ECONOMIC RESEARCH FORUM
منتدى البحوث الاقتصادية
2015

working paper series

THE UNFOLDING OF GENDER GAP IN EDUCATION

Nadir Altinok and Abdurrahman Aydemir

Working Paper No. 934

THE UNFOLDING OF GENDER GAP IN EDUCATION

Nadir Altinok and Abdurrahman Aydemir

Working Paper 934

August 2015

This research was supported by Tübitak research grant no. 112K050. The paper benefitted from comments of participants at departmental seminars at ITU and METU, Turkish Labor Market Research Conference, Boğaziçi National Education Workshop, and Economic Research Forum conference. We would like to thank Jean Luc Demeulemeester, Aysit Tansel and Meltem Dayıoğlu for comments on earlier versions. Usual disclaimers apply.

Send correspondence to:
Nadir Altinok
University of Lorraine
nadir.altinok@univ-lorraine.fr

First published in 2015 by
The Economic Research Forum (ERF)
21 Al-Sad Al-Aaly Street
Dokki, Giza
Egypt
www.erf.org.eg

Abstract

The gender gap in education against females becomes smaller as the level of development increases and turns in their favor in developed countries. Through analysis of regional variation in the gender gap within Turkey, which displays a similar pattern to the cross-country pattern, this paper studies the factors that lead to the emergence of a gender gap against females. The data for student achievement and aspirations for further education during compulsory school show that females are just as well prepared and motivated for further education as their male counterparts across regions with very different levels of development. Despite this fact, large gaps arise in high school registration and completion in less developed regions, but not in developed ones. We find that larger sibship size is the main driver of gender gaps in less developed regions. While social norms have a negative influence on female education beyond compulsory school, they play a relatively small role in the emergence of gender gaps. These results are consistent with the fact that resource-constrained families give priority to males for further education, leading to the emergence of education gender gaps.

JEL Classification: I2

Keywords: gender gap, education, achievement, social norms

ملخص

الفجوة بين الجنسين في التعليم ضد الإناث تصبح أصغر كما يرتفع مستوى التنمية وتتحول لصالحهم في البلدان المتقدمة. من خلال تحليل التباين الإقليمي في الفجوة بين الجنسين داخل تركيا، والذي يعرض نمطا مماثلا للنمط عبر البلاد، دراسات هذه الورقة العوامل التي تؤدي إلى ظهور فجوة النوع الاجتماعي ضد الإناث. بيانات التحصيل العلمي للطلاب وتطلعات لمزيد من التعليم أثناء عرض التعليم الإلزامي أن الإناث مثلما هي مستعدة جيدا ودوافع لمواصلة التعليم كما نظرائهن من الرجال عبر المناطق ذات مستويات مختلفة من التطور. على الرغم من هذا الواقع، تنشأ فجوات كبيرة في تسجيل المدارس الثانوية والانتهاء منه في المناطق الأقل نموا، ولكن ليس في البلدان المتقدمة. نجد أن أكبر حجم الأخوة هو المحرك الرئيسي للالفجوات بين الجنسين في المناطق الأقل نموا. في حين المعايير الاجتماعية لها تأثير سلبي على تعليم الإناث بعد المرحلة الإلزامية، وأنها تلعب دورا صغيرا نسبيا في ظهور الفجوات بين الجنسين. هذه النتائج تتفق مع حقيقة أن الأسر محدودة الموارد تعطي الأولوية للذكور لمواصلة التعليم، مما أدى إلى ظهور الفجوات التعليمية بين الجنسين.

1. Introduction

Improvements in the educational attainment of women have been associated with better health outcomes among infants and children (Dancer et al., 2008; Behrman and Deolalikar, 1988; Glewwe, 2000), improved schooling among children (Lam and Duryea, 1999), and reduced fertility (e.g., Osili and Long, 2008, Kirdar et al., 2009). Increases in the educational attainment of women are also associated with higher labor force participation and higher economic growth (e.g., Abu-Ghaida and Klasen, 2004).

Despite the many benefits of female education, there are large gender differences in educational attainment against females in many countries. There are persistent gender gaps against females in primary education in the Middle East, North Africa, South Asia, and Sub-Saharan Africa (Aslam, 2009 ; World Bank, 1999), while in developing countries, gender gaps are observed at secondary and tertiary levels (OECD, 2011a). This contrasts with most industrialized countries, where females have higher educational attainment than males (Pekkarinen, 2012). As income levels rise across countries, gender gaps against females shift from a lower level of education to a higher level, and eventually, the gap reverses (World Bank, 2012).

Similar to the cross-country variation, gender gaps in educational attainment may also vary between regions within a country. We document the gender gap among adults across regions in Turkey in terms of educational attainment and show that the gap against females is much larger in less developed regions.[1] We then investigate the root causes of the relationship between the level of development and the education gender gap by studying academic achievement during compulsory school years and the transition from compulsory to noncompulsory education.

This paper makes two main contributions to the literature. First, we examine how the education gender gap unfolds at different stages of education. Second, we explore several factors that may be responsible for the emergence of gaps. In particular, we assess whether a gap in achievement emerges during compulsory school years that may be due to different levels of parental investment in boys and girls or the household responsibilities girls are expected to fulfill. In addition, using unique questions on parental attitudes toward gender roles and religiosity, we assess the importance of social norms in generating education gender gaps. The analysis of various education stages provides important insights into why the gender gap varies by level of development.

Regional differences in Turkey's gender gap display a similar pattern to the cross-country variation, where the gap in educational attainment is much larger in less developed regions. Figure 1 reports the cross-country variation in educational attainment based on the Barro–Lee data.[2] The gaps vary widely, with gaps against females as large as 4.2 years in Afghanistan and gaps against boys reaching 2.4 years in the UAE. Figure 1 also shows that the variation in regional gaps in Turkey are substantial. The difference in the gender gap between Southeast Anatolia (3.58 years) and Marmara (1.34 years) — the most and least developed regions in Turkey — is similar to difference in the gap between Haiti and Bolivia. The magnitude of the gender gap in Southeast Anatolia places this region in the top decile of the gender gap distribution among countries with a gap against females in the Barro–Lee data, while the Marmara region is in the sixth decile. Hence, the analysis of these substantial regional

[1] A relationship between the level of development (or GDP) and the education gender gap is also observed within countries across time. Goldin et al. (2006) study the trend in the male-to-female ratio of the college enrollment rate in the United States. This ratio has steadily declined over years, falling below parity by 1980 and continuing its decline after.

[2] The Barro–Lee data cover 146 countries. For clarity, Figure 1 displays the variation in the gender gap across countries using a subset of these countries.

differences may provide important insights into the cross-country variation in the education gender gap.

While cross-country variation in the education gender gap has received a great deal of attention, empirical analysis of this variation has been limited. Several studies on international differences in the gender gap focus on educational attainment, documenting trends over time (Grant and Behrman, 2010). However, few studies have tried to explain why this gap varies by development level.[3] Cross-country analysis is complicated because of institutional differences in education systems across countries and other country-specific factors that may lead to an omitted variable bias, as well as measurement issues related to data (Rose, 1995; Woessmann, 2003). Thus, without a uniform institutional setting, analyzing the effects of economic and social factors in generating different levels of the education gender gap across countries is a challenging task. The study of the gender gap across regions within the same country provides an alternative approach for understanding this relationship. Our analysis of the gender gap across regions within a single country is free from the complications inherent in cross-country analysis related to the differing institutional characteristics of countries, such as education and labor market institutions, and allows us to focus on other determinants of these gaps.[4,5]

The literature on education gender gaps mainly focuses on gaps at a given point in time; the unfolding of these gaps over different stages of the education system has received much less attention.[6] In a developing country context, this is the first study to examine the gender gap in achievement at various stages of education. Studying students' school success allows us to examine whether attainment differences by gender are preceded by achievement differences during early years of schooling. Drawing on various cross-sectional data, the gender gap is first studied in grade 4 and then in grade 8, the final year of compulsory school. During the compulsory schooling stage, most boys and girls are enrolled in school; thus, the role of selective school dropout behavior is small. Cognitive skills in reading, mathematics, and science are used to assess achievement differences. As measures of the quality of schooling received by boys and girls, these cognitive skills are important for understanding differences in attainment since students with lower educational achievement may leave school earlier. We also investigate the GPA of students in grade 8 as an alternative assessment of school achievement.

Given this understanding of the relative school success of females prior to the end of compulsory school, we turn to the gender gaps that arise in (i) decisions to continue with high school education, (ii) achievement during high school, and (iii) high school completion. The gender gaps in high school registration and completion are large, play a significant role in the educational attainment gap observed among adults, and mimic the pattern of larger gaps observed in less developed regions in terms of educational attainment. Investigating these sequential outcomes enables the assessment of how the gender gap evolves over school years

[3] A broader body of literature focuses on the development and gender inequality relationship that indicates a two-way relationship (Duflo, 2011). This literature, however, does not focus on the education gender gap.

[4] Cross-country differences in the education gender gap are likely to be influenced by institutional differences as well. While the influence of institutional differences is an interesting research direction, we focus on other determinants of the gender gap.

[5] The within-country analysis in this paper is similar to a cross-country estimation over time with country fixed effects where regions with different economic levels are compared. A shortcoming of our study is that we do not observe the reversal of the gender gap, while this is observed in cross-country data. Therefore, our results shed light on early stages of the reduction in the gender gap.

[6] An exception is Machin and McNally (2005), who study gender differences in achievement at different stages of education in the United Kingdom, where girls outperform boys. Related sociological literature on educational transitions evaluates the effects of individual characteristics and contextual factors on school continuation decisions (e.g., Mare, 1980; Hansen, 1996). This literature also discusses path dependence effects—that is, to what extent particular educational pathways affect transition probabilities (e.g., Breen and Jonsson, 2000).

and reveals information about the stage of education at which the gender gap starts to emerge, which is important for potential policy interventions.

The second aim of the paper is to test several hypotheses about why education gender gaps arise and why they are larger in less developed regions. We examine whether the pattern of achievement gender gap is consistent with the possibility of different parental education investments by gender during early school years or the household responsibilities girls are expected to fulfill. We also assess the importance of social norms in generating larger gender gaps in educational attainment in less developed regions using unique questions on parental attitudes toward gender roles and religiosity.

Several studies argue that families may invest less in girls' education, as incentives may be lower than those for boys if the returns to education are lower for females (Kingdon, 1998) or if parents consider that boys will be responsible for parental care in their old age (Anderson et al., 2002;Connelly and Zheng, 2003). The difference in investments by gender is expected to be larger where parents lack social security or face credit constraints that force them to invest selectively in their children. In less developed regions, social security coverage is lower, access to credit market is more restricted because of a higher incidence of informality, and labor market opportunities for females may be limited. Lower investment in girls' education may work through two channels. First, families may allocate fewer resources to educating girls in school (e.g., buying fewer books or avoiding costly private tutoring or higher quality schools that are more expensive). This would imply lower school success among girls. Second, families may decide to make zero educational expenditure for girls through non-enrollment in schools (Kingdon, 2005). During compulsory schooling years, this second channel is closed for parents. We investigate the first channel by studying whether differences in achievement emerge during compulsory school years that may be due to differential investment in girls.

The literature discusses that the contribution of girls to home production may increase the opportunity cost of schooling for girls (Levison, et al., 1998; Assaad et al., 2010). Girls may have less time to devote to schoolwork because of their contribution to home production, which may give rise to a gender gap in school achievement. In less developed regions, where the average family size is larger, families may require the help of girls more than families in more developed regions. Child labor, however, is not restricted to home production. Children's market work is widespread and is associated with lower educational achievement and attainment (Orazem et al., 2004; Psacharopoulos, 1997). In larger families, children may be expected to contribute through market work. Market work is especially prominent among boys, while at-home work is prominent among girls. Thus, it is unclear whether child labor, either at home or market, leads to a gender gap in school success and whether this potential effect is more pronounced in less developed regions. The data used in this paper provide information on hours allocated to house and market work. Using this information, we explore the association between work responsibilities and school achievement and whether these lead to the emergence of gender gaps.

Achievement differences, the social roles that females are expected to fulfill, and differences in labor market prospects may give rise to differences in boys' and girls' aspirations for further education. For example, if social roles in less developed regions discourage female education, it may lead to lower aspirations among girls relative to more developed regions in which social norms are more supportive. Using information on students' aspirations for university education, we study the gender gap in aspirations in the final year of compulsory school, controlling for school achievement, and assess whether these gaps vary across regions.

School achievement and aspirations for further education in the last year of compulsory school describe the academic preparedness and willingness of students to continue with high school.

The differences that arise in school continuation decisions and high school completion following compulsory school are discussed within this context. Several studies highlight the role of social norms, also referred to as *culture* or *gender culture*, on female labor market outcomes (Fortin, 2005; Algan and Cahuc, 2007; Fortin, 2009). While social norms on gender roles are potentially important forgirls'education and are discussed extensively in the literature (e.g., King and Hill, 1993), their quantitative importance has rarely been assessed. We focus on the role of social norms held by parents in the emergence of education gender gaps in terms of high school completion, as well as the role of family background characteristics, and quantify their relative influence.

In empirical analysis, there is usually no information on an individual's beliefs, values, or attitudes, which are shaped by social norms and may affect choices such as human capital investments or labor force participation. Various studies rely on aggregate measures, mainly indices of social norms constructed at regional or country level based on World Value Surveys, to examine the cross-country correlation between social norms and female outcomes. Another strand of literature investigates the outcomes of immigrants and relates them to characteristics of immigrants' source countries to capture the social norms that immigrants bring to the destination country (e.g., Antecol, 2000).

Just as social norms and culture vary across countries, they may also vary across regions within a country. Moreover, individuals exposed to a set of social norms may also differ in the extent to which they adopt these norms or beliefs. The education of children, especially in the early years, is mostly determined by parents, who make the educational investments. Therefore, the value attached to education by parents may play a significant role in shaping children's educational outcomes. In our analysis of high school completion, our data provide several unique measures of attitudes and values held by parents that reflect these norms at the individual level. These parental attitudes and values may have a significant influence on parental decisions regarding the education of children.

Social norms are measured by the questions of whether parents approve of the wage employment of females, parental views on the proper age for marriage for males and females, the extent to which religion is an influential factor in parents' daily life, and whether parents had an arranged marriage.[7] These questions reflect norms that can be impediments to female employment and education. These parental attitudes and values show considerable heterogeneity in our data, both across regions and across individuals within the same region. For example, in the most developed region of the country, Istanbul and West Marmara, 18% of parents disapprove of female wage employment, while in the least developed region, Southeast Anatolia, this fraction is 55%. This variation raises the question of whether education gender gaps across regions with different levels of development are partly driven by differences in social norms held by parents.

In cross-country studies in which country-level aggregate measures of social norms are used to assess the role of social norms on gender equality, reverse causality and omitted variable bias are important concerns. Cross-country studies also face the challenge of adequately controlling for differences in economic and institutional settings across countries that may be correlated with social norms. In our context, concerns related to reverse causality or omitted variable bias are not as severe, for a number of reasons. First, values and attitudes held by parents are likely to be shaped early in parents' life, and are therefore likely to be exogenous to the education of

[7] "Arranged marriage" refers to marital unions where the parents decide on the marriage of their children. Families that consider a potential couple a "fit" initiate the process. While in some arranged marriages, couples may become acquainted before the decision for marriage is made and their parents seek their approval, in others, they do not take part in the decision process. In this paper, we refer to this latter type as an "arranged marriage." This declining practice of arranged marriage is usually seen in families with authoritarian parents following regional customs.

children. Second, since this study focuses on a single country, challenges posed by different institutional settings across countries are avoided. It is also important to note that we exploit variation in parental attitudes and values while holding region, parental education, and income fixed. Hence, the identifying variations in parental attitudes across families are less likely to reflect the different labor market prospects that children face in different regions and are more likely to capture the beliefs or values held by parents. The availability of data on parental attitudes allows us to directly assess the importance of social norms in influencing the female education gender gap. In addition, some family background characteristics are likely to be correlated with social norms adopted by parents. Information on parental attitudes allows us to assess the role of family background characteristics, controlling for the effect of social norms.[8]

The results of this paper show that in terms of academic achievement, girls perform similarly or better than boys that live in the same region during compulsory school. There is no pattern in the gender gap across regions with different development levels—that is, we do not observe larger gaps in less developed regions. Thus, these results indicate that a gender gap does not emerge in school achievement during the compulsory school stage. In the final year of the compulsory schooling stage, however, while aspirations for further education are higher among girls than boys in more developed regions, girls' aspirations are similar to boys in less developed regions. This result holds after controlling for school and family characteristics and the school success of students. The above results indicate that females are just as prepared and motivated for further education as their male counterparts across regions, with very different levels of development by the end of compulsory school. Unlike the results for achievement and aspirations, however, school continuation decisions from primary school to high school (HS) following the end of the compulsory schooling period show that a much larger fraction of girls than boys dropout of the education system in less developed regions, while in developed regions, no difference is observed. An analysis of HS registration and attainment provides important insights regarding the effect of family background characteristics on the emergence of an education gender gap. We find that while social norms have a negative influence on female education beyond compulsory school, they play a relatively small role in the emergence of the gender gap. The religiosity of parents is found to have no significant effect on HS attainment. We find that larger sibship size is the main driver of gender gaps in less developed regions. While sibship size reduces the HS attainment of both boys and girls, its effect is much larger among girls. These results are consistent with resource-constrained families giving priority to males for further education. Since we control for parental attitudes and values reflecting social norms, the larger effect of sibship size is more likely driven by a rational decision-making process among resource-constrained families rather than by a pure son preference.

In the next section, we provide a brief institutional overview of the education system in Turkey and discuss the related literature in the Turkish context. Section 3 discusses the datasets used in the analysis. Section 4 presents an analysis of educational achievement and the transition from compulsory school to high school. Section 5 concludes.

2. The Turkish Education System and Gender Gap in Educational Attainment

Turkey's central government is responsible for its education system — the Ministry of National Education (MONE) is the highest authority. MONE develops and monitors the curriculum for all schools below the university level and is responsible for the planning of investment in public education. The education system is completely centralized and uniform, with no regional

[8]For example, the number of children a woman or family has may be a status symbol, thus encouraging larger families. Therefore, the number of siblings may capture the effects of social norms as well as the resource constraints families face with increasing family size.

variation in curricula or school times. Teacher hiring, the appointment of administrators, and school financing are all managed by MONE.

Eight years of basic education, composed of five years of primary and three years of lower secondary school, became compulsory in 1997.[9] This basic education has also been referred to as "primary education" since the 1997 change. A single curriculum for general training applies for all 6- to 14-year-old pupils during basic education. Following the completion of basic education, students may continue with upper secondary education, also called "high school." These schools are four years in length and provide either general or vocational–technical training. [10]

In the basic education stage, sex ratios, defined as the ratio of female-to-male net enrollment rates, have improved over time, reaching 0.99 by the 2008/09 school year, the year following the graduation of 8th graders in our sample from basic education. After completing the compulsory basic education, however, a large gender gap emerges during the transition to upper secondary (high) schools. For the 2008/09 school year, the sex ratio for upper secondary school was 0.93, indicating substantially higher dropout rates among females. The decision of whether to continue with upper secondary education is, therefore, critical in shaping the eventual gap in educational attainment levels. Students may continue to post-secondary non-tertiary education or tertiary education following graduation from upper secondary schools. The sex ratio for higher education beyond the upper secondary level for the 2008/09 school year is even lower, 0.88 (MONE, 2010).

We are primarily interested in educational achievement during the basic education period among children subject to eight years of compulsory education. The advantage of focusing on this stage of education is that the sex ratios are close to one and the problem of selection due to dropout decisions is thus limited.

There are three important characteristics regarding educational attainment levels in Turkey. First, there is a significant female–male differential at the national level. Table 1 presents the educational attainment levels from the 2000 Turkish Census for individuals 24–30 years old. High school or more education is 13.6 percentage points higher among males than females. For older cohorts, these differences are more pronounced.

Second, educational attainment levels differ significantly across regions. The available data allow us to identify seven geographical regions consistently across international student achievement surveys.[11] Table 2a presents the differences in the educational distribution between the national level and each of the seven geographical regions in Turkey for individuals 24–30 years old as well as the GNP per capita for each region. For example, the first column indicates that the fraction of individuals in the Mediterranean region with eight years or less of education is 2.3 percentage points higher than the corresponding fraction at the national level. Educational attainment levels are especially low in the Southeast Anatolia region, which also one of the lowest GNPs per capita. Comparing Southeast Anatolia to Central Anatolia (the region with the most favorable education levels),the fraction of those with high school education or more is 15 percentage points higher in the latter. These differences may reflect

[9] Under a new law introduced in 2012, basic education was divided into two four-year periods, and different programs will be available for the second period. Grade-1 students starting school during the 2012/2013 period are the first cohort affected by the new law. The new also aims to extend compulsory schooling to 12 years.

[10] Most schools in Turkey are public schools run by the state, while a small fraction of schools are private. During 2007–2008, about 5% of students were enrolled in private schools at the general upper secondary level and about 2% at the primary school level.

[11] These regions are Marmara, Central Anatolia, the Aegean, the Mediterranean, the Black Sea, Eastern Anatolia, and Southeast Anatolia. Figure 2 presents a map of Turkey highlighting these regions.

differences in the ease of access to schools and regional differences in economic activity that may affect incentives for education. Service and manufacturing have larger sector shares in more developed regions of Marmara, Central Anatolia, the Aegean, and the Mediterranean.

Third, there is large variation in gender gaps across regions. Table 2b presents the within-region gender gap and shows that in all regions, females lag significantly behind males. The gap is smallest for the Marmara region, where the fraction of those with 8 years of schooling or fewer is 9 percentage points higher among females. The corresponding gap is much larger in other regions, reaching 17.4 percentage points in the Black Sea region, 19.3 percentage points in the Southeast Anatolia region, and 23 percentage points in Eastern Anatolia region. There is a pattern a larger gap in less developed regions in the Turkish context, which is similar to cross-country evidence suggesting smaller gaps against females as countries move up the income ladder, which ultimately reverse (World Bank 2012).

Most studies on Turkey focus on educational attainment and, parallel to work in other countries, find that educational attainment varies by age and region (Tansel, 2002). There are large gender disparities in attainment in the Turkish context, where girls perform much worse than boys; the disparity is higher in rural areas and among older age groups, and large variation is observed across ethnic groups (Kirdar, 2009). A recent paper by Kirdar et al. (2014) examines the effect of the extension of compulsory schooling in Turkey on completed years of schooling and finds no evidence of a narrowing in the gender gap. Gender disparities in terms of achievement in schools, however, has not received much attention in the Turkish context.

These substantial gender gaps in educational attainment may be driven by lower achievement among females during early school years. The rest of the text first investigates whether lower attainment among females is preceded by lower levels of school achievement and aspirations for further education. We next examine the dropout behavior during the transition to high school and factors affecting HS attainment. In the next section we discuss the data used for the analysis of these issues.

3. Data

We use several data sources that allow analysis of the gender gap in primary school, the differences that arise in dropout rates during the transition from primary to HS and in HS attainment, and the achievement gap during high school. To analyze school success based on international achievement tests, we use PIRLS 2001, TIMSS 2007, and PISA 2006.[12] Primary school outcomes are analyzed with PIRLS 2001 data for achievement in grade 4 and TIMSS 2007 data for grade 8, capturing school success at two stages of compulsory school. Data from PISA 2006, which is conducted at age 15, is also used to enable assessment of achievement gaps following compulsory schooling.

A common feature of these datasets is the availability of geographic identifiers that allow analysis of the gender gap within regions as well as at the national level. These datasets provide sample sizes of 5,125 for PIRLS 2001, 8,996 for TIMMS 2007, and 4,942 for PISA 2006.[13] PIRLS 2001 tests reading ability, while TIMMS 2007 tests math and science ability. PISA

[12] Respectively, the Progress of International Reading Literacy Survey, the Trends in International Mathematics and Science Study, and the Program of International Student Assessment. Both school participation and student response rates were very high in these tests in Turkey. For example, the PISA 2006 survey Technical Report indicates that the school response rate (among schools that were randomly selected, the fraction that responded to the test) was 100%, while the student response rate was around 98%.

[13] To ensure representativeness, the sampling procedure for the PISA and TIMSS Turkish surveys involved explicit stratification by region (for a total of seven explicit strata referring to the seven regions) along with other stratification variables. The PIRLS 2001 survey, on the other hand, involved implicit stratification by region (81 regions). For the survey with the smallest sample size, PISA 2006, the average sample size per region is 706 observations and the minimum sample size per region is 354 observations.

2006 covers all three areas. All three datasets involve parental characteristics as well as school identifiers that allow within-school comparisons of achievement. TIMSS 2007 also involves information on the aspirations of students for further education. Whether differences arise in aspirations between genders is analyzed during the last year of compulsory school preceding the critical decision of high school continuation.

Students who are in grade 8 face the decision of whether to continue to high school. To analyze the high school continuation decisions of students graduating from basic education, administrative data from MONE for a sample of grade 8 students in the 2007–2008 school year is used.[14] The individual-level data for the 2007–2008 graduating cohort provide information on whether students are registered in high school in the following year in addition to geographic identifiers and school and parental characteristics.[15] These data also include the grade 8 GPAs of students, allowing an alternative measure of school success to provide further insight into the gender gap in the last year of compulsory school .

The above analysis of international achievement tests and administrative data provides a comprehensive picture of school success and high school continuation decisions. We investigate the role of family resources and parental perceptions on gender roles using the 2006 Family Structure Survey. These data indicate whether children in a family graduated from high school as well as geographic information and parental and family characteristics. The association between children's educational outcomes and these background characteristics, particularly the parental attitudes on female gender roles, provide important insights into the emergence of a gender gap in education.

4. The Gender Gap in School Performance

While most papers only compare gender effects on educational attainment, we also focus on achievement scores provided by international assessments. Similar to the educational attainment gap, differences in educational achievement may also arise. Because of lower parental investment, girls may attend lower quality schools or have fewer school-related resources. Household responsibilities that girls are expected to carry out limit their time for school and may lead to both lower educational achievement and early dropout from school. Girls may also put less effort into their studies if they are aware of lower parental aspirations for their education.

School quality has been shown to be an important determinant of earnings (e.g., Behrman et al., 1983; Card and Krueger, 1996; Moffitt, 1996; Bedi, 1997; Bedi and Edwards, 2002; Hanushek et al., 2008). The literature also emphasizes that the quality of education is more important than the quantity for both individual economic outcomes and the development of countries. Therefore, achievement differences are as important as attainment differences in understanding gender inequalities. Using various datasets, we track the extent of the gender gap in achievement during and after compulsory education.

In the analysis of the gender gap at different stages of education, we adopt a common specification facilitating the comparison of results from these datasets. The gender gap is first explored at the national level for grade 4 reading using PIRLS 2001 data and for grade 8 math and science using TIMSS 2007. The following empirical model is used to assess the gender gap in both datasets:

[14]Ideally, we would like to analyze the high school continuation decisions of students from the sampling frame of TIMMS 2007, that is, those in grade 8 in the 2006–2007 school year. Because of data availability, we use the 2007–2008 graduating cohort instead.

[15]Note that these data indicate whether students were registered in high school at the beginning of the school year. Since some students who register may later decide not to attend, high school registration overestimates actual school attendance.

$$y_i = \alpha_0 + \alpha_1 Girl_i + \beta_1 Z_1 + \beta_2 Z_2 + \beta_3 Z_3 + u_i \quad (1)$$

where *Girl* is a dummy variable, Z_1 is a vector of school fixed effects, Z_2 is a set of dummies for the mother's and father's educational attainment, and Z_3 is a set of dummies for the number of books at home. We estimate equation (1) by incorporating Z_i vectors successively in order to assess their explanatory power on the gender gap measured by α_1, the main parameter of interest. The robust standard errors that allow the correlation of test scores within schools are reported. The outcome variables y_i are standardized test scores (or z-scores) that refer to rescaled versions of the test scores that have a mean of zero and a standard deviation of one. Thus, $\alpha_1$indicates how manystandard deviations above or below the population mean girls perform in these tests. Using the same specification for covariatesZ_i, we assess the gender gap in various tests and grade levels.

4.1 National-level gender gaps

Table 3 presents the estimates of the gender gap for different specifications. Column 1 reports the estimates of equation (1) when the gender dummy is included without any of the other covariates, thus refers to the national level gender gaps. These parameter estimates indicate higher achievement in reading at grade 4 for females. At grade 8, there is no evidence of a gender gap in mathematics achievement, whereas for science achievement, girls have a small advantage over boys. Results in reading are similar to other countries in PIRLS 2001, where girls had significantly higher average achievement than boys (PIRLS 2001). For grade 8 achievement differences, girls on average had higher achievement than boys across the TIMSS 2007 countries in both mathematics and science (Martin et al., 2008a, b).

The specifications in Table 3 corresponding to columns (2) to (4) introduce controls for school fixed effects, parents' education, and the number of books at home, respectively. Parental education and number of books at home, which are available across the three datasets used in the paper for grade 4 and 8 achievement and achievement at age 15, allow us to control for the effect of the socioeconomic background of students. The last specification in column (4) presents the gender gap in achievement among students within the same schools who come from similar socioeconomic backgrounds. These results continue to show higher performance in reading for girls but slightly lower performance in both math and science.

4.2 Regional gender gaps

The regional means of test scores for all students are presented in Table 4. The table shows significant achievement differences in grade 4 and 8 across these regions. Students perform much better in the more developed regions. For example, in the Marmara region, the average z-score for reading is 0.127, while in Southeast Anatolia, the score is -0.608. These large differences are similar to the educational attainment differences presented in Table 2a, suggesting that students in less developed regions are also disadvantaged in terms of test scores. The extent of this disadvantage may vary between boys and girls. Table 5 presents the level of gender gaps by region to address this issue.

Table 5 presents the difference in the achievement of girls in a given region relative to all boys in the country. For example, for grade 4 reading, 0.374 is the difference in achievement of girls in the Marmara region relative to all boys in the country. The gaps presented in the table show a deterioration in the relative performance of girls as the level of development in a region decreases, especially for the grade 4 outcome. This may partly reflect the regional differences in achievement presented in Table 4. However, factors that lead to worse outcomes in less developed regions may hurt boys and girls differently. In particular, in less developed regions, economic incentives and norms related to girls' education may intensify the disadvantages

among girls. Thus, we explore the extent of the gender gap within regions by extending equation (1) as follows:

$$y_i = \alpha_0 + \alpha_1 Girl_i * Region_i + \beta_1 Z_1 + \beta_2 Z_2 + \beta_3 Z_3 + u_i \quad (2)$$

Table 6 presents the within-region gender gap in test scores for grades 4 and 8 estimated from equation (2) by excluding controls for Z. These raw differences indicate that girls have comparable or better outcomes than boys in grade 4 reading. In terms of grade 8 mathematics and science scores, with the exception of the mathematics outcome in the Mediterranean region, girls have either similar or better outcomes than boys. Interestingly, girls that reside in Southeastern Anatolia, one of the least developed regions, have better mathematics and science scores than boys.

School characteristics that affect girls' education outcomes, such as the fraction of female teachers, may differ across regions, hence leading to regional differences in gaps. Disadvantaged socioeconomic backgrounds have a large negative effect for girls (OECD, 2011a). Therefore, differences in the socioeconomic backgrounds of children across regions may be an important factor in the regional variation of the gaps. In order to account for the effects of these factors, we control for school fixed effects and the socioeconomic background of students denoted by Z variables in equation (2). The interaction terms between girl dummy and the region dummies in equation (2) capture within-region gender differences adjusted for the school characteristics and socioeconomic characteristics of families.[16] The estimates of these within-region gender gap are reported in Table 7.

The results presented in Table 7 indicate that when students in the same schools from similar backgrounds are compared, girls in grade 4 have better reading scores than boys in all but one region. On the other hand, for both grade 8 math and science, boys perform similarly or slightly better than girls. Two important results emerge. First, Table 2b shows a pattern of larger educational attainment gaps against females in terms of educational attainment in less developed regions. With the full set of controls in Table 7, while a slight deterioration in the relative achievement of girls is observed for grade 4 reading as the development level of the region declines, we do not find a similar pattern for grade 8 math or science scores. In particular, the grade 8 gender gaps in the most and least developed regions are not statistically different from each other. Second, in the least developed three regions, the existing gender gap is not large — at most 0.15 standard deviations below the mean performance of boys. Thus, in grade 8, the last year of compulsory school, the performance of girls in the least developed regions is either similar to or slightly below boys, and there is no pattern in gaps by level of development.

The above results for within region gender gaps among grade 8 students may be biased due to differential dropout rates between boys and girls in different regions. A bias would arise if less successful students are more likely to dropout and if in less developed regions dropout rates are higher among girls. Although there is no evidence of a negative selection in dropout behavior in Turkey during compulsory school, we check the robustness of our results by replicating the analysis in Table 7 with more recent data where compliance with compulsory school attendance was much higher. The analysis for 8th graders is repeated with 2011 TIMSS data. In 2011, primary school enrollment was universal according to the MONE statistics, and the 8th grade completion rates were equal between boys and girls according to the Household and Labor Force Surveys. Appendix Table A1 reports within region gender gaps controlling for the same background characteristics in Table 7. Within region gender gaps in grade 8 for

[16]Note that because the specification includes school fixed effects that capture fixed differences across regions, there is no need to include region fixed effects.

math and science scores are reported in columns 3-4 of Table A1. The results are qualitatively the same as in Table 7. With the exception of math test outcome in Eastern Anatolia, the performance of girls is either the same or better than boys in the same region. More importantly, parallel to results in Table 7 there is no pattern in gaps by level of development. In 2011 Turkey participated in grade 4 testing of TIMSS along with grade 8 testing. Therefore, we can also investigate within region gender gaps in terms of grade 4 math and science scores. The results are presented by columns 1-2 of Table A1. These results also show that among 4th graders in 2011, with the exception of math test outcome in Southeastern Anatolia, there is no evidence of girls performing worse than boys in the same region, and there is no pattern in gaps by level of development.

An important aspect of developing countries is the responsibilities that children are expected to fulfill, which may affect their education outcomes. Girls may be expected to help with household chores while boys may be expected to support the family income by working at a paid job. The effect of work on school success, both at home and outside the home, is analyzed in Table 8 in terms of science scores, where boys and girls tend to have similar performance. We extend our specification of Table 7 by controls for the number of hours of work at home and at a paid job. The data show that females tend to spend time with home responsibilities, while boys tend to work outside home for pay. The results in Table 8 reveal that while both types of work have a negative effect on achievement, controlling for these two effects does not change our conclusion that boys and girls have similar achievement levels across regions.

An interesting question is whether girls and boys that have similar school performance in grade 8 also have similar aspirations for further education; this is addressed next.

4.3 The gender gap in student aspirations

The educational and career aspirations of elementary and middle school students are important factors for future educational attainment (Trice and King, 1991). These aspirations are shaped by gender, academic ability and achievement, socioeconomic status, social roles, and parental expectations (Danzinger, 1983; Duncan et al., 2001; Hossler et al., 1992). Educational and career attainment in adulthood is influenced by aspirations during the middle and high school years (MacBryane, 1987; Trice and Kind, 1991).

The previous section showed that boys and girls have similar academic achievement at grade 8. Before analyzing the gender gap in dropout behavior during the transition to high school, it is interesting to determine whether a gender gap emerges in aspirations within regions at the end of the compulsory school; such a gap may be driven by labor market opportunities, parental influences, or social norms.

Less developed regions of Turkey are characterized by lower levels of female participation in paid work, as well as a large gender gap against females in educational attainment, which may be driven by limited labor market opportunities and social norms. These could potentially lead to lower aspirations for further education among students. In this section, we explore the extent to which gender differences exist in the aspirations of 8th graders for further education.

TIMMS 2007 asks students how far in school they expect to go. The incidence of having aspirations to finish university is analyzed using the model outlined in (1), where the outcome variables y_i are now a dummy variable equal to 1 if student *i* aspires to university education and 0 otherwise. Given that the outcome is a binary response, we estimate a logit model and report the marginal effects. The analysis is carried out for two different samples. In the first sample, those who answered the question with "I don't know" are excluded, while in the second sample, they are coded as having no aspiration to finish university. Since the qualitative results are similar, we discuss the results from the second sample.

The first column of Table 9 reports the fraction with university aspirations for each region, which varies between 57% and 73%. Interestingly, there is no indication of lower aspiration among 8th graders that live in less developed regions. The second column reports the differences between the aspirations of girls in a given region to that of all boys in the country, which indicates that girls in all regions have a similar or higher level of aspirations. The next four columns report the within-region gender gap in aspirations using different specifications. The third column, which controls for school fixed effects and socioeconomic background, indicates that girls have higher aspirations than boys in more developed regions. For example, the fraction of girls in the Aegean region with university aspirations is 17 percentage points higher than that of boys. This finding for developed regions is similar to other studies that generally show higher aspirations among girls than boys (Schoon, Martin, and Ross, 2007). In less developed regions, however, there is no significant difference in girls' aspirations from those of boys. The last specification that adds controls for math and science achievement yields similar results. Previous analysis showed that among 8th graders, the gender gap in achievement exhibits no pattern with the level of development. Unlike the achievement gaps, however, there is a pattern of relatively lower aspirations among girls in less developed regions even after controlling for school success. This pattern may be driven by lower labor market opportunities for girls or social norms encouraging a homemaker rolefor girls.

4.4 The gender gap in school dropout

Students face the decision of whether to continue with high school (HS) education after the end of compulsory school. Ideally, we would like to analyze HS continuation decisions among 8th graders in the 2006–2007 school year, which form the sampling frame for TIMMS 2007. In the absence of individual-level data for the 2006–2007 graduation cohort, we use administrative data from MONE for a random sample of around 73,000 grade 8 students for the 2007–2008 school year. This data provides information about whether students are registered in high school in the following year, as well as information on province, school, and parental characteristics and the grade 8 GPAs of students. Using the provincial information, we construct the regions used in the previous sections. We first investigate the extent of the within-region gender gap in grade 8 GPAs and the gender gap in HS registration.

The following specification is used:

$$y_i = \alpha_0 + \alpha_1(Girl_i * region_i) + \beta_1 Z_1 + \beta_2 Z_2 + \beta_3 Z_3 + u_i \quad (3)$$

Where *Girl* is a dummy variable, *region* is a set of dummy variables indicating the region in which the school is located, Z_1 is a vector of school fixed effects, Z_2 is a set of dummies for the mother's and father's educational attainment where educational attainment is captured by 11 categories (ranging from illiterate to PhD degree), andZ_3 is a set of dummies for the family income. Family income, reported by families on a scale of 1 to 5 (very poor to excellent), relies on a subjective assessment. Families are likely to take into account their financial needs and obligations when assessing their family income. Therefore, while subjective, this income variable is highly relevant for investment decisions, including investments in children's human capital and educational outcomes. In equation (3), the gender gap within region *i* for outcome y_i is measured by the coefficient vector α_1.

We first investigate differences in grade 8 GPAs. GPA is a continuous variable with a maximum level of five that measures performance across different subjects taught during the school year. Unlike international test scores, GPAs are not standardized across schools since teachers may test and grade differently. However, in our preferred specification with school fixed effects, most of the variation in GPAs due to differences in grading practices is eliminated since the gender gap is calculated through a comparison of girls and boys within the same school, where students are assessed by same teachers. The second outcome variable y_i is a

dummy variable equal to 1 if a student in grade 8 registers for HS in the next academic year. We model this outcome using a linear probability model because of the large number of school fixed effects (over 13,500) in our model, which makes the calculation of marginal effects very difficult when HS registration is treated as a binary dependent variable. For this outcome, in addition to variables in Z_1 to Z_3, we extend the model by including the GPA score and other variables that may differentially affect the HS continuation decisions of boys and girls. For all regressions, we report the robust standard errors, which allow the correlation of GPA scores within schools.

Columns 1–3 of Table 10 report the results for the GPA score as the outcome variable, while HS registration is the outcome variable for columns 4–7. The first column reports the within-region gender gap in GPA scores without the controls in Z_i. These results show no evidence of girls lagging behind boys in academic achievement during the last year of compulsory school. In fact, in all regions, girls have higher GPA scores, although their relative advantage is slightly lower in less developed regions. The results in the second column show that controlling for school fixed effects, parental education, and family income does not change this conclusion. These results corroborate our earlier findings using cognitive skills measured by international tests. The third column extends the specification by including controls for the number of children in the family and mother's employment status, as well as their interaction with the girl dummy. The resulting estimates of within-region gender gaps in GPA scores are very similar to those in the first two columns. Students whose mothers are employed and those with a larger sibship size have lower GPA scores. Larger families may have lower resources for educational investment per child. In less developed countries, female employment may result from tight family budgets. These mothers may also have limited time for children if they also have home responsibilities after work. Importantly, neither sibship size nor mother's employment has an additional negative effect on girls' GPA scores.

The first specification for the HS registration outcome without the controls in Z_i, presented in the third column of Table 10, shows that in all regions, girls are less likely to register for HS than boys in the same region despite having higher GPA scores. These gaps are larger in less developed regions. In the second specification, we control for school fixed effects, parental education, family income, and students' GPA score. As expected, students with higher GPA scores in the final year of compulsory school are more likely to register in HS in the next school year. The gender gap becomes much larger when students with similar GPA scores are compared. In the most developed region, Marmara, the HS registration rate for females is 9 percentage points lower than that for boys. The gap becomes much larger in less developed regions, reaching 17 percentage points in Eastern Anatolia. The third column investigates the role of mother's employment status on HS registration. Families in which the mother is employed may encourage girls' education more. While the coefficient on the dummy variable indicating mother's employment is not significant, its interaction with the *girl* dummy (equal to 1 for female students) is positive and significant. The coefficient indicates that holding family income constant, a female student whose mother is employed is 3 percentage points more likely to register in HS than one whose mother is not. Controlling for mother's employment status, however, barely changes the within-region gender gaps. The last column controls for the number of siblings and its interaction with the girl dummy. As the number of siblings increases, holding family income constant, the resources available per child for educational investment decrease. The negative and significant coefficient on the number of siblings confirms this result, suggesting that each additional sibling reduces the HS registration rate by 1 percentage point for male students. More importantly, the interaction term is also negative and larger in magnitude, suggesting that each additional sibling reduces the HS registration rate by 3 percentage points for female students. Controlling for the number of

siblings explains a significant portion of the within-region gender gap, especially in less developed regions, where the fertility rate is higher. As a result, the difference in the gender gap between more and less developed regions becomes smaller. For example, in the third specification, Eastern Anatolia has about a seven percentage point-higher gender gap than the Marmara region, but this gap decreases to around three percentage points after controlling for the effect of the number of siblings.

4.4 Family income, parental attitudes, and female educational outcomes

Previous sections showed that despite having similar or better test scores and GPAs and similar or higher aspirations for university education in the final year of compulsory school, female students were less likely to register for high school in the following school year. The gap in HS registration is also much more pronounced in less developed regions. This section draws on the 2006 Family Structure Survey to assess the importance of two potential explanations for the emergence of the gender gap in education.

First, the differences in HS registration may be due to differential treatment of boys and girls. Several papers report treatment favoring boys in terms of healthcare, childcare time, and breast-feeding (Basu, 1989; Barcellos et al., 2014; Jayachandran and Kuziemko, 2011). This type of differential treatment may also exist in human capital investments. Families may give priority to the education of sons, especially when they face credit constraints. Families may be more likely to face such credit constraints in less developed regions, where family size is larger. For example, Lancaster et al. (2008) report the existence of a gender bias in educational spending in favor of boys in socially and economically less developed areas of India. Moreover, because of larger family sizes, the opportunity cost of female education that requires time outside the home will be larger. Second, female education may be negatively affected by expectations of a homemaker role for females that discourage their participation in the labor force. In less developed regions, such expectations may be stronger.

A unique feature of the Family Structure Survey is that it includes questions about the educational outcomes of children in a family and questions that capture the social norms of parents. Respondents are asked what age they consider appropriate for marriage for each gender. The survey also asks about parental attitudes toward female employment.[17] Parents that attach a homemaker role to females will be less likely to approve of female employment outside the home and are more likely to believe that daughters should marry at an early age. These beliefs may lead to differential treatment of boys and girls and hold girls back from education. Differential treatment may reveal itself in terms of educational expenditures. In the Indian context, Kingdon (2005) finds that the gender bias in educational resource allocation manifests most substantially via the non-enrollment of girls in education. In this section, we focus on differences in school HS attainment rates between boys and girls. The data also report important background characteristics such as parental education, household income, number of children in the family, the gender of children, and the importance of religion in parents' daily life.

We restrict our sample to children between the ages of 18–24 living with their parents at the time of the survey.[18] Using information on educational attainment, we investigate whether a child has a high school degree or higher. The following logit model is used:

[17]The questions about proper marriage age are "What age range do you consider appropriate for marriage for females?" and "What age range do you consider appropriate for marriage for males?" The question about female employment is "Do you approve of the employment of females as wage/salary workers?"

[18] Some children may have moved out of the house because of marriage or other reasons. The survey does not include information on these children. In the resulting sample, 96% of children are unmarried, while 4% are married but live with their parents.

$$H_i = \alpha_0 + \alpha_1(Female_i * region_i) + \beta_1 Z_1 + \beta_2 Z_2 + \beta_3 Z_3 + u_i \quad (4)$$

where H_i is a dummy variable equal to 1 if individual *i*(child *i*) has a HS degree or more and 0 otherwise. Z_1 includes a set of dummies for the 10 regions of Turkey and an urban dummy.[19] Z_2 includes family background characteristics. It involves dummies for the education of the mother and father (six educational categories each), three dummies for monthly household income (600TL or less, 600TL–1200TL, and over 1200TL), the number of siblings, and the sex ratio of siblings (the number of boys to the total number of living children). The interactions of these variables with a female dummy are also included.

Parental attitudes are captured byZ_3. The first variable, "parental attitudes toward female employment," is a dummy variable that takes a value of 1 if parents approve of female employment and 0 otherwise. The survey asks the respondents that do not approve of female employment the reason why. Among this group, about 64% indicate that the main role of females is childcare and household chores. About 12% indicate that female employment is against traditional values, 12% indicate security concerns in the workplace for females, and 7% indicate that female employment hurts children (the remaining 4% give other reasons). Thus, disapproval for female employment is mainly driven by perceived gender roles among the respondents. The second variable, "parental view on the appropriate age for marriage," is a categorical variable for each gender corresponding to "below age 20," "20 to 24," and "above 24." The third variable is related to the extent that religion is an influential factor in parents' daily life. The responses are captured by a categorical variable referring to "very influential," "influential," and "not influential."[20,21] The last variable refers to parental marriage type, which is a dummy variable that takes a value of 1 if parents' marriage was arranged and the decision for marriage was made by the family, and 0 otherwise. Except for the variable referring to parental view on the appropriate age for marriage, which is asked separately for each gender, we include the interactions of the remaining variables with a female dummy. The questions that refer to the variables in Z_3 were in some cases answered by both parents.[22]When parents respond differently, we take the most negative attitude toward female employment the lowest appropriate age for marriage, and the strongest effect of religion in daily life (e.g., if one of the parents approves of female employment and the other does not, we take the negative view). Values and religious beliefs are likely to be mostly shaped by the time an individual reaches adulthood. Hence, they can be treated as exogenous factors affecting the educational outcomes of children.

We sequentially introduce various controls in equation (4) and present the results in Tables 11a and 11b. Table 11a shows the estimation results for the coefficient vector α_1, which

[19]Given the available regional information in the data, we cannot construct the same regional classification used in earlier sections. The first region, Istanbul, is the reference category in the following analysis.

[20] The question asks "To what extent are your religious beliefs a decisive factor for the following?" The respondents provide separate answers for the following items: (i) Choice of spouse, (ii) Choice of dress, and(iii) choice of food and drinks. For each item, the possible responses are (1) very decisive, (2) decisive, (3) not decisive. We generate the "religion as a decisive factor" variable by creating a categorical variable that takes a value of 1 if the respondent indicates that religion is very decisive for all three items, a value of 2 if religion is decisive for all three items, and a value of 3 if otherwise.

[21] Low educational attainment among females in Muslim countries is often attributed to an inherent bias against educating girls because of religious influences. Marshall (1984) notes the considerable range of variation in female participation within the Muslim world and argues that the religious factor is an insufficient explanation for the disadvantage of females. Rather than comparing individuals with different religious backgrounds (e.g., Christians, Muslims, etc.), this paper examines the effect of religiosity on the female education disadvantage in a country in which 96% of the population report being Muslims. If religious teachings have an effect on female education, it is expected to be stronger among those who are more observant, that is, those for whom religion is a more decisive factor in daily life.

[22] When both parents answered the questions referring to the variables in Z_3, in the majority of cases, parents gave the same answer. For example, for the question regarding the appropriate age for marriage for females when both the mother and father answered, 64% of the time, their answers were identical.

corresponds to within-region gender gaps in HS attainment, while Table 11b presents the remaining coefficient estimates. Specification (1) controls for region dummies and urban status along with region times the female interaction terms, hence corresponding to the raw within-region gender gaps. Region female interaction coefficients are presented starting with the most developed region and moving toward less developed ones. In line with the HS registration results, while there is no gap in HS school attainment in developed regions, a large gap emerges against females in the least developed regions. For Northeast, Mideast, and Southeast Anatolia, the gaps are over 13 percentage points, reaching almost 19 percentage points in Southeast Anatolia. Specifications (2) to (4) show that controlling for parental education, household income, the number of children, and the sibling sex ratio results in even larger within-region gender gaps. In specification (5), however, where we control the number of children, the sibling sex ratio, and their interaction with a female dummy, negative within-region gender gaps disappear for the least developed regions. When specification (6) adds parental education and household income as controls to specification (5), within-region gender gaps in the least developed regions remain insignificant. These results suggest that among family background characteristics, the number of children in the family and the sibling sex ratio, both interacted with a female dummy, have the largest explanatory power for HS completion rates. These results are in line with the results shown in the last column in Table 10 that the number of siblings has a large power for explaining within-region HS registration gaps. In specification (7), we only include variables that pertain to parental values/attitudes (i.e., Z_3), such as attitudes toward female employment and religion in daily life, while omitting other background characteristics. The coefficients for within-region gender gaps for the least developed regions still remain negative, large, and significant. This suggests that parental values/attitudes captured by these variables are not major determinants for the emergence of within-region gender gaps. The final specification controls for all the variables in the model. Conditional on these controls, within-region gender gaps are not statistically different from zero in any region, and there is no statistically significant difference in the gender gap across regions with different levels of development.[23]

Next, we turn to Table 11b for estimates of the other coefficients in equation (4). Parental education coefficients, which are not reported in Table 11b because of their large number, carry the expected signs suggesting a higher HS completion rate for children of more educated parents. Females benefit more from a more educated mother than males, while no difference exists for father's education. Columns (3) and (4) indicate that higher household income leads to a higher HS completion rate, while a higher number of children and a higher fraction of males among children (a higher sibling sex ratio) lead to a lower HS completion rate. In column (5), when number of children and the sibling sex ratio are interacted with a female dummy, both the main effects and those of the interaction terms are negative and significant. These effects persist in column (6) when household income is added to the model.

There is a large body of literature on the effect of sibship size on educational outcomes that recognizes the endogeneity of sibship size. Endogeneity may arise due to potential differences between families in unobserved characteristics of parents, such as preferences. While other studies address reverse causality using an instrumental variable strategy this paper proxies for differences in unobservables by including controls for parental values/attitudes. The negative coefficient on the number of children in the family may reflect that fewer resources are available per child as the number of children in a family increases. Hence, in larger families, parents may not be able to afford to finance the education of all their children, leading to a lower HS completion rate. In addition, as family size increases, children may be increasingly

[23] While the coefficients for more developed regions are of considerable magnitude, they are imprecisely estimated.

expected to contribute to the household income or to help with household chores. This means an increase in the opportunity cost of children's time in school, resulting in lower educational attainment.

Column (7) reports the coefficients of parental values/attitudes. The coefficient estimates for these variables remain similar in column (8) when parental values/attitudes and other background characteristics are included. Hence, we discuss these coefficients based on the estimates reported in column (8). In families where parents do not approve of female employment, there is about 15 percentage points lower probability of finishing HS among females. More importantly, the results show that higher values of parental views on the appropriate age for marriage lead to higher HS completion rates, and this effect is much stronger for females. For example, in families where the parental view of the appropriate age for marriage is 20–24, females' HS completion rate is 9 percentage points higher than the reference category, which is less than 20. This effect is much stronger if the parental view on the appropriate age for marriage is above 24. These results show that parental views on female employment and the appropriate age for marriage are important correlates of HS completion for females. However, as discussed above, parental values/attitudes cannot explain the negative within-region gender gaps in the least developed regions. The number of children and the sibling sex ratio are the most important correlates of the negative gender gaps. Interestingly, in families where the parents had an arranged marriage, the probability of finishing HS is also higher. The coefficient for the interaction of arranged marriage with the female dummy is negative but insignificant, suggesting that the positive effect of arranged marriage on children is smaller among daughters. Parents who had an arranged marriage may be more likely to hold traditional values. The extent to which marital satisfaction and stability influence the environment in which children are brought up may also differ for couples with different marriage types. The cumulative effect of such factors on the educational outcomes of children is found to be positive.[24] Similarly, we find no negative effect of religiosity on educational outcomes. Specification (8) shows that both boys and girls born to parents who report religion to be a very influential factor in their daily life do not have different HS completion rates from those born to parents who report religion to be not influential in their daily lives. These results suggest that parental views that have negative influences on female education, such as views on female employment and the appropriate age for marriage, are cross-cutting across parents with different marriage types and levels of religiosity.

In column (8), the coefficients for the number of children and its interaction with a female dummy remain negative and significant. This is a remarkable result, as it holds even after we include a battery of variables capturing parental values/attitudes. The negative coefficients on number of children and sibling sex ratio suggest that similar to female children, male children are negatively affected by a higher number of children in family, and in particular by a higher fraction of sons among the children. These effects are stronger among females. For the sibling sex ratio, the effect more than doubles. The low explanatory power of parental values/attitudes for within-region gender gaps and the negative effects of the number of children and the sibling sex ratio for both sons and daughters even after controlling for parental values suggests that lower educational outcomes among females are less likely to be due to a son preference. While we cannot rule out discriminatory behavior based on parental preferences, the above results are more consistent with an investment motive, where parents that face credit constraints may allocate more of their resources to their sons if they perceive higher returns on this investment. Decisions on the allocation of educational expenditures in these cases result in zero educational

[24] Arranged marriage and the other parental values/attitudes captured in the model may be correlated. However, the results regarding arranged marriage are robust to the exclusion of parental views on female employment and the appropriate age for marriage from the model.

expenditure for some children, especially females, in the form of HS non-attendance following the end of compulsory schooling. As a result, a lower registration rate in HS and lower HS degree attainment is observed among females.

4.5 The gender gap in achievement, post-compulsory schooling

Different dropout rates between boys and girls during the transition from compulsory school to high school indicates that girls and boys may select differently into higher education. This section investigates gender differences among 15-year-olds using PISA data, where most Turkish students attend their first or second year of high school at this age.

The same specifications in model (1) are estimated for the national level, and the results are presented in Table 12. Without any control, the gender gap favors girls in reading and science but is against girls in mathematics. As the last column indicates, when school fixed effects and socioeconomic background are controlled for, the gender gap still favors females in reading, is against girls in mathematics, and shows no significant difference in science. These results are similar to evidence in OECD countries, where in most countries, boys perform better than girls in mathematics, girls outperform boys in reading, and no significant gender differences exist in science (OECD, 2011a).

Table 13 shows the gender gap across regions controlling for school fixed effects and socioeconomic background. The first column of Table 13, reading scores, shows the within-region gender gap to be in favor of girls in all regions. Importantly, at age 15, the gender gap in favor of girls is not larger in more developed regions. The second column of Table 13 shows the gender gap in math scores against females in all seven regions, whereas for 8th graders, there was such a gap in only three regions (Table 7). The gaps in science for age 15 are mostly zero, similar to the results for 8th graders shown in Table 7. Importantly, for the reading, mathematics and science scores, there is no evidence of the gender gap differing by the regional level of development.

5. Discussion

This paper investigated the gender gap in achievement at different stages of education across regions with different levels of development. The gender gap in educational attainment across regions is characterized by much larger gaps in less developed regions, similar to the differences observed across countries that differ in the level of income.

We first analyzed the regional variation in the gender gap in achievement and aspirations for further education during compulsory school. In terms of grade 4 reading scores, girls perform better than boys in all regions except one, where they perform similarly. The gender gaps for grade 8 math and science outcomes within regions are mostly zero. Interestingly, although there is no evidence of a larger gender gap against girls in less developed regions in the final year of compulsory school, the aspirations of girls for higher education are different across regions at this education stage, with relatively lower aspirations in less developed regions.

Next, the paper investigated the transition from the end of compulsory school to high school. Despite similar achievement levels in the final year of compulsory school across regions, we find a large gender gap against girls in terms of HS registration and HS attainment in the less developed regions. The analysis provides important insights regarding the effect of family background characteristics on the emergence of an education gender gap. We find that while parental attitudes -that disapprove female employment and consider younger ages as the proper age for female marriage- have a negative influence on female education beyond compulsory school, they play a relatively small role in the emergence of a gender gap. The religiosity of parents, on the other hand, is found to have no significant effect on gender gap. We find that the higher negative effect of sibship size is the main driver of the emergence of education

gender gaps in less developed regions. These results are consistent with resource-constrained families giving priority to males for further education.

Finally, the paper explored the achievement gap at age 15, where students are mostly in their first or second year of high school. These results indicate a within-region gender gap in favor of girls in terms of reading, a gap in favor of boys in math, and no significant gap in science. Moreover, in the first few years of high school following dropout decisions, the within-region gender gap in achievement is similar across regions with different development levels. This result is interesting since the dropout rate among girls relative to boys is much higher in less developed regions. If higher dropout rates in less developed regions work as a screening mechanism during school continuation decisions that allowed more able girls to enroll in high school, girls at the high school level would be expected to display higher relative performance in less developed regions. The absence of such a pattern supports the conclusion that decisions to continue with high school education for girls are not influenced by student success or ability, pointing rather to other factors that may be responsible for the higher school dropout rates and the resulting lower education levels among females in less developed regions. The above results suggest that efforts to improve the educational outcomes of females that focus on the transition from the end of compulsory school to the next level of education may be especially fruitful.

References

Abu-Ghaida, D. and S. Klasen (2004),"The Costs of Missing the Millennium Development Goal on Gender Equity," World Development 32(7): 1075–1107.

Algan, Y. and P. Cahuc (2010), "Inherited Trust and Growth," American Economic Review 100(5): 2060–92.

Anderson, K.H., King, E.M., Wang, Y. (2002),"Market Returns, Transfers, and Demand for Schooling in Malaysia, 1976–1989," *Journal of Development Studies* 39(3): 1–28.

Antecol, H, (2000),"An Examination of Cross-Country Differences in the Gender Gap in Labor Force Participation Rates," *Labour Economics* 7(4): 409–26.

Aslam, M. (2009), "Education Gender Gaps in Pakistan: Is the Labor Market to Blame?" *Economic Development and Cultural Change,* University of Chicago Press, 57(4): 747–84.

Assaad, R., D. Levison, and N. Ziban (2010), "The Effect of Domestic Work on Girls' Schooling: Evidence from Egypt," *Feminist Economics* 16(1): 79–128.

Barcellos, Silvia Helena, Leandro S. Carvalho, and Adriana Lleras-Muney (2014),"Child Gender and Parental Investments in India: Are Boys and Girls Treated Differently?" *American Economic Journal: Applied Economics* 6(1): 157–89.

Barro, Robert and Jong-Wha Lee, "A New Data Set of Educational Attainment in the World, 1950-2010," forthcoming, *Journal of Development Economics*.

Basu, A. M. (1989), "Is Discrimination in Food Really Necessary for Explaining Sex Differentials in Childhood Mortality?" *Population Studies* 43(2): 193–210.

Bedi, A.S. (1997), 'The Importance of School Quality as Determinant of Earnings in a Developing Country: Evidence from Honduras," *International Journal of Educational Development* 17(4): 427–37.

Bedi, A.S., Edwards, J.H.Y. (2002),"The Impact of School Quality on Earnings and Educational Returns–Evidence from a Low-income Country," *Journal of Development Economics* 68(1): 157–85.

Behrman, J.R. and N. Birdsall (1983), "The Quality of Schooling: Quantity Alone Is Misleading," *American Economic Review* 73(5): 928–46.

Behrman, J. and A. Deolalikar (1988),"Health and Nutrition." In *Handbook of Development Economics*, Vol. 1, ed. Chenery, H. and T. Srinivasan. Amsterdam, North Holland: 631–704.

Breen, R. and J.O. Jonsson (2000),"Analyzing Educational Careers: A Multinomial Transition Model," *American Sociological Review* 65(5): 754–72.

Card, D. and A. Krueger (1996), "Labor Market Effects of School Quality: Theory and Evidence," in G. Burtless (ed.), *The Link Between Schools, Student Achievement and Adult Success*, Washington, DC: Brookings Institution, pp. 97–140.

Connelly, R. and Zheng, Z. (2003),"Determinants of School Enrollment and Completion of 10 to 18 year-olds in China," *Economics of Education Review* 22(4), 379–88.

Dancer, D., Rammohan, A. and Smith, M. D. (2008), "Infant Mortality and Child Nutrition in Bangladesh," *Health Economics* 17: 1015–35.

Danzinger, N. (1983), “Sex-related Differences in the Aspirations of High School Students,” *Sex Roles* 9: 683–94.

Dee, T. (2007),“Teachers and the Gender Gaps in Student Achievement,” *Journal of Human Resources* 42: 528–54.

Duncan, G. J., J. Boisjoly and K. M. Harris (2001), “Sibling, Peer, Neighbor, and Schoolmate Correlations as Indicators of the Importance of Context for Adolescent Development,” *Demography* 38(3): 437–47.

Duflo, Esther (2011), “Women Empowerment and Economic Development,” NBER Working Paper No. 17702.

Fortin, N. (2005), “Gender Role Attitudes and Women’s Labor Market Outcomes Across OECD Countries,” *Oxford Review of Economic Policy* 21: 416–38.

Fortin, N. (2009), “Gender Role Attitudes and Women’s Labor Market Participation: Opting-Out, AIDS, and the Persistent Appeal of Housewifery,” mimeo, University of British Columbia.

Glewwe P. (2000),“Why Does Mother’s Schooling Raise Child Health in Developing Countries? Evidence from Morocco,” *Journal of Human Resources* XXXIV: 124–59.

Goldin, C., L. F. Katz, and I. Kuziemko (2006),“The Homecoming of American College Women: The Reversal of the College Gender Gap,” *Journal of Economic Perspectives* 133–56.

Grant, M. and J. Behrman (2010), “Gender Gaps in Educational Attainment in Less Developed Countries,” *Population and Development Review*, 36(1): 71–89.

Hansen, M.N. (1996),“Social and Economic Inequality in the Educational Career: Do the Effects of Social Background Characteristics Decline?” *European Sociological Review* 13(3): 305–21.

Hanushek, Eric A. and Ludger Woessmann (2008), “The Role of Cognitive Skills in Economic Development,” *Journal of Economic Literature* 46(3): 607–68.

Heckman, James J. (2004), “Invest in the Very Young,” Centre of Excellence for Early Childhood Development; Montreal, Quebec. http://www.excellenceearlychildhood.ca/documents/HeckmanANG.pdf.

Hossler, D. and Stage F. K. (1992), “Family and High School Experience Influences on the Postsecondary Educational Plans of Ninth-Grade Students,” *American Educational Research Journa*l, 29: 425–51.

Jayachandran, S. and I. Kuziemko(2011), “Why Do Mothers Breastfeed Girls Less than Boys? Evidence and Implications for Child Health in India,” *The Quarterly Journal of Economics*, Oxford University Press 126(3): 1485–538.

King, E. M. and M. A. Hill (1993), *Women’s Education in Developing Countries: Barriers, Benefits, and Policies*, John Hopkins University Press, USA.

Kingdon, G. G. (1998),“Does the Labour Market Explain Lower Female Schooling in India?” *The Journal of Development Studies*, Taylor and Francis Journals 35(1): 39–65.

Kingdon G.G. (2002),“Women, Education and Development,” in *Reason and Revelation: Studies in the Babi and Baha’i Religions*, 13, Los Angeles: Kalimat Press.

Kingdon, Geeta Gandhi (2005),"Where Has All the Bias Gone? Detecting Gender Bias in the Intrahousehold Allocation of Educational Expenditure," *Economic Development and Cultural Change* 53(2): 409–51.

Kirdar, Murat (2009),"Explaining Ethnic Disparities in School Enrollment in Turkey," *Economic Development and Cultural Change* 57(2): 297–333.

Kirdar, Murat G. and Dayıoğlu, Meltem and Koç, İsmet (2009), The Impact of Schooling on the Timing of Marriage and Fertility: Evidence from a Change in Compulsory Schooling Law, MPRA Paper No 13410.

Kirdar, Murat G. and Dayıoğlu, Meltem and Koç, İsmet (2014), Does Longer Compulsory Education Equalize Schooling by Gender and Rural/Urban Residence?, IZA DP no. 7939.

Lam, D. and S. Duryea. (1999),"Effects of Schooling on Fertility, Labour Supply and Investments in Children, with Evidence from Brazil," *The Journal of Human Resources* 34(1): 160–92.

Levison, Deborah and Moe, Karine (1998),"Household Work as a Deterrent to Schooling: An Analysis of Adolescent Girls in Peru," *Journal of Developing Areas* 32: 339–56.

MacBryane, P. S. (1987), "Educational and Occupational Aspirations of Rural Youth: A Review of the Literature," *Research in Rural Education* 4(3):135–141.

Machin, S. and S. McNally (2005),"Gender and Student Achievement in English Schools," *Oxford Review of Economic Policy*, Oxford University Press 21(3): 357–72.

Mare, R. (1980),"Social Background and School Continuation Decisions," *Journal of the American Statistical Association* 75(370): 295–305.

Marshall, Susan E. (1984),"Politics and Female Status in North Africa: A Reconsideration of Development Theory," *Economic Development and Cultural Change* 32(3): 499–524.

Martin, Michael O., Ina V.S. Mullis and Pierre Foy (2008a), Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College. TIMSS 2007 International Mathematics Report: Findings from IEA's Trends in International Mathematics and Science Study at the Fourth and Eighth Grades.

Martin, M.O., Mullis, I.V.S., & Foy, P. (2008b). Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College. TIMSS 2007 International Science Report: Findings from IEA's Trends in International Mathematics and Science Study at the Fourth and Eighth Grades

Ministry of National Education (2010), National Education Statistics, Formal Education 2009-2010.

Moffitt, R. (1996),"Symposium on School Quality and Educational Outcomes," *Review of Economics and Statistics* 78: 559–61.

OECD (2011a), Report on the Gender Initiative: Gender Equality in Education, Employment and Entrepreneurship, OECD Publishing.

OECD (2011b), Against the odds: Disadvantaged students who succeed in schools, OECD Publishing.

Orazem, P. and G. L. Victoria(2004),"Child Labour, School Attendance, and Performance: A Review," Iowa State Department of Economics Working Paper #04001. Ames IA: Iowa State University.

Osili, U. and B. Long (2008),"Does Female Schooling Reduce Fertility? Evidence from Nigeria," *Journal of Development Economics* 87(1): 57–75.

Pekkarinen, Tuomas (2012), Gender Differences in Education, IZA Discussion Paper 6390. PIRLS (2001), Progress in International Reading Literacy Study 2001.

Psacharopoulos, G. (1997), "Child Labor versus Education Attainment: Some Evidence from Latin America," *Journal of Population Economics* 10: 377–86.

Rawal, S., and G. Kingdon (2010),"Akin to My Teacher: Does Caste, Religious, or Gender Distance between Student and Teacher Matter? Some Evidence from India," London: Institute of Education, University of London.

Rose, P. (1995), "Female Education and Adjustment Programmes: A Cross-country Statistical Analysis," *World Development*23 (11): 1931–49.

Schoon, I., Martin, P. and Ross, A. (2007), "Career Transitions in Times of Social Change: His and Her Story," *Journal of Vocational Behavior* 70: 78–96.

Schultz, T.P. (1994), Human Capital Investment in Women and Men: Micro and Macro Evidence of Economic Returns, Occasional Paper 44, International Centre for Economic Growth, San Francisco.

Schultz, T.P. (2002), "Why Governments Should Invest More to Educate Girls," *World Development* 30(2): 207–25.

Strauss J. and D. Thomas (1995), "Human Resources: Empirical Modelling of Household and Family Decisions," in J. Behrman and T.N. Srinivasan (eds.), *Handbook of Development Economics*, Vol III.

Tansel, A. (1997), Schooling Attainment, Parental Education, and Gender in Côte d'Ivoire and Ghana," *Economic Development and Cultural Change* 45(4): 825–56.

Tansel, A. (2002), "Determinants of School Attainment of Boys and Girls in Turkey: Individual, Household and Community Factors," *Economics of Education Review* 21: 455–70.

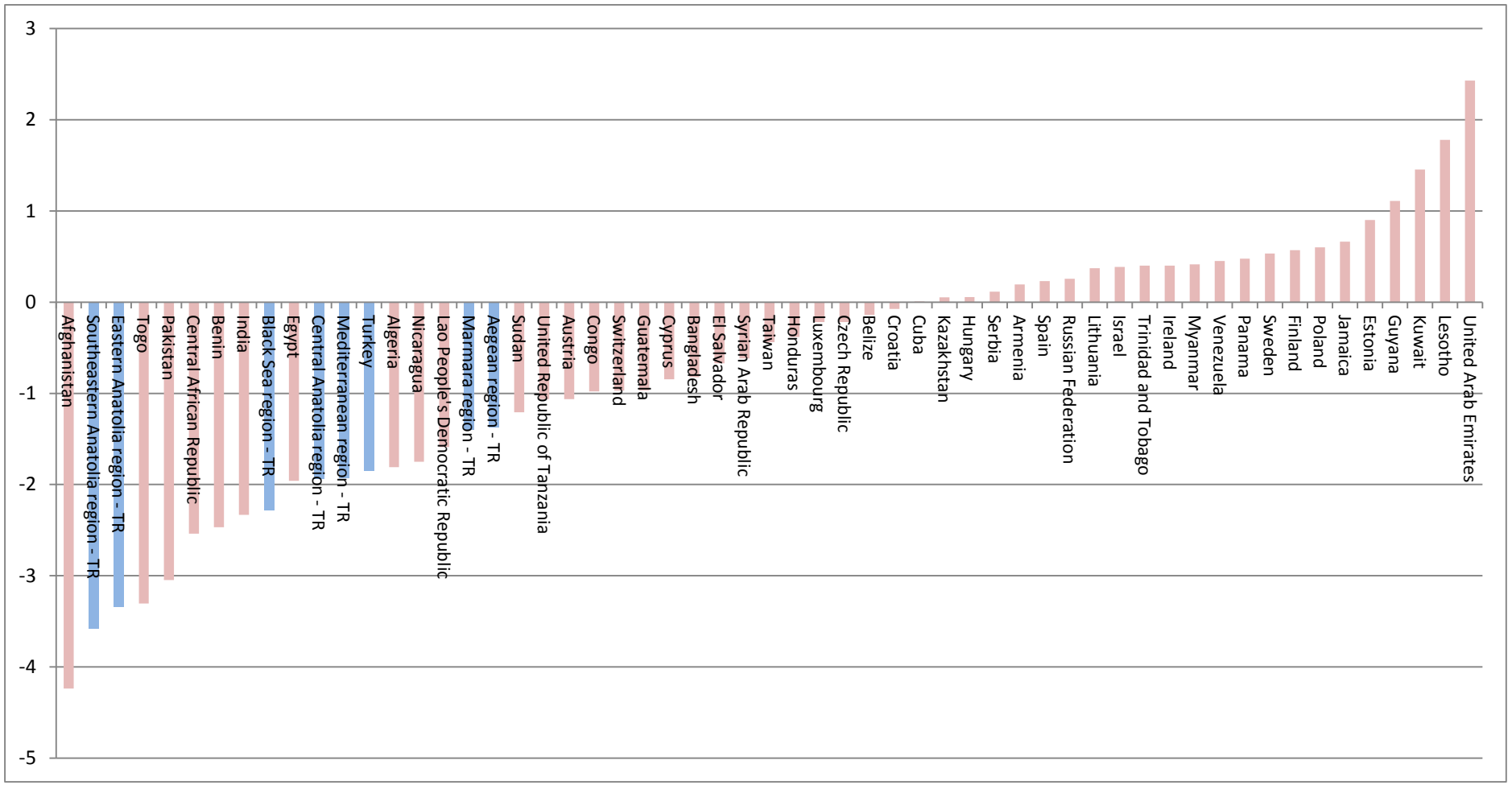
Trice, A. D. and R. King (1991), "Stability of Kindergarten Children's Career Aspirations," *Psychological Reports* 68(3c): 1378.

Woessmann, L. (2003), "Schooling Resources, Educational Institutions and Student Performance: the International Evidence," *Oxford Bulletin of Economics and Statistics*, 65(2): 117–70.

World Bank (1999), Education Sector Strategy, Human Development Network Series, World Bank, Washington, DC, 1999.

World Bank (2012), World Development Report 2012: Gender Equality and Development.

Figure 1: Gender Difference Education Levels across Countries and Turkish Regions, 2010



Note: This figure shows the difference in years of schooling between men and women age 25–64 within each country/Turkish region. Country-level differences are based on the Barro–Lee dataset, which includes 146 countries. We compute the education gender difference for each country. For each decile of the education gender difference distribution, the above figure reports outcomes for a random 1-in-3 sample for ease of presentation. The regional differences for Turkey are based on the HLFS 2000 survey.

Figure 2: Map of Turkey

Table 1: Educational Attainment and Enrollment Rates, National Level

	All	Males	Females	Gender Gap (Females–Males)
A. Educational Attainment				
Primary education or less	67.8	61.2	74.7	13.6
High school	21.2	26.1	16.1	-10.0
More than high school	11.0	12.7	9.2	-3.6
B. Enrollment Rates, 2008-09				
Primary education	96.5	97.0	96.0	-1.0
High school	58.5	60.6	56.3	-4.3
Higher education	27.7	29.4	25.9	-3.5

Notes: Source for Panel A: 2000 Turkish Census, authors' calculations, Age 24–30;
Source for Panel B: Ministry of Education, National Statistics

Table 2a: Educational Distribution by Region, Differences from the National Level

	Eight years of schooling or less	High school	More than high school	GNP per capita
Marmara	-2.8	1.4	1.5	4315
Aegean	1.4	-1.1	-0.3	3443
Central Anatolia	-5.0	2.5	2.5	2964
Mediterranean	2.3	-0.8	-1.5	2769
Black Sea	1.6	0.1	-1.7	2227
Southeast Anatolia	9.9	-6.3	-3.7	1541
Eastern Anatolia	3.0	-1.1	-1.9	1363

Table 2b: Within-Region Gender Gap by Level of Educational Attainment

	Eight years of schooling or less	High school	More than high school
Marmara	9.1	-7.1	-2.1
Aegean	9.5	-7.5	-2.0
Central Anatolia	15.6	-12.0	-3.6
Mediterranean	11.3	-7.9	-3.5
Black Sea	17.4	-12.9	-4.5
Southeast Anatolia	19.3	-13.2	-6.2
Eastern Anatolia	23.0	-16.0	-7.0

Notes: The tables are for individuals age 24–30. The sources are: (i) for schooling variables, the 2000 Turkish Census, authors' calculation, (ii) and for GNP per capita in US dollars for 2000, the Turkish Institute of Statistics.

Table 3: National-Level Achievement Gaps during Compulsory School

	(1)	(2)	(3)	(4)
Grade 4Reading	0.235	0.215	0.209	0.209
	(0.032)***	(0.024)***	(0.024)***	(0.023)***
Grade 8 Math	0.012	-0.061	-0.074	-0.090
	(0.034)	(0.026)**	(0.025)***	(0.024)***
Grade 8 Science	0.061	-0.011	-0.028	-0.042
	(0.034)*	(0.026)	(0.024)	(0.023)*
School fixed effects		Yes	Yes	Yes
Parental education			Yes	Yes
Number of books at home				Yes

Notes: The coefficients show how much higher girls' performance is compared to boys. The coefficients are standardized. In parentheses, we provide cluster-robust standard errors. Grade 4 Reading results use the PIRLS 2001 dataset. Grade 8 Math and Science results use the TIMSS 2007 dataset. School fixed effects include dummies for each school in each sample. Parents' education includes dummies for each level of parental education (standardized as primary, lower secondary, higher secondary, and higher education). Number of books at home is a categorical variable that distinguishes pupils at different levels (fewer than 25 books, between 25 and 100 books, and more than 100 books at home).

*Statistical significance at the 10% level; ** Statistical significance at the 5% level; ***Statistical significance at the 1% level.

Table 4: Regional Means

	Grade 4 Reading	Grade 8 Math	Grade 8 Science
Marmara	0.127	0.033	0.058
	(0.025)	(0.019)	(0.019)
Aegean	0.120	0.192	0.163
	(0.044)	(0.036)	(0.035)
Central Anatolia	0.127	0.193	0.181
	(0.031)	(0.026)	(0.025)
Mediterranean	0.073	0.044	0.050
	(0.037)	(0.031)	(0.030)
Black Sea	0.069	-0.081	-0.025
	(0.045)	(0.029)	(0.029)
Southeast Anatolia	-0.608	-0.389	-0.442
	(0.036)	(0.027)	(0.027)
Eastern Anatolia	-0.267	-0.124	-0.147
	(0.056)	(0.037)	(0.037)

Notes: This table shows the regional means of test scores. In parentheses, we provide cluster-robust standard errors. For example, in the Marmara region, the average z-score for reading is 0.127, while in Southeast Anatolia, the score is -0.608. Grade 4 Reading results use the PIRLS 2001 dataset. Grade 8 Math and Science results use the TIMSS 2007 dataset.

Table 5: Female Gender Gap by Region Relative to All Males

	Grade 4 Reading	Grade 8 Math	Grade 8 Science
Marmara	0.374	0.029	0.101
	(0.082)***	(0.097)	(0.091)
Aegean	0.346	0.174	0.205
	(0.155)**	(0.200)	(0.195)
Central Anatolia	0.339	0.263	0.286
	(0.098)***	(0.123)**	(0.110)***
Mediterranean	0.292	-0.046	0.015
	(0.109)***	(0.169)	(0.161)
Black Sea	0.287	-0.120	-0.017
	(0.100)***	(0.148)	(0.150)
Southeast Anatolia	-0.470	-0.300	-0.300
	(0.098)***	(0.147)**	(0.135)**
Eastern Anatolia	-0.055	-0.149	-0.134
	(0.197)	(0.212)	(0.196)

Notes: In parentheses, we provide cluster-robust standard errors. Grade 4 Reading results use the PIRLS 2001 dataset. Grade 8 Math and Science results use the TIMSS 2007 dataset. *Statistical significance at the 10% level; ** Statistical significance at the 5% level; ***Statistical significance at the 1% level.

Table 6: Within-Region Gender Gap, Baseline Estimation

	Grade 4 Reading	Grade 8 Math	Grade 8 Science
Marmara	0.259	-0.018	0.029
	(0.052)***	(0.054)	(0.054)
Aegean	0.241	-0.047	0.028
	(0.079)***	(0.138)	(0.132)
Central Anatolia	0.192	0.122	0.149
	(0.074)**	(0.054)**	(0.054)***
Mediterranean	0.218	-0.175*	-0.116
	(0.065)***	(0.106)	(0.099)
Black Sea	0.208	-0.083	-0.039
	(0.090)**	(0.100)	(0.094)
Southeast Anatolia	0.047	0.141*	0.193**
	(0.080)	(0.079)	(0.086)
Eastern Anatolia	0.154	-0.053	-0.027
	(0.144)	(0.085)	(0.072)

Notes: The reported coefficients refer to how much the test scores for girls in a region differ from the scores of boys in the same region. Grade 4 Reading results use the PIRLS 2001 dataset. Grade 8 Math and Science results use the TIMSS 2007 dataset.
*Statistical significance at the 10% level; ** Statistical significance at the 5% level; ***Statistical significance at the 1% level.

Table 7: Within-Region Gender Gap, With Controls

	Grade 4 Reading	Grade 8 Math	Grade 8 Science
Marmara	0.290	-0.064	-0.017
	(0.037)***	(0.043)	(0.043)
Aegean	0.204	-0.100	-0.009
	(0.045)***	(0.085)	(0.075)
Central Anatolia	0.219	0.041	0.074
	(0.069)***	(0.044)	(0.045)*
Mediterranean	0.249	-0.283	-0.228
	(0.053)***	(0.070)***	(0.066)***
Black Sea	0.156	-0.148	-0.114
	(0.082)*	(0.065)**	(0.069)*
Southeast Anatolia	0.014	-0.103	-0.067
	(0.067)	(0.052)**	(0.062)
Eastern Anatolia	0.116	-0.071	-0.031
	(0.063)*	(0.071)	(0.074)
School fixed effects	Yes	Yes	Yes
Parental education	Yes	Yes	Yes
Number of books at home	Yes	Yes	Yes

Notes: Specifications for the within-region gender gap with controls. In parentheses, we provide cluster-robust standard errors. Grade 4 Reading results use the PIRLS 2001 dataset. Grade 8 Math and Science results use the TIMSS 2007 dataset. School fixed effects include dummies for each school in each sample.Parental education includes dummies for each level of parental education (standardized as primary, lower secondary, higher secondary, and higher education). Numberof books at home is a categorical variable that distinguishes pupils at different levels (fewer than 25 books, between 25 and 100 books, and more than 100 books at home).
*Statistical significance at the 10% level; ** Statistical significance at the 5% level; ***Statistical significance at the 1% level.

Table 8: Child Labor and the Gender Gap in Achievement, Grade 8 Science Scores

	(1)	(2)	(3)	(4)
Marmara	-0.017	0.018	-0.074	-0.047
	(0.043)	(0.044)	(0.043)*	(0.045)
Aegean	-0.009	0.008	-0.077	-0.063
	(0.075)	(0.074)	(0.078)	(0.076)
Central Anatolia	0.074	0.095	0.025	0.030
	(0.045)*	(0.045)**	(0.040)	(0.039)
Mediterranean	-0.228	-0.191	-0.287	-0.258
	(0.066)***	(0.065)***	(0.059)***	(0.062)***
Black Sea	-0.114	-0.088	-0.145	-0.125
	(0.069)*	(0.063)	(0.068)**	(0.065)
Southeast Anatolia	-0.067	-0.021	-0.198	-0.155
	(0.062)	(0.064)	(0.051)***	(0.054)***
Eastern Anatolia	-0.031	-0.002	-0.055	-0.043
	(0.074)	(0.079)	(0.077)	(0.078)
Working at home				
Less than 1 hour		0.056		0.075
		(0.026)**		(0.025)***
1–2 hours		-0.089		-0.066
		(0.041)**		(0.040)*
2–4 hours		-0.133		-0.087
		(0.060)**		(0.057)
More than 4 hours		-0.385		-0.326
		(0.043)***		(0.043)***
Working at a paid job				
Less than 1 hour			-0.611	-0.616
			(0.070)***	(0.070)***
1–2 hours			-0.569	-0.541
			(0.079)***	(0.078)***
2–4 hours			-0.623	-0.562
			(0.096)***	(0.103)***
More than 4 hours			-0.441	-0.417
			(0.059)***	(0.060)***
School fixed effects	Yes	Yes	Yes	Yes
Parental education	Yes	Yes	Yes	Yes
	Yes	Yes	Yes	Yes

Notes: In parentheses, we provide cluster-robust standard errors. Grade 8 Science results use the TIMSS 2007 dataset. Specifications: (1) school fixed effects, parental education, and number of books at home. (2) adds hours of work at home, (3) adds hours of work for pay, and (4) adds hours work at home and for pay. School fixed effects include dummies for each school in each sample.Parental education includes dummies for each level of parental education (standardized as primary, lower secondary, higher secondary, and higher education). Number of books at home is a categorical variable that distinguishes pupils at different levels (fewer than 25 books, between 25 and 100 books, and more than 100 books at home).

*Statistical significance at the 10% level; ** Statistical significance at the 5% level; ***Statistical significance at the 1% level.

Table 9: Aspirations to Finish University Education, Grade 8

	Regional mean	Gender gap relative to all males	Gender gap within regions			
			(1)	(2)	(3)	(4)
Without "I don't know"						
Marmara	0.79	0.057	0.071	0.099	0.071	0.035
	(0.01)	(0.022)***	(0.017)***	(0.026)***	(0.020)***	(0.008)***
Aegean	0.83	0.101	0.101	0.147	0.110	0.054
	(0.01)	(0.032)***	(0.031)***	(0.039)***	(0.032)***	(0.012)***
Central Anatolia	0.84	0.127	0.129	0.212	0.159	0.069
	(0.01)	(0.022)***	(0.018)***	(0.022)***	(0.019)***	(0.010)***
Mediterranean	0.84	0.055	-0.004	-0.045	-0.019	0.020
	(0.01)	(0.042)	(0.033)	(0.053)	(0.039)	(0.013)
Black Sea	0.80	0.098	0.114	0.164	0.126	0.062
	(0.01)	(0.029)***	(0.028)***	(0.051)***	(0.039)***	(0.015)***
Southeast Anatolia	0.79	0.072	0.083	0.085	0.042	0.016
	(0.01)	(0.027)***	(0.026)***	(0.039)**	(0.043)	(0.016)
Eastern Anatolia	0.86	0.072	-0.003	0.014	0.011	0.024
	(0.02)	(0.037)**	(0.044)	(0.055)	(0.045)	(0.017)
With "I don't know"						
Marmara	0.65	0.054	0.061	0.068	0.048	0.037
	(0.01)	(0.031)*	(0.022)***	(0.027)**	(0.026)*	(0.018)***
Aegean	0.69	0.125	0.131	0.178	0.171	0.131
	(0.01)	(0.073)***	(0.061)**	(0.055)***	(0.049)***	(0.026)***
Central Anatolia	0.73	0.179	0.154	0.220	0.184	0.121
	(0.01)	(0.034)***	(0.028)***	(0.034)***	(0.029)***	(0.019)***
Mediterranean	0.65	-0.001	-0.041	-0.114	-0.116	-0.042
	(0.02)	(0.056)	(0.047)	(0.060)**	(0.057)**	(0.041)
Black Sea	0.67	0.101	0.112	0.130	0.111	0.097
	(0.02)	(0.050)**	(0.052)**	(0.073)*	(0.070)	(0.042)***
Southeast Anatolia	0.57	0.000	0.075	0.026	-0.017	-0.005
	(0.01)	(0.053)	(0.036)**	(0.048)	(0.049)	(0.030)
Eastern Anatolia	0.70	0.050	-0.034	-0.002	-0.012	0.006
	(0.02)	(0.066)	(0.048)	(0.046)	(0.048)	(0.040)
School fixed effects				Yes	Yes	Yes
Parental education					Yes	Yes
					Yes	Yes
Math and science score						Yes

Notes: In parentheses, we provide cluster-robust standard errors. Grade 8 Science results use the TIMSS 2007 dataset. The first group of results do not include students who answered "I don't know" concerning their future aspirations to continue schooling. The second group of results considers that students who answered "I don't know" are those who will not continue with university education. Specifications: (1) without controls, (2) school fixed effects, and (3) school fixed effects, parental education, and number of books at home. School fixed effects include dummies for each school in each sample. Parental education includes dummies for each level of parental education (standardized as primary, lower secondary, higher secondary, and higher education). Number of books at home is a categorical variable that distinguishes pupils at different levels (fewer than 25 books, between 25 and 100 books, and more than 100 books at home).*Statistical significance at the 10% level; ** Statistical significance at the 5% level; ***Statistical significance at the 1% level.

Table 10: Within-Region Gender Gap in Grade 8 GPA and HS Registration, 2007–08 Grad. Cohort

	GPA			Registered in HS			
	(1)	(2)	(3)	(1)	(2)	(3)	(4)
Marmara	0.44***	0.44***	0.43***	-0.03***	-0.09***	-0.10***	-0.06***
	(0.01)	(0.01)	(0.02)	(0.00)	(0.01)	(0.01)	(0.01)
Aegean	0.46***	0.44***	0.44***	-0.02**	-0.09***	-0.10***	-0.06***
	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
Central Anatolia	0.45***	0.45***	0.44***	-0.03***	-0.10***	-0.11***	-0.06***
	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
Mediterranean	0.47***	0.46***	0.45***	-0.03***	-0.11***	-0.12***	-0.07***
	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
Black Sea	0.38***	0.39***	0.38***	-0.08***	-0.14***	-0.15***	-0.10***
	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
Southeastern Anatolia	0.43***	0.44***	0.41***	-0.07***	-0.17***	-0.18***	-0.08***
	(0.02)	(0.02)	(0.03)	(0.01)	(0.01)	(0.01)	(0.01)
Eastern Anatolia	0.34***	0.33***	0.31***	-0.07***	-0.17***	-0.17***	-0.09***
	(0.02)	(0.02)	(0.03)	(0.01)	(0.01)	(0.01)	(0.01)
GPA					0.15***	0.15***	0.15***
					(0.00)	(0.00)	(0.00)
Mother employed			-0.04***			-0.00	-0.00
			(0.01)			(0.01)	(0.01)
(Mother employed)*female			-0.02			0.03***	0.02***
			(0.02)			(0.01)	(0.01)
Number of siblings			-0.03***				-0.01***
			(0.00)				(0.00)
(Number of siblings)*female			0.01**				-0.02***
			(0.00)				(0.00)
Constant	3.69***	3.26***	3.36***	0.80***	0.12***	0.13***	0.19***
	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.02)
School fixed effects		Yes	Yes		Yes	Yes	Yes
Parental education		Yes	Yes		Yes	Yes	Yes
Family income		Yes	Yes		Yes	Yes	Yes
Observations	72,874	72,286	71,191	72,874	72,286	71,191	71,191
R-squared	0.07	0.39	0.39	0.01	0.44	0.44	0.45

Notes: The analysis is based on a random sample of students who were in grade 8 in the 2007–2008 school year. The data are from the administrative records of the Ministry of Education. For the first two columns, the dependent variable is student. The dependent variable in the second column is whether a student was registered in high school in the 2008–2009 school year. School fixed effects include dummies for each school. Parental education includes dummies for each level of parental education (11 categories). Family income includes five categories. All results are from linear regression models. High school registration is modeled as a linear model because of the large number of school fixed effects. In parentheses, we provide cluster-robust standard errors. *Statistical significance at the 10% level; ** Statistical significance at the 5% level; ***Statistical significance at the 1% level.

Table 11a: HS Completion and Parental Attitudes, Marginal Effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Marmara region	0.022	-0.001	-0.015	-0.049	0.146**	0.107	-0.059	0.082
	(0.037)	(0.101)	(0.049)	(0.043)	(0.070)	(0.124)	(0.058)	(0.137)
Agean region	0.042	0.004	-0.000	-0.006	0.174**	0.125	-0.032	0.098
	(0.052)	(0.109)	(0.060)	(0.057)	(0.071)	(0.123)	(0.071)	(0.138)
West Anatolia	0.016	-0.054	-0.025	-0.049	0.151*	0.080	-0.019	0.075
	(0.053)	(0.113)	(0.063)	(0.059)	(0.078)	(0.136)	(0.072)	(0.147)
Mediterranean	0.047	0.003	0.022	0.021	0.214***	0.155	-0.005	0.144
	(0.052)	(0.108)	(0.059)	(0.059)	(0.070)	(0.118)	(0.074)	(0.130)
Middle Anatolia	0.097	0.102	0.072	0.034	0.223***	0.216**	0.025	0.189
	(0.063)	(0.105)	(0.071)	(0.074)	(0.075)	(0.103)	(0.086)	(0.121)
West Blacksea	0.055	-0.011	0.013	-0.021	0.166**	0.119	-0.024	0.097
	(0.069)	(0.122)	(0.079)	(0.078)	(0.084)	(0.132)	(0.087)	(0.144)
East Blacksea	0.062	0.039	0.030	0.011	0.198**	0.158	0.061	0.173
	(0.071)	(0.119)	(0.080)	(0.078)	(0.080)	(0.124)	(0.085)	(0.127)
Northeast Anatolia	-0.137**	-0.140	-0.150**	-0.192***	0.054	0.036	-0.170**	0.032
	(0.066)	(0.121)	(0.073)	(0.069)	(0.105)	(0.155)	(0.078)	(0.164)
Mideast Anatolia	-0.155**	-0.161	-0.191***	-0.209***	0.043	0.014	-0.233***	-0.027
	(0.064)	(0.114)	(0.068)	(0.067)	(0.107)	(0.153)	(0.074)	(0.167)
Southeast Anatolia	-0.189***	-0.220**	-0.236***	-0.223***	0.061	-0.003	-0.192***	0.015
	(0.052)	(0.100)	(0.054)	(0.055)	(0.107)	(0.155)	(0.068)	(0.163)
Region dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Urban dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Parental education		Yes				Yes		Yes
(Parental education)*female		Yes				Yes		Yes
Household income level dummies			Yes			Yes		Yes
(Household income level dummies)*female			Yes			Yes		Yes
No. of children in family				Yes	Yes	Yes		Yes
(No. of children in family)*female					Yes	Yes		Yes
Sibling sex ratio				Yes	Yes	Yes		Yes
(Sibling sex ratio)*female					Yes	Yes		Yes
Parental attitudes toward female employment							Yes	Yes
Parental marriage type							Yes	Yes
Parental view on proper age for marriage							Yes	Yes
Religion as aninfluential factor in parents' daily life							Yes	Yes
Observations	3,368	3,368	3,368	3,368	3,368	3,368	3,368	3,368

Table 11b: HS Completion and Parental Attitudes, Marginal Effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Household income 600–1200TL			0.128***			0.027		0.030
			(0.027)			(0.029)		(0.030)
Household income above 1200TL			0.178***			0.077**		0.082**
			(0.031)			(0.036)		(0.037)
(Household income 600–1200TL)*female			0.037			0.053		0.063
			(0.041)			(0.044)		(0.044)
(Household income above 1200TL)*female			0.060			0.048		0.035
			(0.052)			(0.059)		(0.061)
No. of children in family				-0.097***	-0.082***	-0.050***		-0.051***
				(0.006)	(0.008)	(0.009)		(0.009)
Sibling sex ratio				-0.244***	-0.156***	-0.157***		-0.149**
				(0.043)	(0.055)	(0.057)		(0.058)
(No. of children in family)*female					-0.030**	-0.025*		-0.018
					(0.012)	(0.014)		(0.014)
(Sibling sex ratio)*female					-0.181**	-0.166*		-0.168*
					(0.090)	(0.094)		(0.095)
Parental attitudes toward female employment								
Does not approve of female wage employment							-0.071**	-0.017
							(0.029)	(0.030)
(Does not approve of female wage emp.)*female							-0.137***	-0.148***
							(0.045)	(0.050)
Parental marriage type								
Arranged marriage							-0.014	0.062**
							(0.025)	(0.027)
(Arranged marriage)*female							-0.045	-0.028
							(0.039)	(0.043)
Parental view on proper age for marriage								
Male, 20-24							0.051	0.022
							(0.046)	(0.049)
Male, above 24							0.169***	0.095*
							(0.047)	(0.052)
Female, 20-24							0.118***	0.090***
							(0.025)	(0.026)
Female, above 24							0.208***	0.151***
							(0.035)	(0.040)
Religion as an influential factor in parents' daily life								
Somewhat influential							-0.037	-0.044
							(0.031)	(0.032)
Not influential							-0.026	-0.057
							(0.035)	(0.037)
(Somewhat influential)*female							0.085*	0.058
							(0.045)	(0.048)
(Not influential)*female							0.134***	0.082
							(0.048)	(0.054)
Region dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Urban dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Parental education		Yes				Yes		Yes
(Parental education)*female		Yes				Yes		Yes
Observations	3,368	3,368	3,368	3,368	3,368	3,368	3,368	3,368

Table 12: .National-Level Gender Gap, Post-Compulsory School, PISA 2006

	(1)	(2)	(3)	(4)
Reading	0.480	0.357	0.358	0.359
	(0.060)***	(0.024)***	(0.023)***	(0.023)***
Math	-0.115	-0.197	-0.196	-0.201
	(0.065)*	(0.006)***	(0.024)***	(0.024)***
Science	0.122	0.026	0.025	0.024
	(0.061)**	(0.023)	(0.023)	(0.022)
School fixed effects		Yes	Yes	Yes
Parental education			Yes	Yes
Number of books at home				Yes

Notes: In parentheses, we provide cluster-robust standard errors. School fixed effects include dummies for each school in each sample. Parental education includes dummies for each level of parental education (standardized as primary, lower secondary, higher secondary, and higher education). Number of books at home is a categorical variable that distinguishes pupils at different levels (fewer than 25 books, between 25 and 100 books, and more than 100 books at home). *Statistical significance at the 10% level; ** Statistical significance at the 5% level; ***Statistical significance at the 1% level.

Table 13: Within-Region Differences, Post-Compulsory Schooling, PISA

	Reading	Math	Science
Marmara	0.342	-0.292	-0.029
	(0.042)***	(0.047)***	(0.042)
Aegean	0.275	-0.219	-0.000
	(0.044)3	(0.066)***	(0.045)
Central Anatolia	0.370	-0.158	0.084
	(0.060)***	(0.060)***	(0.059)
Mediterranean	0.418	-0.133	0.063
	(0.057)***	(0.047)***	(0.057)
Black Sea	0.408	-0.097	0.108
	(0.077)***	(0.060)*	(0.056)*
Southeast Anatolia	0.389	-0.131	0.018
	(0.096)***	(0.082)	(0.091)
Eastern Anatolia	0.253	-0.319	-0.114
	(0.045)***	(0.071)***	(0.056)**
School fixed effects	Yes	Yes	Yes
Parental education	Yes	Yes	Yes
Number of books at home	Yes	Yes	Yes

Notes: In parentheses, we provide cluster-robust standard errors. School fixed effects include dummies for each school in each sample. Parents' education includes dummies for each level of parental education (standardized as primary, lower secondary, higher secondary, and higher education). Number of books at home is a categorical variable that distinguishes pupils at different levels (fewer than 25 books, between 25 and 100 books, and more than 100 books at home). *Statistical significance at the 10% level; ** Statistical significance at the 5% level; ***Statistical significance at the 1% level.

Appendix

Table A1: Within Region Gender Gap, With Controls (TIMSS 2011)

	Grade 4 –math	Grade 4 - Science	Grade 8 - math	Grade 8 - science
Marmara	-.0410	-.0258	-.0284	.0262
	(.031)	(.034)	(.038)	(.033)
Aegean	.0565	.0887	-.0087	.0599
	(.044)	(.051)*	(.053)	(.056)
Central Anatolia	-.0520	-.0597	.0800	.1392
	(.064)	(.064)	(.050)	(.052)***
Mediterranean	-.0260	-.0254	-.0219	.0714
	(.053)	(.055)	(.049)	(.049)
Black Sea	-.0108	-.0053	.0017	.0646
	(.050)	(.055)	(.086)	(.079)
Southeastern Anatolia	-.1258	-.0517	.0824	.1730
	(.053)**	(.045)	(.073)	(.075)**
Eastern Anatolia	-.0247	.0086	-.1760	-.0639
	(.061)	(.059)	(.055)***	(.055)
School fixed effects	Yes	Yes	Yes	Yes
Parents' education	Yes	Yes	Yes	Yes
Books at home	Yes	Yes	Yes	Yes

Notes: Specifications for within-region gender gap with controls. In brackets, we provide cluster robust standard errors. All results are based on TIMSS 2011 dataset. School fixed effects include dummies for each school in each sample .Parental education includes dummies for each level of parental education (standardized as primary, lower secondary, higher secondary, and higher education). Number of books at home is a categorical variable that distinguishes pupils at different levels (fewer than 25 books, between 25 and 100 books, and more than 100 books at home). *Statistical significance at the 10% level; ** Statistical significance at the 5% level; ***Statistical significance at the 1% level.