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DISCUSSION PAPER SERIES

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ABSTRACT

Attainment and Gender Equality in Higher Education: Evidence from a Large Scale Expansion*

We examine the dramatic expansion in the Turkish higher education system during 2006-2008, which resulted in the establishment of 41 new public universities and a 60% increase in the number of available slots. Using the variation in the exposure intensity of expansion across cohorts and regions, we estimate the causal effect of the expansion on overall attainment and the gender gap in higher education. Before the expansion, women had lower higher education rates. The expansion increased the attainment rates of both men and women but failed to reduce the gender gap. Comparing the scale of expansion across fields of study, we observe that the largest growth in available slots was in social sciences and engineering. The expansion of slots in social sciences benefited men and women evenly, but the expansion in engineering benefited men more than women, thereby raising the gender gap.

JEL Classification: I23, I24, I28

Keywords: higher education expansion, educational attainment, gender gap, Turkey

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1 Introduction

In recent years, the share of university graduates among young adults has been increasing in Turkey as in many other countries. Among 25-34 year-olds, the rate of university graduation was 9% in 2000, 21% in 2012, and 31% in 2016. Although the rate has been increasing recently, at 31% it is still below the OECD average of 43% (OECD, 2017)[1].

In addition to low levels of higher education graduation rates, there is a gender gap to the detriment of girls in all levels of education. In ages 8 to 12, 2.2% of boys and 5.4% of girls never make it to school. In ages 12 -15, participation in education among girls is 10 percentage points lower than the rate among boys. Furthermore, 11% of women in ages 18-22 enroll in higher education, whereas the corresponding rate is 17% for men (Household Labor Force Surveys (HLFS), 2004-2005). Even among developing countries, Turkey is one of the few countries where a substantial gender gap in education still exists (Pekkarinen, 2012).

This study analyzes the dramatic expansion in the Turkish higher education system during 2006-2008, which resulted in the establishment of 41 new public universities and a 60% increase in the number of available slots. In 2005, prior to the expansion, the number of cities (provinces) that lacked a university was 42 out of 81, whereas in 2009 there were only 2 cities without a university. Hence the expansion increased the supply of and reduced the distance to higher education. Card (1995) notes that proximity to college has a strong effect on completed college education, even after controlling for parental education, region, and IQ. There are substantial monetary costs of going to a college away from home. Furthermore, in the Turkish context there can also be significant psychic costs for parents of sending their children away for education and these psychic costs might be higher for daughters (Caner et al., 2016).

We introduce an exposure intensity variable similar to Duflo (2001), Berlinski and Galiani (2007), defined as the region and cohort specific increase in available slots per high school graduate, that shows the extent that individuals are exposed to the expansion, when they were 18 years old. We identify the causal effect of policy on educational attainment and the gender gap using the variations in the level of exposure to expansion. Since our exposure intensity measure varies across regions and cohorts, we can control for cohort, region, and wave fixed effects in our estimations and disentangle the effect of the expansion from time trends.

In recent years, many countries, including Italy, France, England, Russia, and Turkey, have implemented reforms aimed at promoting higher education attainment and increasing equality of opportunity in higher education. An increase in the supply of higher education may not necessarily raise educational attainment, if the increased supply is not used by students. Moreover, an increase in supply may not necessarily reduce existing inequalities in access to ed-

[1] Organisation for Economic Co-operation and Development (OECD) is currently comprised of 36 members, including 21 European Union member states and other countries including the USA, the UK, Mexico, and Turkey

ucation, if the initially disadvantaged groups do not benefit from the increased supply. Whether and to what extent expansion policy improves education outcomes and reduces the gender gap in education are essential questions in the literature and in the design of education policies.

A small but growing literature examines the effects of an expansion in higher education on attainment and socio-economic inequalities (Bratti et al., 2008; Oppesidano, 2011; Blanden and Machin, 2004; Reimer and Pollak, 2009; Devereux and Fan, 2011; Di Pietro and Cutillo, 2008). Bratti, Checci, and De Blasio (2008) analyzed the effect of an increase in the supply of higher education in Italy between 1995 and 1998 on equalizing opportunities in education. They found that the drop-out rates increased parallel to the rise in enrollment rates, so the expansion did not affect educational attainment. Oppesidano (2011) found similar results by using the same data and concluded that reform did not diminish regional differences. Blanden and Machin (2004) showed that higher education expansion in the UK increased higher education attainment but has not been equally distributed across people from richer and poorer backgrounds. Reimer and Pollak (2009) analyzed the educational expansion in Germany and found that expansion has not provided equality in terms of the social origins of students. They also showed that the choices of the field of study across groups of different social backgrounds did not change with the increase in educational opportunities.

There are two studies that focused on the 2006-2008 higher education expansion in Turkey. Yılmaz (2014) examines, using aggregate city level data, the effects of the increase in the number of universities on narrowing the gender gap in higher education graduation rates and finds that the expansion reduced the gender gap. Since the expansion is defined as a policy dummy variable and data is aggregated at the city level, it is not possible to control for time specific and region specific effects in this study. Furthermore the expansion is measured by the number of universities rather than number of available slots. Polat (2017) analyzes the impact of expansion on education outcomes by comparing higher education enrollment of 18-25-year-olds in HLFS 2004 to that in HLFS 2012 and observes a rise in enrollment. As a before and after study using two data points in time, this study also cannot control for time specific effects. Furthermore, the main question in this paper is different from ours as the paper analyzes whether the effect of family income on higher education has declined following the expansion. Polat (2017) finds that the effect of family income on enrollment in higher education is significantly lower in 2012 for women in the north and southeast regions and concludes that the expansion policy has decreased the income inequalities in access to higher education.

From a methodological perspective, the higher education expansion that we study is attractive for several reasons. First, it was exogenous and unanticipated from the perspective of university candidates. It occurred in a short period and did not evolve endogenously with the changing patterns in demand across time. Prior to the expansion, demand for higher education was much higher than available slots (Council of Higher Education (COHE); 2004, 2007), and a centralized competitive examination was and still is applied to ration excess demand for higher education. Hence the first-order effects of the expansion are expected to be on the supply side of the education market. Second, the higher education expansion was politically motivated and driven by requests from members of the parliament (Arap, 2010). Turkish general election was to be held in 2007 to elect the members of parliament. Because of the pressure from the members of the parliament who represented different cities and pursued reelection, by 2008 the number of newly established public universities was 16 more than the number initially proposed in 2005. Third, even though the Turkish higher education system consists of four-year, two-year, and open education programs, expansion in four-year programs was the overwhelming component of the expansion in supply, allowing us to focus on the expansion in four-year programs. Enrollment in open education programs, most of which are not quota-restricted, remained almost constant during the expansion; therefore, open education programs do not distort our measurement of the effects of the expansion on higher education attainment.

Careful and detailed work was required in the construction of the dataset used in the empirical analyses in this paper. The data was obtained from three different sources: First, educational attainment at the individual level was obtained from the 2016-2017 waves of the Household Labor Force Survey (HLFS), an annual and nationally representative survey conducted by the TurkStat. Second, the data for available slots in four-year higher education programs, published yearly for each university by Measuring, Selection and Placement Center (OSYM), were collected from these OSYM almanacs and converted into electronic format. This newly constructed dataset includes information on the number of available slots for each university, the field of study, city, and year for the 2000-2013 period. Third, the number of high school graduates at the city level was obtained from the Turkish Statistical Institute (TurkStat).

We use two complementary approaches to study the impact of higher education expansion. First, we define a binary policy variable, which indicates whether an individual's cohort was exposed to the expansion policy or not. Then, we introduce an exposure intensity variable similar to Duflo (2001), Berlinski and Galiani (2007) defined as the increase in available slots per high school graduate. The intensity measure shows the extent of an individual's exposure to the expansion. We identify the causal effect of the expansion on educational attainment by exploiting the variation in intensity across regions and cohorts.

Our empirical approach is significantly different from earlier studies. Using HLFS, we focus on individuals who are 18 years old and hence expected to start higher education in the years 2000-2013. The year that the individual is 18 years old defines the cohort of that individual. The measure of exposure intensity for cohort t is defined as the increase in available slots in a region from 2005 to year t, per high school graduate in year t. For 2000-2005 cohorts, exposure intensity is defined as zero. Since our exposure intensity measure varies across regions and cohorts, we can control for cohort, region, and wave fixed effects in our estimations and disentangle the effect of the expansion from time trends. Moreover, our data set enables us to investigate the expansion policy in more detail and to study the underlying reasons for the observed changes in educational attainment for men and women. In particular, we examine and compare the effects of the changes in slots across fields of study and old (existing) and newly established universities.

Our results show that the expansion policy increased the higher education attainment of both men and women but failed to decrease the gender gap. Examining the underlying reasons for the changes in educational attainment for men versus women, and how the scale of the expansion varied across fields of study, we observe that the highest growth in available slots occurred in the fields of social sciences and engineering. We then examine whether the expansion in these fields had differential effects across genders. We find that the expansion in social sciences benefited men and women almost evenly; therefore, it had no effect on the gender gap. However, the expansion in engineering, a major traditionally preferred by men, benefited men more than it did women; therefore, it increased the gender gap. Since the expansion helped women achieve higher education attainment only as much as it helped men, it failed to reduce the gender gap.

The existing literature focuses on the effects of expansion policies on the socio-economic gap in higher education and generally finds that expansion policies do not decrease the socio-economic gap (Blanden and Machin, 2004; Reimer and Pollack, 2009). We contribute to this literature by finding that the expansion policy failed to reduce the gender gap in higher education in Turkey. Hence expansion policies as they have been designed may not have been the best tools to address inequalities across different socio-economic and demographic groups. Our findings on the fields of study offered in available slots in the way they affect the gender gap, inform us that an expansion policy with a specific target to reduce inequality needs to consider how preferences for fields of study may vary across different socio-economic and demographic groups.

We also examine the differential effects of expansion in existing versus new universities on higher education attainment and the gender gap. We find that the expansion of slots in existing universities (rather than new universities) explains a larger share of the increase in educational attainment, for both men and women. The estimated effect of the expansion in existing universities is somewhat larger, compared to the effect of the expansion in new universities; however, the two effects have been found to be statistically the same. Therefore, the greater explanatory power of the expansion in existing universities may be related more to its greater magnitude compared to the expansion in new universities, than to their established reputation. Evidence indicates that the uncertainty regarding the quality of education in newly established universities did not reduce much the effect of their expansion on higher education attainment.

The remainder of the paper is organized as follows: Section 2 introduces the institutional context and expansion in Turkish higher education system; section 3 introduces the conceptual framework; Section 4 describes the data used in the analysis. Section 5 introduces the econometric methodology to analyze the effect of the expansion policy on higher education attainment, and Section 6 and 7 present the results and the robustness of our results. Finally, Section 8 concludes.

2 Institutional Context

This section introduces the education system in Turkey and the changes in education policy in the years that are relevant to our study. In Turkey, the Ministry of National Education (MONE) is in charge of all structural reforms and education policies for primary and secondary education. Since 1981, all universities are affiliated with the Council of Higher Education (COHE), which is an independent entity of the central government, and COHE regulates the tertiary (higher) education.

Prior to 1997, formal education consisted of five years of primary school, three years of lower secondary education (four years if a preparatory year was required), three years of upper secondary education (four years if a preparatory year was required), and higher education. Primary education was compulsory for all citizens. In 1997, the government increased mandatory schooling from five to eight years by merging primary and lower secondary education under the umbrella of primary school. According to the law, students who had not yet graduated from the 5th grade in the summer of 1997 were supposed to finish eight years of compulsory schooling. Upper secondary education is provided in general, vocational, or technical high schools and takes three years. Since 2005, students starting high school were required to study for four years. All levels of education up to higher education is free in public schools.

Higher education in Turkey includes two-year vocational colleges, four-year undergraduate programs, in addition to post-graduate level education. In this study, we are interested in four-year undergraduate programs[2]. Demand for undergraduate education has been greater than supply in Turkey (COHE; 2004, 2007). Therefore, a centralized competitive examination is applied to ration excess demand since 1974. Although the questions that students face in the university exam change over time, it is mainly composed of the four main subjects that students study during their high school education: mathematics, Turkish, science, and social sciences.

There are two types of universities in Turkey, namely public and private (non-profit foundation) universities. Public and private universities offer three types of training: normal education, evening education, and open (distance) education. Students who study in normal or evening education receive education at the university, whereas those who attain an open education program are only obliged to pass centralized exams. Normal and evening education programs have limited quotas determined by the COHE, but many programs of open education do not have quotas.

[2]The overwhelming majority of programs take four years. There are only a few exceptions that take longer: Schools of Dentistry, Pharmacy, and Veterinary take 5 years; School of Medicine takes 6 years of education. These are also included in our study.

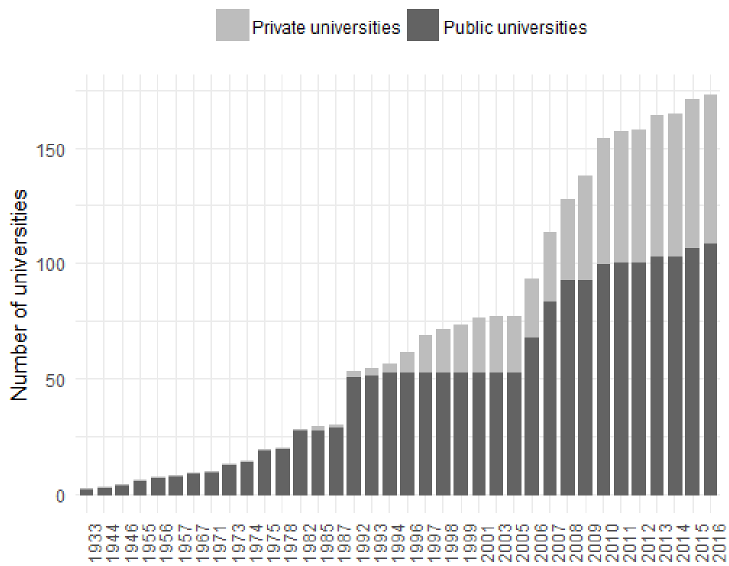


Figure 1: The number of universities across years.
Source: Council of Higher Education, Higher Education Statistics

The first public university was introduced in 1933, and there was a gradual increase in the number of public universities until 1987. Turkish government introduced the first wave of higher education expansion in 1992-1993. During the two years of the expansion, 24 new public universities were established in 23 cities that did not have a university before. Between 1992 and 2005, the number of public universities remained relatively constant, and the number of private universities slightly increased, as shown in Figure 1. In the second wave of the higher education expansion, as in the first wave, cities without universities were the target of the expansion policy and 41 new public universities were established in these cities between 2006 and 2008. As a result, the number of public universities increased from 53 in 2005 to 94 by 2009, and the number of available slots increased by more than 60%. The rise in enrollment in higher education started in 2006, the first year of the expansion, and continued even after the expansion period. The enrollment rates of 18-20-year-old men and women increased from 13% and 8% in 2005 to 17% and 13% in 2010, respectively (Figure 2). This second wave of higher education expansion is the focus of our study.

The higher education expansion was politically motivated and driven by requests from members of the parliament to establish universities in their cities (Arap, 2010). The Turkish general election was to be held in 2007 to elect 550 members of parliament. Before this, in 2005, 25 new public universities were

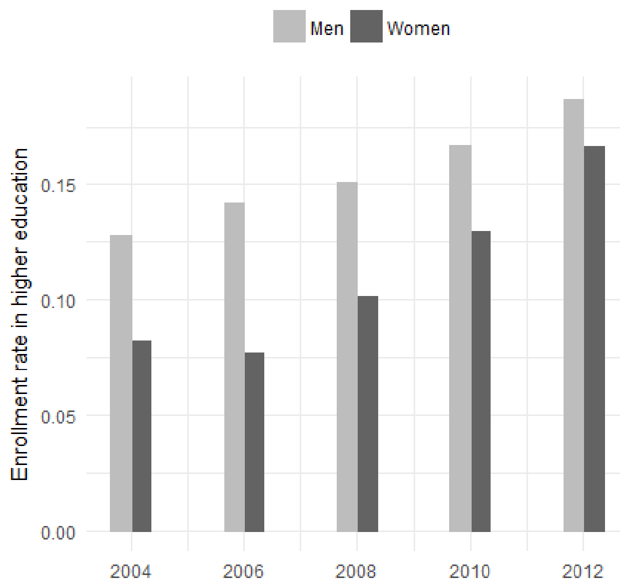


Figure 2: The enrollment rate of 18-20 year olds in higher education.
Source: HLFS, 2004-2013 (Authors' calculations).

planned to open with the primary purpose of providing economic benefits to the regions where they were established. Due to pressures from members of the parliament who represented different cities and sought reelection, by 2008, 15 more public universities were opened than initially planned.

In 2005, prior to the expansion, the number of cities that lacked a university was 42 out of 81, whereas in 2009 there were only two cities without a university. The number of cities with more than one university increased from 6 to 8. In many cities, the number of available slots in higher education more than doubled with the establishment of new universities and an increase in slots in existing universities. As a result, the number of students who enrolled in a four-year program in a higher education institution and the schooling rate in higher education increased dramatically (Table 1).

The COHE serves as the head of all higher education institutions since 1981 and monitors available slots for each university and each academic track. In Turkey, demand for four-year undergraduate programs exceeds the number of available slots, whereas the opposite is true for two-year vocational colleges (COHE, 2007). Therefore, the expansion targeted four-year undergraduate programs. Between 2005 and 2009, the available slots in four-year and two-year programs increased by 62% and 56%, and the number of new students increased by 56% and 29 % percent, respectively. Even though there is no quota constraint in most of the open education programs, the increase in new students in open education is only 6%. Thus, we conclude that the expansion in four-year programs was the primary component of the expansionary policy on the supply side.

Table 1: Higher education statistics

	Slots in four-year programs	New students in four-year programs	Slots in two-year programs	New students in two-year programs	New students in open educ. programs
2005	190,655	194,516	195,667	216,608	266,122
2006	188,393	177,258	193,541	235,033	256,138
2007	193,886	193,541	211,460	236,881	256,818
2008	259,748	264,088	260,155	287,547	387,660
2009	309,167	300,029	305,354	280,016	282,918
2010	360,968	327,869	310,836	233,134	202,513

Source: OSYM Almanacs.

When reform was adopted at the end of 2005, the Council of Higher Education opposed the draft by saying that there were insufficient human resources and infrastructure for the establishment of the new universities. Indeed, despite the fact that a total of 29 new universities were established in 2006 and 2007, there was no increase in the number of new students in the universities or available slots in higher education programs in those years. Table 1 presents higher education statistics across years in the country. It shows that the main increase in available slots and new students in higher education is observed in 2008, so in this paper, we determine the post-expansion years as 2008 and later. This is also consistent with the political background of the expansion policy. The COHE president who opposed the expansion was replaced by his successor in December 2007. The new COHE president embraced and implemented the expansion policy immediately after he took office (Arap, 2010).

3 Conceptual Framework

In the absence of credit constraints and rationing of higher education, individuals make privately optimal higher education decisions. However, in Turkey, the number of available slots has been much lower than the number of applicants for higher education. Prior to the expansion, 42 of the 81 cities did not have any universities. Hence, many high school graduates lived at a considerable distance from a university. Although tuition has been very low in public universities, distance to university can be a significant factor in increasing both monetary and psychic costs of going to college. Card (1995) notes that proximity to college has a strong effect on completed college education, even after controlling for parental education, region, and IQ. There are substantial monetary costs of going to a college away from home. Furthermore, in the Turkish context, there can also be significant psychic costs for parents of sending their children far away for education and these psychic costs might be higher for daughters (Caner et al., 2016).

Hence, the effect of the intensity of exposure to higher education expansion is strongly related to proximity to nearby universities. The expansion in higher education relaxed these constraints by increasing supply and also bringing universities closer to individuals. Also, students, as well as their parents, especially in less developed countries, may lack information and underestimate the returns to education. When universities are closer to people's homes, more information might be available on the returns to higher education. Hence, we expect the higher education expansion to increase the higher education attainment of both men and women. Furthermore, the proximity to new universities may also help narrow the gender gap in higher education attainment.

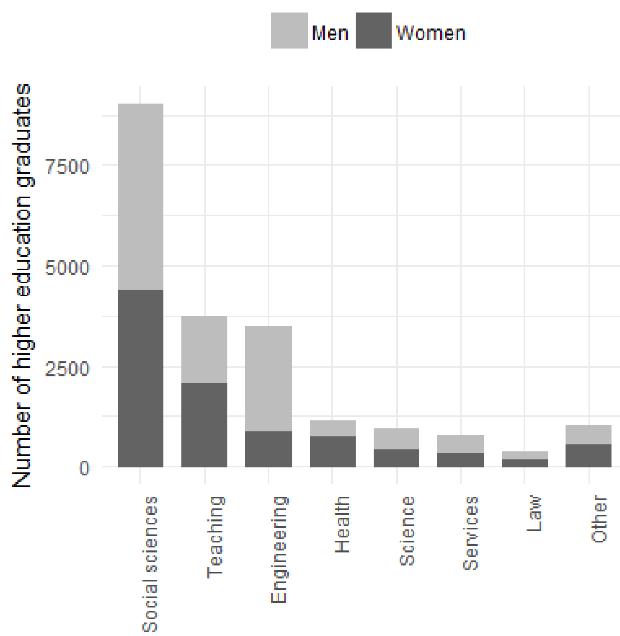


Figure 3: The number of higher education graduates prior to expansion cohorts (2000-2005) across fields of study.
Source: HLFS, 2016-2017 (Authors' calculations).

In addition to an increase in supply and a decrease in costs, fields of study offered in new slots can affect higher education outcomes. After all, preferences for college majors and the supply constraints jointly determine higher education placements in the centralized university entrance exam. Caner and Okten (2010) suggest that there are important differences in the fields of study that are preferred by men and women. Figure 3 shows these major preferences in the pre-expansion period cohorts (See Table A.1 in the Appendix for the program list of each field of study). While there seems to be an equal distribution of men and women in social science majors, men appear to dominate the engineering field. Reimer and Pollak (2009) show that the choices of the field of study across groups of different social background have not changed with the higher education expansion. There is no reason to expect a change in preferences with the reform. If preferences are relatively stable in the period of our analysis, we expect expansion in engineering to benefit men more compared to women, whereas the expansion in social sciences to benefit the two genders almost evenly. Therefore, how the increase in available slots varied across majors becomes an essential component of the expansion policy that can affect higher education attainment and the gender gap. As we mentioned in the previous section, expansion was sudden, happened over a short period without much planning. Hence, it is reasonable to assume that supply side constraints mostly drove the majors offered.

4 Data Description

We combine data collected from three different sources: Our first data source is the HLFS, which are carried out annually by TurkStat. The survey questionnaire collects data on the characteristics of household members (age, gender, marital status, and highest educational degree, major in university if the individual has at least high school degree). The location of each household is known at NUTS-1 and NUTS-2 levels.[3]

The second source is the Almanacs of the OSYM. Each year OSYM publishes data on the available slots for all four-year higher education programs (majors) in all universities and the number of students placed in these programs. We collected these data for the 2000-2013 period. The location identifiers (city (NUTS-3), NUTS-1, and NUTS-2 regions) of each university are also known. We aggregate the available slots at the NUTS-2 level to merge with our HLFS data. The number of available slots in higher education programs is an indicator of the supply of higher education in a given year and region.

Our third data source is the number of high school graduates at the city level, obtained from the TurkStat. Similarly, we aggregate the number of high school graduates at the NUTS-2 level and merge with our HLFS data. The number of high school graduates represents the size of the population that can potentially benefit from the higher education opportunities in a particular region. Hence, it is an indicator of the potential demand for higher education in a given region.

We use the 2016-2017 waves of the HLFS to study individuals who are expected to have started university education between 2000 and 2013. There is no information on which year an individual graduated from high school or took the university entrance exam in HLFS. Therefore, we assume that individuals start higher education at age 18. Thus, we restrict our sample to individuals who were 18 years old in 2000-2013; simply called the cohorts of 2000-2013 in the rest of the paper. Hence the cohort that the individual belongs defines the year that the individual was 18 years old.

[3]There are 12 NUTS-1 and 26 NUTS-2 regions in Turkey.

Table 2: Higher education statistics across cohorts

Cohort	Higher education graduation	Higher education attainment
2000	0.218	0.233
2001	0.229	0.244
2002	0.243	0.261
2003	0.244	0.266
2004	0.275	0.300
2005	0.278	0.302
2006	0.297	0.324
2007	0.307	0.343
2008	0.327	0.371
2009	0.327	0.379
2010	0.326	0.402
2011	0.291	0.410
2012	0.249	0.418
2013	0.176	0.406

Source: HLFS, 2016-2017

We define our dependent variable *higher education attainment* as a binary variable which is equal to 1 for those who graduated from or is currently enrolled in a university. The reason why we do not restrict our definition to graduates is explained as follows: In Turkey, the mean age of college graduation is 25 (according to OECD, 2017). However, individuals in the post-expansion group belong to cohorts 2008 and later, and they are 21-27 years old in our sample. Thus, they are more likely to be continuing their higher education than the pre-expansion group. To elaborate on our point, Table 2 compares the shares of higher education graduates and the shares of graduates plus current students (attainment) by cohorts in our sample. As expected, the rates of graduation are low in younger cohorts, since many of them are still students. For this reason, we use higher education attainment as our dependent variable instead of higher education graduation to analyze education outcomes of expansion policy.

We construct a binary *policy* variable which is equal to 1 for those in cohorts 2008 and onwards. The policy dummy represents whether an individual has been exposed to the expansion policy or not. The mean higher education attainment rates of 2000-2013 cohorts who belong to pre- and post-expansion periods are 28.2% and 39.8% respectively.

We also construct a continuous variable, called *exposure intensity* to measure the level of exposure to expansion policy, which varies across regions and cohorts. Exposure intensity variable (*intensity* from here on) is defined as the increase in the available slots for a given cohort and region, divided by the number of high school graduates. In the measure of exposure, we use the increase in the available slots as the measure of supply shock and the number of high school graduates as the potential demand for higher education.

We argued in introduction and institutional background sections that expansion was exogeneous to individual demand for higher education and unanticipated by students. One concern can be that expansion intensity may not have evolved randomly across regions. In other words, there can be important

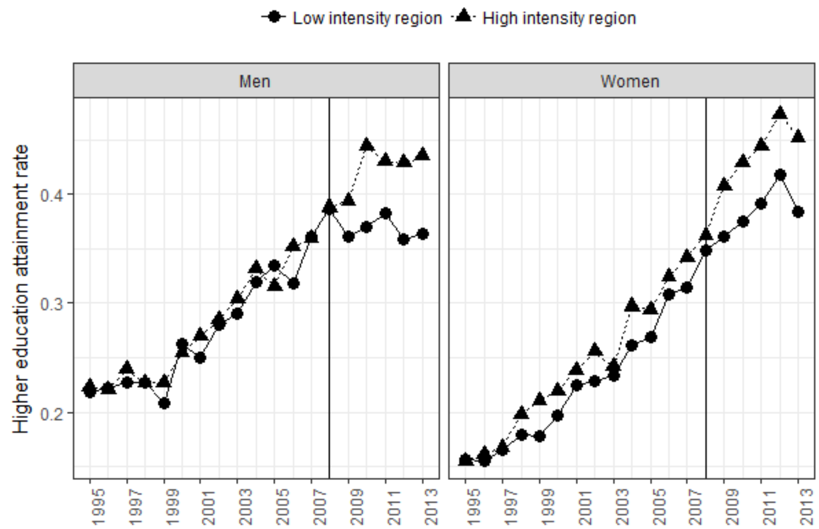


Figure 4: The higher education attainment rates over the years.
Source: HLFS 2016-2017, OSYM Almanacs 2005-2013 and TurkStat Education Statistics (Authors' calculations).

differences in higher education attainment rates across high intensity versus low intensity regions in the pre-expansion period. To see the comparative evolution of higher education attainment rates in the low- and high-intensity regions, we divide the regions into two groups according to exposure intensity variable in 2012 and calculate the mean higher education attainment rates across years in high-intensity regions (i.e., intensity higher than the median) and low-intensity regions. As shown in Figure 4, attainment rates were very close in the two groups before 2006-2008 after which a gap emerged between the two groups of regions.

Next, we decompose the intensity into two components as *old intensity* and *new intensity* to represent the increase in the slots in the universities that existed even before the expansion started and the ones established after 2005 respectively. Figure 5 shows the regional variation in these variables in the post-expansion year 2012. The graph clearly shows that there is a large regional variation in available slots per high school graduate and there is also a variation in the increase of these slots in the existing (old intensity) and newly established universities (new intensity).

An individual's exposure level to the expansion in higher education is determined by the individual's cohort and region of residence. For each cohort, the intensity of expansion is measured by the increase in the number of available slots per high school graduate in the region. The HLFS provides us with information on the city of residence in addition to how long an individual has

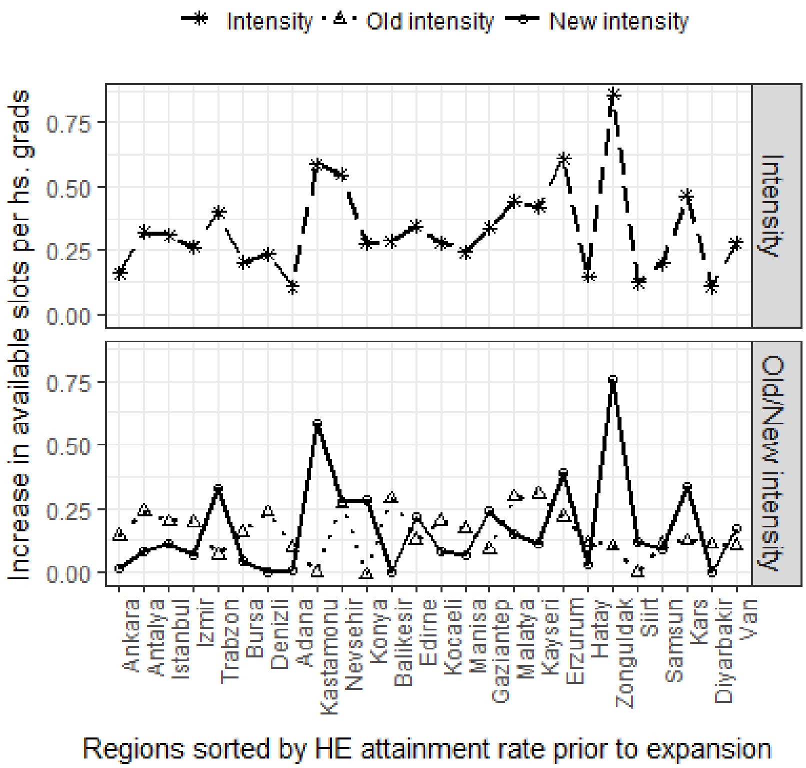


Figure 5: The intensity of expansion policy in 2012 across regions. Source: HLFS 2005, OSYM Almanacs 2005-2013 and TurkStat Education Statistics (Authors' calculations).

been living in the current city. Thus, we assume that they reside in the same region when they make their higher education decision, and they live in the year of the survey. However, this assumption does not hold for every individual. We observe that in the sample of cohorts 2000-2013, 73% of men's and 68% of women's current city of residence is the same as when they are 16 years old (before making their higher education decision). Thus, we construct a *Natives* sample, which includes the individuals who did not migrate since age 16. This sample allows us to examine the effects of the regional expansion in higher education on education outcomes of the native population since native individuals in this sample were exposed to any expansion that took place in their region. One caveat is that the Natives sample could suffer from selection bias since some studies suggest that the migration probability increases with education (Aydemir et al., 2018). While this caveat exists for most studies that examine the effects of external events such as immigration, migration or the effects of government policies such as changes in taxes, minimum wages on education and labor market outcomes of natives, we can address this possible selection problem in our paper by focusing on both graduation from and enrollment in higher education as the outcome variable of interest with a focus on younger cohorts in some of our specifications.

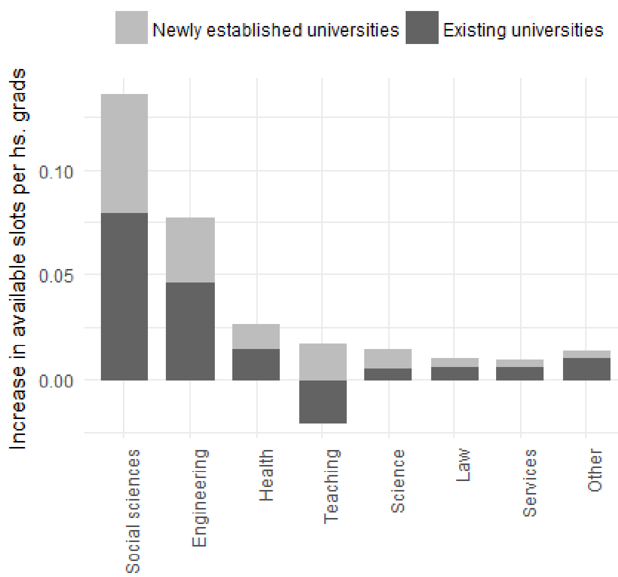


Figure 6: The decomposition of intensity in 2012 across majors. Source: OSYM Almanacs 2005-2013 and TurkStat Education Statistics (Authors' calculations).

The data we collected on higher education supply in four-year college programs allows us to analyze the expansion policy by introducing more detailed measures of the supply increase. To further investigate the impact of the expansion and check the robustness of our results, we consider the increase in available slots in public versus private universities. These variables also vary across regions and cohorts and hence are useful in the identification of the effects of supply changes on higher education attainment. Table A.2 in the Appendix shows the evolution of the intensity variables across years after the expansion period. We observe that the increase in available slots is mostly in public universities. While *new intensity* constitutes 34% of the intensity variable in the first year after the expansion (2009), its share rises to 47% in 2013, as the resources of the new universities increase over time.

Next, we decompose the intensity variable across the field of study and present the decomposition of intensity in 2010 in Figure 6. We observe that there are significant differences in the magnitude of expansion across fields of study. By far, the highest growth is in the field of social sciences. The second highest growth is in the field of engineering, followed by much lower growth in the field of science.

5 Identification Strategy

In this paper, cohort year is defined as the year that the individual is 18 years old. In the econometric analyses, cohorts of 2000-2005 are pre-expansion cohorts and cohorts 2009-2013 are post-expansion cohorts. Several cohorts in-between are excluded for the following reasons: First, 2006 and 2007 cohorts were excluded because of the uncertainty regarding their exposure to expansion. In Turkey retaking the university entrance exam is very common.[4] Thus, 2006 and 2007 cohorts could have been exposed to the policy or not, depending on whether they retake the exam in 2008 and later, or not. Second, 2008 cohort has a lower number of high school graduates in 2008, as a result of an earlier policy change.[5] The 2008 cohort was excluded to prevent any possible distortion to the results caused by this change. Therefore, our sample includes individuals in cohorts of 2000-2005 and 2009-2013. Since we use the 2016 and 2017 waves of HLFS, the age range of these individuals in our full sample is 21-35.

In econometric analyses, our first goal is to evaluate the causal effect of higher education expansion on those exposed to the policy. The year of birth and region of residence at university entrance age jointly determine exposure to higher education expansion. We first define exposure to higher education by cohort year, since new slots in higher education in a particular year may affect everyone who is at college entrance age regardless of their region of residence. We estimate the following baseline linear probability model:

$$h_{irt} = \alpha_d X_{irt} + \beta_d d_{it} + \gamma_d w_i d_{it} + \epsilon_{irt} \tag{1}$$

where h_{irt} represents the binary higher education attainment variable of individual i residing in region r from cohort t and w_i represents the woman dummy. The binary variable d_{it} represents the exogenous policy treatment variable, which is equal to 1 if an individual is 18 years old or younger in 2008 and hence expected to be exposed to the expansion policy. The vector of control variables X_{irt} includes a constant, the woman dummy, time trend before and after the expansion (by adding the interaction of the time trend with policy dummy), region and wave fixed effects, and the interaction of all control variables with the woman dummy. Time trend is constructed by subtracting the policy year (2008) from the cohort variable.

[4]Krishna et al. state that retaking decreases with the number of attempts in the university exam. Indeed, 49% of university exam takers are the ones who take the exam for the first time, while the students who take their second and third attempts in the examination accounted for 25% and 13% of all students, respectively

[5]In 2005, the upper secondary education was extended from three to four years. Thus, the number of high school graduates in 2008 was lower than in other years (i.e., less than half the number in 2007).

Our focus of interest are the coefficients β_d and $\beta_d + \gamma_d$, which capture the structural increase in higher education attainment of men and women as a result of expansion policy.

Card (1995) notes that college proximity has a strong effect on completed college education even after controlling for parental education, region, and IQ. There are substantial monetary and psychic costs of going to a college away from home. Hence, the intensity of exposure to higher education expansion strongly depends on proximity to nearby universities. In our next empirical analysis, the year of birth and region of residence at university entrance age jointly determine exposure to higher education expansion. We measure the causal effect of the exposure to expansion by exploiting the variation in the intensity of expansion policy across regions and cohorts induced by the timing and location of available slots. Our empirical approach is similar to Card (1992), Duflo (2001), Berlinski and Galiani (2007).

We measure the exposure to higher education expansion for an individual in region r and cohort t by the increase in available higher education slots in the region of residence r and year t, where t is the year that the individual was 18 years old. We use the increase in available slots rather than the levels of slots in order to remove the effect of the stock of available slots accumulated prior to expansion. We normalize the increase in available slots by the number of high school graduates. Thus, for example, for an individual in cohort 2010 (an individual was 18 years old in 2010), exposure intensity is measured as the increase in available higher education slots from 2005 (the year that the expansion policy was initiated) to 2010, divided by the number of high school graduates in 2010. We refer this variable as *intensity*. Similarly, we define *old intensity* and *new intensity* as available slots introduced in the universities established before and after 2005 divided by the number of high school graduates, in order to measure the causal effect of higher education slots in the existing and new universities on higher education attainment. Note that, the intensity variables are zero for cohorts which belong to the pre-expansion period.

In estimating the impact of such a program, the traditional problem that researchers face is identifying the effects of a compensatory intervention (Rosensweig and Wolpin, 1988) and the concern that the intervention may be correlated with the pre-existing attainment rates. In the data section, we showed that attainment rates were very close across high intensity and low intensity regions before 2006-2008 after which a gap emerged between the two groups (Figure 4).

To respond to this concern further, we next show that none of the intensity variables in post-expansion years are correlated with the higher education attainment rates in the pre-expansion period (Table A.3 in the Appendix). Besides, to eliminate any regional differences prior to the expansion policy, we condition on region fixed effects in all specifications.

The idea behind the identification strategy can be summarized using Table 3, which shows the means of higher education attainment for different cohorts and levels of intensities. Regions are identified as *high intensity* regions if their intensity in 2012 is higher than the median intensity in 2012, and as *low intensity* regions if their intensity is lower than the median. In the experiment of interest, we compare the individuals exposed to the expansion (cohorts 2009-2013) with the ones not exposed to the expansion (cohorts 2000-2004), in both types of regions. In both cohort groups, the mean higher education attainment is higher in regions with high increase in available slots per high school graduate, compared to the low increase regions. In both types of regions, average higher education attainment increases over time with a higher increase in high-intensity regions. The difference in these differences can be interpreted as the causal effect of the expansion policy, under the assumption that the increase in two types of regions would be similar in the absence of the expansion policy.

Table 3: Mean of higher education attainment by cohort and level of intensity

Experiment of interest			
	Level of HE expansion in the region of residence		
	High intensity (1)	Low intensity (2)	Difference (3)
Cohorts 2009-2013	0.434	0.377	0.057
	(0.003)	(0.003)	(0.004)
Cohorts 2000-2004	0.268	0.253	0.015
	(0.002)	(0.002)	(0.003)
Difference	0.166	0.124	0.042
	(0.004)	(0.004)	(0.005)
Control (Placebo) experiment			
	Level of HE expansion in the region of residence		
	High intensity (1)	Low intensity (2)	Difference (3)
Cohorts 2000-2004	0.268	0.253	0.015
	(0.002)	(0.002)	(0.003)
Cohorts 1995-1999	0.203	0.193	0.010
	(0.002)	(0.002)	(0.003)
Difference	0.065	0.060	0.005
	(0.003)	(0.003)	(0.004)

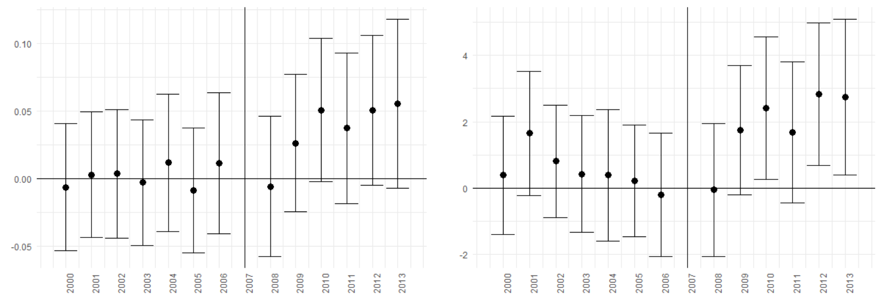
Notes: The standard errors are given in parentheses.

One of the tests for the identification assumption is a placebo test. Here, we compare two cohort groups, both of which were not exposed to the expansion policy, in order to explore whether the increase in higher education attainment in the high- and low-intensity regions systematically differ prior to the expansion policy. The results are shown in the second panel of Table 3. The average attainment is higher in both high- and low-intensity regions for later-born cohorts, but the difference in differences is not statistically significant, unlike the case in the experiment of interest.

Next, we introduce a generalized regression framework of the identification strategy by exploiting the variations in the intensity across regions and cohorts. If the average higher education attainment increases as a result of expansion policy, then the increase should be positively correlated with the additional slots per high school graduate in the region.

More formally, we estimate the following linear probability model:

$$h_{irt} = \alpha_s X_{irt} + \beta_s s_{irt} + \gamma_s w_i s_{irt} + \nu_{irt} \tag{2}$$



(a) Cohort interactions with high intensity (b) Cohort interactions with intensity

Figure 7: Coefficients of cohort interactions with binary high intensity and continuous intensity variables.
Source: Authors' estimation as described in the text. Each point represents a coefficient estimate and the bars extending from each point is the 95% confidence interval calculated from standard errors that are clustered at the region×cohort level. All models include region and wave fixed effects as well as controls for female dummy. Models include interactions between cohorts and binary high intensity in (a) and continuous intensity in (b) by 2012 intensity.

where s_{irt} represents the intensity for an individual in cohort t and region r. The vector of control variables includes a constant, woman dummy, the number of high school graduates in year t and region r in addition to region, cohort and wave fixed effects, and the interaction of all fixed effects with woman dummy.

Our parameters of interest β_s and $\beta_s + \gamma_s$ capture the average effect of an extra slot per high school graduate on higher education attainment of men and women, respectively. We are also interested in examining the differential effects of a new slot in an existing versus a new university. Thus, we estimate equation 2 also by decomposing intensity into old and new intensity and introducing separate controls for each. (Note that old intensity and new intensity add up to intensity.)

In the regressions where we use the intensity variable, we control for the number of high school graduates in the region for each cohort —the denominator of the intensity variable— in order to account for any variation in the (supply-side) intensity measure that originates from changes on the demand side, such as demographic changes due to migration.

The main identification assumption embedded in these models is that the trends in enrollment among higher-intensity regions would have been the same as the comparison group of lower-intensity regions in the absence of the reform. We presented ample evidence supporting this assumption.

In addition to the analyses shown in Table 3, we also estimate event study models in which we interact cohorts with intensity (both the continuous variable itself and the binary high- versus low-intensity variables and estimate the impacts on our outcome of interest. This allows us to test explicitly for the existence of differential pre-treatment trends in these outcomes. Figure 7 shows event study estimates of the coefficients of the cohort interactions with binary high intensity variable in (a), and with continuous intensity variable in (b). There is no statistically significant differential upward trend in the higher intensity regions prior to the reform. Any differences between cohorts in the two groups emerge only after the reform has been implemented; in all years prior to the reform, differences between the two groups remain constant. Therefore, in overall, we find no evidence for differential trends, which supports our empirical strategy.

In our conceptual framework section, we theorized that men and women differ in their preferences for college majors. Indeed, in the pre-expansion period, engineering graduates were mostly men, whereas social science majors were more gender-balanced. In the data section, we show that the largest growth in the intensity variable occurred in social sciences, followed by engineering. Hence we decompose the intensity variable into social science, engineering, and other majors and estimate equation 2 with these variables to examine how the differences in the scale of expansion across majors affected higher education attainment.

In all of our analyses, we report robust standard errors clustered at region and cohort level, since the sampling of our dataset (HLFS) is at the region level (NUTS-2, 26 regions) and clustering at the cohort level captures the time-trend related autocorrelation in the sample (Bertrand et al., 2004).

As an alternative specification, we control for age and age-squared variables instead of wave fixed effects. We also confirm the robustness of our results by using the weights in the survey in the regressions. These results, though not presented, are available upon request.

6 Results

In this section, we first establish that higher education attainment increased for both men and women as a result of the expansion. First, we estimate equations 1 and 2 for men and women separately and hence do not include the woman dummy as a control. Then, we examine the effect of expansion on the gender gap by pooling the samples for men and women and estimate the full equations 1 and 2.

6.1 Expansion policy on higher education attainment

Here, we analyze the effect of the expansion policy on higher education attainment of men and women separately. Table 4 presents the estimates from equations 1 and 2. The dependent variable in this table, higher education attainment, is equal to 1 if the individual has graduated from or is currently enrolled in higher education.

In columns (1) and (4), we control for the policy dummy in equation 1 and show that the expansion policy increased educational attainment for both men and women, although the effect is somewhat imprecisely estimated for men. The estimates indicate that the percentage point increase in the probability of higher education attainment is 1.5 for men and 6.1 for women. In these regressions, we control for time trends before and after the expansion separately, as well as region and wave fixed effects.

Next, we estimate the coefficient of the *intensity* variable in equation 2 and find that the estimates are statistically highly significant for both men and women. Columns (2) and (5) in Table 4 show that one addition in the intensity variable (an additional slot per high school graduate) raises attainment by 21.4 and 13.1 percentage points for men and women, respectively. These estimates show the increase in higher education attainment among young adults in the region. The expansion of available slots took place in existing as well as new universities. The total increase in available slot per high school graduate can be expressed as the sum of the increases in universities that existed before the reform (*old intensity*) and those established in the post-reform period (*new intensity*). Column (3) of the table shows the separate effects of the two changes. For men, an additional slot (per high school graduate) in old and new universities increases attainment by 25.1 and 20.5 percentage points, respectively. In a similar vein, in column (6) of the table, we show that for women, an additional slot (per high school graduate) in old and new universities increases attainment by 14.4 and 12.8 percentage points, respectively. For both men and women, the coefficient estimates for old and new intensity are statistically the same. In regressions where intensity variables are used (columns (2), (3), (5) and (6)), we control for region, cohort and wave fixed effects, and the number of high school graduates.

Table 4: The effect of expansion policy on educational attainment

	Dependent variable: Higher education attainment					
	Men			**Women**		
	(1)	(2)	(3)	(4)	(5)	(6)
Policy	0.015			0.061***		
	(0.016)			(0.015)		
Intensity		0.214***			0.131***	
		(0.045)			(0.037)	
Old intensity			0.251***			0.144**
			(0.073)			(0.069)
New intensity			0.205***			0.128***
			(0.048)			(0.040)
Observations	70,676	70,676	70,676	74,521	74,521	74,521

Notes: Included cohorts 2000-2005 and 2009-2013. In columns (1) and (4), constant, time trends before and after the expansion, region and wave fixed effects are included as control variables. In columns (2)-(3) and (5)-(6) constant, region, cohort, wave fixed effects and the number of high school graduates are included as control variables. The standard errors clustered at region×cohort level are given in parentheses.*p<0.1 **p<0.05 ***p<0.01.

Regression results yield support to the descriptive statistics on higher education attainment rates in the pre-reform and post-reform cohorts. Comparing the 2005 and 2010 cohorts, we see that average higher education attainment increased from 32.5% to 40.4% (by 7.9 percentage points) for men and from 28.1% to 40.0% (by 11.9 percentage points) for women. During the same period, the average increase in available slots per high school graduate was 0.233. Therefore, the average increase in the probability of higher education attainment as a consequence of the increase in slots per student was approximately 4.9 percentage points (0.214×0.233) for men and 3.1 percentage points (0.131×0.233) for women. Hence, the expansion policy explains 62% (4.9/7.9) of the increase in men's education outcomes, whereas only 26% (3.1/11.9) of the increase in women's outcomes. The increase in slots can explain a larger share of the overall increase in higher attainment of men than women. The reason for this outcome can be related to the distribution of the increase in slots across majors, which we examine in section 6.3.

Considering the increases in available slots in universities that existed before the reform and those established in the post-reform period, the descriptive statistics show that the average increase (from 2005 to 2010) in available slots per high school graduate was 0.091 in newly established universities and 0.141 in the universities established before the expansion. The average increase in the probability of higher education attainment as a consequence of *old intensity* was approximately 3.5 percentage points (0.251×0.141) for men and 2.0 percentage points (0.144×0.141) for women. Thus, the expansion in old universities explains 44% (3.5/7.9) of the increase in men's education outcomes, whereas only 17% (2.03/11.9) of the increase in women's outcomes. Similar calculations for *new intensity* shows that the average increase in the probability of higher education attainment was approximately 1.9 percentage points (0.205×0.091) for men and 1.16 percentage points (0.128×0.091) for women. Hence, the expansion in new universities explains 24% (1.9/7.9) of the increase in men's education outcomes, whereas only 9.7% (1.16/11.9) of the increase in women's outcomes. The expansion in old universities (rather than new universities) explains a larger share of the increase in educational attainment, both for men and women.

6.2 Expansion policy on the gender gap in higher education attainment

Before the expansion, women were disadvantaged in higher education attainment compared to men. The average higher education attainment among pre-expansion cohorts was 29% for men and 24% for women. In this section, we investigate the effect of the expansion policy on the gender gap in higher education attainment by comparing the differential effects of the reform on women and men. In Table 5, we present the estimation results of equations 1 and 2 for the full sample where we pool the samples for men and women.

The results presented in columns (1), (3) and (5), obtained by estimating equations 1 and 2 on the full sample, are parallel to the earlier results in Table 4. On average, the probability of higher education attainment in the post-reform period has increased by 3.9 percentage points across the country, compared to the pre-reform period. An increase in the slots per high school graduate in a region has increased educational attainment in that region by 17.2 percentage

Table 5: The effect of expansion policy on gender gap

	Dependent variable: Higher education attainment					
	(1)	(2)	(3)	(4)	(5)	(6)
Policy	0.039***	0.015				
	(0.012)	(0.016)				
Policy×Woman		0.046**				
		(0.018)				
Intensity			0.172***	0.204***		
			(0.033)	(0.046)		
Intensity×Woman				-0.064		
				(0.050)		
Old Intensity					0.196***	0.258***
					(0.054)	(0.073)
New Intensity					0.166***	0.193***
					(0.035)	(0.048)
Old Intensity×Woman						-0.120
						(0.092)
New Intensity×Woman						-0.053
						(0.054)
Observations	145,197	145,197	145,197	145,197	145,197	145,197

Notes: Included cohorts 2000-2005 and 2009-2013. In columns (1) and (2), constant, woman dummy, time trends before and after the expansion and their interactions with woman dummy, region and wave fixed effects and their interactions with woman dummy are included as control variables. In columns (4)-(6) constant, woman dummy, region, cohort, wave fixed effects and their interactions with woman dummy and the number of high school graduates are included as control variables. The standard errors clustered at region×cohort level are given in parentheses.*p<0.1 **p<0.05 ***p<0.01.

points on average. The corresponding figures for old and new intensities are 19.6 and 16.6 percentage points, respectively. The results presented in columns (2), (4) and (6), obtained by estimating equations 1 and 2 on the full sample, show us whether the effects differ by gender. The regression in column (2) includes the interaction of the policy dummy in equation 1 with the woman dummy. The regressions in columns (4) and (6) include the interaction of the intensity, old intensity, and new intensity variables in equation 2 with woman dummy.

As explained in the methodology section, regressions in columns (1) and (2) control for the woman dummy, the time trend before and after the expansion, region and wave fixed effects and the interactions of all control variables with woman dummy; and columns (3) to (6) control for the woman dummy, number of high school graduates, in addition to region, cohort, and wave fixed effects, and their interactions with woman dummy.

Our results in column (2), which show the countrywide effect, suggest that the expansion policy increased education attainment more for women than for men, thereby reducing the gender gap in attainment. These results are in line with the earlier results presented in Table 4. Next, we show the effect of the increase in slots per high school graduate on the gender gap in attainment. Column (4) shows that the effect was statistically the same for men and women (the coefficient of the interaction term is statistically insignificant). Hence, the expansion policy has failed to reduce the gender gap that existed before the expansion. Similarly, in column (6) we observe that the effects of increasing slots in existing and new universities have been statistically the same for men and women. Taken together, these findings suggest that at the country level, the gender gap is lower in the post-reform period than in the pre-reform period. However, the increase in slots at the regional level did not translate to a reduction in the gender gap in the region. Such a result could be possible if the additional slots were not used more by women than by men.

6.3 Intensity of expansion policy across majors

Caner et al. (2016) find that men and women have different preferences in major choices. We observe gender differences in college major choices in our dataset as well (Figure 3). In the pre-expansion period, while the top two favorite majors for men were social sciences (43%), and engineering (24%); the top two favorites for women were social sciences (45%), and teaching (22%). Furthermore, although men and women seem to be equally represented in social sciences, men appear to dominate the engineering field. Here, we investigate how the expansion in slots across different majors affected the gender gap.

Table 6: The expansion policy across majors

	Dependent variable: Higher education attainment			
	(1)	(2)	(3)	(4)
Intensity in engineering	0.323***	0.468***		
	(0.088)	(0.123)		
Intensity in engineering×Woman		-0.292**		
		(0.132)		
Intensity in social sciences	0.225**	0.184	0.232***	0.189
	(0.088)	(0.127)	(0.088)	(0.128)
Intensity in social sciences×Woman		0.079		0.083
		(0.162)		(0.164)
Intensity in other majors	-0.016	0.025	-0.030	0.003
	(0.077)	(0.111)	(0.079)	(0.114)
Intensity in other majors×Woman		-0.080		-0.065
		(0.140)		(0.141)
Old intensity in engineering			0.178	0.248
			(0.160)	(0.217)
New intensity in engineering			0.382***	0.558***
			(0.082)	(0.126)
Old intensity in engineering×Woman				-0.132
				(0.215)
New intensity in engineering×Woman				-0.362**
				(0.151)
Observations	145,197	145,197	145,197	145,197

Notes: Included cohorts 2000-2005 and 2009-2013. The constant, woman dummy, region, cohort, wave fixed effects and their interactions with woman dummy and the number of high school graduates are included as control variables. The standard errors clustered at region×cohort level are given in parentheses.*p<0.1 **p<0.05 ***p<0.01.

During the expansion, the distribution of slots across majors may have depended on supply-side constraints, since infrastructure and human resources such as instruction faculty were limited and the expansion occurred in a short period. We observed in the data section that the highest increase in slots occurred in majors of social sciences and engineering. Hence, we decompose each intensity variable into three categories: intensity in engineering, intensity in social sciences, and intensity in other majors. Our results, presented in Table 6 column (1), suggest that the intensity in engineering and social sciences significantly increased educational attainment, but there is no significant effect of intensity in other majors on educational attainment. In the second column, where we look at the gender differences in impact of the expansion across the fields of study on higher education attainment, we find that the increase in engineering slots increases men's education more than women's, whereas the effects of the increase in slots in social sciences on men and women are statistically the same. These results are consistent with our expectations: Men are more likely to prefer majoring in engineering compared to women; an increase in slots in engineering benefits men more than it does women. An increase in slots in social sciences benefits men and women equally, since these majors are preferred both by men and women.

Having found that the increase in engineering slots benefitted men more than women, we further decompose this variable into two components (*old intensity in engineering* and *new intensity in engineering*) to observe their separate effects on overall educational attainment and to detect which component changes the gender gap. We find that it was the increase in engineering slots in new universities (rather than old universities) that had a statistically significant effect on overall attainment (column (3)) and on the gender gap (column (4)). We find that the *new intensity in engineering* benefitted men more than it did women (i.e., in column (4), the coefficient estimate of the *new intensity in engineering* is positive and significant; its interaction with woman dummy is negative and significant) and thereby increased the gender gap. Increase in slots in social sciences benefitted both men and women with no significant differential effects. Our results show that the variation in the scale of expansion across majors has important consequences for higher education attainment and the gender gap.

7 Robustness Checks

Turkey experienced two other changes in education policy that overlapped with the expansion policy in higher education. In this section, we show that these policies alone cannot explain the observed changes in higher education attainment. We also show that our results are robust to restricting the sample to individuals with at least a high school degree, to natives, and to those who live in smaller cities; in addition to their robustness under the alternative explanation of exposure intensity in public universities.

7.1 Compulsory schooling

Prior to 1997, the education system in Turkey consisted of five years of compulsory primary education, followed by three years of lower secondary and three years of upper secondary (high school) education. In 1997, the lower tiers were merged, and compulsory schooling was extended from five to eight years. The new policy covered all children who did not already hold a primary school diploma at the beginning of the 1997-98 school year. Considering that children typically start school at age 6, we can say that children born in or after

January 1987 were affected by the policy. In our sample, this corresponds to the cohorts of 2005 and later. The treatment cohorts in our analyses (2009-2013 cohorts) coincide with those who were exposed to compulsory schooling extension. In this section, we address the concern that our earlier results may be generated by the 1997 compulsory schooling reform. We show that the compulsory schooling law alone cannot explain the results we present earlier.

First of all, since the compulsory schooling policy was implemented at the country level, we do not expect it to influence our estimates of the effect of *intensity*, which varies by region and cohort and where we control for region, cohort and wave fixed effects. To see whether the compulsory schooling policy changes our results on the effects of *policy*, we examine the cohorts which were affected only by the 1997 reform and not by the higher education expansion.

In Table 4, 2005 and earlier cohorts were the control group and 2009 and later cohorts were the treatment group. We excluded the cohorts 2006-2008 from our sample because in those years the expansion was still continuing. Hence, 2005-2008 cohorts were affected by the 1997 reform, but not the higher education reform according to our analysis. Therefore, to isolate the effect of the 1997 reform, we can use them as the new treatment group. Hence, we re-define the control group as 2004 and earlier cohorts, and 2005-2008 cohorts as the treatment group. We exclude the later cohorts from the treatment group in order not to incorporate the effects of higher education expansion.

We experiment with two sub-samples: 2002-2007 cohorts (which includes three control and three treatment cohorts) and 2001-2008 cohorts (which includes four control and four treatment cohorts). In these estimations, we control for the first-order polynomial of time trend to avoid overfitting, in addition to region and wave fixed effects. In Table A.4 in the Appendix, we show that compulsory schooling policy does not increase the probability of higher education attainment of men or women. Using earlier waves of the HLFS, Aydemir and Kirdar (2017) find that the 1997 reform increased the years of schooling, but not the probability of higher education attainment. We confirm their results in our sample. Therefore, we conclude that the compulsory schooling policy change is not a contributing factor to the structural increase we estimate.

7.2 Expansion effect on the transition from high school to higher education

In case of a steady rate of high school education attainment, our results on the evolution of gender gap would be valid for both the full population and also for those who attain at least high school education. Earlier studies also find that compulsory schooling law has increased high school graduation (Dayioglu et al., 2012; Aydemir and Kirdar, 2017). In our regressions, we do control for the number of high school graduates to account for possible changes in higher education applicants. However, the compulsory schooling law affected not only the number of high school graduates but also their gender composition. Indeed, Dayioglu et al. (2012) show that the compulsory schooling policy change failed to narrow the gender gap in the post-compulsory high school education; on the contrary, the gender gap in high school education increased in urban areas.

Here, we question whether the expansion in higher education eased the transition from high school to university and whether it affected the gender gap in higher educational attainment.

We restrict our sample to those who have at least a high school degree. In this sample, women have an advantage in making the transition to higher education.[6] The descriptive statistics suggest a small reduction in women's relative advantage over time: Before the reform, the probability of transition from upper secondary to higher education was 54% for men and 60% for women. After the reform, the probabilities were 70% for men and 73% for women. Regression results, presented in Table 7, confirm that the expansion eased the transition to higher education for both men and women. Similar to our earlier result, the expansion policy did not change the gender gap in higher education attainment.

Table 7: The effect of expansion policy on gender gap in transition from high school to higher education

	Dependent variable: Higher education attainment					
	(1)	(2)	(3)	(4)	(5)	(6)
Policy	0.068***	0.078***				
	(0.017)	(0.020)				
Policy×Woman		-0.022				
		(0.025)				
Intensity			0.093**	0.130**		
			(0.043)	(0.057)		
Intensity×Woman				-0.080		
				(0.063)		
Old Intensity					0.187**	0.256***
					(0.077)	(0.097)
New Intensity					0.072	0.104*
					(0.047)	(0.062)
Old Intensity×Woman						-0.144
						(0.119)
New Intensity×Woman						-0.071
						(0.066)
Observations	74,111	74,111	74,111	74,111	74,111	74,111

Notes:The sample is restricted to those who attain at least upper secondary education. Included cohorts 2000-2005 and 2009-2013. In columns (1) and (2), constant, woman dummy, time trends before and after the expansion and their interactions with woman dummy, region and wave fixed effects and their interactions with woman dummy are included as control variables. In columns (4)-(6) constant, woman dummy, region, cohort, wave fixed effects and their interactions with woman dummy and the number of high school graduates are included as control variables. The standard errors clustered at region×cohort level are given in parentheses.*p<0.1 **p<0.05 ***p<0.01.

7.3 Relaxation of headscarf ban

Before 2008, women who covered their heads were banned (known as the "headscarf ban") from attending universities in Turkey. In 2008, the practice of headscarf ban was relaxed in higher education. This policy change overlaps with the

[6]This might be due to positive selection of higher ability women to upper secondary education since fewer women attain high school degree than men.

expansion in the higher education system, and it might have positively affected the demand for higher education among women who wore a headscarf. However, this policy alone cannot explain our results. First of all, we find a positive and significant effect of the expansion policy on men, who should not be affected by the headscarf ban. Second, in our estimation of equation 2, where our measure for the expansion (*intensity*) varies across both cohorts and regions, we find that *intensity* positively affects the higher education attainment of both men and women. It is highly unlikely that the distribution of women wearing headscarf across regions and time is correlated with *intensity* to generate the observed result. Besides, we find differential effects of the intensity variable across majors on the higher education attainment of men and women: An increase in engineering slots increases the gender gap. Relaxation of the headscarf ban cannot explain these results by itself.

Nevertheless, we can interpret our results about women as an upper bound. It is possible that if the ban were not relaxed, we would observe a smaller positive effect on the higher education attainment of women. This possibility will not change our main result that the expansion did not reduce the gender gap in higher education attainment.

7.4 Expansion effect on natives

In our analyses, the *intensity* measure is based on the available slots in the region of residence (at the time of the survey) in the year that the individual was 18 years old. Ideally, we would like to use the region information where the individual was residing when she was 18 years old to measure exposure to policy change. However, we do not have this information in the HLFS. What we do have is how long the individual has been living in her current region. In this section, we restrict the sample to those who have been living in the same town since age 16 and refer to this sample as *Natives*. Since the Natives sample represents those who have not migrated for higher education, *intensity* in this sample has no misspecification error.

First, we estimate equation 1 in the Natives sample and show that there is a structural increase during the expansion period in the education outcomes of men and women who did not migrate to receive higher education. We also estimate equation 2 for the causal effect of the increase in slots per student to education outcomes and show that the expansion policy increases natives' higher education attainment for both men and women (Table 8). The coefficient of intensity variable is slightly lower for men and slightly higher for women, compared to our baseline results presented in Table 4 for the full sample. Similar to earlier results, both *old intensity* and *new intensity* increase the higher education attainment of men and women. Moreover, the coefficient estimates of *old intensity* and *new intensity* are statistically the same, similar to our baseline results for the full sample.

Among natives, higher education attainment of men and women prior to the expansion were 20% and 17%, respectively. Our results in Table 9 obtained for the pooled Natives sample suggest that the gender gap in educational at-

Table 8: The effect of expansion policy on natives sample

	Dependent variable: Higher education attainment					
	Men			**Women**		
	(1)	(2)	(3)	(4)	(5)	(6)
Policy	0.033*			0.038**		
	(0.018)			(0.016)		
Intensity		0.181***			0.157***	
		(0.041)			(0.042)	
Old intensity			0.200***			0.193***
			(0.071)			(0.071)
New intensity			0.176***			0.148***
			(0.044)			(0.046)
Observations	51,459	51,459	51,459	50,304	50,304	50,304

Notes: The sample is restricted to natives, those who did not migrate since age 16. Included cohorts 2000-2005 and 2009-2013. In columns (1) and (4), constant, time trends before and after the expansion, region and wave fixed effects are included as control variables. In columns (2)-(3) and (5)-(6) constant, region, cohort, wave fixed effects and the number of high school graduates are included as control variables. The standard errors clustered at region×cohort level are given in parentheses.*p<0.1 **p<0.05 ***p<0.01.

Table 9: The effect of expansion policy on gender gap in natives sample

	Dependent variable: Higher education attainment					
	(1)	(2)	(3)	(4)	(5)	(6)
Policy	0.036***	0.033*				
	(0.014)	(0.018)				
Policy×Woman		0.005				
		(0.020)				
Intensity			0.170***	0.172***		
			(0.032)	(0.041)		
Intensity×Woman				-0.004		
				(0.052)		
Old Intensity					0.196***	0.209***
					(0.055)	(0.071)
New Intensity					0.163***	0.162***
					(0.034)	(0.044)
Old Intensity×Woman						-0.025
						(0.091)
New Intensity×Woman						0.001
						(0.057)
Observations	101,763	101,763	101,763	101,763	101,763	101,763

Notes: The sample is restricted to natives, those who did not migrate since their age 16. Included cohorts 2000-2005 and 2009-2013. In columns (1) and (2), constant, woman dummy, time trends before and after the expansion and their interactions with woman dummy, region and wave fixed effects and their interactions with woman dummy are included as control variables. In columns (4)-(6) constant, woman dummy, region, cohort, wave fixed effects and their interactions with woman dummy and the number of high school graduates are included as control variables. The standard errors clustered at region×cohort level are given in parentheses.*p<0.1 **p<0.05 ***p<0.01.

tainment only slightly decreased (statistically insignificant) after the reform. Similar to our baseline results, the impact of newly available slots was similar across genders; therefore, the expansion policy did not reduce the gender gap in educational attainment.

7.5 The effect of expansion by intensity in public universities

Our intensity measure includes the increase in available slots in both public universities and private (non-profit foundation) universities. One could argue that the increase in private university slots is more demand-driven than the increase in public university slots (which is mainly politically motivated) and that the expansion in private universities is not necessarily a part of the expansion policy. To address this concern, we check the robustness of our results in columns (3)-(6) of Table 5, by re-defining the intensity variable as based on the increase in available slots in all public universities (*public intensity*), and decomposing it into *old public intensity* and *new public intensity*. We control for the increase in available slots in private universities in order to control for changes in slots due to preferences of applicants. All intensity variables are per high school graduate, as before.

Table 10: The effect of expansion by the intensity in public universities

	Dependent variable: Higher education attainment			
	(1)	(2)	(3)	(4)
Public intensity	0.183***	0.201***		
	(0.032)	(0.042)		
Public intensity×Woman		-0.037		
		(0.046)		
Old public intensity			0.209***	0.233***
			(0.056)	(0.073)
New public intensity			0.175***	0.193***
			(0.033)	(0.046)
Old public intensity×Woman				-0.047
				(0.090)
New public intensity×Woman				-0.035
				(0.052)
Private intensity	0.020	0.021	0.036	0.038
	(0.127)	(0.127)	(0.130)	(0.130)
Observations	145,197	145,197	145,197	145,197

Notes:Included cohorts 2000-2005 and 2009-2013. The constant, woman dummy, region, cohort, wave fixed effects and their interactions with woman dummy; the number of high school graduates and the private intensity are included as control variables. The standard errors clustered at region×cohort level are given in parentheses.*p<0.1 **p<0.05 ***p<0.01.

During the expansion period, the share of public universities in the increase in available slots was 73-83%. Similarly, public universities constituted 81-87% of the increase in slots in the universities established after 2005 (new universities) (Table A.2). Our results, presented in Table 10, on the coefficient of *public intensity* variable are very similar to our baseline results for the (aggregate) intensity variable. Increase in available slots in public universities per high school graduate increases higher education attainment without reducing the gender gap, controlling for increase in available slots in private universities (columns (1) and (2)). Increase in slots in both existing public universities and newly established public universities increase higher education attainment, but the coefficient on the existing public universities is slightly higher, again similar to our earlier results (columns (3) and (4)). Note that, we do not find any significant effect of the increase in available slots in private universities on higher education attainment.

7.6 The effect of expansion in smaller cities

In metropolitan areas, men and women are on an almost equal footing in higher education attainment. In the three largest cities of Turkey, namely Istanbul, Ankara, and Izmir, the higher education attainment rates before the expansion for men and women were 36% and 35%, while in all other cities the attainment rates were 27% and 21%. One could argue that the equalizing effect of the reform would be stronger in smaller cities. Here, we restrict our sample by excluding the three largest cities and ask whether the reform helped reduce the gender gap in attainment in the rest of the sample. The results in Table 11 show that the coefficient estimates for the *intensity* variables are larger in magnitude than before. Yet, we observe no differential effect of the reform on men and women. Hence, our results are qualitatively the same as our baseline results.

Table 11: The effect of expansion policy on gender gap in smaller cities

	Dependent variable: Higher education attainment					
	(1)	(2)	(3)	(4)	(5)	(6)
Policy	0.037**	0.018				
	(0.015)	(0.020)				
Policy×Woman		0.037*				
		(0.022)				
Intensity			0.304***	0.340***		
			(0.044)	(0.055)		
Intensity×Woman				-0.072		
				(0.053)		
Old Intensity					0.294***	0.357***
					(0.058)	(0.079)
New Intensity					0.308***	0.339***
					(0.049)	(0.059)
Old Intensity×Woman						-0.122
						(0.099)
New Intensity×Woman						-0.062
						(0.056)
Observations	114,107	114,107	114,107	114,107	114,107	114,107

Notes:The sample is restricted to those who live outside of the three metropolitan regions; Istanbul, Ankara and Izmir. Included cohorts 2000-2005 and 2009-2013. In columns (1) and (2), constant, woman dummy, time trends before and after the expansion and their interactions with woman dummy, region and wave fixed effects and their interactions with woman dummy are included as control variables. In columns (4)-(6) constant, woman dummy, region, cohort, wave fixed effects and their interactions with woman dummy and the number of high school graduates are included as control variables. The standard errors clustered at region×cohort level are given in parentheses.*p<0.1 **p<0.05 ***p<0.01.

7.7 Different samples of cohorts

In our analyses, we used 2000-2005 and 2009-2013 cohorts as pre-expansion and post-expansion cohorts, respectively. In order to check the robustness of our results, we replicate our baseline regressions in Table 5 with different cohort samples. Specifically, we use cohorts of 2002-2005 and 2009-2012 as pre-expansion and post-expansion cohorts, respectively. Table A.5 in the Appendix presents these results. Our main variable of interest, the exposure intensity variable, has a positive and significant effect on higher education attainment of men and women. Statistical significance of the estimates of intensity is similar to those in Table 5, although the estimates are slightly smaller in the smaller sample. The effect of intensity does not significantly differ for women compared to men (Columns (3) and (4)). In these regressions, we control for the number of high school graduates, and cohort, region, and wave fixed effects. We also experiment with cohorts of 2003-2005 and 2009-2011 as pre-expansion and post-expansion cohorts. Once again, the sign and significance of all coefficients are similar to those in Table 5 although there is some decrease in the magnitudes of the coefficients. These results though not shown, are available upon request.

8 Conclusion

Turkey experienced a dramatic expansion in tertiary education during 2006-2008, which resulted in the establishment of 41 new public universities and a 60% increase in the number of available slots. In 2005, prior to the expansion, the number of cities that lacked a university was 42 out of 81, whereas in 2009 there were only two cities without a university.

Among 25-34 year-olds, the rate of university graduation was 9% in 2000, 21% in 2012, and 31% in 2016. Although the rate has been increasing recently, at 31% it is still below the OECD average of 43% (OECD, 2017).

The higher education expansion was politically motivated and driven by requests from members of the parliament to establish universities in their cities (Arap, 2010). Hence the higher education expansion was exogenous and unanticipated from the perspective of university candidates.

We introduce an exposure intensity variable similar to Duflo (2001), Berlinski, Galiani (2007), defined as the region- and cohort-specific increase in available slots per high school graduate, that shows the extent that individuals are exposed to the expansion, when they were 18 years old. We identify the causal effect of policy on educational attainment using the variation across regions and cohorts in the level of exposure to expansion.

Since our exposure intensity measure varies across regions and cohorts, we can control for cohort, region, and wave fixed effects in our estimations and disentangle the effect of the expansion from time trends. Our results show that the expansion policy has increased the higher education attainment of both men and women, but failed to decrease the gender gap. Examining how the scale of the expansion varied across fields of study, we observe that the highest growth in available slots occurred in the fields of social sciences and engineering. The expansion in social sciences benefited men and women almost evenly, but the expansion in engineering, a field traditionally preferred by men, benefited men more than it did women, thereby increasing the gender gap in higher educational attainment.

Further analyses show that our results cannot be explained by two other changes in education policy (namely, the expansion of compulsory schooling and the relaxation of the headscarf ban). Moreover, our results are robust to restricting the sample to individuals with at least a high school degree, to natives, to those who live in smaller cities, in addition to their robustness under the alternative definition of exposure intensity and alternative choice of cohorts.

References

[1] Arap, K. (2010). Türkiye yeni üniversitelerine kavuşurken: Türkiye'de yeni üniversiteler ve kuruluş gerekçeleri. *Ankara Üniversitesi SBF Dergisi*, **65**(3), 001-029.

[2] Aydemir, A., Kirdar, M. G. (2017). Low wage returns to schooling in a developing country: Evidence from a major policy reform in Turkey. *Oxford Bulletin of Economics and Statistics*, **79**(6), 1046-1086.

[3] Aydemir, A., Kirdar, M. G., Torun, H. (2018).The effect of education on geographic mobility: Incidence, timing and type of migration. *Working paper.*

[4] Berlinski, S., Galiani, S. (2007). The effect of a large expansion of pre-primary school facilities on preschool attendance and maternal employment. *Labour Economics*, **14**(3), 665-680.

[5] Bertrand, M., Duflo, E., Mullainathan, S. (2004). How much should we trust differences-in-differences estimates? *The Quarterly journal of economics*, **119**(1), 249-275.

[6] Blanden, J., Machin, S. (2004). Educational inequality and the expansion of UK higher education. *Scottish Journal of Political Economy*, **51**(2), 230-249.

[7] Bratti, M., Checchi, D., De Blasio, G. (2008). Does the expansion of higher education increase the equality of educational opportunities? Evidence from Italy. *Labour*, **22**(S1), 53-88.

[8] Card, D. (1993). Using geographic variation in college proximity to estimate the return to schooling. *National Bureau of Economic Research*, (No. w4483).

[9] Caner A., Demirel M., Okten C. (2019). Expansion of higher education and labor market outcomes: Evidence from Turkey. *Working Paper*

[10] Caner A., Okten C. (2010). Risk and Career Choice: Evidence from Turkey. *Economics of Education Review*, **29**(6), 1060-1075.

[11] Caner A., Guven, C., Okten, C., Sakalli, S.O. (2016). Gender roles and the education gender gap in Turkey. *Social Indicators Research*, **129**(3), 1231-1254.

[12] Council of Higher Education (2004). *Türk Yükseköğreniminin bugünkü durumu*. Council of Higher Education, Ankara.

[13] Council of Higher Education (2007). *Türkiye'nin Yükseköğrenim Stratejisi*. Council of Higher Education, Ankara.

[14] Dayioğlu, M., Kirdar, M. G, Koc, I. (2015). Does longer compulsory education equalize schooling by gender and rural/urban residence?. The World Bank.

[15] Devereux, P. J., Fan, W. (2011). Earnings returns to the British education expansion. *Economics of Education Review*, **30**(6), 1153-1166.

[16] Duflo, E. (2001). Schooling and labor market consequences of school construction in Indonesia: Evidence from an unusual policy experiment. *American Economic Review*, **91**(4), 795-813.

[17] Krishna, K., Lychagin, S., Frisancho, V. (2018). Retaking in High Stakes Exams: Is Less More?. *International Economic Review*, **59**(2), 449-477.

[18] Kyui N. (2016). Expansion of higher education, employment and wages: Evidence from the Russian Transition. *Labour Economics*, **39**, 68-87.

[19] Maurin, E., McNally, S. (2008). Vive la revolution! Long-term educational returns of 1968 to the angry students. *Journal of Labor Economics*, **26**(1), 1-33.

[20] Measuring, Selection and Placement Center (2000-2013). OSYM Almanacs.

[21] Organisation for Economic Co-operation and Development (2017). Education at a glance 2017: OECD indicators, *OECD Publishing*.

[22] Oppedisano, V. (2011). The (adverse) effects of expanding higher education: Evidence from Italy. *Economics of Education Review*, **30**(5), 997-1008.

[23] Pekkarinen, T. (2012). Gender differences in education. *Nordic Economic Policy Review*, **1**(1), 165-194.

[24] Polat, S. (2017). The expansion of higher education in Turkey: Access, equality and regional returns to education. *Structural Change and Economic Dynamics*, **43**, 1-14.

[25] Di Pietro, G., Cutillo, A. (2008). Degree flexibility and university drop-out: The Italian experience. *Economics of Education Review*, **27**(5), 546-555.

[26] Reimer, D., Pollak, R. (2009). Educational expansion and its consequences for vertical and horizontal inequalities in access to higher education in West Germany. *European Sociological Review*, **26**(4), 415-430.

[27] Rosenzweig, M.R., Wolpin, K.I. (1986). Evaluating the effects of optimally distributed public programs: Child health and family planning interventions. *The American Economic Review*, **76**(3), 470-482.

[28] Turkish Institute of Statistics (2006). National Education Statistics, Formal and Non-Formal Education. Turkish Institute of Statistics, Ankara.

[29] Turkish Institute of Statistics (2018). Household Labor Force Surveys.

[30] Walker, I., Zhu, Y. (2008). The college wage premium and the expansion of higher education in the UK. *The Scandinavian Journal of Economics*, **30**(5), 997-1008.

[31] Yilmaz, B. (2014). The effects of the university reform in Turkey on narrowing gender gap in higher education. MSc. Thesis, Bilkent University, Ankara.

9 Appendix

Table A.1: Programs by field of study

Major	Programs
Social Sciences	Economics, business and administration, anthropology, philosophy, sociology, psychology.
Engineering	All engineering programs, architecture, construction and building, computing, manufacturing and processing.
Science	Biology, molecular biology and genetics, physics, chemistry, mathematics, statistics.
Teaching	All education programs except for teaching in higher education.
Health	Medicine, nursing, dentistry, pharmacy, veterinary.
Law	Law
Services	Social services, personal services, transportation services, security services.
Other	Arts, journalism, agriculture, forestry and fishery.

Source: Authors' definitions.

Table A.2: The intensity of expansion policy across years

Intensity variable	2009	2010	2011	2012	2013
Intensity	0.201	0.233	0.240	0.283	0.298
New intensity	0.068	0.092	0.096	0.122	0.141
Old intensity	0.133	0.141	0.144	0.162	0.157
Intensity	0.201	0.233	0.240	0.283	0.298
Public intensity	0.167	0.197	0.200	0.227	0.234
New public intensity	0.059	0.074	0.074	0.090	0.104
Old public intensity	0.108	0.124	0.126	0.137	0.129
Private intensity	0.034	0.035	0.040	0.057	0.065
New private intensity	0.009	0.018	0.021	0.032	0.037
Old private intensity	0.025	0.018	0.019	0.025	0.027
Intensity	0.201	0.233	0.240	0.283	0.298
Intensity in social science	0.084	0.099	0.106	0.136	0.148
New intensity in social sciences	0.026	0.036	0.041	0.056	0.065
Old intensity in social sciences	0.058	0.063	0.064	0.080	0.083
Intensity in engineering	0.043	0.054	0.056	0.077	0.079
New intensity in engineering	0.014	0.020	0.021	0.030	0.036
Old intensity in engineering	0.029	0.034	0.035	0.047	0.044
Intensity in science	0.026	0.029	0.020	0.014	0.005
New intensity in science	0.011	0.014	0.009	0.008	0.003
Old intensity in science	0.015	0.016	0.011	0.006	0.008
Intensity in teaching	0.014	0.012	0.013	0.003	0.002
New intensity in teaching	0.020	0.019	0.019	0.017	0.020
Old intensity in teaching	0.006	0.007	0.006	0.020	0.022
Intensity in health	0.013	0.016	0.019	0.026	0.038
New intensity in health	0.005	0.007	0.008	0.011	0.014
Old intensity in health	0.007	0.009	0.011	0.015	0.024
Intensity in law	0.007	0.007	0.009	0.010	0.014
New intensity in law	0.001	0.001	0.002	0.003	0.004
Old intensity in law	0.006	0.006	0.006	0.007	0.010
Intensity in services	0.004	0.006	0.007	0.010	0.013
New intensity in services	0.001	0.001	0.002	0.003	0.005
Old intensity in services	0.003	0.005	0.005	0.006	0.007
Intensity in other	0.011	0.010	0.012	0.013	0.014
New intensity in other	0.002	0.002	0.002	0.003	0.004
Old intensity in other	0.010	0.009	0.010	0.011	0.011

Source: OSYM Almanacs and Turkstat Education Statistics (Authors' calculations).

Table A.3: The correlation of exposure intensity with the educational attainment prior to expansion

	Dependent variable: Intensity in year				
	2009	2010	2011	2012	2013
Higher education attainment rate in 2005	-0.398 (0.951)	-1.588 (1.239)	-1.394 (1.273)	-0.924 (1.587)	-0.792 (1.774)
Observations	26	26	26	26	26
	Dependent variable: Old intensity in year				
	2009	2010	2011	2012	2013
Higher education attainment rate in 2005	-0.398 (0.951)	-1.588 (1.239)	-1.394 (1.273)	-0.924 (1.587)	-0.792 (1.774)
Observations	26	26	26	26	26
	Dependent variable: New intensity in year				
	2009	2010	2011	2012	2013
Higher education attainment rate in 2005	-0.398 (0.951)	-1.588 (1.239)	-1.394 (1.273)	-0.924 (1.587)	-0.792 (1.774)
Observations	26	26	26	26	26

Notes: Higher education attainment rate in 2005 of 26 regions is calculated using HLFS 2005. A constant is included in all regressions. The standard errors are given in parentheses.*p<0.1 **p<0.05 ***p<0.01.

Table A.4: The effect of compulsory schooling law on higher education attainment

	Dependent variable: Higher education attainment			
	Men		**Women**	
	(1)	(2)	(3)	(4)
Compulsory schooling policy	-0.024** (0.011)	-0.020* (0.012)	-0.004 (0.010)	-0.010 (0.012)
Observations	51,148	38,149	55,131	41,344
Cohorts	2001-2008	2002-2007	2001-2008	2002-2007

Notes: Constant, time trends before and after the compulsory schooling policy, region and wave fixed effects are included as control variables. The standard errors clustered at region×cohort level are given in parentheses.*p<0.1 **p<0.05 ***p<0.01.

Table A.5: The effect of expansion policy on gender gap in sample of different cohorts

	Dependent variable: Higher education attainment					
	(1)	(2)	(3)	(4)	(5)	(6)
Policy	0.023	0.010				
	(0.016)	(0.020)				
Policy×Woman		0.026				
		(0.023)				
Intensity			0.151***	0.195***		
			(0.037)	(0.052)		
Intensity×Woman				-0.088		
				(0.063)		
Old Intensity					0.144**	0.178**
					(0.056)	(0.076)
New Intensity					0.153***	0.200***
					(0.042)	(0.057)
Old Intensity×Woman						-0.066
						(0.101)
New Intensity×Woman						-0.093
						(0.067)
Observations	104,124	104,124	104,124	104,124	104,124	104,124

Notes: Included cohorts 2002-2005 and 2009-2012. In columns (1) and (2), constant, woman dummy, time trends before and after the expansion and their interactions with woman dummy, region and wave fixed effects and their interactions with woman dummy are included as control variables. In columns (4)-(6) constant, woman dummy, region, cohort, wave fixed effects and their interactions with woman dummy and the number of high school graduates are included as control variables. The standard errors clustered at region×cohort level are given in parentheses.*p<0.1 **p<0.05 ***p<0.01.