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Does Longer Compulsory Education Equalize Schooling by Gender and Rural/Urban Residence?

Murat G. Kırdar, Meltem Dayıoğlu, and İsmet Koç

This study examines the effects of the extension of compulsory schooling from 5 to 8 years in Turkey in 1997—which involved substantial investment in school infrastructure— on schooling outcomes and, in particular, on the equality of these outcomes between men and women, and urban and rural residents using the Turkish Demographic and Health Surveys. This policy is peculiar because it also changes the sheepskin effects (signaling effects) of schooling, through its redefinition of the schooling tiers. The policy is also interesting due to its large spillover effects on post-compulsory schooling as well as its remarkable overall effect; for instance, we find that the completed years of schooling by age 17 increases by 1.5 years for rural women. The policy equalizes the educational attainment of urban and rural children substantially. The urban-rural gap in the completed years of schooling at age 17 falls by 0.5 years for men and by 0.7 to 0.8 years for women. However, there is no evidence of a narrowing gender gap with the policy. On the contrary, the gender gap in urban areas in post-compulsory schooling widens. JEL codes: I21, I24, I28, J15, J16

Educational attainment remains at dismally low levels in several developing countries. The fraction of children who persist to grade 5 was below 40 percent in Chad and Madagascar, below 50 percent in Angola, Ethiopia, and Rwanda in 2009 (World Bank 2013). In addition, great disparities in schooling by gender and place of residence still exist in many parts of the world. Despite the progress made toward equality in schooling, women continue to lag behind men in many developing countries.[1] For instance, the gender schooling gap in primary schools

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1. Orazem and King (2008) as well as Grant and Behrman (2010) report significant improvement over time in the schooling attainment of women relative to that of men.

THE WORLD BANK ECONOMIC REVIEW, VOL. 30, NO. 3, pp. 549–579 doi:10.1093/wber/lhv035
Advance Access Publication July 28, 2015
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exceeds 10 percentage points in Yemen, Niger, Cote d'Ivoire, Mali, and Pakistan. Urban-rural divide in schooling is another stylized fact in many parts of the developing world. Orazem and King (2008) report that urban-rural gaps around the world are even larger than the gender gaps. Gender and urban-rural disparities in schooling outcomes in Turkey—the context of this study—are also quite significant. In this paper, we investigate how the extension of compulsory schooling from 5 to 8 years in Turkey in 1997 affects schooling attainment by gender and urban/rural residence and whether this schooling reform narrows or further exacerbates the existing differences across these groups. While this paper does not examine outcomes beyond schooling attainment such as labor market and social outcomes, it lays the groundwork for the analysis of the consequences of increased schooling.[2]

Within a period of three years following the 1997 reform, the number of students in grades 1 to 8 increased from about 9 million to 10.5 million, which represents a 15-percent rise compared to the 1-percent fall in the preceding three years. This is due to both the large number of additional years that are made compulsory (3 years) and the high drop-out rate in non-compulsory schooling grades before the policy. Equally interesting are the large spillover effects that we observe in post-compulsory schooling levels. These changes make Turkey's 1997 compulsory schooling reform one of the education policies with the highest impact on enrollment ever implemented.

Such a dramatic change in compulsory schooling in a developing country raises concerns about implementation, as well as schooling quality. However, in the Turkish context, there was a substantial investment in school infrastructure to ensure universal accessibility to the newly mandated compulsory grade levels, as well as the recruitment of additional teachers. In the absence of such interventions, schooling quality would suffer given the substantial increase in enrollment. Nevertheless, in our context, many of the basic indicators of schooling quality like student-to-classroom and student-to-teacher ratios change only slightly. The investment in schooling infrastructure implies that our estimates on the effect of the extension of compulsory schooling on educational attainment encompass the effects of these interventions as well. However, this is the relevant question in a developing country; a change in compulsory schooling in a developing country cannot be considered without a simultaneous investment in infrastructure that guarantees a seat for every child of school age.

Effects of compulsory schooling policies on schooling outcomes are rarely studied in developing countries. An exception is Taiwan's 1968 education reform, which increased tuition-free compulsory schooling from 6 to 9 years. Spohr (2003) finds the initial effect of the reform to be smaller for girls than for boys, while in a later study, Tsai et al. (2009) find a reduction in the gender

2. See, e.g., Kırdar et al. (2010), Aydemir and Kırdar (2013), Güleşçi and Meyersson (2013), Güneş (2013), Dinçer et al. (2014) for the social and labor market consequences of increased schooling in this context.

schooling gap due to the policy. Another policy that has recently received attention in the literature is the 1986 compulsory school reform in China. Fang et al. (2012) find that this policy has much stronger effects on girls than boys, as girls are more likely to be on the margin of being affected. They report similar effects by urban/rural status.

Numerous studies around the world show that compulsory schooling has beneficial causal effects on several socioeconomic outcomes.[3] Although most of these studies are for developed countries, the benefits of compulsory schooling could be even higher in developing countries because first, human capital is scarcer in developing countries and second, students who are compelled to complete additional years of schooling are less likely to come from the lower end of the ability distribution due to the much lower enrollment rates in developing countries.

Compulsory schooling could also improve equity in educational outcomes as it forces everyone, albeit imperfectly, to complete a minimum level of schooling. In addition, the fall in the price of schooling— due to the substantial investment in schooling infrastructure—could benefit girls more than boys and rural areas more than urban areas because the price elasticity of schooling demand is found to be higher for girls and for rural residents (Orazem and King 2008). Equalizing educational outcomes by gender and rural/urban residence is important for both equity and efficiency reasons. Schultz (2002) highlights the particular benefits of investing in women's schooling, such as better child health and schooling as well as reduced fertility. Other studies show that investing in human capital in less-developed regions has higher returns, which implies that improving schooling outcomes in rural areas could be beneficial for efficiency reasons as well.[4]

A key distinguishing feature of the compulsory schooling policy in Turkey is that it alters the sheepskin effects of schooling (i.e., the signaling effects of schooling; Spence 1973) through its redefinition of the number of years of schooling required to obtain various diplomas. Acquiring a primary school diploma requires the completion of grade 5 before the policy, but the completion of grade 8 after the policy. The completion of grade 8 would give the students a secondary school diploma before the policy. Hence, the sheepskin effects of the completion of both grade 5 and grade 8 fall with the policy. Since the sheepskin effects are more important for men than for women (due to the much lower labor-force participation of women in Turkey) and in urban areas than in rural areas (due to much higher self-employment in rural areas) the sheepskin effects could counteract the equalizing effect of the policy on schooling disparities by gender and rural/urban residence.

3. It increases earnings (Angrist and Krueger 1991), boosts economic growth and improves intergenerational income distribution (Eckstein and Zilcha 2002), and improves schooling (Oreopoulos et al. 2006) and health (Chou et al. 2010) of future generations. It also reduces wage inequality (Brunello et al. 2009), crime (Lochner and Moretti 2004), and teenage fertility (Black et al. 2008).

4. Fleisher et al. (2010) finds that investing in human capital has higher returns in the less-developed regions of China. Mejia and St-Pierre (2008) show that unequal opportunities in education could lead to a lower level of average human capital even when there are no financial constraints.

In our empirical analysis, we use the 2003 and 2008 Demographic and Health Surveys data for Turkey, which are nationally representative. The key feature of our data set is that it includes information on childhood place of residence at age 12; therefore, we are able to identify urban/rural residence at the age at which individuals in our sample make their schooling decisions. In the identification of the policy effect by gender and urban/rural residence, we compare the birth-cohorts that are affected by the policy with those that are not within a regression discontinuity design, where we allow the time trends in schooling outcomes to be different before and after the discontinuity. We use various subsamples—defined by gradually taking narrower time intervals around the discontinuity—and various polynomial specifications conditional on the width of the time interval.

We find that the policy equalizes the educational attainment of urban and rural children substantially. The urban-rural gap in the completed years of schooling at age 17 falls by 0.5 years for men and by 0.7 to 0.8 years for women. However, there is no evidence of a narrowing gender gap as a result of the policy. On the contrary, we find that the gender gap in urban areas in post-compulsory schooling (grades 9 to 11) increases. This finding for post-compulsory schooling is consistent with stronger sheepskin effects for men in urban areas, which results from the substantial difference in the labor-force participation rates of men and women. This finding also implies that lowering the cost of schooling, by providing free and accessible schooling, is not sufficient to eradicate the gender gap in Turkey, despite its substantial positive effect on girls. School availability must be combined with other policies that especially target girls to eradicate the gender gap.

The rest of the paper is organized as follows. Next, we explain the education system as well as the new compulsory schooling policy in Turkey. In section II, we discuss the conceptual framework for the interpretation of our findings. In section III, we present the data and descriptive statistics. In section IV, we discuss the identification method and estimation. This section is followed by a presentation of the results in section V. Section VI concludes.

I. Education System in Turkey and the New Compulsory Schooling Policy

Prior to 1997, the education system in Turkey was built on a 5+3+3 system, which meant five years of compulsory primary, three years of noncompulsory lower secondary, and three years of upper secondary schooling. Schools in Turkey are coeducational. In 1997, just before the implementation of the policy, the net enrollment rate in secondary schooling, the first level of non-compulsory schooling, was only 52 percent (World Bank 2013). In addition, the gender gap and urban-rural gap in education were substantial. According to the 1998 wave of the Turkish Demographic and Health Survey, among 11- to 15-year-old boys, while 79.4 percent of urban residents were enrolled in school, this figure was 67.1 percent among rural residents. The urban-rural gap was much wider among

girls of the same age: 38.3 percent of rural residents were enrolled in school compared to 64.5 percent of urban residents.

In 1997, through amendments made to the Basic Education Law (no. 4306, dated 16 August 1997) the government of Turkey increased compulsory education from five to eight years by merging the first two levels under the umbrella of basic education. The amendment was short and simple, requiring all children—without making any exceptions for any group of children—to complete eight years of schooling. Parents who do not comply with the compulsory schooling laws face monetary penalties and in extreme cases incarceration.[5] Tracking of children is the teachers' responsibility, along with the local administrative body. However, noncompliance is quite common both before and after the policy.[6]

Although the extension of compulsory schooling was not a new issue, its enactment in the summer of 1997 was politically motivated. The secular government at the time seized the opportunity to curb religious education by extending compulsory schooling.[7] The Turkish Ministry of National Education (MONE) reacted to the challenge of accommodating new students by expanding the number of classes in existing schools, by bussing rural children to nearby schools, and by constructing boarding schools primarily for children living in distant rural areas.[8] MONE's share in the public investment budget, which was around 15 percent in 1996 and 1997, jumped to 37.3 percent in 1998 and remained high at around 30 percent until 2000 (see table S1 in the supplemental appendix, available at http://wber.oxfordjournals.org/).

The changes in the student population in basic education (8 years of schooling) with the reform was substantial in both urban and rural areas (see figure S1). Since the policy did not bind the students who finished the fifth grade in the 1996–97 school year, which earned them a primary school diploma, the jump in

5. Parents who do not comply with the compulsory schooling laws face only monetary penalties in the first two violations. In the third violation, there are additional monetary penalties, as well as a risk of incarceration. After four or more violations, parents would face incarceration up to 6 months.

6. Among the youngest birth cohorts that are not affected by the policy, about ten percent of girls and two to three percent of boys did not complete primary schooling (according to the 2003 and 2008 Turkish Demographic and Health Surveys).

7. This fulfilled their goal in two ways. First, it eliminated lower secondary religious schools (*İmam-Hatip*), where both religious and secular courses were given, by making this level a part of compulsory secular schooling. While İmam-Hatip schools were originally established to train government-employed imams, the students in these schools could go on to secular education and major in any field at university. In the 1996–97 school year, 11.5 percent of male and 13.1 percent of female secondary school students were enrolled in this type of schools. Almost all of these schools were in urban areas; less than 1 percent of rural children were enrolled in these schools. Second, the new policy delayed enrollment in Quranic Studies, which involved only religious education but could be done only after the completion of compulsory schooling.

8. In urban areas, the high lower secondary school attendance prior to the extension of compulsory schooling meant that physical capacity was already there, which could be used more efficiently to accommodate the rising demand through practices like the double-shift system, where some children go to school in the morning and some in the afternoon. Even without such schemes, the merging of primary and lower secondary schools probably increased the efficiency at which the existing capacity could be used.

the sixth grade student population took place for the first time in the 1998–99 school year. From the 1997–98 school year to the 2000–2001 school year, the number of students in urban areas increased from around 6.75 to 7.67 million—a 13.7-percent increase—compared to the 1.8-percent increase in the preceding 3-year interval and the 0.5-percent increase in the succeeding 3-year interval. The number of students in rural areas rose from around 2.35 to 2.8 million over the same period, which is equivalent to a 20-percent increase compared to the 7-percent fall in the preceding 3-year interval and the 1.4-percent fall in the succeeding 3-year interval (due to rural to urban migration).

Interestingly, not only compulsory school attendance but also high school attendance was favorably affected by the policy in both rural and urban areas (see figure S2). The number of high school students in urban areas increased from 2.27 million in the 2000–2001 school year to 2.88 million in the 2003–2004 school year, which is equivalent to a 27-percent increase, in contrast to the 10.5-percent increase in the preceding 3-year interval. Note that the 10.5-percent increase in the preceding 3-year interval is also influenced by the policy as this period is after the announcement of the policy. The increase in high school enrollment in the 3-year interval before the announcement of the policy was 3.5 percent. Similarly, the number of high school students in rural areas displays a much larger increase between the 2000–2001 and 2003–-04 school years, when the first cohort forced to attend the sixth grade reaches high school age.

MONE utilized two key instruments in the implementation of the new policy: bussing rural children to nearby schools and the construction of boarding schools at the basic education level. There was a dramatic rise in the number of students bussed to school with the policy, which jumped from 127,683 students in the 1996–97 school year to 621,986 students in the 1999–2000 school year (see figure S3). This change accounts for most of the remarkable increase in the number of students in compulsory education in rural areas. With this grand bussing scheme, several small schools in rural areas that could not provide the facilities for all grades from 1 to 8 were closed.

The other key instrument that MONE utilized in the implementation of the new policy was the construction of co-educational boarding schools that housed all grade levels (1 through 8) and were free of charge. In the 1996–97 school year, 34,465 students were enrolled in these schools. This number increased to 281,609 in the 2001–02 school year (see figure S4). These boarding schools, as well as the bussing scheme, would substantially decrease the cost of schooling in grades 6 to 8 (the new compulsory grade levels) in rural areas because these schooling levels were not locally available in many rural areas prior to the policy, which meant that children had to travel to the nearest town or live with relatives residing in towns to attend these grade levels. At the same time, there was a substantial increase in the total number of classrooms with the policy in both rural and urban areas (see figure S5). This increase results from the construction of new schools, including boarding schools, as well as from the expansion of the capacity of the existing schools.

Finally, we examine the changes in certain measures of school quality as deterioration in school quality could affect enrollment, as well as human capital accumulation of students. The student-to-classroom ratio increased during the first few years after the policy. (There had already been a slightly rising trend before the policy.) It rose from 28.6 in the 1997–98 school year to 31.2 in the 1999–2000 school year. However, as MONE's investments materialized, this ratio fell back to 28.3 in the 2001–02 school year and kept declining. In addition, MONE was able to adjust the number of teachers as the number of students increased so that the student-to-teacher ratio remained constant at around 30 in the first few years after the policy, and started decreasing after the 2000–2001 school year, falling below 28 by the 2002–03 school year.[9] Therefore, there was no significant detrimental effect of this policy on school quality.

II. Conceptual Framework

In a standard model of optimal schooling investment decisions, where individuals maximize lifetime earnings, extending compulsory schooling would only decrease individuals' welfare because it restricts choice. Nonetheless, there are a number of motivations for longer compulsory schooling. First, individuals could make suboptimal decisions due to financial constraints, especially in developing countries, and compulsory schooling—by providing free schooling and thereby, lowering the price of schooling—prevents this to some degree.[10] Second, there are positive externalities of schooling, which individual decision making does not account for. Third, in socially conservative countries, there are frequently adverse cultural and social norms, which increase the costs of children's schooling from their parents' perspective, resulting in suboptimal choice for the child when the goals of the parents and children do not overlap. Fourth, children as well as their parents, especially in poorer countries, may lack information and underestimate the returns to education.[11] Finally, children may make irrational decisions; for instance, they may be myopic and give too much weight to present costs of schooling. Several of these potential causes of suboptimal education decisions—in particular, financial constraints, the agency problem, and the information problem—are likely to be more prevalent in rural areas. Furthermore, gender may interact with rural residence to produce worse outcomes for rural girls

9. The rise in the number of teachers, which was about 15 percent between the 1997–98 and 2000–2001 school years, could imply a drop in average teacher quality.

10. As outlined by Orazem and King (2008), in a model of local schooling market where both demand and supply factors are at work, we can interpret the expansion of compulsory schooling - and the mandatory provision of grades 6 to 8 to all children by the state—as a full subsidy on school provision. Orazem and King show that such a subsidy unambiguously increases schooling and decreases its price.

11. There is evidence for this in both developed and developing country settings. For instance, Dominitz et al. (2001) report, for the United States, that students' expectations about returns on schooling are often very much off the mark. Jensen (2012) reports that perceived returns on secondary school of students in the Dominican Republic are much lower than the measured returns.

(see, e.g., Kırdar [2009] for evidence in the Turkish setting). Therefore, compulsory schooling policies could be especially effective for girls and rural residents.

In order to understand how the new compulsory schooling policy in Turkey affects the schooling differences by gender and rural/urban residence at age 12, we first need to understand the causes of those differences in schooling outcomes. For this purpose, we first outline a simple model of individuals' optimal schooling duration decisions. Then, within this model, we discuss how the new compulsory schooling policy changes the costs and benefits.

Understanding Schooling Differences by Gender and Rural/Urban Residence

The duration of schooling decision is determined by the trade-off between the discounted value of higher future earnings capacity and the direct as well as indirect costs of schooling in the present. According to the human capital theory, schooling is an investment activity that increases worker productivity (Schultz 1963; Mincer 1974; Becker 1975). The signaling hypothesis emphasizes the role of education as a filtering mechanism in environments of imperfect information (Spence 1973). The information gap between an employer and an employee as to the employee's productivity is resolved by a signal in terms of educational attainment that the employee sends. Therefore, there is an additional benefit of completing a certain schooling level—often referred to as the "sheepskin effect" —in addition to its productivity effect.[12]

The costs of schooling include direct monetary costs like transportation costs and purchases of school supplies, and indirect costs in the form of the opportunity cost of school time like foregone wages and home production, as well as the psychic costs of sending children to school. These costs would be lower during compulsory schooling years because the state ensures the availability and accessibility of schools to all children of compulsory schooling age. In addition, there are costs associated with not complying with compulsory schooling, which include both monetary elements—like the penalties imposed by the state—and psychic elements that result from not complying with the legal machinery. We could interpret these noncompliance costs as a negative cost of schooling attendance. Another factor that influences the duration of schooling decision is the discount rate, which weighs the future benefits of schooling against its present current costs. The value of the discount rate would be higher for poorer households.

In this framework, several factors contribute to a lower demand for the schooling of girls in Turkey. First, due to the distinctly lower labor-market participation rates for women in Turkey (25 percent for women vs. 70 percent for men in 2008; TÜİK 2012), the higher earnings capacity resulting from schooling would be less important for girls.[13] It is not obvious whether the opportunity

12. Empirical support for the sheepskin effects is found in various contexts: Jaeger and Page (1996) in the United States; Schady (2003) in the Philippines; and Munich et al. (2005) in the Czech Republic.

13. Another reason for the lower schooling demand of girls would be lower returns for them; however, using the same quasi-experiment, Aydemir and Kırdar (2013) estimate higher returns for girls than for boys.

cost of schooling would be higher for boys or girls because while boys are more likely to work in the market, the value of girls' home production would be higher. On the other hand, the psychic costs of schooling would be especially high for girls due to the social norms in Turkey. For instance, the cost of traveling away from home to go to school as well as the cost of attending schools would be much higher for girls than for boys. There is no reason to expect the cost of not complying with the policy to differ by gender. Finally, the value of future earnings would be discounted more for girls as daughters are more likely to move away from their parents after marriage.

The benefits of schooling, in particular the sheepskin effects, are likely to be larger in urban areas than in rural areas due to the higher prevalence of wage employment in the former—the sheepskin effects matter more in wage employment as compared to self-employment and agricultural work (Wolpin 1977; Glewwe 2002).[14] The opportunity cost of schooling would surely be higher in rural areas as field work is readily available. In addition, the monetary as well as psychic costs of schooling would also be higher due to the longer distances to schools.[15] The discount rate would also be higher in rural areas as residents of rural areas are on average poorer in Turkey. Finally, the enforcement of compulsory schooling would be more difficult in rural areas, implying a lower cost of non-compliance. All these factors contribute to a lower schooling demand in rural areas.

Effect of the Policy

The new compulsory schooling policy in Turkey affects both the benefits and costs of schooling. It brings about an important fall in the costs of schooling in grades 6 to 8 due to the increased classroom capacity in both urban and rural areas but particularly in rural areas as illustrated in section I. (At the same time, since schools in Turkey are coeducational, the government had no direct levers to adjust male and female school participation separately.) With this fall in the price of schooling, the groups for whom the price elasticity of schooling demand is higher would be affected more. Alderman and Gertler (1997) theoretically show—under the same assumptions on market incentives or parental preferences that lead to higher school attainment for girls than for boys—that the price elasticity of schooling demand is higher for girls. There is also substantial empirical support for this finding.[16] Thus, we assume that the price elasticity is also higher for girls than for boys in Turkey in the interpretation of our empirical findings.[17]

14. Using household data from 46 developing countries, Orazem and King (2008) find higher returns on schooling for urban residents than for rural residents.

15. Glewwe and Jacoby (1994), Alderman et al. (1996), Lavy (1996), and Glick (2008) report negative association between distance to school and educational outcomes in various developing countries.

16. Orazem and King (2008, 3521) review a large body of empirical analyses and conclude that "In places where girls receive less schooling than boys (South Asia and the Middle East, rural areas of many countries), the elasticities of girls' schooling with respect to income and prices are higher than for boys."

17. That the gender gap is wider in rural areas—where the price of schooling is higher—than in urban areas in Turkey also supports this assumption.

This implies that the fall in the price of schooling with the new policy would decrease the gender gap in Turkey, particularly in rural areas where the drop in schooling costs is especially high. In addition, to the degree that credit constraints impede school enrollment, the price elasticity of schooling demand would be higher in rural areas where average family income is lower. In fact, Orazem and King (2008) report that the elasticity of schooling demand with respect to distance to school is higher in rural areas. Thus, rural areas would benefit more than urban areas from the fall in the price of schooling not only due to the larger magnitude of this fall but also due to the larger price elasticity of schooling demand there.[18]

In terms of benefits, the policy could influence both the productivity and the sheepskin effects of schooling. The sheepskin effects are substantially altered by the policy due to the redefinition of schooling tiers. First, the sheepskin effect of completing five years of schooling (primary school diploma before the policy) no longer exists. Second, the marginal sheepskin effect of completing 8 years of schooling (secondary school diploma) is eliminated with the policy. Therefore, to distinguish themselves from the large pool of primary school graduates, students who would complete 8 years of schooling in the absence of the policy would have to finish 11 years of schooling (high school) with the policy. The reduced benefits of 5 and 8 years of schooling—due to lost or diminished sheepskin effects—would be especially important for men as their labor-force participation rate is much higher and for urban residents as they are less likely to be self-employed.

These changes in sheepskin effects could also explain why we see spillover effects of the policy on high school grade levels. First, some of those who would choose 8 years of schooling in the absence of the policy could choose 11 years of schooling with the policy because the sheepskin effects of 8 years of schooling is reduced. Second, a person who would choose compulsory school (5 years) over high school (11 years) before the policy could choose high school (11 years) over compulsory school (8 years) after the policy because of both the reduction in the sheepskin effects of completing grades 5 and 8 and the fall in the marginal cost of high school over compulsory school by the cost of three years of schooling.[19] Third, after being compelled to complete another three years of schooling, some students could change their mind about high school enrollment due to improved information on the returns on schooling, higher ability of asserting their will against that of their parents, and/or a lower probability of irrational decision making as an older individual, as discussed earlier. Spillover effects could also arise if there were a surge in the

18. Another potential source of change in schooling costs is a change in the degree of enforcement of the compulsory schooling law. However, there is no indication of such a change; noncompliance rates with the first five years of schooling—which are mandatory both before and after the policy—are similar before and after the policy.

19. This event becomes even more likely when the marginal benefit of 8 years over 5 years is not as high as the marginal benefit of 11 years over 8 years. In fact, as can be seen in table S2 of the supplemental appendix, earning a secondary school diploma over a primary school diploma increases the wage rate by 12 percent whereas earning a high school diploma over a secondary school diploma increases it by 30 percent.

supply of high schools concurrent with the policy, which would directly lower the cost of enrollment in high school. Since there is no discontinuity in the high school supply as a result of the policy despite the overall upward time trend (see figure S6), a lower cost of enrollment in high school could not be the source of spillover effects.

In the absence of sheepskin effects, spillover effects could still take place if there is a fall in the productivity of 8 years of schooling vis-à-vis that of 11 years of schooling because of the general equilibrium effects resulting from the increase in the supply of workers with 8 years of schooling. However, in their study that tests human capital and sorting models against each other, Lang and Kropp (1986) argue that the effect of compulsory schooling laws on those not constrained by the laws—which would be equivalent, in our context, to those who would finish 8 or more years of schooling in the absence of the policy—should be "near zero." Some of the reasons that they put forward in explaining this assertion are valid in our context as well. First, the rise in the supply of workers with 8 or more years of schooling in the labor market would be gradual; it would take many years until a significant rise in the supply takes place. Second, substitutability among workers with different skill levels would diminish the effect of the rising labor supply of certain skill groups. In addition, there is a particular feature of the Turkish context that would dissipate the general equilibrium effects. Due to the strong spillover effects, not only the supply of workers with 8 years of schooling, but also the supply of workers with higher schooling levels rises significantly. Therefore, we would expect the general equilibrium effects to be quite small especially in comparison to the sheepskin effects, as in Lang and Kropp (1986), given that sheepskin effects in our context are much stronger than those in Lang and Kropp, due to the redefinition of schooling tiers in Turkey.[20]

Changes in the productivity of schooling could take place via other channels as well. One such channel is school quality; however, school inputs that affect productivity such as class size and teacher-to-student ratio do not exhibit a significant deterioration, as explained in section I. Another factor that could affect productivity is a change in the curricula; however, the redefinition of lower secondary schooling as part of basic education was done without a substantial change in curricula. The exception is for children who would take technical education at the secondary school level in the absence of the policy. For these students, we might expect a fall in productivity conditional on completing eight years of schooling. However, in the 1996–97 school year (just before the policy), the fraction of students in secondary school who were enrolled in technical schools was only 1.3 percent.[21]

In understanding the impact of the new compulsory schooling policy on the schooling of various groups, there are also selection dynamics to consider. As

20. Using the same methodology, Yüret (2009) tests the human capital model vs. the sorting model in the Turkish context. His findings are in support of the sorting model.

21. There is no reason to expect a fall in the productivity of students who would attend religious secondary schools in the absence of the policy, as most of these students work in jobs not related with their religious education.

noted earlier and will be demonstrated shortly, drop-out rates—even in compulsory schooling levels—differ considerably by gender and rural/urban residence. Due to the higher drop-out rates of girls and rural residents in lower grades, those who make it to higher grades among these groups are likely to be a more select group with stronger school attachment.

III. Data

The data for this study come from the 2003 and 2008 Turkish Demographic and Health Surveys (DHS), both of which are nationally representative. The main advantage of DHS over other data sources for the purposes of this study is that it provides information on the location of residence at age 12, which allows us to identify rural/urban residence at ages that are pertinent to the schooling decisions examined in this study. Another advantage of DHS is that it provides information not only on the highest schooling level but also on the highest grade completed, which is lacking in other Turkish data sources.

Students who complete grade 4 or a lower grade in the 1996–97 school year are covered by the policy (i.e., students who do not have a primary school diploma by the beginning of the 1997–98 school year). This means that the first cohort affected by the policy is the one that begins grade 1 in the 1993–94 school year. Most children in Turkey start school at age 6. In that case, children who are born after September 1986 would be affected by the policy. However, a considerable fraction of children delay starting school to age 7. Among these children, those who are born after September 1985 would be affected by the policy. Our sample covers those who are born between 1975 and 1996 with the exception of those born in 1985 and in 1986. We drop these two cohorts because of the fuzziness in their treatment status, as explained above. Hence, our sample includes 10 birth-cohorts who are not affected by the policy (1975–84) and 10 birth-cohorts who are affected (1987–96). The female sample in our analysis is drawn from the 2003 and 2008 surveys, whereas the male sample is drawn only from the 2008 survey because information on the location of residence at age 12 is not available for men in the 2003 survey. As a result, while the female sample includes 14,851 observations, the male sample includes 7,860 observations. Table 1 provides descriptive statistics for the variables used in the estimation. About 39 percent of men and 36 percent of women live in rural areas. The rural-urban distinction in DHS is based on population size; settlements with a population less than 10,000 are defined as rural areas.[22]

22. The rural-urban classification of the Ministry of Education in the statistics provided in section I, on the other hand, is an administrative one. District centers (*ilçe merkezleri*), including province centers, are defined as urban areas while villages and subdistricts (*bucak*) are defined as rural areas. The two categorizations overlap with the exception of district centers that fail the population criterion in DHS. However, these district centers with a population less than 10,000 form only 1.7 percent of the population of all district centers.

TABLE 1. Descriptive Statistics

	A) Male Sample		B) Female Sample	
	Mean	No. Obs.	Mean	No. Obs.
Geographical region at age 12				
West	0.323	7,860	0.350	14,851
South	0.114	7,860	0.129	14,851
Center	0.142	7,860	0.152	14,851
North	0.140	7,860	0.121	14,851
East	0.281	7,860	0.248	14,851
Type of location at age 12				
Large city (Urban)	0.401	7,855	0.431	14,844
Small city (Urban)	0.206	7,855	0.206	14,844
Village (Rural)	0.393	7,855	0.362	14,844

Note: The female sample is based on 2003 and 2008 waves of TDHS, whereas the male sample is based on only 2008 wave of TDHS because information on the location of residence at age 12 is not available for men in the 2003 survey.

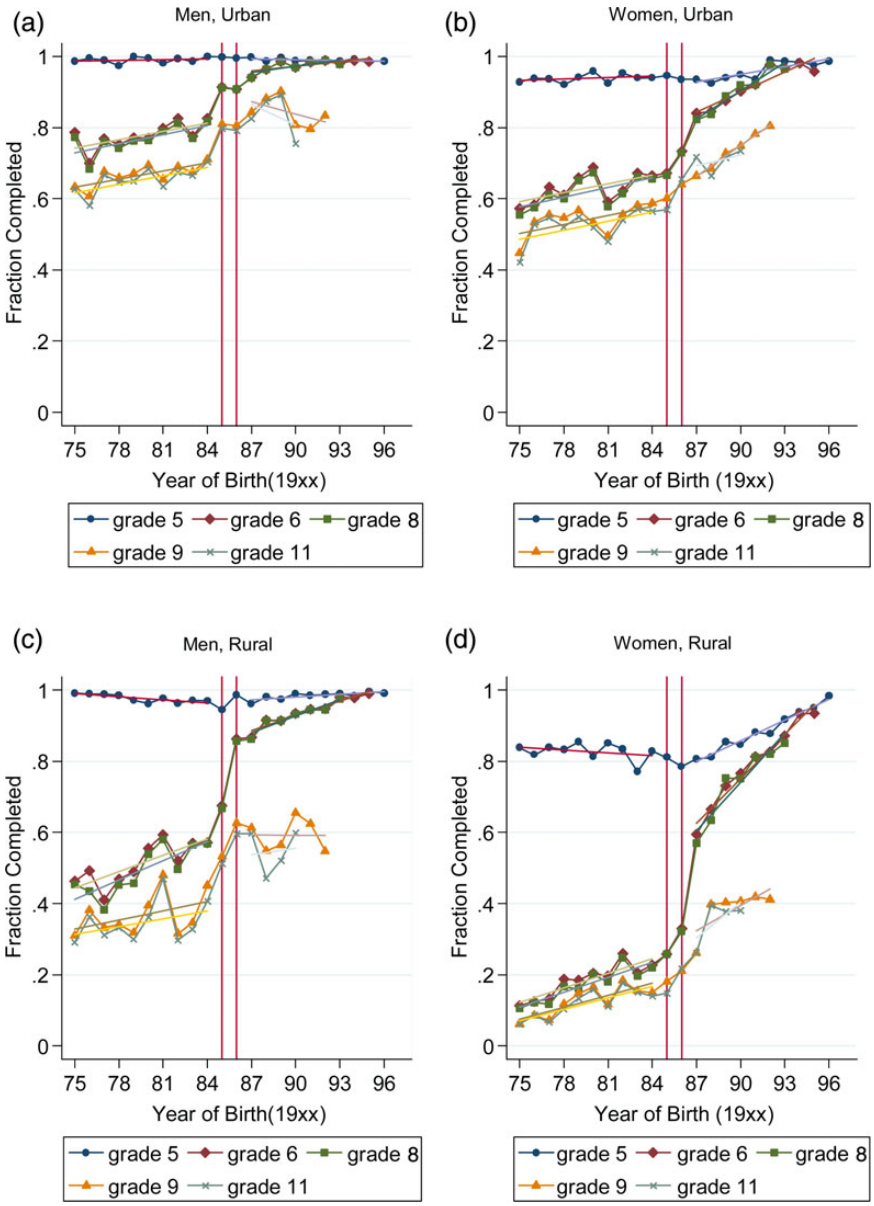
Source: Authors' calculations based on 2003 and 2008 Turkish Demographic and Health Survey.

Figure 1 displays the change in the fraction completing selected grade levels in four panels: panel (a) for urban men, panel (b) for urban women, panel (c) for rural men, and panel (d) for rural women. The selected grade levels are grade 5 (last year of pre-reform primary school), grade 6 (first year of new compulsory schooling years), grade 8 (last year of new compulsory schooling years), grade 9 (first year of high school), and grade 11 (last year of high school). The key feature in all panels is the remarkable jump in the fraction completing grades 6 to 8 at the time of policy. This is particularly visible in rural areas, partly due to the lower pre-policy levels. In fact, while the fraction completing grades 6 to 8 for rural women is around 0.2 before the policy, it is above 0.6 after the policy. At the same time, figure 1 suggests that the effect of the policy is not limited to grades 6 to 8. In all panels, there is a remarkable rise in the fraction completing grades 9 to 11 as well, which are not compulsory post-reform. For instance, while the fraction completing grades 9 to 11 for urban men is around 0.7 before the policy, it is above 0.8 after the policy.[23]

Another important feature of the profiles in figure 1 is the time trends, which exist both before and after the policy and are quite strong in some cases. Moreover, the time trends before and after the policy differ significantly for certain groups. For example, for both urban and rural women, the time trend in

23. We examine the spillover effects using a different data source as well. Figure S7 in the supplemental appendix illustrates the fraction completing high school based on the Turkish Labor Force Surveys, conducted by the Turkish Statistical Institute. In this data set, we cannot distinguish between rural and urban status (as this information at age 12 is not available); therefore, the figure is by gender only. The advantage of this data set is its sample size, which allows for tight confidence intervals. An important jump in the fraction completed high school is also visible for both men and women in figure S7.

FIGURE 1. Fraction Completing Selected Grades by Gender and Rural/Urban Status



Note: The birth cohorts to the left of the vertical lines are not affected by the policy, whereas the birth cohorts to the right are affected.

Source: Authors' calculations based on 2003 and 2008 Turkish Demographic and Health Survey.

the fraction completing grades 6 to 8 after the policy is stronger than that before the policy. In all panels, separate linear lines are fitted to the profiles before and after the policy, which do a good job of capturing the time trends.

IV. Identification Method and Estimation

The structure of our data in Figure 1—where there is a stark jump at the time of the policy—fits the regression discontinuity design well. The data generating process, without distinguishing across subpopulations for notational simplification, can be expressed as follows:

$$E(Y_{0i}|x_i) = \alpha + \beta_{01}x_i^{'} + \beta_{02}x_i^{'2} \tag{1}$$

$$E(Y_{1i}|x_i) = \alpha + \rho + \beta_{11}x_i^{'} + \beta_{12}x_i^{'2} \tag{2}$$

$$x_i^{'} = x_i - x_0 \tag{3}$$

where Y_0 and Y_1, respectively, are the outcome variables before and after the policy and x is the year of birth. We normalize the year of birth using x_0, which coincides with the time of discontinuity. To account for the time trends in the outcome variable, we take polynomials up to the second order, which are allowed to be different before and after the policy. The effect of the education policy on the outcome variable is denoted by ρ. Hence, the model we estimate takes the following form:

$$Y_i = \alpha + \beta_{01}x_i^{'} + \beta_{02}x_i^{'2} + \rho D_i + \beta_1^* D_i x_i^{'} + \beta_2^* D_i x_i^{'2} \tag{4}$$

$$\beta_1^* = \beta_{11} - \beta_{01} \tag{5}$$

$$\beta_2^* = \beta_{12} - \beta_{02} \tag{6}$$

where D denotes the treatment variable, which is 1 when the assignment variable (year of birth) is greater than 1986, and 0 otherwise.[24] In the estimation of equation (4), we run a logistic regression for each grade level separately, where the dependent variable (grade-completion status) is 1 if the individual completed that grade level, and 0 otherwise. We also include the location of residence at age 12 in the form of the size of the location (large city, small city, and village) and the region of the location (West, Central, South, North, and East) as control variables in the estimation of equation (4) to improve efficiency. (We check the sensitivity of our coefficient estimates to the inclusion of these control variables.)

We run four sets of regressions to examine any differential effects of the policy: (i) by gender in urban areas, (ii) by gender in rural areas, (iii) by rural/urban

24. Our identification strategy is similar to that in Oreopoulos (2006). However, Oreopoulos does not allow the time trends to be different before and after the policy. He uses higher-order polynomials as the time interval of his analysis is much wider.

residence at age 12 for men, and (iv) by rural/urban residence at age 12 for women.[25] We allow all the parameters in equation (4) —the constant term, all trend parameters, and the key policy parameter—to vary across subgroups. For instance, in the examination of differential effects by gender, the regressions include interactions of the policy dummy and the time trend variable with the female dummy, as well as the female dummy itself.

The critical issue in our identification strategy is to disentangle the effect of the education policy from the time trends in our measured outcome. As illustrated above, we account for the time trends by using polynomial splines—separate polynomials on both sides of the cut-off—that are up to the second order. In this case, the question that arises is whether or not the results are sensitive to less-restrictive polynomial specifications. However, since the time frame on each side of the cut-off includes at most 10 years, the risk of overfitting increases with high-degree polynomials—especially given the fuzziness around the cut-off in our data. Therefore, we check the robustness of our findings by taking gradually narrower windows around the discontinuity, rather than increasing the order of polynomial splines. The risk of misspecification would fall when we take narrower windows around the discontinuity. In fact, as stated by van der Klaauw (2008, 235), "A linear control function is likely to provide a reasonable approximation of the true functional form within a small neighborhood of the cut-off." However, the problem with restricting the sample to birth-cohorts that are just above and below the cut-off is the fall in efficiency, particularly so given our relatively small sample. Therefore, we take a number of data intervals around the cut-off and alternative polynomial specifications that depend on the width of the data interval.[26]

We start with 10-year intervals on both sides of the cut-off (1975–84 and 1987–96 birth cohorts). Within this interval, we use two different models to account for the time trends. While linear polynomial splines are used in model A1, quadratic polynomial splines are used in model A2. Then, we trim the tails of the interval and take 5-year intervals on both sides of the cut-off. In this case (which we call model B) we take only linear polynomial splines on both sides of the discontinuity. Model C also incorporates linear polynomial splines; however,

25. While running these four sets of regressions generates some redundancies, it makes it easier to interpret the results within the conceptual framework of section II because it allows us to focus on a particular thought experiment, e.g., male vs. female given location.

26. It is important to note that we measure the immediate effect of the policy. If it takes time until the policy becomes fully effective, its long run effects could be somewhat different. Moreover, this could differ by gender as well as rural and urban status. In fact, as can be seen in figure 1, the time trend after the policy vis-à-vis the time trend before the policy is steeper for women than for men. (A potential reason for the changing time trend could be the establishment of new social norms with the policy.) This might imply that the trend after the policy soaks up some of the policy effect, particularly for women. However, the "bubble" around the cut-off we take by eliminating two cohorts from the analysis alleviates this problem. Moreover, since the jump at the point of discontinuity is substantial, even if the time trend after the policy captures part of the policy effect, this would be relatively small.

the time frame is further reduced to include 3-year and 4-year intervals on both sides of the cut-off, which are the narrowest time-intervals that allow us to separate the effect of the policy from that of the time trend given the sample size. As can be seen in figure 1, linear polynomial splines provide a good approximation to the time trends for most subpopulations. Finally, model D includes the shortest-time interval—2 years around the cut-off—but no time trends.

This approach of taking subsamples that are clustered around the cut-off by trimming the tails of the sample interval, which puts no weight on observations at the tails, is similar in a way to non-parametric modeling. As argued by Lee and Lemieux (2010, 284), ". . .the procedure of regressing the outcome Y on X and a treatment dummy D can be viewed as a parametric regression, or as a local linear regression with a very large bandwidth. Similarly, if one wanted to exclude the influence of data points in the tails of the X distribution, one could call the exact same procedure 'parametric' after trimming the tails, or 'nonparametric' by viewing the restriction in the range of X as a result of using a smaller bandwidth."

The validity of our identification strategy requires that the timing of the policy be independent of the realizations of the outcome variable. For instance, if the policy were passed in a period of low grade-completion rates, this requirement would fail. However, as explained in section I, the timing of the policy was determined by the political developments of the time, which were completely independent of educational outcomes. The validity of our identification strategy also requires that there be no other policy change at the same time that affects schooling decisions. Education policies are likely to coincide with other policy interventions on health, infrastructure, or social services that would also influence schooling outcomes because the timing of all these policies depend on the availability financial resources. However, the timing of the Turkish policy was related to the political actors' ideological agendas on education and did not coincide with other social programs. The other two notable educational programs of the last decade in Turkey were implemented much later than 1997. The public CCT program was first implemented in 2003, and another NGO-driven CCT program targeting girls only (*Baba Beni Okula Gönder*) started in 2005. Our identification with subsamples involving shorter time intervals would not be affected by these policies. In subsamples with longer time intervals, the effects of these programs, as well as of their interaction with the compulsory schooling policy, would be captured by the time trend after the discontinuity. In any case, the effects of these programs would be trivial compared to that of the compulsory schooling policy due to the limited number of program beneficiaries. Finally, the universal application of our policy prevents a potential problem in other policies reviewed earlier like school construction programs: parents who care more about their children's schooling are also more likely to migrate to areas where schools are constructed (Rosenzweig and Wolpin 1988).

V. Results

Table 2 provides the estimated parameters for the policy effect on different subgroups at each grade level for model A1; and, based on these estimates, figure 2 illustrates how the predicted gaps in grade completion rates across subgroups change as a result of the new policy. The results both in table 2 and in figure 2 are presented by gender separately in urban and rural areas, and by urban and rural status separately for men and for women. (We also examine the policy effect by gender for all of Turkey.) Note that the predictions in figure 2 take into account not only any differential policy effect between groups (presented in table 2) but also the pre-policy grade-completion rates. It is possible, for instance, that no differential policy effect by gender in table 2 is observed, yet the gender gap in figure 2 narrows; this would be due to the lower pre-policy grade completion rates for women. Estimates of the policy effect for other models (A2, B, C, and D) and the corresponding predictions are given in tables S3 to S10 in the supplemental appendix. The findings discussed below are robust across these different models unless otherwise specified in the discussion below.

In each panel of table 2, three sets of estimates of rho in equation (4) are given. The "policy" row shows the policy effect for men in panels (A) and (B) and the policy effect for urban areas in panels (C) and (D). The "policy*female" row shows how the policy effect for women is different from that for men in panels (A) and (B), and "policy*rural" row shows how the policy effect for rural areas is different from that for urban areas in panels (C) and (D). The "composite female" row gives the cumulative effect for women in panels (A) and (B), that is, the sum of the coefficients of "policy" and "policy*female" variables; and the "composite rural" row gives the cumulative effect for rural areas in panels (C) and (D).

The policy effect on each grade level is presented separately in table 2. Here, there are three effects worth considering: (i) policy effects on grades directly targeted by the reform (grades 6 through 8), (ii) policy effects on grades not targeted by, but directly affected by the reform (grades 1 through 5); these effects operate through the implementation measures, (iii) policy effects on grades not covered by, but indirectly affected by the reform (grades 9 through 11); we call these spillover effects. We interpret each effect within the conceptual framework outlined in section II.

Analysis by Gender in Urban Areas

As can be seen from panel (A) of Table 2, there is a positive effect of the policy for both men and women not only in grades 6 to 8 but also in grades 9 to 11. In other words, there is a spillover effect of the policy on post-compulsory schooling grade levels. The coefficients of the interaction term of the policy and female variable for grades 6 to 8 are negative and statistically significant in panel (A); however, they are not statistically significant in models A2, B and C despite the negative and sizable coefficients (see Table S3). Therefore, we cannot claim a robust differential impact of the policy by gender in urban areas in grades 6 to 8. The coefficients for grades 9 to 11 are also negative and statistically significant except for grade 11

TABLE 2. Estimates of Policy Effect on Grade Completion

Grade Level	1	2	3	4	5	6[a]	7[b]	8[c]	9[d]	10[e]	11[f]
A) By gender ın urban areas											
Policy	0.215	−0.227	−0.201	−0.394	−0.199	1.528***	1.525***	1.500***	1.058***	1.154***	1.072***
	[0.749]	[0.898]	[0.907]	[0.842]	[0.836]	[0.250]	[0.250]	[0.251]	[0.215]	[0.286]	[0.307]
Policy * female	−0.391	0.019	−0.089	0.015	−0.277	−0.756**	−0.840**	−0.794**	−0.805***	−0.764*	−0.625
	[0.633]	[0.751]	[0.758]	[0.768]	[0.779]	[0.341]	[0.364]	[0.331]	[0.242]	[0.402]	[0.424]
Composite female	−0.176	−0.208	−0.290	−0.379**	−0.476**	0.772***	0.685***	0.706***	0.253**	0.390**	0.447***
	[0.173]	[0.189]	[0.181]	[0.191]	[0.186]	[0.129]	[0.139]	[0.120]	[0.107]	[0.169]	[0.167]
B) By gender ın rural areas											
Policy	1.112***	1.049***	1.069***	0.718***	0.693***	1.467***	1.484***	1.481***	0.611**	0.556**	0.545*
	[0.285]	[0.247]	[0.250]	[0.222]	[0.233]	[0.139]	[0.154]	[0.161]	[0.242]	[0.263]	[0.298]
Policy * female	−1.087***	−1.116***	−1.182***	−0.928***	−0.888**	−0.141	−0.182	−0.215	−0.305	−0.047	−0.150
	[0.324]	[0.301]	[0.316]	[0.339]	[0.351]	[0.197]	[0.221]	[0.228]	[0.423]	[0.433]	[0.527]
Composite female	0.026	−0.067	−0.112	−0.210	−0.195	1.326***	1.302***	1.265***	0.307	0.509**	0.395
	[0.191]	[0.160]	[0.169]	[0.195]	[0.183]	[0.155]	[0.140]	[0.144]	[0.244]	[0.220]	[0.273]
C) By urban/rural for men											
Policy	0.266	−0.151	−0.128	−0.296	−0.112	1.534***	1.531***	1.510***	1.069***	1.166***	1.094***
	[0.733]	[0.880]	[0.886]	[0.823]	[0.816]	[0.244]	[0.243]	[0.245]	[0.212]	[0.283]	[0.309]
Policy * female	0.842	1.182	1.174	0.983	0.782	−0.136	−0.116	−0.083	−0.450	−0.600	−0.556
	[0.780]	[0.917]	[0.923]	[0.883]	[0.875]	[0.296]	[0.280]	[0.279]	[0.354]	[0.456]	[0.545]
Composite female	1.108***	1.032***	1.046***	0.687***	0.670***	1.398***	1.415***	1.428***	0.619***	0.566**	0.538*
	[0.289]	[0.248]	[0.249]	[0.232]	[0.242]	[0.128]	[0.142]	[0.151]	[0.232]	[0.253]	[0.292]
D) By urban/rural for women											
Policy	−0.183	−0.214	−0.299*	−0.388**	−0.492***	0.804***	0.712***	0.731***	0.258**	0.391**	0.449***
	[0.173]	[0.188]	[0.182]	[0.193]	[0.191]	[0.129]	[0.138]	[0.118]	[0.107]	[0.168]	[0.165]
Policy * female	0.214	0.155	0.196	0.192	0.314	0.568***	0.633***	0.575***	0.061	0.112	−0.070
	[0.205]	[0.194]	[0.177]	[0.234]	[0.224]	[0.203]	[0.187]	[0.186]	[0.265]	[0.309]	[0.370]

(Continued)

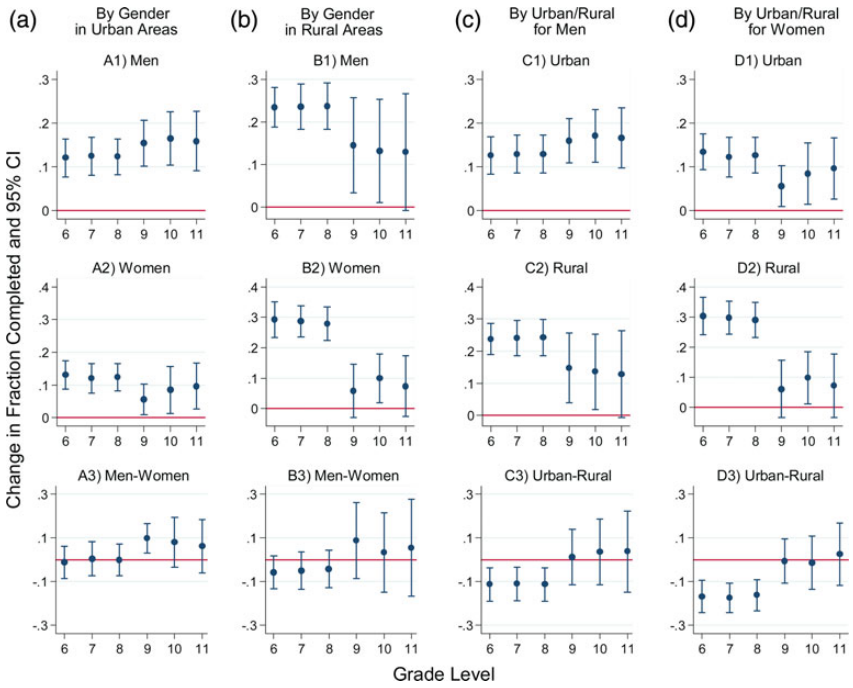
TABLE 2. Continued

Grade Level	1	2	3	4	5	6[a]	7[b]	8[c]	9[d]	10[e]	11[f]
Composite female	0.031	−0.059	−0.102	−0.196	−0.178	1.372***	1.346***	1.307***	0.320	0.503**	0.379
	[0.188]	[0.158]	[0.166]	[0.191]	[0.178]	[0.156]	[0.140]	[0.146]	[0.257]	[0.233]	[0.288]

Notes: The data include 10-year intervals on both sides of the cut-off, except for the following cases when the right hand side of the cut-off includes (a) 9 years, (b) 8 years, (c) 7 years, (d) 6 years, (e) 5 years, (f) 4 years. A separate logit regression is run for each grade level. The dependent variable is grade completion status. "Composite female" coefficient is the sum of the "policy" and "policy*female" coefficients. "Composite rural" coefficient is the sum of the "policy" and "policy*rural" coefficients. All specifications include linear time trends, which are allowed to be different before and after the policy and by gender in panels (A) and (B) and by rural/urban status in panels (C) and (D). Control variables also include dummies for 5 geographical regions, large city/small city, and gender. Standard errors are clustered at the level of year of birth. Statistical significance is *** at 1 percent level, ** at 5 percent level, * at 10 percent level.

Source: Authors' calculations based on 2003 and 2008 Turkish Demographic and Health Survey.

FIGURE 2. Effect of Policy on Grade Completion Rates



Source: Authors' calculations based on 2003 and 2008 Turkish Demographic and Health Survey.

where the sample size and the number of birth cohorts that are affected by the policy are smaller. This finding is robust across all models (see Table S3). Thus, we can conclude that the policy has a weaker effect on post-compulsory schooling for urban women than for urban men.

As can be seen in panel (A) of figure 2, the change in the gender gap in the predicted completion rates of grades 6 to 8 is zero, despite the sizeable negative coefficients for the female interaction of the policy variable in grades 6 to 8 in table 2. This stems from the lower pre-policy values for women in the completion of grades 6 to 8. The completion rate of grade 8 increases by 11–13 percentage points for men and 11–19 percentage points for women (see table S4). However, the improvement in the fraction of women completing grades 9 to 11 lags behind that of men in panel (A) of figure 2, as with the effectiveness of the policy in panel (A) of table 2. For instance, the improvement in the completion rate of grade 9 is about 10 percentage points higher for men than for women. (This is statistically significant at the 1-percent level in models A1, B, and D, and just marginally insignificant at the 10-percent level in models A2 and C in table S4.) Put differently, while the improvement in the completion rates of grades 9 to 11 is much lower than that of grades 6 to 8 for women in all models (5–10 percentage points lower), the former is at least as high as the latter for men in all models.

This implies that not only is the policy more effective in improving the completion rates of high school grade levels for men but it also increases the gender gap in the completion of high school grade levels.

In sum, while the policy does not narrow the gender gap in the completion of the newly mandated grade levels, it widens the gender gap in post-compulsory levels. There is not much change in schooling costs during the post-compulsory schooling years. However, given the dynamic nature of schooling decisions, the lower costs in grades 6 to 8 also imply a lower total cost of completing high school. Since the price elasticity of schooling demand is higher for girls, we would expect a stronger effect on girls. Another factor that would have a bearing on the widening gender gap in post-compulsory schooling is the selection issue: the difference in the average characteristics of the male and female samples that are treated by the policy would cause the effect of the policy to vary by gender. However, in this case, we would expect a stronger effect on women because women who are treated by the policy form a less-marginal group as compared to men due to their lower pre-policy completion rates. (Note that both the price elasticity effect and the selection effect would be weaker in urban areas due to, respectively, the smaller fall in schooling price and the smaller pre-policy gender gap.) In addition, as discussed earlier, as a result of the delay in post-compulsory schooling decision by three years, children could have better information on the returns to schooling, higher ability in asserting their will against their parents', and a lower probability of irrational decision making. However, these effects would be expected to be at least as strong for girls because the fraction that is induced to finish grades 6 to 8 is at least as large. On the other hand, the sheepskin-effect argument is consistent with the widening gender gap in post-compulsory schooling in urban areas. Since the sheepskin effects are more important for men than for women—especially in urban areas due to the remarkable difference in labor-force participation rates by gender—the effectiveness of the policy would be higher for men, and this is what we find.

Analysis by Gender in Rural Areas

Panel (B) of table 2 indicates a positive policy effect on the completion of all grade levels from 6 to 11 for both men and women in rural areas. While the statistical significance is below the conventional levels for grades 9 and 11 in model A1 for women, it is much higher in the other models (see table S5). In other words, spillover effects of the policy on high school grade levels exist in rural areas as well.[27] There is no evidence of a differential policy effect by gender in rural areas in both grades 6 to 8 and grades 9 to 11. As illustrated in section I, the

27. Since rural and urban status is defined based on location at age 12, students who are classified as rural residents in this paper might be residing in urban areas when they make their decision on high school attendance (at around ages 15 to 17). Therefore, part of the spillover effects we observe in rural areas might be stemming from migration to urban areas after age 12 but before reaching high school age. Nevertheless, this effect would be small because of the small gap between the age at high school and age 12 (which is always less than five years).

policy reduces the costs of schooling in grades 6 to 8 in rural areas substantially. Due to the higher price elasticity of the demand for schooling for girls than for boys, we would expect a stronger effect in grades 6 to 8 for girls. Although the gender interaction of the policy variable for grades 6 to 8 has a negative coefficient in all models but one in table S5, it is not statistically significant. An explanation for this finding, within our conceptual framework, is that the stronger sheepskin effects of completing basic education for boys counteract the effect of the higher price elasticity for girls.

Compared to the coefficients of the female interaction of the policy variable for urban areas discussed in the previous subsection, the female interaction coefficients for rural areas are less negative in both grades 6 to 8 and grades 9 to 11. In particular, there is no evidence of weaker spillover effects for women than for men in grades 9 to 11 in rural areas, unlike in urban areas. This fact could arise from a smaller gender difference in the importance of the sheepskin effects in rural areas. As the importance of the sheepskin effects for men diminishes in rural areas, the relative effectiveness of the policy for women vis-à-vis men would increase. Another explanation would be the higher price elasticity of schooling demand for women, along with the higher reduction in the costs of schooling in rural areas. This effect would be relevant not only in grades 6 to 8 but also in grades 9 to 11 because the reduction in schooling costs in grades 6 to 8 also lowers the cost of high school completion.

As displayed in panel (B) of figure 2, there is no robust evidence of a narrowing gender gap in the completion rate of any grade level in rural areas. Nevertheless, the improvement in the fraction completing grades 6 to 8 is substantial for both men and women. The fraction of women completing grade 8 is estimated to increase by 28–37 percentage points (see table S6). The corresponding increase for men is slightly smaller. Another notable finding is the improvement observed in grades 1 to 3 for boys (see table 2 and table S5). It is likely that certain instruments of the new policy, like the bussing of rural students to schools in more central locations and the construction of boarding schools, which are available to students of all compulsory school grades, improve the schooling outcomes in earlier grade levels as well.

After we examine the policy effect by gender separately for urban and rural areas, we repeat the analysis for all of Turkey because of high rural to urban migration in Turkey.[28] If recent migrants in urban areas are different from earlier ones in terms of abilities and preferences, such as willingness to take up employment, the groups we compare before and after the policy could be different in ways pertaining to their schooling decisions. For all of Turkey, there is weak evidence of a narrowing gender gap in grades 6 to 8 as well as weak evidence of an increasing gender gap in grades 9 to 11 (see table S11). This evidence of an increasing gender gap in grades 9 to 11 is similar to that for urban areas but weaker both in magnitude and statistical significance. In sum, the finding that

28. Figure S8 redraws figure 1 by gender separation only.

there is no robust evidence of a narrowing gender gap holds for all of Turkey as well.

Analysis by Urban/Rural Residence for Men

Panel (C) of table 2 shows that the policy has a positive effect on grade completion in all grade levels from 6 to 11 for men in both urban and rural areas. In addition, there is a robust positive policy effect in grades 1 to 3 in rural areas (see table S7), which is consistent with the finding in section V.2. There is no evidence for a differential effect of the policy by rural and urban residence; none of the coefficients of the interactions of the policy and the rural dummies are statistically significant. Nonetheless, in grades 9 to 11, the rural interaction term is always negative and quite sizeable in magnitude (see also table S7). A number of factors contribute to this finding. First, the availability of schools is an important issue in grades 9 to 11 even after the policy, and urban areas are much ahead of rural areas in this. Second, as argued before, the sheepskin effects of earning a high school degree are more valuable in urban areas. On the other hand, there is one factor that makes the policy more effective in rural areas. Just before the implementation of the policy, roughly 70 percent of urban men were in high school whereas 40 percent of rural men were. Therefore, the pool of men who are treated by the new policy in urban areas is more marginal, and accordingly, probably less able on average. Besides, as argued above, the larger fall in the schooling costs in grades 6 to 8 in rural areas means a larger fall in the total schooling costs of completing high school.

Panel (C) of figure 2 shows a significant improvement in the fraction completing grades 6 to 8 in urban areas, and even more so in rural areas. The rise in the fraction completing grade 8 is about 10–15 percentage points in urban areas and about 24–33 percentage points in rural areas (see table S8). Consequently, the urban-rural gap in the fraction completing grade 8 shrinks by about 11–18 percentage points. The lower pre-policy completion rates in rural areas play an important role in this finding because there is no evidence of a differential effect of the policy by urban and rural residence in panel (C) of table 2. In the completion rates of grades 9 to 11, there is no evidence for a changing urban-rural gap despite the lower starting values in rural areas because the negative coefficients of the rural interaction term in table 2 counteract the low initial values in rural areas. Finally, there is some evidence for a narrowing urban-rural gap in the first three grade levels (see table S8).

Analysis by Urban/Rural Residence for Women

As can be seen from panel (D) of table 2, there is strong evidence—statistically significant at the 1-percent level—that the policy has a stronger effect on the completion of grades 6 to 8 in rural areas than in urban areas, unlike for the male sample where the rural-policy interaction terms are smaller in magnitude and statistically insignificant at the conventional levels. Within the conceptual framework outlined in section II, a number of factors would contribute to the facts

that the policy effect in grades 6 to 8 is stronger in rural areas than in urban areas and stronger for women as compared to men. First, with the substantial fall in schooling costs in grades 6 to 8 in rural areas, the improvement in school completion rates in rural areas vis-à-vis urban areas would be bigger for women than for men because the price elasticity of schooling demand is higher for women. Second, the sheepskin effects would be more important for urban men than for rural men whereas there would not be much difference in the sheepskin effects by rural and urban residence for women. Third, the selection effect would also favor rural women. Before the policy, the completion rate of grade 8 was roughly 80 percent for urban men, 60 percent for rural men, almost 70 percent for urban women, but just above 20 percent for rural women (figure 1). Thus, the rural women who are treated by the policy constitute a much less-marginal group (with presumably higher average ability) than urban women whereas there is not as much of a difference in this sense between urban and rural men.

Panel (D) of figure 2 indicates a substantial narrowing of the urban-rural gap in grades 6 to 8 for women. In fact, according to the various models considered (see table S10), the completion rate of grade 8 increases by 12–20 percentage points in urban areas, and by a striking 29–41 percentage points in rural areas. Consequently, the urban-rural gap in the completion rate of grade 8 narrows by 16–30 percentage points.

Analysis of Completed Years of Schooling

In this section, we examine the effect of the policy on the completed years of schooling at age 15 and at age 17 for urban men, urban women, rural men, and rural women separately. This is equivalent to cumulating the effects presented by grade level in the previous subsections to grade 8 and grade 10 levels.[29] We use the exact same methodology explained in section IV; the only difference is the dependent variable. We use three models at age 15: 7-year intervals (maximum possible at this age) on both sides of the cutoff with linear splines and with quadratic splines, and 2-year intervals on both sides of the cutoff with no time trends. At age 17, we use two models: 5-year intervals (maximum possible at this age) on both sides of the cut-off with linear splines and 2-year intervals with no time trend.

Table 3 presents the estimation results for completed years of schooling. In panel (A), the changes in the completed years of schooling at age 15 in urban areas are very similar for men and women, at around 0.4 to 0.5 years. From age 15 to age 17, this change increases by an additional 0.3 years for both men and women, and the total increase by age 17 reaches 0.7 to 0.8 years. The improvement in the completed years of schooling by age 17 is lower for women by about

29. We use grade 10 rather than grade 11 because the small number of birth-cohorts that are affected by the policy at grade 11 do not yield estimates that are robust to specification checks. Further, in tables S3 to S10, the estimates for grade 11 vary much more across various specifications than those for grades 9 and 10.

TABLE 3. Effect of the Policy on Completed Years of Schooling at Age 15 and Age 17 by Gender and Rural/Urban Residence

	Age 15			Age 17	
Birth Cohorts:	1978-1984, 1987-1993		1983-1984, 1987-1988	1980-1984, 1987-1991	1983-1984, 1987-1988
Time trend (Splines):	Linear	Quadratic	None	Linear	None
	A) Gender differences in urban areas				
Policy	0.349**	0.511	0.535**	0.803**	0.910**
	[0.150]	[0.344]	[0.130]	[0.272]	[0.177]
Policy * female	0.067	−0.058	−0.019	−0.072	−0.075
	[0.147]	[0.455]	[0.114]	[0.343]	[0.207]
Composite female	0.417***	0.454	0.517***	0.731**	0.835***
	[0.081]	[0.450]	[0.016]	[0.236]	[0.087]
N	8,755	8,755	2,947	5,734	2,292
R-squared	0.145	0.145	0.140	0.145	0.144
	B) Gender differences in rural areas				
Policy	0.797***	1.051**	0.993***	1.391***	1.327***
	[0.092]	[0.350]	[0.046]	[0.239]	[0.071]
Policy * female	0.329	−0.042	0.272	0.080	0.294
	[0.210]	[0.458]	[0.122]	[0.243]	[0.162]
Composite female	1.125***	1.009***	1.265***	1.471***	1.621***
	[0.152]	[0.295]	[0.120]	[0.178]	[0.168]
N	5,518	5,518	1,818	3,565	1,426
R-squared	0.332	0.333	0.335	0.333	0.327
	C) Rural/urban differences for men				
Policy	0.331**	0.480	0.512**	0.786***	0.885***
	[0.127]	[0.295]	[0.110]	[0.238]	[0.149]
Policy * female	0.463**	0.459	0.466**	0.526*	0.433***
	[0.173]	[0.457]	[0.120]	[0.242]	[0.068]
Composite female	0.795***	0.939**	0.979***	1.312***	1.318***
	[0.081]	[0.313]	[0.077]	[0.240]	[0.086]
N	5,185	5,185	1,488	3,512	1,415
R-squared	0.167	0.167	0.137	0.180	0.170
	C) Rural/urban differences for women				
Policy	0.425***	0.494	0.523***	0.719***	0.820***
	[0.076]	[0.417]	[0.015]	[0.216]	[0.072]
Policy * female	0.713***	0.552	0.756***	0.757**	0.811*
	[0.148]	[0.478]	[0.099]	[0.271]	[0.261]
Composite female	1.137***	1.046***	1.279***	1.476***	1.631***
	[0.141]	[0.271]	[0.114]	[0.156]	[0.194]
N	9,088	9,088	3,277	5,787	2,303
R-squared	0.307	0.307	0.307	0.313	0.318

Source: Authors' calculations based on 2003 and 2008 Turkish Demographic and Health Survey.

0.07 to 0.08 years, but it is not statistically significant. The improvement in the completed years of schooling in rural areas, given in panel (B), is striking. There is already a substantial improvement by age 15, which is almost one year for men and more than one year for women. The completed years of schooling at age 17

increase roughly by about 1.3 to 1.4 years for men and by about 1.5 years for women with the policy. Comparing the changes in rural areas and urban areas by age, we see that for both men and women, the fraction of the improvement by age 15 in the total improvement by age 17 is much larger in rural areas than in urban areas.

In panel (C), the changes in the completed years of schooling are displayed for men in urban and rural areas. The improvement by age 15 for rural men, 0.8 to 0.9 years, is much higher than that for urban men, 0.3 to 0.5 years. By age 17, the improvement in the completed years of schooling further increases, but the gap between urban men and rural men in the improvement persists. While the completed years of schooling at age 17 increase by 0.8 to 0.9 years for urban men, the corresponding improvement for rural men is 1.3 years. Finally, in panel (D), we present the changes in the completed years of schooling for urban and rural women. There is a remarkable difference between urban and rural women in the improvement of the completed years of schooling at age 15, as well as at age 17. The improvement by age 15 is about 0.7 years higher for rural women. This narrowing of the urban-rural gap by age 15 for women is higher than that for men, given earlier in panel (C). Finally, the narrowing of the urban-rural gap for women by age 17, at around 0.75 to 0.8 years, is only slightly higher than that by age 15.

VI. Conclusion

The extension of compulsory schooling from 5 to 8 years with the 1997 education reform in Turkey—in the backdrop of significant disparities by gender and rural/urban residence—substantially increases the completion rates in both the new compulsory grade levels and in the post-compulsory grade levels for all subgroups by gender and rural/urban residence. Since compliance with compulsory schooling policies is far from perfect in Turkey, establishing that the policy indeed positively and significantly affects all subgroups is important. The completion rate for grade 8 of rural women (the most disadvantaged group) increases by about 30–40 percentage points with the policy. The more surprising finding is the favorable spillover effects of the policy on the post-compulsory schooling years. For instance, the high school completion rate of urban men increases by 10–18 percentage points. The resulting total effect on the completed years of schooling is impressive, particularly in rural areas. The completed years of schooling at age 17 increases by about 1.3 years for rural men, by about 1.5 years for rural women, and by about 0.8 years for both urban men and urban women.

The policy equalizes the educational attainment of urban and rural children substantially. The urban-rural gap in the completed years of schooling at age 17 falls by about 0.5 years for men and by about 0.7 to 0.8 years for women. Our analysis allows us to decompose the changes in grade completion into a part that result from the effectiveness of the policy—measured by the policy effect on the

odds of grade completion—and a part that stems from the lower pre-policy levels of grade completion. We find that the closing of the urban-rural gap for men results only from the lower pre-policy levels for rural men, whereas the closing of the gap for women results from both the lower pre-policy levels and the higher effectiveness of the policy for rural women. That the policy has a stronger bite in rural areas for women but not for men could result from a number of factors. First, women would benefit more from the large reduction in schooling costs in rural areas because the price elasticity of schooling demand is higher for them. Second, the sheepskin effects of schooling are more important for urban men than for rural men whereas there is not such a difference between urban and rural women due to the very low labor-market participation of urban women. Third, due to the greater pre-policy urban-rural schooling gap for women than for men, the difference between rural and urban residents who are treated by the policy in terms of ability and motivation for schooling would be higher for women than for men.

There is no evidence of a narrowing gender gap with the policy, in both urban and rural areas. On the contrary, the gender gap in post-compulsory schooling in urban areas widens despite improvements in both men and women. This surely results from the higher effectiveness of the policy for men in urban areas because the pre-policy grade-completion rates are also higher for men. This finding is consistent with the stronger sheepskin effects for men in urban areas resulting from the large gender differences in the labor-force participation rates in urban Turkey.

One of the most important findings of the study is the clear success of the policy in improving the schooling of rural women, the most disadvantaged group. If the real impediments to girls' schooling were cultural or social, increased availability and/or lower costs of schooling would not make a difference. However, in the Turkish case, we see that increased availability and lower costs of schooling—via an increase in the years of compulsory schooling—make a huge difference in girls' schooling even in rural areas. Obviously, the starting levels are important here. In the low pre-policy post-compulsory school attendance environment of rural women in Turkey, the policy operates on a large pool of children. In another environment with high enrollment rates where drop-outs are only the marginal students, more targeted policies may be needed.

Another interesting finding is the strong spillover effects of the policy to post-compulsory schooling years. Such spillover effects are generally not reported in the previous literature; an exception is Oreopoulos (2009), although the magnitude of the spillovers is much smaller there. A unique feature of our study that contributes to the large spillover effects is the change in the sheepskin effects with the policy. The fall in the sheepskin effects for 5 and 8 years of schooling make completing high school much more attractive. In addition, since a large fraction of children are induced to finish the new compulsory schooling years and these children are less-marginal students in terms of ability and motivation compared to their counterparts in developed countries, spillover effects resulting from other factors could be

important as well. For instance, after being induced to finish three additional years of schooling, some children may improve their knowledge about the true returns to education or be more assertive when their parents' and their own goals do not overlap. There may be another channel that could contribute to the spillover effects for rural women. The policy instruments —transportation and boarding schools—could leave a permanent impact on psychic costs of schooling because both instruments imply attending schools in distant areas.

The improvements in educational outcomes for men and women, and urban and rural residents, but particularly for those who traditionally lag behind, have important implications for both individual and social welfare. There is a growing literature on the causal effects of education on various demographic and labor-market outcomes in developed-country settings. However, we know very little about such causal relationships in developing countries, where such relationships could significantly differ. For instance, longer schooling of mothers could change infant health through its effect on the probability of out-of-wedlock pregnancy in a Western setting, whereas such a channel may not exist in a socially conservative developing country. Thus, it will be important to establish such causal relationships in the Turkish context in future works, using the policy in this paper as a source of exogenous variation in schooling. This study lays the groundwork for future works regarding the causal effects of schooling by illustrating the groups whose schooling outcomes are altered the most.

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