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Education and Mental Health: Causal Effects and Intra-Family Spillovers

Abstract

Mental health is essential for well-being and quality of life. Yet, our knowledge of the determinants of mental health is limited. We analyze the impact of education on mental health using survey data on self-reported health of Turkish women. To deal with the potential endogeneity, we rely on a natural experiment: an increase in the compulsory education from 5 to 8 years in 1997. The results suggest that education has a favorable effect on mental health, physical health, and being target of abusive behavior. We specifically consider intra-family spillovers, which are important: husband's education has favorable effects on the wife's mental health, and both parents' educational attainments improve mental health of children. We account for the implications of assortative mating whereby the spouses' educational attainment are correlated. We show that each spouse's education has a favorable impact on women's mental health, but the effect of husbands' education dominates that of wives' education. These effects are particularly pronounced among women who grew up in low-income provinces and in families without history of childhood abuse.

JEL-Codes: H510, H520, I120, I260.

Keywords: health, mental health, education, instrumental variable, natural experiment.

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1 Introduction

Mental health directly impacts individual well-being, social cohesion, and economic productivity. Therefore, understanding the determinants of mental health is of paramount societal importance. Education is another crucial determinant of individual well-being: it is positively correlated with earnings, career progression, physical health, civic engagement ([Harmon et al., 2003](#); [Sianesi and Reenen, 2003](#)). Moreover, education and mental health (and health overall) are interrelated: educated individuals tend to have better mental and overall health ([Jiang et al., 2020](#); [Kondiroli and Sunder, 2022](#); [Cutler and Lleras-Muney, 2006, 2010](#); [Grossman, 2006](#)). However, the direction of causality between them is not clear. On the one hand, educated people have higher earnings and can, in turn, afford better quality of life ([Devereux and Hart, 2010](#); [Meghir and Palme, 2005](#); [Oreopoulos, 2006](#)). In this way, education can translate into better (mental) health ([Thomson et al., 2022](#)). On the other hand, poor mental health can make acquiring education more difficult or outright impossible ([Kessler et al., 1995](#); [Cornaglia et al., 2015](#)). Omitted variables (e.g. genes, ability, and/or time preferences) may be another reason for the correlation between education and (mental) health ([Fuchs, 1980](#); [Grossman, 2006](#)). Any of the preceding explanations would imply that the relationship between education and health is plagued by endogeneity bias.

For these reasons, much of the recent research has focused on finding endogeneity-robust evidence on the relationship between education and health outcomes. One promising avenue relies on identifying natural experiments – such as changes in the length of compulsory education – as an instrument for schooling. The advantage of this approach is that such educational reforms lead to a one-off increase in educational attainments for the affected cohort (treatment group) compared to their slightly older peers (control group). As exposure to the reform is determined only by the timing of birth, the allocation of individuals into the treatment and control groups is as good as random.

The studies that have used this approach, however, report mixed results. Some identify a significant causal effect of education on overall health ([Dursun et al., 2018](#); [Fletcher, 2015](#); [Kemptner et al., 2011](#); [Lleras-Muney, 2005](#); [Oreopoulos, 2006](#); [Silles, 2009](#); [Ma et al., 2018](#)). Similarly, [Demange et al. \(2023\)](#) and [Jiang et al. \(2020\)](#) find evidence of favorable causal effect of education on mental health. Others, however, find no or only a weak relationship between education and health ([Albouy and Lequien, 2009](#); [Baltagi et al., 2019](#); [Braakmann, 2011](#); [Clark and Royer, 2013](#); [Gathmann et al., 2015](#); [Mathers, 2008](#); [Mazumder, 2008](#); [Tansel and Karaođlan, 2019](#); [Xie and Mo, 2014](#)). Such mixed findings might be attributable to the differences in the measures of health used, datasets, estimation methods, or in the nature of the identification strategy used to resolve the endogeneity bias ([Gathmann et al., 2015](#); [Li and Powdthavee, 2015](#)).

As in many other contexts, the previous literature addresses the relationship between education and (mental) health almost exclusively in the context of developed countries. Only

a few studies investigate the health effects of education in developing countries (Xie and Mo, 2014; Dursun et al., 2018; Baltagi et al., 2019; Tansel and Karaođlan, 2019; Jiang et al., 2020). Dursun et al. (2018) use the 1997 educational reform in Turkey which increased compulsory education there from 5 to 8 years. They find that education increases the probability of being obese among males but lowers obesity for women, it enhances women’s overall health whereas no effect is observed for males, and it has no significant effect on smoking of either gender. However, Baltagi et al. (2019), considering the same reform, find no health return to education. Tansel and Karaođlan (2019) exploit an earlier compulsory education reform, which increased compulsory education from three to five years in rural areas in 1961. They find that the exogenous increase in education reduces smoking, however, education does not impact the probability of being obese.

In this paper, we focus on mental health rather than health overall. Mental health is an aspect of overall health that has been often neglected in the previous literature. This, however, is not because mental health is not an important issue. Steel et al. (2014), in a systematic review and meta-analysis of 174 surveys in 63 countries, find that 1 in 5 survey participants displayed symptoms of common mental health problems during the 12 months prior to the survey, and around 1 in 4 people experienced mental health issues at some point during their lifetime. Women are significantly more likely to experience depression than men, irrespective of whether they live in middle or high-income countries (Mathers, 2008). Consequences of depression can extend to others: maternal depression has been identified as one of the reasons for poor development and growth outcomes among adolescents in developing countries (Rahman et al., 2008).

Our identification strategy relies on the fact that Turkey implemented a compulsory education reform (CER henceforth) in 1997. The CER extended the compulsory education from 5 to 8 years for all individuals born after 1986. This was a greater increase than those due to similar reforms in other countries: one (in the UK, US, Germany and France) or two (Denmark). As we argue below, the reform was implemented mainly due to political considerations. It increased the duration of compulsory education without modifying the curriculum for the years concerned. Exposure to the reform depended on children’s year of birth. Therefore, the reform created a quasi-random variation in education between the treated individuals and their marginally-older peers.

For our analysis, we use the 2008 and 2014 waves of the Turkey’s National Research on Domestic Violence against Women (NRDVW): a nationally-representative survey that targets a broad range of aspects of physical and mental health and well-being of Turkish women. The respondents are women. Therefore, we consider, in the first instance, the education and mental health of women. However, the data also contains detailed information on the respondents’ husbands and children. Within family, the education of either spouse can have impact on the mental health of both, as well as on their children. We believe our paper is the first one to explicitly consider such intra-family spillovers in the effect of education on mental health. More-

over, individuals have the tendency to choose partners with characteristics, including education, that are similar to their own; this phenomenon is known as *assortative mating*. This, however, implies that the educational attainments of the two spouses are not assigned independently of each other. Therefore, attributing any effect of education to either of them is questionable. To address the implications of *assortative mating*, we also consider sub-samples where the CER exposure varies only for one of the two genders.

The results of our analysis show that education also has a favorable effect on women’s mental health and well-being: it improves their mental health and empowers them within the household. The intra-family spillovers are also important: husbands’ education has favorable effects on the wives’ and children’s outcomes. In fact, it appears that the effect of husband’s education on women’s mental health dominates the effect of their own education. This is confirmed when we control for assortative mating by constructing sub-samples where either the husbands’ or the wives’ exposure to the CER varies while that of the other spouse is held constant. Furthermore, the favorable effects of education on mental health outcomes are primarily observed in families without a history of childhood abuse and among women who grew up in low-income provinces.

The next section discusses the education system in place in Turkey and explains the background of the 1997 CER. Sections 3 and 4 present the data used in our analysis and outline our methodology, respectively. The results are discussed in Section 5, while Section 6 presents a number of robustness checks. Section 7 focuses on the implications of *assortative mating* when seeking to identify the causal mental-health effect of education. To this effect, we discuss results obtained with subsamples where the CER exposure varies only for one gender within the couple while it is fixed for the other gender. The last section, finally, presents some brief conclusions.

2 Compulsory Education in Turkey

The main characteristics of Turkey’s contemporary education system can be summarized in three main points. First, the education system is centralized, whereby the Ministry of National Education (MONE) acts on behalf of the state to hire teachers, principals, and other administrative staff. MONE also oversees the allocation of roles, salary payments, and maintains and builds educational infrastructure. Second, education is free at all levels; private schools have a very limited role in delivering basic education. Thus, the vast majority of children are taught in public schools that follow a government-approved curriculum. Third, as in most other countries, the government stipulates the minimum number of years that each child needs to stay in school for.

The compulsory education in Turkey underwent a number of reforms. In January 1961, the mandatory education period was extended from three to five years in rural areas, which had a direct and immediate effect on increasing the duration of schooling in rural regions (Erdoğan, 2005; Şen, 2013). The reform at the core of our analysis, the revision of the Compulsory Education

Law in August 1997, extended it further to eight years across the whole country. Thereafter, compulsory education was further increased to twelve years in March 2012; this last reform remains in effect also at present.

Prior to the 1997 CER, Turkey's education comprised five segments. Pre-primary education, aimed at children between three and six years, was not mandatory. Primary education, spanning grades 1 to 5, was obligatory and comprised children aged 6 to 10. After this phase, students could advance to a three-year lower secondary education (henceforth referred to as junior high school, or JHS), covering grades 6-8. This stage was followed by three years of senior high school (henceforth SHS), comprising grades 9-11. Lastly, university-level higher education typically ranged from 2 to 4 years. The CER extended mandatory schooling to eight years, that is, up to and including the JHS stage. As a part of this change, primary education (grades 1-5) and the JHS (grades 6-8) were merged.

The 1997 CER was implemented largely for political reasons. The general election in December 1995 was won by the *Welfare Party (Refah Partisi (RP))* in Turkish), an Islamist political group. The *Welfare Party* was therefore invited to put forward a government, which it succeeded in doing in June 1996 (with the *True Path Party* as its junior coalition partner). This was the first time in modern Turkish history that a government was formed under the leadership of an openly Islamist party. In February 1997, the *National Security Council* dominated by the Turkish Army asked the government to resign after it accused it of undermining the secular character of modern Turkey. At the same time, the Council decreed that compulsory education was to increase from five to eight years. The Council had two stated motives for extending the compulsory education, First, it envisaged that the increase in the level of education would speed up the process of becoming a full member of the European Union. Second, the CER was to prevent children from enrolling in religious junior high schools after having finished the originally-compulsory five years of schooling in state-approved primary schools. For this reason, only schools following the state-approved curriculum counted towards the eight years of compulsory education.

The extension of compulsory education came into effect in September 1997, only a few months after the education law was amended. Children enrolled in the fifth grade in September 1997 were required to stay in school until completing the 8th grade whereas older students were not subject to the reform. [Dulger \(2004\)](#) observes that the national education curriculum (introduced in 1968) has not changed because of the short period of time to implement the reform. Instead, the Ministry of National Education of Turkey focused on creating sufficient capacity to accommodate the additional students: it built 81,500 new classrooms between 1997 and 2002 – a 30% capacity increase ([Bankası, 2005](#)) After the 1997 CER, a significant impact was observed on gross enrollment rates in the sixth grade for both boys and girls. Specifically, sixth-grade enrollment numbers soared from 866,000 during the 1996-97 academic year to 1.227 million in the 1997-98 school year, marking an increase of over 30% ([Dulger, 2004](#); [Özer et al., 2018](#)).

3 Data

3.1 Variables

The analysis is based on the 2008 and 2014 waves of the National Research on Domestic Violence against Women (NRDVW) in Turkey. These surveys contain a range of questions used to identify known symptoms of mental health disorders.¹ The responses to these questions are likely to be correlated: respondents who suffer from mental-health ailments typically respond affirmatively to multiple questions. Therefore, we use factor analysis to extract the underlying sources of variation in the respondents' responses. This results in three distinct dimensions of mental health. The first factor, which we label *Emotional Distress and Daily Functioning*, comprises symptoms such as difficulty carrying out daily activities, loss of interest, feeling useless, feeling worthless, unhappiness, reluctance to participate in daily life activities, feeling tired all the time, getting easily tired, incapable of thinking clearly, and crying more frequently than usual. This factor predominantly reflects the challenges in emotional regulation and daily functioning capabilities. The second factor, *Anxiety and Somatic Symptoms*, includes symptoms like frequent headache, poor appetite, having trouble sleeping, being easily frightened by many things, shaky hands, poor digestion, nervousness, and stomach pain – highlighting the physical manifestations commonly associated with anxiety. The third factor, *Depression and Suicidal Ideation*, comprises suicidal thoughts, representing severe depressive states and self-harm inclinations.

Similarly, we construct an index of mental well-being of children aged 6 to 14, also by means of factor analysis, based on symptoms such as the frequency of nightmares, bed-wetting, shyness or withdrawal, aggression, and crying with anger. This allowed for the reduction of factors representing the children's mental health into a single measure.

The survey includes two questions on physical health. Self-Reported Health Status (SRH) is a commonly used health measure in literature. In the NRDVW, respondents were asked "How would you describe your health, in general?". The responses ranged from 1 (excellent) to 5 (very poor). We transformed these responses into a dummy variable, assigned the value of 1 for "excellent" or "good" health, and 0 otherwise. Good self-rated health has been identified as a predictor of mortality, morbidity, and functional disabilities, making it a reliable indicator of health status (Case et al., 2002; Ross and Mirowsky, 1999). The second question is about the severity of pain or discomfort experienced in the last four weeks, with responses ranging from 1 (no pain or discomfort) to 5 (extreme pain or discomfort). This is also converted into a dummy variable, where 1 represents "no" or "slight" pain or discomfort, and 0 otherwise.

¹The survey asks whether the respondent has experienced, during the four weeks before the interview, any of the following: frequent headache, poor appetite, having trouble sleeping, being easily frightened by many things, shaky hands, poor digestion, incapable of thinking clearly, crying more frequently than usual, difficulty in decision making, loss of interest, feeling useless, feeling worthless, stomach (abdomen) ache, unhappiness, nervousness, reluctance to participate in daily life, difficulty carrying out daily activities, feeling tired all the time, and getting easily tired and having suicidal thoughts. Each variable equals 1 if the woman reports that she has experienced that particular mental health problem in the past four weeks and zero otherwise. Furthermore, the surveys also contain a question whether the woman has ever had suicidal thoughts at any point in her life. We construct a variable equal to 1 if the woman reports that she has never had suicidal thoughts at any point in her life and zero otherwise.

Domestic violence can be an important factor underlying women’s mental health. We construct a *Domestic Violence Index*, again using factor analysis, reflecting the prevalence and frequency of spousal abuse across 16 specific indicators encompassing physical abuse (slapping, throwing harmful objects, hair pulling, punching or hitting with objects, kicking, dragging, beating, burning, choking, and using or threatening with weapons like guns or knives), sexual abuse (forced sexual intercourse, coerced intercourse due to fear, and forced participation in humiliating sexual acts), economic abuse (preventing or ending the woman’s employment, withholding financial support, and taking the woman’s earnings without permission), and emotional abuse (verbal insults, humiliation, inducing fear, and threats of physical harm). Furthermore, some couples find themselves in a forced marriage (that is, in a marriage concluded without the woman’s consent). We measure this by means of a dummy variable assigned the value of 1 when the woman reports not wanting the marriage, and 0 otherwise.

Next, we construct a *Woman’s Autonomy and Empowerment Index*. To this effect, we use four dummy variables measuring agreement with women’s independence in financial decision-making, fair division of domestic labor, that men are not automatically accountable for a woman’s actions, and that women can openly disagree or argue with their partners. These variables are measured as dummy variables, and the composite index is again constructed by means of factor analysis.

The *Partner Dominance and Restrictive Behavior Index*, also created using factor analysis, integrates nine binary indicators of specific negative behaviors by the husband. The behaviors include limiting access to friends, restricting communication with wife’s family or relatives, requiring information on her whereabouts, exhibiting neglect or minimal interest in her activities, expressing annoyance when she interacts with other men, regularly suspecting unfaithfulness, insisting on having to give permission for health-care visits, enforcing his preferences for her clothing, and controlling her social media usage.

Finally, we employ a number of dummy variables to measure financial endowments and strains within the household. *Women’s employment status* reflects whether the respondent works or no, (with values of 0 indicating absence and 1 indicating presence of employment). Similarly, *Husbands’ employment status* denotes unemployment with 0 and employment with 1. *Poor access to health care* signifies the absence of health insurance. Lastly, *House ownership* indicates whether either spouse owns a house.

3.2 Descriptive Statistics

Figure 1 illustrates the JHS completion rates by birth year. The 1997 education reform in Turkey applied to children born in 1986 and later. The data display distinct rise in completion rates followed by a further continuous rise for the individuals born in 1986 and later. Hence, the CER had an clear and sizable effect on educational attainments. For those born prior to 1986, the completion rates exhibit little variation: these individuals were not subject to the reform and

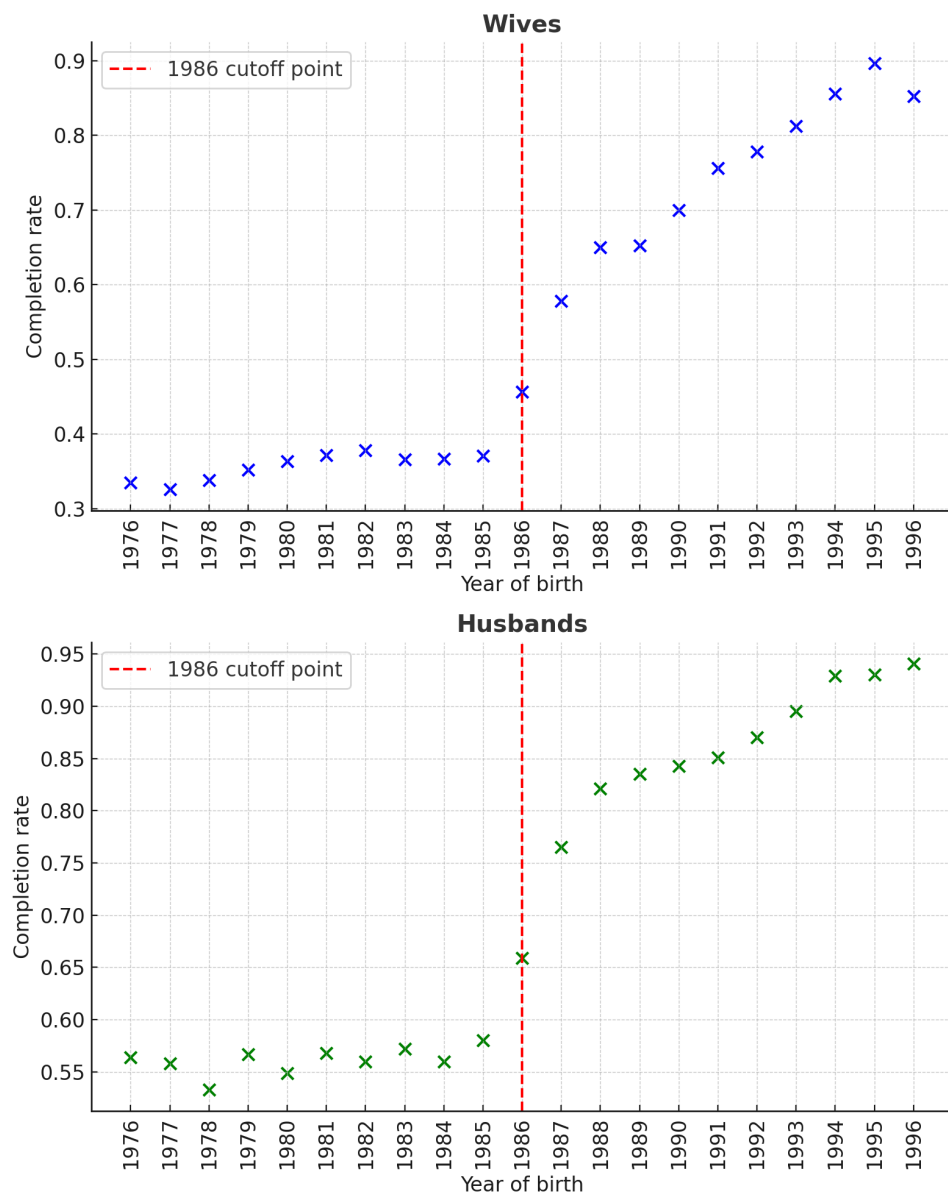


Figure 1: Junior high school completion rate by birth year

Table 1: Descriptive statistics

	Control group (1976 to 1985)		Treatment group (1986 to 1996)		t-test result
	Obs.	Mean	Obs.	Mean	P-value
Completing 8 years of schooling (wife)	5487	0.266	2262	0.734	0.000
Completing 8 years of schooling (husband)	6142	0.467	771	0.717	0.000
Type of place of residence(rural)	5823	1.278	1927	1.291	0.144
Total mental health index	5415	0.042	2243	-0.124	0.000
Emotional distress and daily functioning index	5415	0.039	2243	-0.116	0.000
Anxiety and somatic symptoms index	5415	0.048	2243	-0.131	0.000
Severe depression and suicidal ideation index	5415	0.034	2243	-0.127	0.000
Child mental health index	3145	0.064	459	-0.181	0.000

Notes: This is based on data from 2008 and 2014 waves of the National Research on Domestic Violence against Women surveys for Turkey.

therefore there was little reason for their enrollment rates to change.

In Turkey, children start school in September of the year during which they turn six. The CER, enacted in 1997, applied to children entering year 5 in that year, mandating them to stay in school until year 8. Those finishing year 5 in 1997, in contrast, could quit full-time education in that year. Thus, formally, children born in 1987 and later were subject to the reform. However, the birth-year cutoffs for enrollment are not enforced strictly, and, in practice, children often enroll in school one year later. Thus, some children born in 1986 were also affected by the CER. This can be seen quite clearly in Figure 1, where JHS completions rates increase moderately for the 1986 birth year.²

The more pronounced increase in completion rates among women, compared to men, suggests the reform had a differential impact by gender. This is mainly due to the fact that more than half of boys were already staying in full-time education up until the JHS before the CER. Among the girls, only around a third graduated from JHS before the reform. Following the CER implementation, both genders converged to more than 90% completion rate. The relative gain was thus greater for women.

Table 1 presents a comparison between the control group, unaffected by the educational reform, and the treated group that was subject to it. The latter again displays a notable increase in educational attainment, with women affected by the CER completing eight years of schooling more frequently than their slightly-older peers in the control group. Mental health indexes also reveal improvements for the treated group, with lower mean scores for emotional distress, anxiety, and severe depression, which are statistically significant. Additionally, the child mental health index suggests enhanced mental well-being among children born to mothers in the treated group. T-test results confirm the significance of these differences.

²In our analysis, we present results where, alternatively, we include 1986 in the treatment group and in the control group. We show that our findings are not materially affected by the treatment status of those born in this year.

4 Model

As we argue above, the relationship between education and mental health can be plagued by endogeneity. To address this possibility, we employ instrumental variables, constructed based on exposure to the 1997 CER. This reform, which extended compulsory education from five to eight years, did not substantially change the content or quality of education in the affected years. This makes it a suitable instrument for our analysis.

We define two distinct groups: the control group consists of individuals born between 1976 and 1985, representing the decade prior to the reform, and the treatment group includes those born from 1987 to 1996, covering the decade after the reform. We include those born in 1986 alternatively in the control or treatment group and present both sets of results. The analysis is thus based on a twenty-year window around the pivotal year of 1986. This choice of estimation window also ensures that the treated individuals were impacted by the 1997 reform but not by the subsequent 2012 reform. The 2012 reform increased compulsory education to twelve years. This reform, effective from the 2012-2013 academic year, applied to individuals born in 1997 and thereafter.

Previous research has shown that the implementation of educational reforms often varies across different geographical areas. In particular, the Turkish 1997 CER was more extensively implemented in regions with initially low secondary school enrollment (Özer et al., 2018, 2023, 2024). To overcome the limitations of using a single dummy variable in regions with diverse educational achievements, we build upon the insights of Duflo (2001) and construct an interaction of the treatment dummy and an intensity measure. In line with Özer et al. (2024), we construct two alternative instruments, so as to allow a more comprehensive examination of the impact of the reform, considering the regional and temporal variations in its implementation.

The first instrument combines the exposure to the CER (at the individual level) with the number of school teachers in years 1-8:

$$S_{ipc} = \gamma_0 + \xi_p + \omega_c + \sigma_p + \rho_c + \gamma_1(\text{Teach}_{pc} \times \text{Treat}_i) + \gamma_2\left(\sum_{c=1976}^{1996} \text{GenAdm96}_p \times \text{birthyear}_c\right) + \gamma_3\left(\sum_{m=1}^{12} h_{mi} \times \sigma_d\right) + \eta_{idc}, \quad (1)$$

where S_{ipc} represents the education level of individual i living in province p and born in year c . The term Treat_i indicates the treatment status and takes the value of 1 for the respondents born between 1987-1996 who were obliged to complete 8 years of schooling due to the education reform, and 0 for those born between 1976-1985 who were not affected by the reform. Teach_{pc} is the reform-intensity variable, obtained by dividing the number of teachers in grades 1 to 8 by the total number of children aged 6 to 13 at primary and secondary school level, both measured at the level of cohort c and province p .³ The construction of this instrument, as an the interaction

³Teacher data per province and year were collected from Turkey's National Education Statistics yearbooks, requiring manual

between $Treat_i$ and $Teach_{pc}$, hereafter referred to as 'IV1,' follows [Özer et al. \(2024\)](#).

$GenAdm96_p$, which represents the gross admission rate to sixth grade in the 1996-97 academic year, is included to control for the pre-reform state of education in the province. ξ_p denotes the province fixed effects, capturing unobserved and time-invariant provincial factors such as socio-economic development, school and teacher quality, urbanization rates. To capture cohort-specific influences, we incorporate year-of-birth fixed effects (ω_c). These are crucial for accounting for the variation in mental health and education outcomes potentially arising from the distinct characteristics of different birth cohorts. These could arise because of different educational policies, access to different early life opportunities, or exposure to specific socio-economic conditions during their formative years. The model incorporates survey-wave fixed effects (σ_d) to account for period-specific variations impacting education and mental health. This includes shifts in education policy and economic conditions between survey periods. ρ_c denotes rural residence for cohort c . h_{mi} accounts for regional fixed effects for region m , which is interacted with the survey wave effect. Finally, η_{idc} is the error term.

To satisfy the exclusion restriction, the exposure to reform, used as our instrument, must operate solely through its effect on educational attainments. In other words, the exposure to the CER has to be uncorrelated with unobserved variables that are subject to regional or temporal fluctuations. To counteract potential biases, the model includes interactions between birth year cohorts and $GenAdm96_p$, as well as between survey waves and NUTS1 regions. This is essential for controlling for the variations in enrollment patterns and educational resources across different provinces, thereby enabling a more precise evaluation of the reform's actual impact.

As an alternative instrument, we follow [Özer et al. \(2018\)](#) in using the change in expenditure on classroom construction per 1,000 children between the 1996–1997 and 1997–1998 academic years, calculated for each province as the other intensity measure of the 1997 education reform.⁴ The increased enrollment following the CER required substantial capacity investment in Turkish schools. The interaction of the treatment variable with this intensity measure serves is hereafter referred to as 'IV2'.

$$S_{ipc} = \gamma'_0 + \xi'_p + \omega'_c + \sigma'_d + \rho'_c + \gamma'_1(\text{Spend}_{pc} \times \text{Treat}_i) + \gamma'_2\left(\sum_{c=1976}^{1996} \text{GenAdm96}_p \times \text{birthyear}_c\right) + \gamma'_3\left(\sum_{m=1}^{12} h_{mi} \times \sigma'_d\right) + \eta'_{idc}, \quad (2)$$

where the interaction of Spend_{pc} and treatment status (Treat_i) serves as an alternative instrumental variable. Apart from this change, the model retains the same structure and control

compilation at the provincial level. Child population aged 6 to 13 was determined from the 1975, 1980, 1985, 1990, and 2000 censuses, with missing years estimated using exponential methods.

⁴The expenditure data were derived from the 1996 and 1997 statistical yearbooks of the Turkish Ministry of Development, adjusted for inflation. Data collation involved carefully reviewing all yearbooks and manually consolidating expenditure figures at the provincial level. To estimate the population aged 6–13 in 1996 and 1997, census statistics from 1990 and 2000 provided by the Turkish Statistical Institute were utilized, with any gaps in data filled using the exponential function method.

variables as in Equation (1).

The second-stage regression, assessing the impact of education on mental health, is formulated as follows:

$$\begin{aligned}
 M_{jpc} = & \delta_0 + \delta_1 \hat{S}_{ipc} + \sigma_d^M + \delta_3 (\text{GenAdm96}_p \times \text{birth year}_c) \\
 & + \delta_4 \left(\sum_{m=1}^{12} h_{mi} \times \sigma_d^M \right) + \xi_d^M + \omega_c^M + \eta_{ide}^M,
 \end{aligned} \tag{3}$$

M_{jpc} represents mental health outcomes. \hat{S}_{ipc} indicates the predicted educational attainment from the first-stage regression in equation (1). Note that we consider both the effect of the respondents own education on her mental health, and intra-family spillovers in the effects of education. To measure the own-education effect, $i = j$ so that we regress M_{ipc} on S_{ipc} . To assess intra-family spillovers, we consider the mental-health outcomes of the wife as a function of her husband’s education, or the mental health of the children as a function of either the wife’s or the husband’s education. The second-stage regression retains all first-stage controls, except, of course, for the instrumental variable. In all specifications, the standard errors are clustered at province level.

Note that we do not control for contemporaneous variables reflecting the state of the local economy (e.g. the unemployment and poverty levels) or the quality of the local health-care system (e.g. numbers of medical staff and hospital capacity). This is because these measures may be correlated with educational outcomes (and, in particular, with the local differences in the implementation of the educational reform). Including them could introduce endogeneity bias.

For the same reason, we also exclude individual-level characteristics potentially influenced by educational attainment, such as employment status, indicators of women’s autonomy, and access to healthcare.

5 Results

Table 2 reports the results of estimating the first stage of our analysis, namely equations (1) and (2). As we argue above, it is possible that some individuals born in 1986 were affected by the CER while others, who started school one year earlier, were not. For this reason, we estimate two alternative model specification: with those born in 1986 included in the treatment group, or in the control group. The baseline model covers the full twenty-year period (1976-1996). The results show that the CER has a strong and statistically significant effect on JHS completion, regardless of the instrumental variable used (the two first-stage coefficients are different in magnitude because of the different reform-intensity variables used to construct the two instruments). The CER effect remains consistent even when we narrow the bandwidths around the 1986 birth year cutoff, as shown in the subsequent columns of Table 2. This pattern

reinforces our findings, indicating that they hold true across various bandwidths.

Table 3 reports the results of estimating equation (3) by Ordinary Least Squares (OLS) and Instrumental Variables (IV), with the education variable used being either that of the wife or the husband. Three observations can be made. First, the OLS tends to underestimate the impact of education for both spouses (with the exception of the effect of wife’s own education on her mental health). This resonates with the existing literature on the causal effects of education on health, including mental health (Agüero and Bharadwaj, 2014; Crespo et al., 2014; Cutler and Lleras-Muney, 2010; Li and Sunder, 2024). Second, the effect of the husband’s education dominates that of the wife’s education, suggesting that intra-family spillovers are important. Third, the favorable effect of education (of both spouses) is observed across the different aspects of women’s mental health: emotional distress, anxiety, and suicidal ideation.

Table 4 considers the effects of both parents’ education on the children’s mental health. Again, the OLS estimates fall short of the causal estimates obtained with instrumental variables augmented for reform intensity, and the effect of the father’s education dominates that of the wife’s education. Therefore, children’s mental health is crucially determined by the education of the parents.

Besides mental health, we also consider the effects of both spouse’s education on the women’s physical health (Table 5), domestic violence, abusive behavior and women’s empowerment (Table 6), marriage formation (Table 7), and economic and financial outcomes of both spouses (Table 8). The results point in the same direction as those for mental health: education has generally favorable effects, the IV results are stronger than the OLS ones, and the effect of the husband’s education is stronger than that of the wife’s educational attainment. Thus, education is associated with improved physical health and less reporting of pain, and lower incidence of domestic violence and abusive or inappropriate behavior. Note that we find education having no significant causal effect on some outcome variables. This is the case with women’s empowerment, women’s age at marriage and the age gap between the two spouses, the gap in their educational attainments, employment/unemployment, access to healthcare and house ownership. Nevertheless, in no case do we observe an adverse effect, that is, education worsening health outcomes or position of women: we find either favorable effect, or no effect.

6 Robustness Checks

To probe the robustness of our baseline findings in Table 3, we explore the impact of the policy across different birth cohorts. Thus, we modify equation (1) and (2) by introducing interactions between the policy intensity variable and birth cohort dummies. This allows us to assess the effect of the reform on educational attainment separately for each cohort.

Table 2: The impact of instruments on the likelihood of achieving 8 years of mandatory education: Effects across bandwidths near 1986 birth year cutoff (first-stage)

	Model I (1976 to 1996)		Model II (1977 to 1995)		Model III (1978 to 1994)		Model IV (1979 to 1993)		Model V (1980 to 1992)		Model VI (1981 to 1991)	
	1986 incl.	1986 excl.	1986 incl.	1986 excl.	1986 incl.	1986 excl.	1986 incl.	1986 excl.	1986 incl.	1986 excl.	1986 incl.	1986 excl.
Panel A.												
Wife's Education												
Reform effect-Instrument 1	12.044*** (0.945)	12.295*** (0.929)	12.043*** (0.945)	12.294*** (0.930)	12.023*** (0.946)	12.274*** (0.931)	11.989*** (0.949)	12.238*** (0.933)	12.066*** (0.977)	12.313*** (0.959)	11.934*** (0.983)	12.181*** (0.964)
F-statistic (first-stage)	162.55	175.00	162.25	174.68	161.48	173.89	159.63	171.94	152.49	164.85	147.50	159.58
Reform effect-Instrument 2	0.003*** (0.000)	0.003*** (0.000)	0.003*** (0.000)	0.003*** (0.000)	0.003*** (0.000)	0.003*** (0.000)	0.003*** (0.000)	0.003*** (0.000)	0.003*** (0.000)	0.003*** (0.000)	0.003*** (0.000)	0.003*** (0.000)
F-statistic (first-stage)	165.48	157.93	165.85	158.35	165.47	157.95	167.02	159.52	174.91	168.23	174.67	167.88
Panel B.												
Husband's Education												
Reform effect-Instrument 1	5.183*** (0.767)	5.111*** (0.750)	5.176*** (0.768)	5.104*** (0.751)	5.155*** (0.766)	5.082*** (0.749)	5.102*** (0.771)	5.026*** (0.754)	5.200*** (0.784)	5.120*** (0.770)	5.181*** (0.779)	5.105*** (0.765)
F-statistic (first-stage)	45.66	46.40	45.46	46.17	45.29	45.99	43.78	44.39	44.01	44.24	44.26	44.53
Reform effect-Instrument 2	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)
F-statistic (first-stage)	76.33	71.00	76.26	70.95	75.33	69.98	74.09	68.88	74.78	69.42	71.45	66.37
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year of birth fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Survey wave fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Type of residence (rural)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
12-region×survey wave FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Standard errors are clustered at province level. The number of observations ranges from 3413 to 7657. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Table 3: Education and women's mental health

	Wife's Education		Husband's Education	
	1986 included	1986 excluded	1986 included	1986 excluded
Panel A. Total mental health index				
Education effect (OLS)	-0.223*** (0.019)	-0.225*** (0.020)	-0.240*** (0.022)	-0.239*** (0.022)
Education effect (IV-2SLS) - Instrument 1	-0.212*** (0.080)	-0.196** (0.083)	-0.507*** (0.173)	-0.488*** (0.182)
<i>F</i> -statistic (first-stage)	162.24	175.60	45.12	45.63
Education effect (IV-2SLS) - Instrument 2	-0.235*** (0.091)	-0.219** (0.096)	-0.530*** (0.197)	-0.512** (0.211)
<i>F</i> -statistic (first-stage)	173.82	166.21	79.55	73.35
Panel B. Emotional distress and daily functioning index				
Education effect (OLS)	-0.032 (0.024)	-0.029 (0.024)	-0.067** (0.030)	-0.064** (0.029)
Education effect (IV-2SLS) - Instrument 1	-0.172** (0.070)	-0.181** (0.75)	-0.372** (0.175)	-0.410** (0.191)
<i>F</i> -statistic (first-stage)	162.24	175.60	45.12	45.63
Education effect (IV-2SLS) - Instrument 2	-0.244*** (0.078)	-0.251*** (0.088)	-0.533*** (0.183)	-0.571*** (0.211)
<i>F</i> -statistic (first-stage)	173.82	166.21	79.55	73.35
	Wife's Education		Husband's Education	
	1986 included	1986 excluded	1986 included	1986 excluded
Panel C. Anxiety and somatic symptoms index				
Education effect (OLS)	-0.312*** (0.014)	-0.317*** (0.015)	-0.277*** (0.019)	-0.279*** (0.20)
Education effect (IV-2SLS) - Instrument 1	-0.408*** (0.087)	-0.405*** (0.087)	-0.981*** (0.213)	-1.008*** (0.205)
<i>F</i> -statistic (first-stage)	162.24	175.60	45.12	45.63
Education effect (IV-2SLS) - Instrument 2	-0.398*** (0.084)	-0.402*** (0.083)	-0.904*** (0.196)	0.942*** (0.186)
<i>F</i> -statistic (first-stage)	173.82	166.21	79.55	73.35
Panel D. Severe depression and suicidal ideation index				
Education effect (OLS)	-0.092*** (0.022)	-0.096*** (0.023)	-0.125*** (0.020)	-0.124*** (0.029)
Education effect (IV-2SLS) - Instrument 1	-0.271** (0.114)	-0.315*** (0.102)	-0.594** (0.269)	-0.722*** (0.253)
<i>F</i> -statistic (first-stage)	162.24	175.60	45.12	45.63
Education effect (IV-2SLS) - Instrument 2	-0.313** (0.138)	-0.362*** (0.122)	-0.683** (0.310)	-0.823*** (0.289)
<i>F</i> -statistic (first-stage)	173.82	166.21	79.55	73.35
Province fixed effects	Yes	Yes	Yes	Yes
Year of birth fixed effects	Yes	Yes	Yes	Yes
Survey wave fixed effect	Yes	Yes	Yes	Yes
Type of place of residence(rural)	Yes	Yes	Yes	Yes
12-region×survey wave fixed effect	Yes	Yes	Yes	Yes
# of observations	7657	7290	6777	6436

Notes: Standard errors are clustered at province level. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

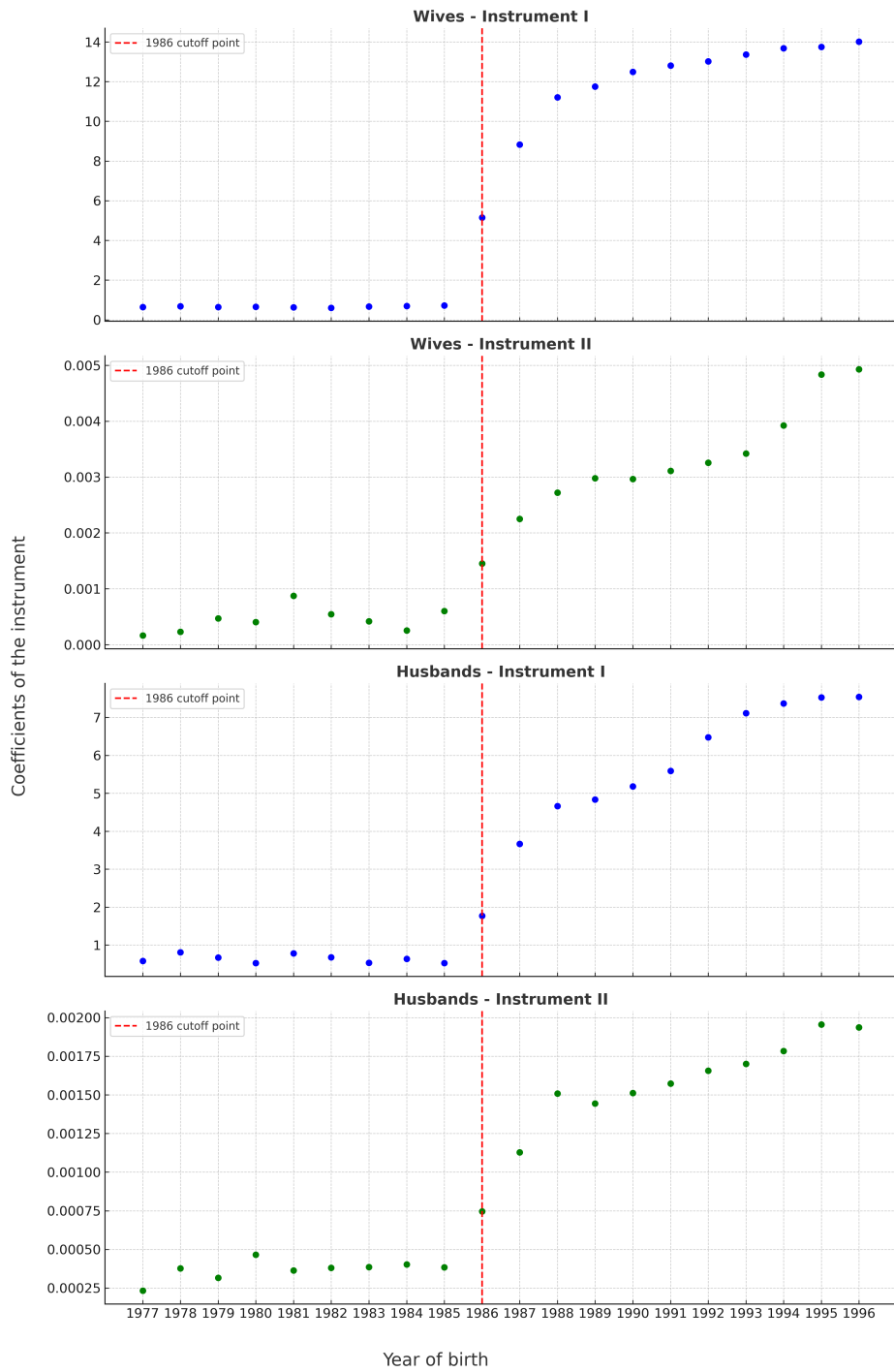


Figure 2: The impact of education reform on junior high school completion rates by birth year

Table 4: Effects of parental education on children’s mental health

	Wife’s Education		Husband’s Education	
	1986 included	1986 excluded	1986 included	1986 excluded
Education effect (OLS)	-0.211*** (0.022)	-0.211*** (0.021)	-0.111*** (0.022)	0.113*** (0.022)
Education effect (IV-2SLS) - Instrument 1	-0.924*** (0.360)	-0.916** (0.364)	-2.461*** (0.916)	2.548*** (0.941)
<i>F</i> -statistic (first-stage)	37.99	37.89	12.24	11.61
Education effect (IV-2SLS) - Instrument 2	-1.060*** (0.378)	-1.060*** (0.386)	-2.677** (1.073)	-2.809** (1.135)
<i>F</i> -statistic (first-stage)	32.70	32.42	10.99	10.01
Province fixed effects	Yes	Yes	Yes	Yes
Year of birth fixed effects	Yes	Yes	Yes	Yes
Survey wave fixed effect	Yes	Yes	Yes	Yes
Type of place of residence(rural)	Yes	Yes	Yes	Yes
12-region×survey wave fixed effect	Yes	Yes	Yes	Yes
# of observations	3603	3497	3540	3435

Notes: Standard errors are clustered at province level. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

$$\begin{aligned}
 S_{ipc} = & \gamma'_0 + \xi'_p + \omega'_c + \sigma'_d + \rho'_c + \gamma'_1 \left(\sum_{i=1}^{20} (Teach_{pc} \times birthyear_{ic}) \right) \\
 & + \gamma'_2 \left(\sum_{c=1976}^{1996} Gen96_d \times birthyear_c \right) + \gamma'_3 \left(\sum_{m=1}^{12} h_{mi} \times \sigma'_d \right) + \eta'_{idc},
 \end{aligned} \tag{4}$$

$$\begin{aligned}
 S_{ipc} = & \gamma'_0 + \xi'_p + \omega'_c + \sigma'_d + \rho'_c + \gamma'_1 \left(\sum_{i=1}^{20} (Spend_{pc} \times birthyear_{ic}) \right) \\
 & + \gamma'_2 \left(\sum_{c=1976}^{1996} GenAdm96_d \times birthyear_c \right) + \gamma'_3 \left(\sum_{m=1}^{12} h_{mi} \times \sigma'_d \right) + \eta'_{idc},
 \end{aligned} \tag{5}$$

where $birthyear_{ic}$ represents the different cohort dummies. The results of this analysis are presented in Figure 2. In alignment with our prior results, we find that the effect of the reform is insignificant for the respondents born before policy implementation. However, it becomes highly significant and positive for the individuals born in 1987 and later.

Next, we alter the bandwidths around the pivotal 1986 birth year. This involves repeating our analysis with bandwidths extending from 5 to 10 years, decreasing in one-year steps. The coefficients derived with this approach are summarized in Table 9. The findings consistently show a negative relationship between education and mental health issues, indicating that higher education tends to improve mental health. Importantly, these findings remain statistically significant across the different bandwidths, suggesting that our main results are stable regardless of the bandwidth used.

Table 5: Effects of education on women’s physical health

	Wife’s Education		Husband’s Education	
	1986 included	1986 excluded	1986 included	1986 excluded
Panel A. Self reported poor physical health				
Education effect (OLS)	-0.219*** (0.014)	-0.218*** (0.014)	-0.173*** (0.012)	-0.172*** (0.012)
Education effect (IV-2SLS) - Instrument 1	-0.613*** (0.077)	-0.610*** (0.078)	-1.433*** (0.171)	-1.476*** (0.184)
<i>F</i> -statistic (first-stage)	162.60	175.05	45.65	46.38
Education effect (IV-2SLS) - Instrument 2	-0.706*** (0.080)	-0.708*** (0.082)	-1.590*** (0.192)	-1.651*** (0.213)
<i>F</i> -statistic (first-stage)	165.57	158.01	76.29	70.96
Panel B. Any pain or discomfort				
Education effect (OLS)	-0.118*** (0.006)	-0.118*** (0.007)	-0.106*** (0.010)	-0.105*** (0.010)
Education effect (IV-2SLS) - Instrument 1	-0.202*** (0.034)	-0.197*** (0.035)	-0.476*** (0.090)	-0.480*** (0.093)
<i>F</i> -statistic (first-stage)	161.46	173.86	46.47	47.26
Education effect (IV-2SLS) - Instrument 2	-0.266*** (0.045)	-0.263*** (0.045)	-0.594*** (0.113)	-0.608*** (0.116)
<i>F</i> -statistic (first-stage)	167.27	159.49	80.42	74.93
Province fixed effects	Yes	Yes	Yes	Yes
Year of birth fixed effects	Yes	Yes	Yes	Yes
Survey wave fixed effect	Yes	Yes	Yes	Yes
Type of place of residence(rural)	Yes	Yes	Yes	Yes
12-region×year fixed effects	Yes	Yes	Yes	Yes
# of observations	7742-7745	3,131,622	6854-6858	3,131,622

Notes: Standard errors are clustered at province level. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Table 6: Education and empowerment of women

	Wife's Education		Husband's Education	
	1986 included	1986 excluded	1986 included	1986 excluded
Panel A. Domestic violence index				
Education effect (OLS)	-0.180*** (0.045)	-0.186*** (0.045)	-0.197*** (0.025)	-0.195*** (0.026)
Education effect (IV-2SLS) - Instrument 1	-0.663*** (0.131)	-0.650*** (0.132)	-1.602*** (0.338)	-1.632*** (0.358)
<i>F</i> -statistic (first-stage)	139.43	149.66	42.87	43.79
Education effect (IV-2SLS) - Instrument 2	-0.746*** (0.165)	-0.733*** (0.169)	-1.646*** (0.368)	-1.674*** (0.399)
<i>F</i> -statistic (first-stage)	113.01	104.30	98.77	88.08
Panel B. Forced marriage				
Education effect (OLS)	-0.083*** (0.006)	-0.085*** (0.006)	-0.074*** (0.006)	-0.075*** (0.007)
Education effect (IV-2SLS) - Instrument 1	-0.152*** (0.022)	-0.149*** (0.022)	-0.351** (0.079)	-0.357*** (0.081)
<i>F</i> -statistic (first-stage)	156.99	170.29	40.95	41.53
Education effect (IV-2SLS) - Instrument 2	-0.169*** (0.025)	-0.168*** (0.024)	-0.373*** (0.077)	-0.383*** (0.082)
<i>F</i> -statistic (first-stage)	176.61	170.05	82.33	78.09
	Wife's Education		Husband's Education	
	1986 included	1986 excluded	1986 included	1986 excluded
Panel C. Women's autonomy and empowerment index				
Education effect (OLS)	0.717*** (0.019)	0.721*** (0.018)	0.465*** (0.015)	0.471*** (0.014)
Education effect (IV-2SLS) - Instrument 1	-0.170 (0.139)	-0.181 (0.138)	-0.374 (0.362)	-0.413 (0.336)
<i>F</i> -statistic (first-stage)	146.26	156.61	51.72	52.19
Education effect (IV-2SLS) - Instrument 2	-0.181 (0.133)	-0.193 (0.132)	-0.394 (0.304)	-0.438 (0.314)
<i>F</i> -statistic (first-stage)	148.64	140.58	63.19	57.90
Panel D. Partner dominance and restrictive behaviour index				
Education effect (OLS)	-0.177*** (0.019)	-0.186*** (0.022)	-0.152*** (0.022)	-0.152*** (0.023)
Education effect (IV-2SLS) - Instrument 1	-0.589*** (0.114)	-0.616*** (0.111)	-1.369*** (0.344)	-1.484*** (0.365)
<i>F</i> -statistic (first-stage)	177.05	190.40	43.12	43.80
Education effect (IV-2SLS) - Instrument 2	-0.599*** (0.126)	-0.631*** (0.119)	-1.346*** (0.342)	-1.467*** (0.352)
<i>F</i> -statistic (first-stage)	158.30	150.28	69.09	64.41
Province fixed effects	Yes	Yes	Yes	Yes
Year of birth fixed effects	Yes	Yes	Yes	Yes
Survey wave fixed effect	Yes	Yes	Yes	Yes
Type of place of residence(rural)	Yes	Yes	Yes	Yes
12-region×year fixed effects	Yes	Yes	Yes	Yes
# of observations	4969-7473	4721-7110	4476-6443	4716-6778

Notes: Standard errors are clustered at province level. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Table 7: Education and marriage formation

	Wife's Education		Husband's Education	
	1986 included	1986 excluded	1986 included	1986 excluded
Panel A. Age at marriage of women				
Education effect (OLS)	-0.104 (0.206)	-0.103 (0.213)	0.050 (0.087)	0.066 (0.089)
Education effect (IV-2SLS) - Instrument 1	0.543 (0.546)	0.518 (0.523)	0.404 (0.558)	0.204 (0.287)
<i>F</i> -statistic (first-stage)	162.24	175.60	45.12	45.63
Education effect (IV-2SLS) - Instrument 2	0.871 (0.866)	0.861 (0.889)	0.616 (0.722)	0.781 (0.727)
<i>F</i> -statistic (first-stage)	173.82	166.21	79.55	73.35
Panel B. Age gap-husband age-wife age				
Education effect (OLS)	-0.020 (0.016)	-0.017 (0.018)	-0.005 (0.013)	-0.004 (0.013)
Education effect (IV-2SLS) - Instrument 1	0.754 (0.565)	0.728 (0.599)	0.615 (0.617)	0.668 (0.978)
<i>F</i> -statistic (first-stage)	162.24	175.60	45.12	45.63
Education effect (IV-2SLS) - Instrument 2	0.484 (0.369)	0.471 (0.349)	0.309 (0.307)	-0.320 (0.313)
<i>F</i> -statistic (first-stage)	173.82	166.21	79.55	73.35
Panel B. Education gap-husband education-wife education				
Education effect (OLS)	-0.270*** (0.016)	-0.268*** (0.017)	0.429*** (0.016)	0.433*** (0.016)
Education effect (IV-2SLS) - Instrument 1	-0.205 (0.314)	-0.263 (0.270)	-0.168 (0.248)	-0.055 (0.307)
<i>F</i> -statistic (first-stage)	162.24	175.60	45.12	45.63
Education effect (IV-2SLS) - Instrument 2	-0.248 (0.217)	-0.284 (0.197)	0.197 (0.227)	0.407 (0.613)
<i>F</i> -statistic (first-stage)	173.82	166.21	79.55	73.35
Province fixed effects	Yes	Yes	Yes	Yes
Year of birth fixed effects	Yes	Yes	Yes	Yes
Survey wave fixed effect	Yes	Yes	Yes	Yes
Type of place of residence(rural)	Yes	Yes	Yes	Yes
12-region×year fixed effects	Yes	Yes	Yes	Yes
# of observations	6635-7749	6304-7379	6302-6861	5982-6517

Notes: Standard errors are clustered at province level. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Table 8: Education and financial strain

	Wife's Education		Husband's Education	
	1986 included	1986 excluded	1986 included	1986 excluded
Panel A. Employed wife				
Education effect (OLS)	0.097*** (0.012)	0.098*** (0.013)	0.048*** (0.013)	0.049*** (0.013)
Education effect (IV-2SLS) - Instrument 1	0.788 (0.721)	0.727 (0.746)	0.502 (0.542)	0.516 (0.740)
<i>F</i> -statistic (first-stage)	162.24	175.60	45.12	45.63
Education effect (IV-2SLS) - Instrument 2	0.735 (0.772)	0.518 (0.528)	0.827 (0.794)	0.946 (0.888)
<i>F</i> -statistic (first-stage)	173.82	166.21	79.55	73.35
Panel B. Unemployed husband				
Education effect (OLS)	-0.029*** (0.008)	-0.029*** (0.008)	-0.040*** (0.008)	-0.038*** (0.008)
Education effect (IV-2SLS) - Instrument 1	0.110 (0.150)	0.089 (0.140)	0.247 (0.266)	0.574 (0.599)
<i>F</i> -statistic (first-stage)	162.24	175.60	45.12	45.63
Education effect (IV-2SLS) - Instrument 2	-0.484 (0.445)	0.199 (0.171)	-0.324 (0.356)	-0.371 (0.613)
<i>F</i> -statistic (first-stage)	173.82	166.21	79.55	73.35
	Wife's Education		Husband's Education	
	1986 included	1986 excluded	1986 included	1986 excluded
Panel C. Poor access to health care				
Education effect (OLS)	-0.132*** (0.016)	-0.155*** (0.015)	-0.221*** (0.014)	-0.225*** (0.013)
Education effect (IV-2SLS) - Instrument 1	0.339 (0.356)	0.287 (0.299)	0.306 (0.284)	0.423 (0.870)
<i>F</i> -statistic (first-stage)	162.24	175.60	45.12	45.63
Education effect (IV-2SLS) - Instrument 2	0.408 (0.402)	0.271 (0.261)	0.378 (0.487)	0.414 (0.386)
<i>F</i> -statistic (first-stage)	173.82	166.21	79.55	73.35
Panel D. House ownership				
Education effect (OLS)	0.053*** (0.008)	0.057*** (0.008)	0.040*** (0.009)	0.042*** (0.008)
Education effect (IV-2SLS) - Instrument 1	-0.071 (0.223)	-0.091 (0.192)	-0.058 (0.171)	0.211 (0.262)
<i>F</i> -statistic (first-stage)	162.24	175.60	45.12	45.63
Education effect (IV-2SLS) - Instrument 2	-0.076 (0.151)	-0.063 (0.155)	-0.094 (0.203)	0.597 (0.577)
<i>F</i> -statistic (first-stage)	173.82	166.21	79.55	73.35
Province fixed effects	Yes	Yes	Yes	Yes
Year of birth fixed effects	Yes	Yes	Yes	Yes
Survey wave fixed effect	Yes	Yes	Yes	Yes
Type of place of residence(rural)	Yes	Yes	Yes	Yes
12-region×year fixed effects	Yes	Yes	Yes	Yes
# of observations	6635-7749	6304-7379	6302-6861	5982-6517

Notes: Standard errors are clustered at province level. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Table 9: Education and mental health: Effects across bandwidths near 1986 birth year cutoff (IV-2SLS)

	Model (1976 to 1996)		Model II (1977 to 1995)		Model III (1978 to 1994)		Model IV (1979 to 1993)		Model V (1980 to 1992)		Model VI (1981 to 1991)	
	Woman	Husband	Woman	Husband	Woman	Husband	Woman	Husband	Woman	Husband	Woman	Husband
Panel A. Total mental health												
Education effect	-0.196** (0.083)	-0.488*** (0.182)	-0.197** (0.083)	-0.489*** (0.182)	-0.197** (0.083)	-0.490*** (0.183)	-0.196** (0.083)	-0.491*** (0.184)	-0.201** (0.088)	-0.501*** (0.189)	-0.220** (0.090)	-0.540*** (0.195)
Education effect (IV-2SLS) - Instrument 1	-0.219** (0.096)	-0.512** (0.211)	-0.220** (0.097)	-0.514** (0.212)	-0.219** (0.097)	-0.515** (0.213)	-0.220** (0.096)	-0.519** (0.213)	-0.230** (0.103)	-0.541** (0.224)	-0.240** (0.105)	-0.567** (0.232)
Panel B. Emotional distress												
Education effect	-0.181** (0.075)	-0.410** (0.191)	-0.182** (0.075)	-0.411** (0.191)	-0.183** (0.076)	-0.414** (0.193)	-0.183** (0.077)	-0.417** (0.198)	-0.195** (0.078)	-0.443** (0.196)	-0.191** (0.079)	-0.429** (0.198)
Education effect (IV-2SLS) - Instrument 1	-0.251*** (0.088)	-0.571*** (0.211)	-0.252*** (0.088)	-0.572*** (0.212)	-0.253*** (0.088)	-0.576*** (0.213)	-0.253*** (0.089)	-0.579*** (0.216)	-0.262*** (0.089)	-0.598*** (0.215)	-0.255*** (0.090)	-0.584*** (0.219)
Panel C. Anxiety												
Education effect	-0.405*** (0.087)	-1.008*** (0.205)	-0.405*** (0.087)	-1.008*** (0.205)	-0.404*** (0.087)	-1.008*** (0.206)	-0.404*** (0.088)	-1.018*** (0.208)	-0.383*** (0.083)	-0.952*** (0.194)	-0.394*** (0.090)	-0.971*** (0.205)
Education effect (IV-2SLS) - Instrument 1	-0.402*** (0.083)	-0.942*** (0.186)	-0.402*** (0.083)	-0.943*** (0.186)	-0.401*** (0.083)	-0.943*** (0.187)	-0.403*** (0.084)	-0.955*** (0.189)	-0.389*** (0.081)	-0.920*** (0.185)	-0.404*** (0.087)	-0.959*** (0.196)
Panel D. Severe depression												
Education effect	-0.315*** (0.102)	-0.722*** (0.253)	-0.315*** (0.102)	-0.722*** (0.253)	-0.315*** (0.102)	-0.723*** (0.254)	-0.317*** (0.102)	-0.736*** (0.257)	-0.298*** (0.111)	-0.678** (0.280)	-0.264** (0.108)	-0.590** (0.258)
Education effect (IV-2SLS) - Instrument 1	-0.362*** (0.122)	-0.823*** (0.289)	-0.362*** (0.122)	-0.822*** (0.290)	-0.363*** (0.123)	-0.827*** (0.292)	-0.364*** (0.122)	-0.836*** (0.295)	-0.338** (0.135)	-0.774** (0.326)	-0.322** (0.130)	-0.739** (0.312)
Panel E. Child mental health												
Education effect	-0.916** (0.364)	-2.548*** (0.941)	-0.915** (0.364)	-2.553*** (0.944)	-0.931*** (0.356)	-2.631*** (0.921)	-0.961*** (0.352)	-2.868*** (1.013)	-0.963*** (0.353)	-2.871*** (1.013)	-0.970*** (0.354)	-2.961*** (1.076)
Education effect (IV-2SLS) - Instrument 1	-1.060*** (0.387)	-2.809** (1.135)	-1.058*** (0.386)	-2.822** (1.144)	-1.081*** (0.371)	-2.928*** (1.099)	-1.121*** (0.368)	-3.204** (1.306)	-1.124*** (0.368)	-3.200** (1.303)	-1.122*** (0.371)	-3.257** (1.352)
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year of birth fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Survey wave fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Type of place of residence (rural)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
12-region×survey wave fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Standard errors are clustered at province level. The number of observations ranges from 1361 to 7657. F-statistics are not reported as they are similar to those presented in Tables 3 and 4. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Table 10: Additional robustness tests (IV-2SLS)

	Model I (Birth cohort clustering)		Model II (Married-Only Sample)	
	Woman	Husband	Woman	Husband
Panel A. Total mental health index				
Education effect (IV-2SLS) - Instrument 1	-0.196*** (0.073)	-0.488** (0.190)	-0.192** (0.080)	-0.490** (0.191)
Education effect (IV-2SLS) - Instrument 2	-0.219*** (0.071)	-0.512** (0.200)	-0.206** (0.093)	-0.497** (0.221)
Panel B. Emotional distress and daily functioning index				
Education effect (IV-2SLS) - Instrument 1	-0.181*** (0.053)	-0.410*** (0.150)	-0.181** (0.079)	-0.438** (0.207)
Education effect (IV-2SLS) - Instrument 2	-0.251*** (0.063)	-0.571*** (0.189)	-0.248*** (0.094)	-0.600*** (0.232)
Panel C. Anxiety and somatic symptoms index				
Education effect (IV-2SLS) - Instrument 1	-0.405*** (0.130)	-1.008*** (0.304)	-0.399*** (0.083)	-1.037*** (0.208)
Education effect (IV-2SLS) - Instrument 2	-0.402*** (0.110)	-0.942*** (0.264)	-0.389*** (0.079)	-0.954*** (0.189)
Panel D. Severe depression and suicidal ideation index				
Education effect (IV-2SLS) - Instrument 1	-0.315*** (0.113)	-0.722*** (0.242)	-0.318*** (0.094)	-0.800*** (0.259)
Education effect (IV-2SLS) - Instrument 2	-0.362*** (0.117)	-0.823*** (0.233)	-0.373*** (0.115)	-0.921*** (0.301)
Panel E. Child mental health				
Education effect (IV-2SLS) - Instrument 1	-0.916*** (0.113)	-2.548** (1.251)	-0.910** (0.364)	-2.795** (1.130)
Education effect (IV-2SLS) - Instrument 2	-1.060*** (0.181)	-2.809* (1.574)	-1.057*** (0.393)	-3.035** (1.360)
Controls				
Province fixed effects	Yes	Yes	Yes	Yes
Year of birth fixed effects	Yes	Yes	Yes	Yes
Survey wave fixed effect	Yes	Yes	Yes	Yes
Type of place of residence(rural)	Yes	Yes	Yes	Yes
12-region×year fixed effects	Yes	Yes	Yes	Yes
# of observations	3497-7290	3435-6436	3387-6334	3329-6232

Notes: Standard errors are clustered at province level. F-statistics are not reported as they are similar to those presented in Tables 3 and 4. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Table 11: Exploring the role of childhood physical abuse and provincial income disparity (IV-2SLS)

	Model I <i>WCPA</i>		Model II <i>WNCPA</i>		Model III <i>HCPA</i>		Model IV <i>HNCPA</i>		Model V <i>LIP</i>		Model VI <i>HIP</i>	
	Woman	Husband	Woman	Husband	Woman	Husband	Woman	Husband	Woman	Husband	Woman	Husband
Panel A. Total mental health												
Education effect	0.018 (0.189)	0.012 (0.391)	-0.297*** (0.093)	-0.751*** (0.221)	-0.056 (0.179)	-0.225 (0.544)	-0.211** (0.087)	-0.507** (0.208)	-0.287*** (0.085)	-0.663*** (0.194)	-0.048 (0.147)	-0.191 (0.316)
Education effect	0.000 (0.159)	-0.033 (0.299)	-0.344*** (0.108)	-0.823*** (0.264)	-0.050 (0.174)	-0.182 (0.491)	-0.249*** (0.094)	-0.581** (0.232)	-0.259** (0.114)	-0.566** (0.254)	-0.143 (0.153)	-0.401 (0.340)
Panel B. Emotional distress												
Education effect	0.084 (0.126)	0.243 (0.265)	-0.277*** (0.096)	-0.676*** (0.256)	-0.166 (0.205)	-0.467 (0.661)	-0.255** (0.101)	-0.561** (0.271)	-0.190** (0.068)	-0.588** (0.242)	-0.186 (0.120)	-0.402 (0.302)
Education effect	0.080 (0.154)	0.189 (0.300)	-0.374*** (0.112)	-0.898*** (0.296)	-0.235 (0.246)	-0.652 (0.710)	-0.290** (0.118)	-0.647** (0.309)	-0.283** (0.113)	-0.605** (0.253)	-0.173 (0.159)	-0.456 (0.423)
Panel C. Anxiety												
Education effect	-0.166 (0.204)	-0.341 (0.440)	-0.408*** (0.099)	-1.051*** (0.250)	-0.163 (0.181)	-0.580 (0.585)	-0.448*** (0.118)	-1.078*** (0.263)	-0.588*** (0.087)	-1.423*** (0.247)	-0.122 (0.135)	-0.349 (0.293)
Education effect	-0.186 (0.233)	-0.427 (0.545)	-0.409*** (0.118)	-0.985*** (0.285)	-0.116 (0.198)	-0.367 (0.592)	-0.449*** (0.123)	-1.052*** (0.272)	-0.515*** (0.077)	-1.173*** (0.208)	-0.200 (0.169)	-0.506 (0.353)
Panel D. Severe depression												
Education effect	-0.283 (0.277)	-0.917 (0.642)	-0.230** (0.108)	-0.566* (0.304)	-0.313 (0.228)	-0.867 (0.709)	-0.447*** (0.144)	-1.001*** (0.373)	-0.305** (0.132)	-0.776** (0.359)	-0.129 (0.156)	-0.313 (0.295)
Education effect	-0.274 (0.264)	-0.907 (0.597)	-0.266** (0.126)	-0.649** (0.327)	-0.307 (0.220)	-0.979 (0.639)	-0.416*** (0.153)	-0.930** (0.376)	-0.304** (0.149)	-0.736** (0.364)	-0.171 (0.179)	-0.367 (0.404)
Panel E. Child mental health												
Education effect	-0.077 (0.277)	-0.254 (0.850)	-1.181** (0.492)	-2.992*** (1.081)	-0.619 (0.429)	-0.576 (0.614)	-1.549* (0.818)	-3.344** (1.697)	-1.556** (0.638)	-2.756** (1.108)	-0.417 (0.265)	-0.438 (0.410)
Education effect	-0.093 (0.249)	-0.476 (2.596)	-1.423** (0.559)	-3.017** (1.326)	-0.655 (0.425)	-0.807 (0.993)	-1.799* (0.923)	-3.656* (2.075)	-1.579*** (0.519)	-2.752*** (1.021)	-0.505 (0.364)	-0.464 (0.522)
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year of birth fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Survey wave fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Type of place of residence (rural)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
12-region×survey wave fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Standard errors are clustered at province level. The number of observations ranges from 3413 to 7657. F-statistics are not reported as they are similar to those presented in Tables 3 and 4. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$. Model I: Women with childhood physical abuse (WCPA); Model II: Women without childhood physical abuse (WNCPA); Model III: Husbands with childhood physical abuse (HCPA); Model IV: Husbands without childhood physical abuse (HNC-PA); Model V: Low income inequality province pre-reform (LIP); Model VI: High income inequality province pre-reform (HIP).

Table 12: Placebo tests for mental health outcomes robustness (IV-2SLS)

	Wives (1966 to 1985)	Husbands (1966 to 1985)
Panel A. Total mental health index		
Education effect (IV-2SLS) - Instrument 1	-0.141 (0.482)	-0.061 (0.361)
Education effect (IV-2SLS) - Instrument 2	-0.445 (0.492)	-0.097 (0.376)
Panel B. Emotional distress and daily functioning index		
Education effect (IV-2SLS) - Instrument 1	0.696 (0.716)	0.585 (0.550)
Education effect (IV-2SLS) - Instrument 2	0.311 (0.647)	0.293 (0.539)
Panel C. Anxiety and somatic symptoms index		
Education effect (IV-2SLS) - Instrument 1	-0.392 (0.475)	-0.318 (0.376)
Education effect (IV-2SLS) - Instrument 2	-0.253 (0.317)	-0.284 (0.262)
Panel D. Severe depression and suicidal ideation index		
Education effect (IV-2SLS) - Instrument 1	-0.348 (0.459)	-0.219 (0.295)
Education effect (IV-2SLS) - Instrument 2	-0.414 (0.429)	-0.258 (0.277)
Panel E. Child mental health		
Education effect (IV-2SLS) - Instrument 1	-0.643 (0.958)	-0.746 (0.926)
Education effect (IV-2SLS) - Instrument 2	-0.430 (0.971)	-0.412 (0.732)
Province fixed effects	Yes	Yes
Year of birth fixed effects	Yes	Yes
Survey wave fixed effect	Yes	Yes
Type of place of residence(rural)	Yes	Yes
12-region×year fixed effects	Yes	Yes
# of observations	6574-10165	6458-9825

Notes: Standard errors are clustered at province level. In the placebo tests, F-statistics are less than 10 and close to zero across all specifications, indicating a weak instrument. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

Table 13: Assessing educational impacts on mental health: addressing assortative mating in IV estimations (IV-2SLS)

	Model I	Model II	
	Average education	Women whose husbands were not exposed to CER	Husbands whose wives were exposed to CER
Panel A. Total mental health index			
Education effect (IV-2SLS) - Instrument 1	-0.361*** (0.117)	-0.222*** (0.082)	-0.567*** (0.195)
Education effect (IV-2SLS) - Instrument 2	-0.291** (0.121)	-0.215** (0.090)	-0.517** (0.213)
Panel B. Emotional distress and daily functioning index			
Education effect (IV-2SLS) - Instrument 1	-0.468*** (0.150)	-0.235*** (0.080)	-0.555*** (0.213)
Education effect (IV-2SLS) - Instrument 2	-0.261** (0.114)	-0.252*** (0.084)	-0.588*** (0.217)
Panel C. Anxiety and somatic symptoms index			
Education effect (IV-2SLS) - Instrument 1	-0.468*** (0.113)	-0.412*** (0.082)	-1.051*** (0.217)
Education effect (IV-2SLS) - Instrument 2	-0.609*** (0.140)	-0.391*** (0.083)	-0.945*** (0.208)
Panel D. Severe depression and suicidal ideation index			
Education effect (IV-2SLS) - Instrument 1	-0.444*** (0.135)	-0.344*** (0.109)	-0.808*** (0.272)
Education effect (IV-2SLS) - Instrument 2	-0.464*** (0.169)	-0.361*** (0.117)	-0.845*** (0.278)
Panel E. Child mental health			
Education effect (IV-2SLS) - Instrument 1	-1.300*** (0.423)	-0.957** (0.395)	-2.896** (1.265)
Education effect (IV-2SLS) - Instrument 2	-1.250** (0.541)	-1.119*** (0.422)	-3.091** (1.277)
Province fixed effects	Yes	Yes	Yes
Year of birth fixed effects	Yes	Yes	Yes
Survey wave fixed effect	Yes	Yes	Yes
Type of place of residence(rural)	Yes	Yes	Yes
12-region×year fixed effects	Yes	Yes	Yes
# of observations	3451-6485	3297-6114	

Notes: Standard errors are clustered at province level. F-statistics are not reported as they are similar to those presented in Tables 3 and 4. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

As another robustness test, we conduct clustering based on the running variable, specifically the birth year, in addition to the main regression analyses clustered at the province level. The findings in Table 10 confirm that the results are robust to this alternative clustering approach.

For the baseline results, we consider any women who were married at any point in their lives, that is, also including divorced and widowed women. As another check, we only include women who were married at the time of the survey. The results, presented as Model II in Table 10, are again very similar to our baseline findings.

Poor mental health can be driven by specific childhood experiences. In Table 11, we split the sample according to the presence or absence of history of abuse during childhood, and according to the level of income in provinces in which the respondents grew up. Specifically, in Models I to IV, we report estimates for respondents with (without) history of abuse or for those whose husbands report (do not report) having experienced such abuse. In Models V and VI, we split the respondents into those who grew up in provinces with income per capita below and above the median level for Turkey, respectively. The results show that the significant effects of education observed in the main findings are primarily driven by families without a history of childhood abuse and those who grew up in low-income provinces. Hence, having abuse in childhood diminishes or even cancels out the gains from education in terms of mental health. The stronger impact of education in low-income provinces, in turn, is probably driven by the fact that such regions are lagging behind not only economically but also with respect to educational outcomes. Educational reform can thus constitute *low hanging fruit*: ensuring that girls in economically repressed regions receive sufficient education bestows important benefits on them.

Finally, it is also possible that the effects we observe are in fact attributable to age (since the individuals in the control group are slightly younger) or to an underlying trend in improving the quality of education over time (independently of the 1997 CER). To allow for this possibility, we perform a placebo test, where we shift our window back in time by ten years, to 1966-1986. Thus, neither the placebo-control group (1966-1975) nor the placebo-treatment group (1976-1976) were in fact affected by the CER that took place in 1997. The results are reported in Table 12. If our findings are due to age or time trends, this placebo test should be also statistically significant. Reassuringly, it is not significant: neither for the wife's nor for the husband's education.

7 Assortative Mating

Marriages often bring together individuals with similar characteristics: this tendency is generally known as *Assortative Mating*. This means, however, that the educational attainments of the two spouses are correlated and not randomly drawn. Therefore, when assessing the causal impact of the education of either spouse, it is difficult to separate it from the impact of the other spouse's education.

In the first instance, we consider the average educational attainment of the two spouses

instead of their individual attainments. The results, shown as Model I in Table 13, are similar to those presented above.

To separate the effects of the two spouses' educational attainments, we utilize the fact that in Turkey, as in many other countries, husbands tend to be older than their wives. This allows us to construct two sub-samples: one with the wives either affected or unaffected by the CER but with all their husbands unaffected, and another with the husbands either affected or unaffected by the CER but with their wives all affected by the reform. Thus, in the former, we vary the wives' exposure to the CER varies while keeping the husbands' exposure constant. Similarly, in the latter, we vary the husbands' exposure to the CER while keeping the wives' exposure constant. The results, presented as Model II in Table 13, are similar to the baseline results, but appear stronger when we vary the education of the husbands. Thus, it is the husband's education that seems to have more impact on the women's mental health.

8 Conclusions

It is well known that education has important favorable effects on labor-market outcomes and overall quality of life. We show that it also has favorable – and causal – effects on women's mental health and well-being. Education improves women's mental health and strengthens their position within the household. These effects are driven by families that do not have a history of domestic violence and abuse: adverse effects of abuse extend to the next generation by counteracting the favorable effect of education. The impact is also more pronounced among respondents from low-income provinces, underscoring the potentially important gains that can be derived from the extension of education in economically-backward areas of emerging countries.

We believe that our paper is the first analysis to explicitly consider intra-family spillovers. We find such spillovers to be important: the husbands' education has favorable effects on the wives' and children's outcomes, and the education of either parent improves the mental health outcomes of their children.

We also explicitly recognize the importance of *assortative mating* for identifying the impact of the spouses' education on their mental health (and other outcomes). Because of *assortative mating*, the educational attainment of the husband and wife are jointly determined rather than randomly drawn. We separate the effects of the husband's and wife's education and show that they are both favorable. Moreover, the effect of husband's education dominates that of the wife's education. Thus, we show that education has important favorable effects on women's mental health, and that these favorable effects are not limited to the individual in question but may accrue also to other family members. In a socially conservative and male-dominated society such as Turkey, improving the educational attainments of men can have particularly important favorable spillover effects for the remaining family members.

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