-1.583)	(-2.690)	(-2.558)	(-2.508)	(-2.498)
Bias-corrected	-5.219***	-12.858***	-1.852	-6.622***	2.249
	(-1.583)	(-2.690)	(-2.558)	(-2.508)	(-2.498)
Robust	-5.219***	-12.858***	-1.852	-6.622***	2.249
	(-1.785)	(-2.720)	(-3.293)	(-2.429)	(-2.430)
Observations	56,811	25,710	31,101	40,851	15,960
BW loc. poly. left of cutoff	10.63	12.60	11.31	10.01	14.88
BW loc. poly. right of cutoff	10	10	10	10	10
BW bias left of cutoff	17.85	21.83	20.78	16.31	35.09
BW bias left of cutoff	9.869	9.604	9.556	9.569	10

Notes: The data come from 2008, 2010, and 2012 of Turkey Health Survey (THS) of TurkStat. The dependent variable in Panel A is at least middle school completion status after regressing it on the dummy variables for female, urban, NUTS1 region of residence and the age of the respondent. The dependent variable in Panel B is the MHI-5 total scale on the same covariate list except female dummy in Columns 3 and 4 and urban dummy in columns 5 and 6. Each cell comes from a separate regression. Local polynomial approach to RDD of CCFT is used. In this method, MSE-optimal bandwidths two different MSE-optimal bandwidth selectors (below and above the cutoff) were taken. The order of local polynomial is one and the order of bias is two. A triangular kernel is used. Clustering is done at the level of birth year. p values for the wild-cluster bootstrapped standard errors are presented. Statistically significant: *** 1 percent level; ** 5 percent level, * 10 percent level.