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Female Admission Cap in Higher Education: the Case of Iran

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Abstract: We study the effect of an Iranian educational policy implemented in 2012 that restricted access to higher education for women in 30% of Iran's public universities, mostly in sciences and engineering. To analyze the effect of the policy, we use a triple difference strategy across gender, cohorts and regions. We find that the admission cap was binding, as it significantly reduced university attendance by women relative to men. Additionally, we find that the policy had a negative impact on female labor force participation and employment, and a positive impact on marrying at a young age. Furthermore, we explore heterogeneous treatment effects for urban and rural areas and show that most observed effects are driven by individuals in urban areas.

J.E.L. Classification: I23, I24, I28, J12, J16, J21, O53.
Keywords: Higher education, policy evaluation, admission ban, quotas, female labor market, urban-rural divide, marriage, Iran.

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1 Introduction

In September 2012, the implementation of a new higher education policy in Iran was reported by news outlets around the world. This policy restricted access to higher education for women in several fields at various universities, raising concerns about the status of women's rights in the country. The restrictions affected about 50 public universities (about 30% of all public universities) all over Iran and reduced the share of Bachelor programs and seats available to women, mainly in popular and prestigious fields, such as engineering. The announcement of this policy caused outspoken dissatisfaction among students in the country. Female students feared that it would hinder their ability to attend their preferred subject or university, or even to join university at all.[1]

The restrictions were imposed in the 2012-13 academic year, and were gradually lifted starting from the following year (2013-14). The motivations behind the policy, as explained by some of the university presidents that implemented restrictions, were to direct women towards more traditional subjects, and at the same time to decrease competition for men at university. One argument in favour of the restrictions to subjects such as engineering was that women are less likely to work after their degree, so it is more productive to reserve more seats for men for these subjects.[2]

Despite the wide media coverage, to date no systematic evaluation of the effect of this policy has been conducted. The aim of this paper is thus to analyze the effect of this policy on university education, on the labor market and on the marriage market. A large body of literature investigates the impact of affirmative action at university on education attainment (e.g. Arcidiacono and Lovenheim, 2016; Bagde et al., 2016; Bowen and Bok, 2016; Epple et al., 2008; Howell, 2010; Khanna, 2020). This literature mainly focuses on analyzing the effect of policies aimed at promoting higher education of disadvantaged groups, such as ethnic minorities and women. However, to the best of our knowledge there are no studies estimating the impact of a higher education policy that explicitly aims at favoring men over women. Hence, whether the effect of restrictions is simply the mirror image of a positive quota is an open question.

[1] These concerns are well represented by the following quote by a young Iranian woman, reported by the BBC: "I wanted to study architecture and civil engineering, but access for girls has been cut by fifty per cent, and there's a chance I won't get into university at all this year.". See https://www.bbc.com/news/world-middle-east-19665615.

[2] Asr-e Iran Analytical News, Issue 226750 19 Mordad 1391 (August 9, 2012).

In the past, many countries had policies in place that restricted the access to education of minorities and women.[3] Nowadays, formal admission restrictions based on ethnicities and gender are forbidden in most countries, and in some countries even replaced with affirmative action (e.g. U.S. and India). As a consequence, there has been a worldwide increase in higher education for women over the last decades. However, informal barriers to higher education due to cultural and gender norms persist. Therefore, while in most high-income countries women nowadays represent the majority of undergraduate students, in big parts of the world (Sub-Saharan Africa, South and West Asia and Central Asia) women still represent a minority of undergraduate students, highlighting the fact that not everywhere men and women have the same opportunities (UNESCO-IESALC, 2021).

Whereas in Iran restrictions for women in universities were imposed in the past, the implementation of this policy came as a surprise for many. The country made considerable progress in promoting education for women since the Islamic Revolution in 1979, and in 2001 for the first time women outnumbered men at university, and women's admissions accounted for over 60% of total new enrollments before 2012 (Rezai-Rashti and Moghadam, 2011; Moinifar, 2012). Thus, today the differences in education attainment between men and women are very small, and the largest differences across individuals are due to regional heterogeneity. However, even though women are doing as well as men in terms of education, they still represent only a very small fraction of the formal labor force and suffer from higher unemployment rates compare to men. Female labor force participation in Iran was as low as 18% in 2019.[4]

The 2012 higher education policy represents a unique setting to study the effect of restrictions on education outcomes. It further allows to evaluate the importance of a university degree for women in the Iranian labor and marriage market, as this policy provides an exogenous variation in the number of programs and seats available at public

[3]Historically, universities in most countries were open only to men. In the United States, up until in the early-mid 20th century, universities such as Stanford and Yale imposed quotas for women, some of which were only eliminated in the 1970s (Parker, 2015). Other recent examples are Saudi Arabia, where university campuses have been segregated and the subjects women can take are limited (Hamdan, 2005), and Afghanistan during the Taliban regime (1996-2001), which banned girls from attending schools (Noury and Speciale, 2016). There is also a long list of restrictions to schooling and university eduction for minority groups. For instance in Europe, in the wake of the second world war, some countries such as Germany and Italy banned Jewish students and faculty.

[4]International Labour Organization, ILOSTAT database, data retrieved on June 15, 2021. Other countries exhibit a poor performance in the labor market for women even if women's education levels are not far from those of men, for instance Egypt and Saudi Arabia (UNESCO Institute for Statistics, uis.unesco.org, data as of September 2020).

universities.

Iran has a central admission system that allocates students across universities and programs depending on their scores in the university entrance exam (*konkur*). The university entrance exam is specific to broad fields of study (mathematics, natural sciences, humanities, arts and foreign languages) and gives access only to corresponding programs. The changes were announced in August 2012 after students had already taken the university entrance exam. Hence, prospective students who wished to start university in fall 2012 saw the overall number of choices reduced—in particular those females women, who took the *konkur* in mathematics and natural sciences. Thus, the direct consequence of the admission cap was a decrease in the share of Bachelor programs and seats for females enrolling at university in 2012, with strong restrictions in specific fields.

The restrictions are expected to differentially affect university attendance for women and men. First, the increase in competition among women for a smaller proportion of seats and programs in popular subjects reduces the probability of women to enroll in these programs (the opposite should happenholds for men). Women who cannot enroll in their preferred program might decide to study a different program, the same program in a different university, or decide to not join university that year.[5] Students with low scores at the entrance exam, or females who are displaced from public universities might still decide to enroll in a private university, although degrees from private universities are much less prestigious and more costly. Thus, it is a priori not clear whether the restrictions would have an important adverse effect on university attendance of women. Second, by reducing significantly access to a very popular program (engineering), females were much more likely to enroll in less popular programs. This should lead to a higher mismatch between females and programs. Importantly, whether or not a female attends university, and the program of study, can have long-term impacts on later life outcomes, such as labor force participation, employment, and the decision to get married.

To identify the impact of these policy changes, we implement two empirical strategies. In our baseline specification we compare women and men in affected and unaffected cohorts. We expect the policy to have a stronger impact on the cohort of high school graduates of 2012 compared to younger or older cohorts. In 2013, the allocation of seats

[5]It is common for students who are not satisfied with their ranking in the *konkur* to take one additional year to prepare for the entry examination, and re–take the exam again in the follwing year. This is particularly the case for women, as men have the obligation to attend military service if they are not officially enrolled in a study program.

was less gender unequal compared to the previous year, and younger students would have had more time to adjust their choices in light of the 2012 changes. Older cohorts who graduated from high school and applied to university in earlier years should also be less affected by the policy changes. However, this strategy might suffer from omitted variable bias, due to the possibility that other changes might have happened at that time and that affect all women in the same cohort.

Our main empirical analysis therefore relies on a triple-difference strategy that uses variation across gender, cohorts and regions. For this, we exploit the fact that only a subset of the 177 public universities implemented restrictions and this also at various degrees.[6] We further rely on the fact that the overwhelming majority of Iranian students continues to live with their parents while studying, and thus choose to attend a university near their family's residence. As a consequence, the policy is expected to have a larger impact on individuals living in cities where stronger restrictions had been implemented, with stronger restrictions leading to a stronger disadvantage for the local female population compared to the prospective male students. We construct two measures for the degree of restrictions in each city: one based on the change in the share of total programs between 2011 and 2012 that are available for women and one measure based on the change in the share of seats. These measures are then interacted with gender and cohort dummies and represent our main variables of interest.

We find a strong negative effect of the policy on university attendance for women relative to men. The effect is strongest for individuals who are 19 in 2012 and which corresponds to the cohort starting university in 2012: the differential effect for women relative to men in this cohort is of about 3 percentage points. This negative impact of the policy on the high school graduates of 2012 is confirmed when we rely on our triple difference strategy that exploits the variation of restrictions across cities. In addition, we explore heterogeneous effects for urban and rural areas, and we find a stronger negative effect on university attendance in urban areas. Furthermore, we show that the impact of the policy extends beyond education, to the labour and marriage markets. We consider the following outcomes: labour force participation, unemployment, employment for a wage and on the probability of being married at the age of 20. Our findings suggest that women in cohorts affected by the policy are more likely to be married at 20, and less likely to enter the labor force and to be employed for a wage.[7] We find similar adverse labor

[6] See Section 2.3 for more details on the policy and which universities participated.

[7] Ideally, we would like to investigate the effect of the policy on the wage gap. However, given the very

market effects when considering only students who attended university; this suggests that the policy caused a mismatch between female students and university programs, which lead women who attended university during the year of the policy to perform worse in the labor market.

Our paper contributes to the literature on the impact of quotas in higher education. A wide literature has focused on affirmative action in higher education, particularly in the context of the United States and India. In the U.S., the literature has found a positive effect of affirmative action on elite college enrollment for African Americans (e.g. Bowen and Bok, 2016; Epple et al., 2008; Long, 2004; Howell, 2010; Hinrichs, 2012). However, the evidence on whether affirmative action benefits targeted students is more mixed: while some studies find that minority students benefit from attending selective colleges and do not find evidence of mismatch in universities due to affirmative action (e.g. Alon and Tienda, 2005; Fischer and Massey, 2007), others, such as Sander (2004), claim that affirmative action in law schools may harm African American students, leading to poor performace of these students.[8] Whereas the U.S. studies focus on affirmative action based on ethnicity, the studies on India investigate the effect of affirmative action based on caste and gender. This literature mostly finds a positive effect on education outcomes for groups targeted by affirmative action (Bagde et al., 2016; Bertrand et al., 2010; Khanna, 2020), with the exception of Frisancho and Krishna (2016), who find that affirmative action is not necessarily beneficial for targeted minority students, as their academic performance is lower than that of their less disadvantaged peers, and they earn less than they could have if they had chosen a less selective major.[9] Our paper contributes to this literature by analyzing the effect of imposing restrictions to higher education for women. As opposed to the existing literature on affirmative action in higher education, that focuses on promoting equal opportunities across genders or ethnic groups, this paper studies a policy that focuses on restricting equal opportunities across genders[10]

low share of women who are working for a wage in Iran and our triple difference strategy that exploits variation across cities and cohorts, it is difficult to get reliable estimation results.

[8]See Arcidiacono and Lovenheim (2016) for a recent review of the literature.

[9]Bertrand et al. (2010) analyze affirmative action in favour of "lower caste" groups and find that non-targeted minorities, such as women, can lose out from affirmative action policies targeting other minority groups. Moreover, their findings suggest that such policies can be costly for displaced students: they show that, while targeted groups tend to gain from affirmative action in terms of later earnings, the losses incurred by displaced applicants from less disadvantaged castes are larger in absolute terms.

[10]Related to our paper, although not focused on higher education, is the work of Noury and Speciale (2016), who analyze the effect of a ban on women's schooling during the Taliban regime in Afghanistan. Their findings indicate a negative effect of the ban on schooling and on the probability to work outside the house, a positive effect on fertility and a reduction in the age at first marriage.

This study also contributes to the literature on the effect of higher education policies involving quotas on the labor and marriage markets. While numerous studies exist on the effect of higher education quotas (such as affirmative action policies) on the labor market (e.g. Arcidiacono, 2005; Arcidiacono et al., 2010; Bertrand et al., 2010), the empirical evidence on the effect of such policies on the marriage market is instead scarce. However, several studies show that higher education can have an impact on the marriage market, particularly for women (Goldin, 1997; Goldin et al., 2006; Kaufmann et al., 2015).

Finally, our study contributes to the literature on the gender gaps by documenting key descriptive facts on the evolution of the gender gap in higher education and the labor market in Iran for the period 2010 to 2015, combining various sources. Iran is a relatively understudied country in the field of economics, and only limited rigorous empirical evidence exists on the differential effect by gender of government policies in Iran; one exception is the paper by Moeeni and Tanaka (2020), which investigates the effect of a hiring quota that reduced labour market opportunities for high skilled women on women's education and marriage outcomes.

The paper is structured as follows. Section 2 provides details on the higher education system in Iran, and on the policy that we examine. Section 3 describes the data and provides descriptive statistics for the main variables. Section 4 explains the empirical strategy used to estimate the effects of the policy. Section 5 presents and discusses the results. Finally, Section 6 concludes.

2 Higher Education in Iran

The schooling system in Iran is divided into primary school, lower secondary school and high school. Primary school starts when the children have turned 6 years old. For the birth cohorts analyzed in this study (1990-1995), it lasted for 5 years.[11] After primary school, students attend lower secondary school (3 years) and high school (3 years). Students who wish to attend university need to complete a further year of pre-university studies after having obtained a high school diploma. After finishing high school, at age 18 to 19, Iranian teenagers have three options: either regular work, study for a two-year *Associate*

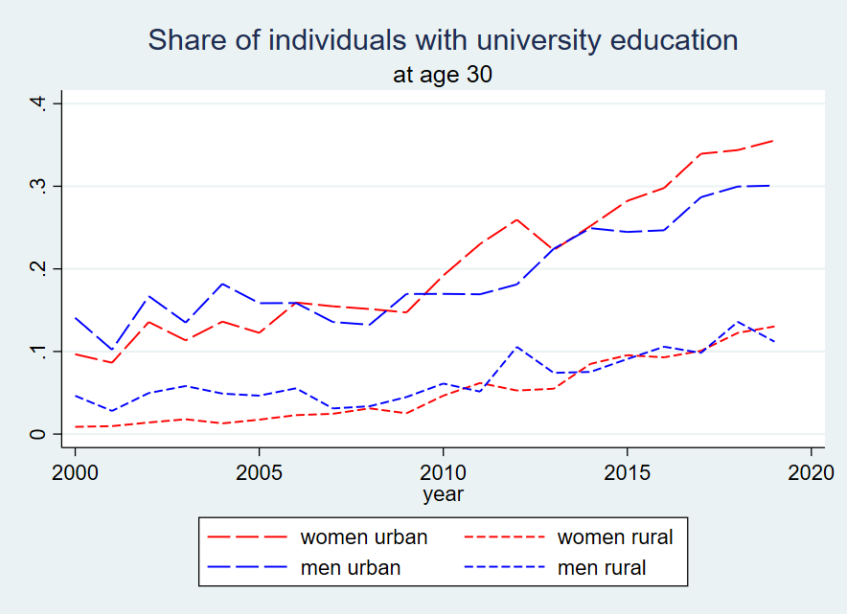
[11]The schooling system in Iran underwent several changes in recent years, and the duration of primary school has now increased to 6 years.

degree,[12] or attend university for Bachelor degree.

In the following subsections, we first discuss the evolution of higher education in Iran and the link between higher education and the labor market (Section 2.1). In Section 2.2, we present the university admission system and gender segregation policies that have preceded the 2012 policy. Finally, in Section 2.3 and 2.4 we detail the restrictions implemented to university admission in 2012 and their implications in terms of education and labor market outcomes for the concerned cohorts.

2.1 Higher education and labor market trends in Iran

Figure 1: Share of individuals with university education by gender and urban-rural location

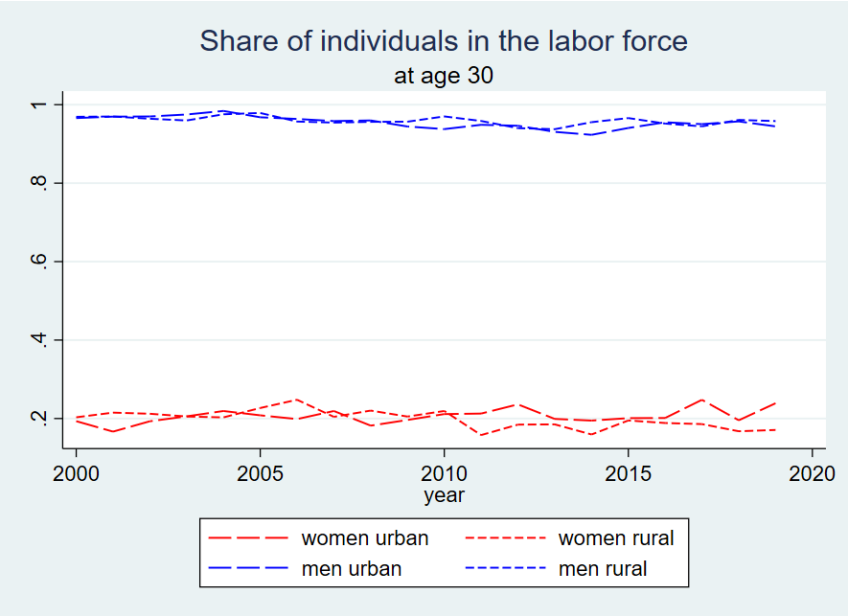


Notes: This figure shows the evolution of the share of individuals with some university education at age 30, by gender and by urban-rural location of the household. Data from the Household Income and Expenditure Survey.

Over the last two decades, Iran has seen a large increase in the share of individuals in higher education for both genders, but particularly for women. While women and men are now very similar in terms of educational attainment, the largest differences across individuals in terms of education are due to regional heterogeneity.

[12]This is a more practical formation. However, it is common that after finishing this degree, students join university to do a Bachelor program. Generally, they can do this in a shorter time than regular Bachelor students, i.e. 2 academic years.

Figure 2: Differences in labor force participation by gender and region (at age 30)



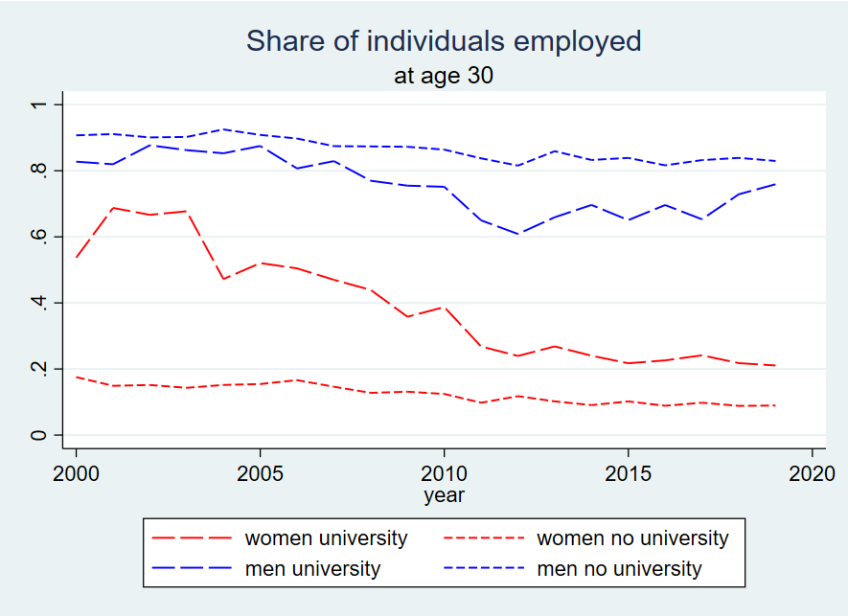
Notes: Data from the Household Income and Expenditure Survey.

Figure 1 shows the evolution of individuals who have ever attended university by gender and location of the household in rural versus urban areas. We notice that both men and women from rural households are much less likely to have higher education compared to individuals in urban areas. In the past decade, urban women have surpassed urban men in terms of probability of attending university.

We also observe stark differences in university education by region. Figure B.2 represents the share of individuals between 19 and 30 who have ever attended university by city (*shahrestan*) in 2011, the year before the policy under study. Predominantly rural regions, such as the South-East of the country, have a very low share of young individuals with university education. The regional variation in university attendance reflects to some extent differences in access to high-quality higher education. Figure B.3 depicts the number of public universities in each city in 2012, the year the policy was implemented. In fact, we note a low prevalence of universities throughout the East and the South-East, with many cities not hosting any public university. A larger number of universities are concentrated in the Center-East of the country. There is only one city (Tehran) with more than 10 public universities, and a few with 5-9, while a large number of cities have only 1 or 2.

Interestingly, the recent gains for women in terms of higher education have not trans-

Figure 3: Differences in employment by gender and education (at age 30)



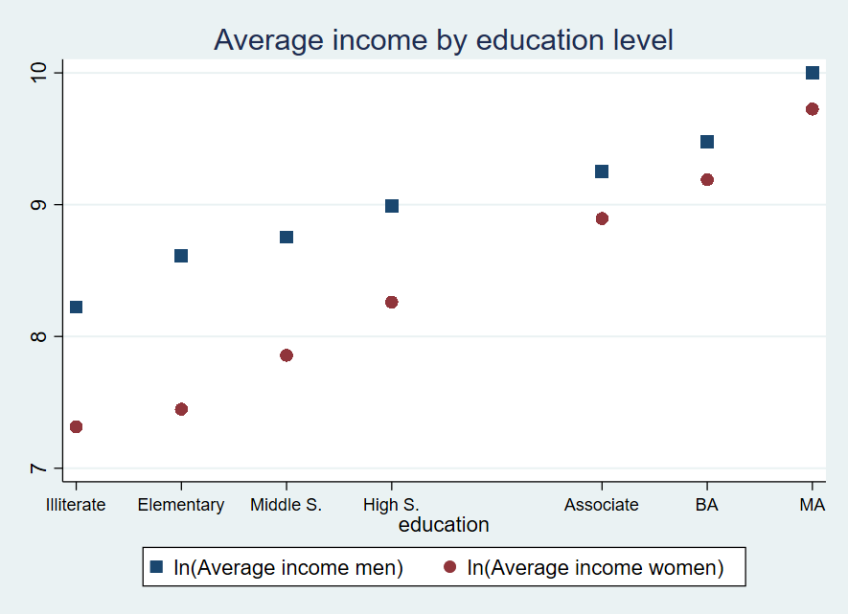
Notes: Data from the Household Income and Expenditure Survey.

lated into gains in the labor market. Figure 2 shows the differences in labor force participation by gender, again separately for urban and rural households. We observe here very sharp differences between men and women, but little heterogeneity for both genders when considering the differences between rural and urban areas. Whereas nearly all men at age 30 are part of the labor force, only about 20% of both urban and rural women are declaring to work or look for a job. The share of women entering the labor force has been roughly the same in the past two decades, despite the increase in higher education attendance. However, Figure 3 highlights a clear link between university education and probability of being employed: even though over the last years the importance of a university degree seemed to have decreased for both genders, women with higher education are still more likely to be employed than other women.[13] Furthermore, Figure 4 shows the average wages by education level and gender for individuals that report income from work. While the figure illustrates very clearly that women earn much less compared to men for all levels of education, it also shows that for women the returns to education are higher. On average a women will earn as much as an illiterate man when she has a high school degree. Only for post-secondary education the gender gap significantly decreases.

[13]The economic situation in Iran had worsened substantially since 2005, also due to international economic sanctions and increased political isolation of Iran. This has led to an overall increase in youth unemployment.

Overall, this figure suggests that restrictions to university education for women are likely to have harmful consequences for women in the labor market.

Figure 4: Returns to education by gender



Notes: This figure shows the average income to different levels of education for each gender separately (transformed in ln). Data come from the Household Income and Expenditure Survey (2000 - 2019). The sample contains around 623,000 individuals of at least 16 years old that declare a positive work income. 11% are women.

2.2 University admission system and gender segregation prior to 2012

Iran has a centralized university admission system. If high school graduates want to go to university, they first need to participate in the yearly university entrance exam, the so-called *konkur*, which always takes place in early summer.

The Iranian university system groups fields of study in 5 different disciplines, all of which require their own *konkur*: (*i*) mathematics and technical fields, (*ii*) sciences, (*iii*) humanities, (*iv*) arts, (*v*) languages. Students can only take one *konkur* of the three first disciplines, and may then take a second *konkur* in either arts or languages. The discipline of the chosen *konkur* determines the subjects a prospective student is allowed to study. However, there are a few exceptions. All three of the main *konkur* give access to economics, accounting, chemistry, theology and psychology programs.

Table 1: Extract course book Maths & Physics, 2012

Yasuj University				
Code	Title of BA program	Total nb of seats	Seats female	Seats male
2108	Mathematics and applications	36	18	18
2109	Physics	36	18	18
2110	Polymer Engineering	15	-	Male
2111	Chemical engineering	20	7	13
2112	Civil Engineering	36	12	24
2113	Mechanical Engineering	36	12	24
2114	Materials Engineering	20	7	13
2115	Civil Engineering Technician	15	-	Male

Once the results of the *konkur* have been published, prospective students need to hand in a list with their preferred program/university combinations. The list can contain up to 200 program/university combinations, and should be filled in according to the prospective student's order of preferences. The very best prospective students at the entrance exam are likely to get their first choice and attend the most prestigious universities of Iran (e.g. Sharif University of Technology or University of Tehran). Among the highly prestigious and demanded programs of study are engineering, medicine and biology. Prospective students in the lower part of the grade distribution have to content themselves with less popular subjects at lower ranked universities. The information on the available programs students can choose from is published every year after the announcement of the results in the so-called course books. For each *konkur* a separate course book is published. It contains the list of all the programs, including the number of seats by gender, that students with the corresponding *konkur* can apply for. Table 1 shows an extract from one of the course books of 2012.

With the start of Mahmoud Ahmadinejad's presidency in 2005, more conservative forces gained power in the Iranian administration. Some informal caps on female students had been implemented already in 2006 for specific programs (notably medicine). However, universities continued to offer higher education for both genders in nearly all programs. As we can see from Table 2, in 2010 out of the 156 universities that offered programs for the three main disciplines (humanities, mathematics and sciences), the large majority did not have any gender restrictions in their admission process.[14] There are 10 universities that

[14]In the course books, the columns on female and male seats where then simply filled with "female"

are historically male or female-only universities, and thus never offer common programs or shared seats for both gender. In 2010, 48 universities offered mostly programs that are open to all, but had only few programs or seats that were subject to gender quotas. This can be seen in Table 3, which reports the number of programs in each year that are open for each gender. Notice that the percentage of programs in which women are accepted is higher than the percentage of programs in which men are accepted in the years 2010 and 2011. Most of the programs open for women are in the field of midwifery, which has always been a female-only field of study. The quotas for seats by gender were generally 50-50.

Table 2: Overview on universities with clear or no separation between men and women

	2010	2011	2012	2013	2014
	Nb of universities				
Programs					
No gender segregation	98	79	75	91	112
Full gender segregation	10	16	24	24	18
Partial gender segregation	48	71	78	75	69
Seats					
No gender segregation	96	54	51	64	86
Full gender segregation	12	55	58	47	34
Partial gender segregation	48	57	68	79	79
Total nb of univ.	156	166	177	190	199

Source: Own calculations. Data from the university course books on Mathematics, Sciences and Humanities (2010-2014).

In 2011, some first significant changes appeared in the course books. As can be seen from the lower part of Table 2, now the majority of universities started to list explicitly the number of seats that they attribute to each gender. Only 54 out of the 166 universities did not apply any quotas. However, the universities that split seats by gender generally chose an allocation of 50-50. Table 3 shows that for both men and women the share of programs they could apply to was comparable - and women were still slightly advantaged due to the high number of courses in midwifery.

This gender segregation policy did not get much media attention, likely due to the fact that very few courses got eliminated for each gender. Also, due to the relatively equal

and "male" without specifying beforehand how many seats should go to each of the gender.

Table 3: Gender restrictions in the course books

	Women not accepted		Women accepted		Men not accepted		Men accepted	
	No.	%	No.	%	No.	%	No.	%
2010	67	2.64	2473	97.36	102	4.02	2438	95.98
2011	125	4.65	2565	95.35	187	6.95	2503	93.05
2012	605	18.50	2665	81.50	302	9.24	2968	90.76
2013	487	14.13	2959	85.87	158	4.59	3288	95.41
2014	332	9.26	3255	90.74	166	4.63	3421	95.37

Notes: Data from the University course books published by the Iranian Ministry of Education (2010-2014).

split, this change could have been perceived as fair for both men and women. Nevertheless, these changes very likely resulted in some students not being able to join their preferred program and being displaced by students of the opposite gender with a worse entry exam score. Moreover, since women represented a higher share of *konkur* candidates and had been in the past the majority of students, this change could have already lead to a decrease in admissions for female students. We will thus control for this policy in our empirical analysis, and show in robustness checks that this policy is not driving our results.

2.3 Gender segregation and changes in the admission system in 2012

In 2012 more substantial changes were implemented to university admission—and these changes led to an outcry in the national and the international media. These new admission restrictions can be seen in the course books for 2012, which were published only after the prospective students had taken their university entrance exam. Whereas the media generally only reported that females were banned from engineering-related fields in 36 public universities, Table 2 and 3 rely on the actual data from the course books and give a more complete picture on the degree of banning women from programs and imposing strict gender quotas.[15]

Table 2 shows that the number of university that had no restrictions at all decreased further in 2012 and that the number of universities that offered programs only to one

[15]See https://www.mehrnews.com/news/1666033 for the first Iranian national newspaper article that brought this gender-specific restrictions to the admissions into the spotlight.

gender increased to 24. From the course book data we can observe that, in 2012, actually 53 out of the 177 universities that offered Bachelor programs in 2012 decreased either the share of programs or the share of seats open to women, or both.

Table 3 allows to gauge better the extent of the restrictions by displaying the number and percentage of programs that women and men are permitted/not permitted to enrol in. The percentage of programs not accepting women drastically increases in 2012 by almost 14 percentage points (from 4.65% in 2011 to 18.59%). The percentage of programs not accepting men also increases, but only by about 2.2 percentage points (from 6.95% in 2011 to 9.14%). As in previous years, for both genders the number of available programs continued to increase; however, in 2012 there were about 300 programs more for men then for women.[16] The restrictions were gradually lifted starting from the following year (partly due to the complaints from students), although they were still present to some extent in 2013, as can be seen from Table 2 and 3.

Decisions on the admission process are generally taken by presidents and the boards of the individual universities; however, the Ministry of Sciences coordinates the central admission process, and thus is aware of the available seats proposed by each university.[17] Only very few universities have made official statements on the motivations of their admission policy changes in 2012, but personal preferences of the board or political ties are likely to have played a role. As these changes were implemented at the university level, there was important variation across universities in the scope of the restrictions.

In the few public statements, the main reason brought forward for their chosen restrictions was that this would reduce female competition for males in the labor market, and to encourage females to engage in more traditional (domestic) activities.[18] This intention can be seen when looking at the number of restrictions across the different *konkur* and the subject of the programs that have been affected. Among the concerned programs, the biggest bulk is in the traditionally male-dominated engineering-related subjects; however, several universities also imposed restrictive ceilings for female students in other fields, such as accounting or chemistry, which were generally leading to occupations generally perceived as suitable for Iranian women. This may have contributed to the perception

[16]The overall number of courses and seats available for both genders increases every year. This is expected, due to an increasing demand for higher education, fueled by population growth and a rising share of high school graduates, which naturally leads to an increase in the number of universities, and in programs and seats.

[17]https://education.stateuniversity.com/pages/676/Iran-HIGHER-EDUCATION.html##ixzz721LpzojU.

[18]Asr-e Iran Analytical News, Issue 226750 19 Mordad 1391 (August 9, 2012).

of the restrictions as arbitrary and unfair.[19] One notable pattern is that restrictions in medical universities were relatively uncommon. Only 6 out of the 55 medical universities in 2012 had implemented restrictions according to our measures, which is in stark contrast to 30% of "Universities of Technologies".[20]

By looking at the extent of the restrictions in the different *konkur* disciplines, we can confirm that in particular female students who took the *konkur* in mathematics and technical fields were suddenly facing a much more limited choice of courses compared to their male colleagues. Figure 5 shows the share of total programs available to women (top panel) and men (bottom panel) by discipline. In addition to the three main disciplines of the *konkur*, we create a separate category including the subjects that can be studied at university after taking any of the three entrance examinations (accounting, chemistry, economics, psychology and theology). While in 2012 we observe a decrease in the share of programs available for women in all fields, the largest decrease is in the field of mathematics, which includes technical subjects such as engineering. These subjects are amongst the most popular for both male and female students, as can be seen from Table B.1, which shows the distribution of male and female university students across different fields in 2010. We also observe a decrease in the share of programs available to men in all but one field (sciences), but a lot smaller than for women. In particular, we only observe a slight decrease in mathematics for men. Furthermore, we observe that for men the share of programs increases again in 2013 and returns roughly to the 2010 levels, for women this is not the case, as the share of available programs only gradually increases and remains lower than in 2010 also in 2013 and 2014.

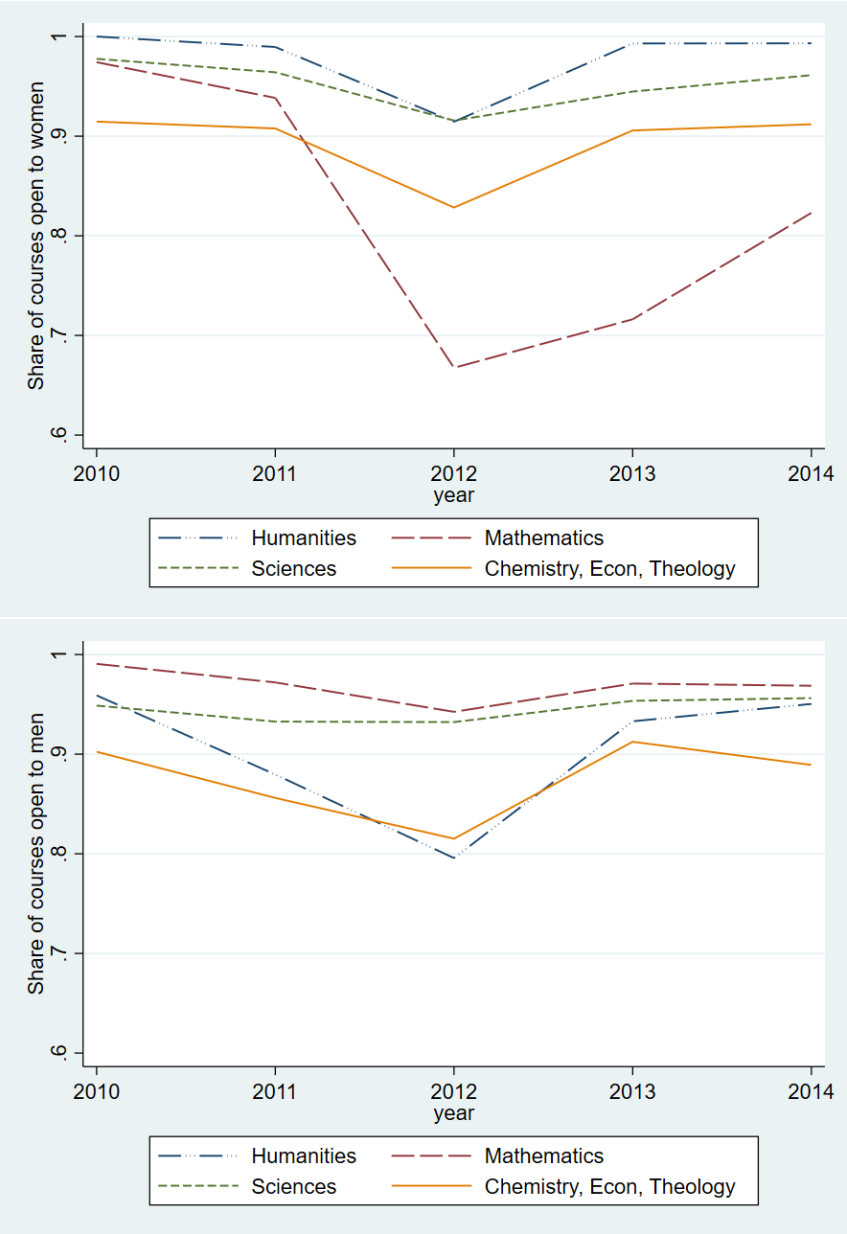
Additionally, we show in Figure B.1 the difference between the number of seats for women and for men by field (a negative number signifies fewer seats for women compared to men). While in 2010 the number of seats for both genders was similar in all fields, by 2012 the difference in mathematics subjects decreases significantly, while there is a slight increase in the seats for women relative to men in the humanities.[21]

[19] Asr-e Iran Analytical News, Issue 226750 19 Mordad 1391 (August 9, 2012).

[20] Restrictions were considered impractical to implement in medical schools (Dokouhaki and Shahrokni). The requirements of the use of laboratory equipment and many practical courses, as well as a high demand for female doctors and health care workers, can be considered also as reasons why gender restrictions in this field are much less common.

[21] Notice that the difference in seats in Mathematics decreases already in 2011, when seats in the course books start to be split by gender.

Figure 5: Admission restrictions for men and women by field

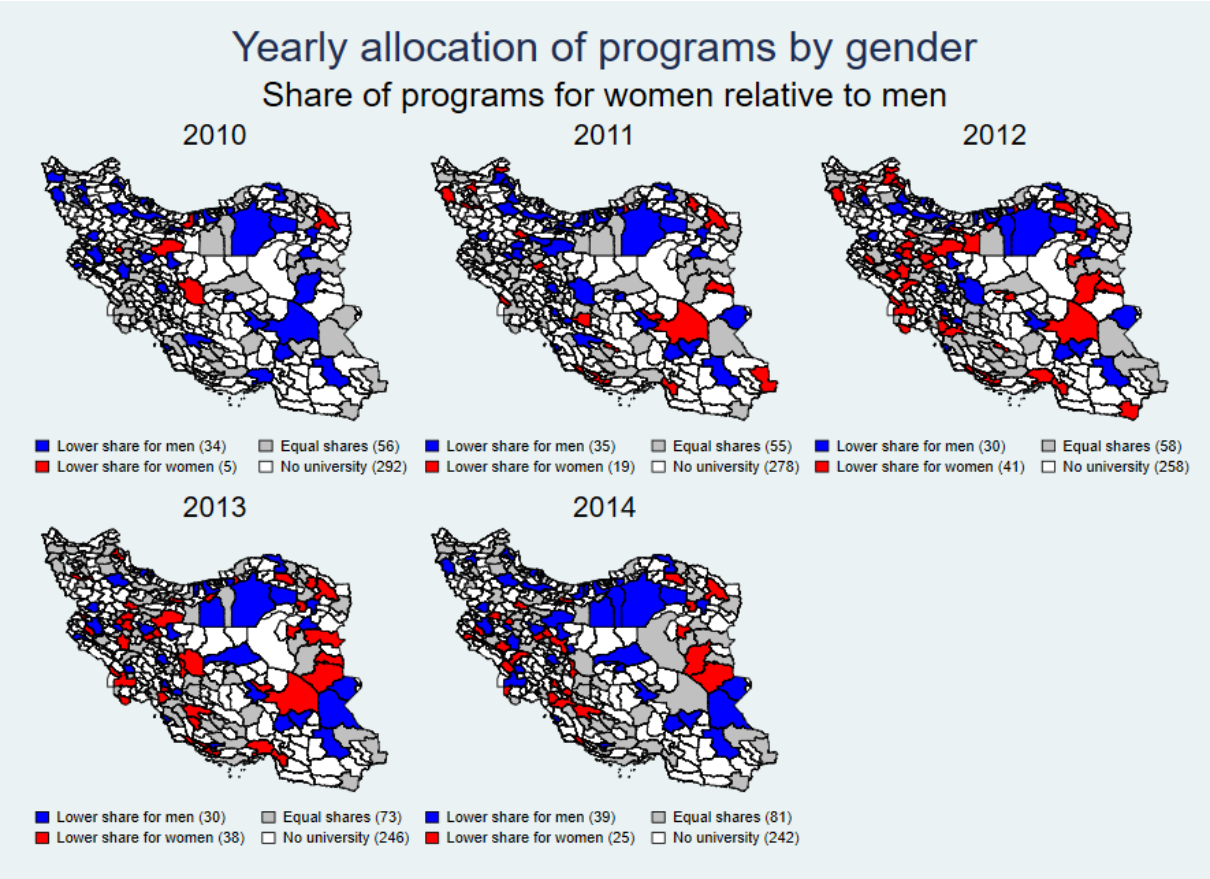


Notes: Data from University course books published by the Iranian Ministry of Education (2010-2014).

Finally, to evaluate the extent of the regional variation in the restrictions, we aggregate the individual programs at the city (*shahrestan*) level according to their location. Figure 6 shows the spatial distribution of programs by gender.[22] The map for 2010 shows well that overall in 2010 most universities had no constraints for women. In 2012, for 41 cities the share of programs for female students was lower compared the share of programs for

[22]Figure B.4 in the Appendix shows the corresponding maps for the allocation of seats.

Figure 6: Spatial distributions of restrictions



Notes: Data from the University course books published by the Iranian Ministry of Education (2010-2014). Programs are aggregated at the *shahrestan* level. The numbers in parentheses indicate the number of cities (*shahrestan* that are in the corresponding category. The share of programs open to men (women) is calculated as the number of programs in the city which either do no give any restrictions by gender or where at least one seat is reserved for a man (woman), divided by the total number of programs offered to new BA students in that year.

males. The map highlights that restrictions for women were common in all parts of the country and there is no clear geographical pattern. In our triple difference strategy, we will rely on the restrictions at the city level and the share of programs open for women will be our main variable of interest.[23]

2.4 What are the potential effects of the 2012 policy?

We expect the restrictions to women's admissions to directly and indirectly affect higher education and labor market outcomes in several ways.

[23]See Section 4.3 for details on the construction of the restriction variables used in the empirical analysis.

First of all, there is a direct mechanical effect on public university education: in the affected cohort, relatively fewer women compared to men are expected to graduate from engineering-related fields. As shown in the previous section, in particular female students who took the *konkur* in mathematics and technical fields suddenly faced a much more limited choice of programs compared to their male colleagues. Furthermore, the overall lower number of seats for females relative to males could lead to women being relatively less likely to attend any university. Additionally, due to the timing of the announcement (after the *konkur*), prospective students in 2012 were unable to react to this policy by adjusting the discipline of their *konkur*: this could have induced some female students facing restrictions not to attend university at all.

Nevertheless, there remain two possible reasons why the reduction in seats in public universities in 2012 did not necessarily had to lead to relatively lower university attendance for women. One possibility is that students who do not obtain a seat in one of their listed programs enrol in a private university. There are however several drawbacks to this: a separate entrance examination is needed for private universities (which is considered generally as less difficult), and degrees from these institutions are much less prestigious, and more costly. Second, female students could wait another year and try the *konkur* again. This is relatively common. As in the following years the restrictions started to fade out, by re-applying to university later women from the affected cohort might still be able to obtain a seat at a public university.

A second important effect of the policy on higher education concerns the allocation of students to programs. Even if the restrictions are concentrated in one discipline, there is likely a substantial "trickle down" effect of this policy change to other prospective students. Many women who planned to study engineering were forced to change their major and enrol in other available programs within the discipline of their *konkur*. As there is a small overlap of programs across the three *konkur* disciplines, this would lead to higher competition in these common programs. Moreover, students who took the mathematics *konkur* and also an additional one in arts or languages might have settled for a program from one of these disciplines; this is likely to increase the competition in those fields and affect program choices of students of other disciplines. Overall, as a consequence of the 2012 changes, more students applying to university in that year were likely to have to settle for one of their less preferred programs. Thus, another possible effect of the policy is that it lead to a higher mismatch between programs and students,

in particular for females.

In turn, both the inability to attend university and the likely mismatch in the allocation of students to university programs could have important consequences for labor market outcomes.

As shown in Figure 3, the direct consequences of not having a university degree for the labor market would be a lower probability of finding a (good) job, as Bachelor degrees, and in particular engineering degrees are highly valued by employers (Rezai-Rashti, 2015). We can expect the opposite effect for male students: as there is less competition from females with a marketable degree, male graduates, especially those from engineering, are likely to find a job more easily, even those who are not among the top graduates. The difference in the employment rate between men and women is thus likely to be particularly high for this cohort.

There are potential effects also for the students who managed to obtain a seat at the university, since women from the affected cohort have an increased probability to have to enroll in a program that is not among their most preferred. On the one hand, female students who enrolled in a field of study that is not among their first preferences might be less motivated and thus perform less well at university (Ayoubi and Ustwani, 2014; Afzal et al., 2010), which can decrease their chances in the labor market or discourage them from even searching for a job. Moreover, in Iran obtaining a bachelor degree from a renowned university is important in the labor market (Rezai-Rashti and Moghadam, 2011); therefore, not being able to obtain a prestigious degree from a public university is likely to harm labor market opportunities for women. On the other hand, if women are pushed towards more "gender appropriate" degrees, they might find it easier to secure a job in professions that traditionally employ more women (for instance, the health sector or education), as employers are more willing to hire females in these sectors than in technical fields (Rezai-Rashti, 2011). This would be in line with the explanation put forward by some university presidents for restricting access to engineering-related subjects.

Besides the cohort of individuals who are 19 in 2012, younger cohorts, and in particular the cohort of individuals starting university in 2013, might also be affected by the policy. However, we would expect these students to be less impacted, as the quotas for female students were less restrictive in 2013. Moreover, younger students would be able to take into account changes that happened in previous years when making choices regarding which discipline to take in the *konkur*, and which programs to apply for. Selecting one

of the less restricted disciplines could increase their chances of getting a seat. Also, these students would have had more time to organize their studies further away from home or apply for private universities.[24] Nevertheless, a negative effect on younger cohorts is still possible, particularly because these changes might discourage young female students from pursuing higher education. However, it is not clear that this effect should be limited to students in cities that actually saw the restrictions. These attitudes would more likely be a more general perception in the population.

We do not expect to see a large impact on university education for older women, as they are mostly not concerned by the *konkur* of 2012. However, there are two ways in which older cohorts could be affected by the policy. First, it is possible that the students who after high school studied for an Associate Degree (which generally takes two years) and then planned on joining university for a Bachelor degree, could also be affected. If this is the case, then also we could also see an impact among the students who were 21, and for some individuals who were 20, at the start of the academic year of 2012. Second, some students could have delayed taking the university entrance examination by one year, which means that the 1991 cohort could potentially be affected by the 2012 policy.

3 Data and Descriptive Statistics

3.1 Data on university programs and seats

We obtain the data on the Bachelor programs at public universities and on the number of seats available for each of the program from the official course books that have been published by the Iranian Ministry of Education. For each program, they contain the code, the name (such as "Chemistry" or "Civil Engineering"), the number of total seats, and how many seats are open for women and men. Our data covers the course books for the three main *konkur* disciplines: humanities, mathematics and technical fields, and sciences. We focus on these subjects because the vast majority of students enroll in one of these disciplines. Only a very small percentage of students chooses arts or languages. We collected data for the years 2010-2014.

[24] While some Iranian students decide to study abroad, this is very costly and only very few families can afford it. Their choice of sending their children to study abroad is likely to be unrelated to changes in local university policy.

3.2 Individual-level data

We obtain the data on individual characteristics such as age, gender, education and income from the Household Income and Expenditure Survey (HIES), which is not publicly available. The HIES is conducted every year by the by the Statistical Center of Iran. We use data for the years 2008-2019. Importantly, it also includes information about the location at the city (*shahrestan*) level, which is the second-level administrative division of the country. The HIES covers nearly all cities in Iran. Over the year the geographical coverage increased from 330 cities in 2008 to 384 in 2018.

Our main sample includes individuals who are between 17 and 22 years of age in 2012. One drawback of the HIES is that it does not contain information on the exact birth date of respondents, but only records the age at the time of the interview. Thus, in our main analysis, we simply consider that everybody who was 17 at the moment of the 2012 interview was born in 1995. The cohort that should be mostly affected by the policy should be those who are 19 in 2012, and thus refer to them as the 1993 cohort, even though some individuals who were 19 at the time of the interview were already born in 1992.[25]

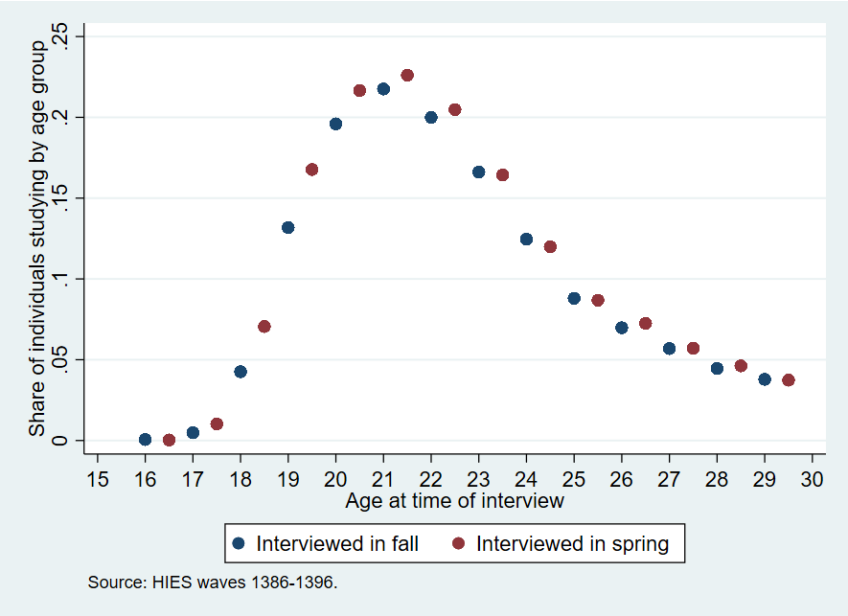
To make sure that we classify individuals indeed correctly even in the absence of the exact birthday, we look at the age distribution of the individuals who report to be studying at university level (Bachelor or Master level). Figure 7 splits every survey into a spring and a fall survey, depening on whether the individual was interviewed in the first sixth or the last six month of the year. While we observe a significant increase in the share of students studying at university already between ages 17 and 18, we see the largest increase between ages 18 and 19. Thus, we define as the most affected cohort by the 2012 policy the one including individuals who were 19 in 2012, i.e. individuals born in 1993.

While in the survey some individuals are interviewed multiple times (up to three consecutive years), the number of individuals in each year that we are able to follow over time is very small due to several reasons. First, there is no personal identification code, but members of the same household are numbered from one onwards, where one is the household head, but there is no rule for the remaining individuals. [26] As a consequence,

[25] If the exact birth date was known, the treated cohort would include individuals who are born between September 1992 and September 1993.

[26] All individuals are classified according to their relation with the household head. The household head (always a male, except when there is no other male person above the age of 18 in the household) is observation No 1. The other persons are classified as either spouse, child, bride/groom, grand-child,

Figure 7: Distribution age for students at university (Bachelor or Master)



Notes: data from the Household Income and Expenditure Survey (2008-2019).

children across different survey waves regularly exchange identifiers. Also, if a household member leaves or a new member enters, the identifiers will not be consistent across waves. In addition, there are no households that we can follow between 2011 and 2012 as the identification system changes. Given that the survey does not ask for the exact date of birth, it is difficult to determine whether the same individual has already been interviewed in the previous year. As a consequence, in our main sample we therefore keep all individuals, but control for multiple appearance of the household and a dummy that indicates that we suspect that this individual appears also in another year based on their age and gender.

In our main analysis we only consider individuals who have attended at least high school, as we consider them as the most suitable comparison group. Since we are interested in the outcomes and effects of higher education, individuals who did not attend high school are not a good comparison group for studying university policy restrictions or labor market outcomes as they are competing largely for different jobs. We also perform robustness checks including individuals who have attended at least lower secondary school (middle school).[27]

sibling, parent, parent-in-law or other.

[27]For robustness and to gain a better insight into general equilibrium effects, we also perform the analysis including all individuals of these cohorts. The main results (unreported) are qualitatively similar.

Table 4: Summary statistics

	Mean	Std.Dev.	Min	Max	Obs.
			Women		
Age	21.361	3.215	17	29	61424
Married	0.363	0.481	0	1	61424
HH size	4.712	1.805	1	25	61424
Urban	0.560	0.496	0	1	61424
Highest level of education	3.864	1.513	2	8	61424
Ever enrolled in university	0.255	0.436	0	1	61424
Share employed for a wage	0.052	0.222	0	1	61424
Labor force participation	0.156	0.363	0	1	61424
Share unempl. in labor force	0.666	0.472	0	1	9566
			Men		
Age	21.424	3.196	17	29	71101
Married	0.126	0.332	0	1	71101
HH size	4.838	1.722	1	26	71101
Urban	0.516	0.500	0	1	71101
Highest level of education	3.734	1.493	2	8	71101
Ever enrolled in university	0.213	0.409	0	1	71101
Share employed for a wage	0.384	0.486	0	1	71101
Labor force participation	0.620	0.485	0	1	71101
Share unempl. in labor force	0.381	0.486	0	1	44113

Notes: data from the Household Income and Expenditure Survey (2008-2019). The sample includes individuals who attended at least lower secondary school.

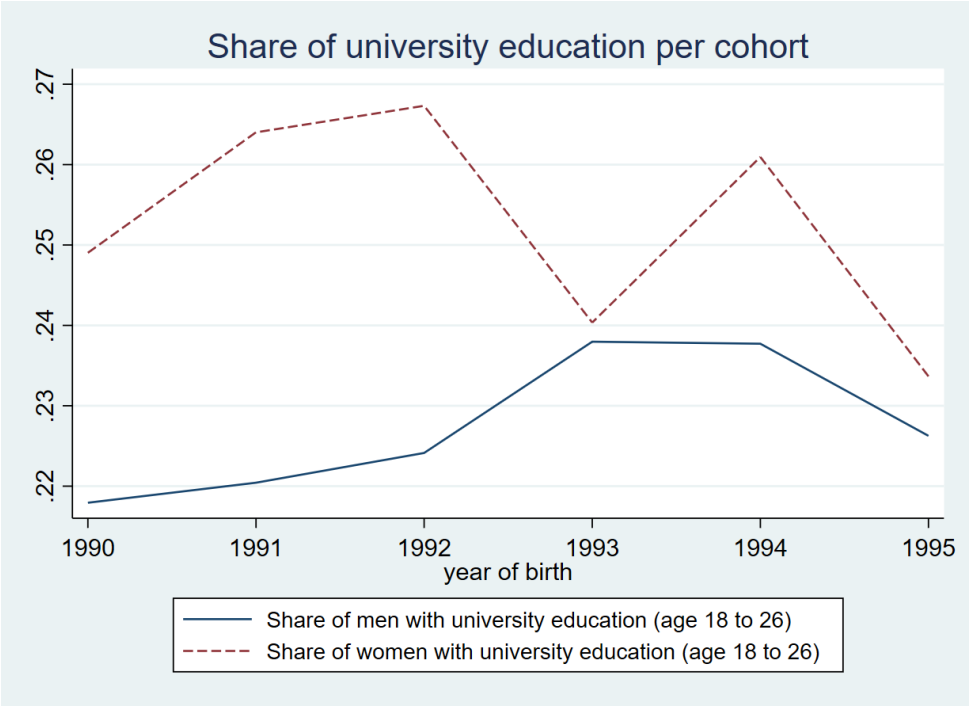
Table 4 shows the summary statistics for the main variables, for women and men separately. Women and men look similar in terms of their domestic environment (number of household members, rural versus urban) and also have on average a very similar age and education.[28] However, the labor market outcomes and the share of individuals married are very different for the two genders. The young women in our sample are about three times as likely to be already married compared to men of the same age. Our statistics confirm that women are more likely to enroll in university, but we also see that they are much less likely participate in the labor force: only 16% of women in our sample are in the labor force, while for men this figure is 62%. Also striking is the difference in the share of

[28]The variable *Highest level of education* indicates the highest education level obtained or the education level an individual is enrolled in. It is defined as follows: 1 = elementary/informal education; 2 = lower secondary school; 3 = upper secondary school; 4- = pre-university (preparation for *Konkur*); 5 = associate degree; 6 = Bachelor degree; 7 = Master degree; 8 = PhD.

young people that are employed and receive a salary: while 38% of the men have a wage paying job, it is only 5% for women. This can partly be explained by a higher likelihood to be enrolled in university and thus not yet being in the labor market. However, we also observe stark gender differences in the unemployed individuals as a share of those in the labour force: while the share of unemployed in the men's sample is 38%, this number is as high as 67% for women. This suggests that, even though the education levels for the two genders are similar, for young women it is significantly more difficult to find work compared to men.

To gain a first idea of the impact of the 2012 policy on education, we turn to the descriptive statistics on the share of men and women with university education for the different cohorts. Figure 8 shows the share of individuals who have obtained a university degree or are studying at university level by cohort and gender. For the cohorts prior to 1993, we observe parallel trends between men and women, and a higher probability for women to have university education (about 4.5 percentage points higher for women than for men). For the 1993 cohort, i.e. the individuals who are most likely to apply to university in the year of the policy, we instead see a large decrease in the share of women with university education (about 3 percentage points) and an increase in the share of men (about 1.5 percentage points); thus, for this cohort the share of individuals of the two genders with university education is very similar. The two genders slightly diverge again in the 1994 cohort, with the women's share increasing by about 2 percentage points. This increase might reflect the fact that the restrictions for women were lifted to some extent already in 2013, as shown in Section 3.1.

Figure 8: University education by gender



Notes: data from the Household Income and Expenditure Survey (2008-2019).

4 Identification Strategy

To identify the effect of the policy, we implement two identification strategies. First, we exploit variation across gender and cohorts that are affected and unaffected by the policy. Second, we use a triple difference approach, where in addition to variation across gender and cohorts we introduce spatial variation in exposure to the policy.

4.1 Baseline specification: gender differences across cohorts

In our baseline specification, we identify the effect of the policy by exploiting differences across gender and across cohorts that are exposed or not to the policy. The cohort that is the most affected by the policy comprises individuals who were likely to apply to their Bachelor studies at the time that the policy was implemented that means, high school graduates in 2012. This corresponds to the cohort 1993, for which individuals are 19 in 2012.

We estimate the following regression equation:

$$Y_{ikct} = \sum_{k=1}^{K} \beta_k cohort_k \times female_i + \alpha_1 X_{ict} + \alpha_2 X_{ict} \times female_i + \alpha_3 Z_{ct} \times female_i + \gamma_{cf} + \lambda_{kc} + \chi_{ft} + \kappa_{ct} + \tau_{kt} + \epsilon_{ickt}. \quad (1)$$

Y_{ickt} is our outcome variable of interest. Our education outcome is an indicator variable measuring whether an individual i from cohort k residing in city c and interviewed in year t is attending/has ever attended university. Our labor market outcomes are: individual labor force participation, whether or not an individual is employed for a wage, and whether or not an individual is unemployed. For the marriage market, our outcome variable is a dummy variable indicating whether or not an individual is married at age 20. $Cohort_k \times female_i$ represent our main independent variables of interest, i.e. the interaction of a dummy variable indicating whether individual i is a female, and a set of dummy variables indicating the cohort that an individual belongs to. Cohorts are defined by year of birth. We include several control variables (X_{ict}) measuring household characteristics (urban, household size, education of household head, household income, dummies for month of interview, and a dummy indicating how many times an individual appears in the dataset). By interacting these variables also with $female_i$, we allow these variables to have a different effect across gender. Furthermore, we include a set of fixed effects, to control for characteristics that vary at the city-gender (γ_{cf}), cohort-city (λ_{kc}), gender-year (χ_{ft}), city-year (κ_{ct}) and cohort-year (τ_{kt}) level. A remaining concern is that city characteristics that vary over time might affect women and men differently. These characteristics would not be picked up by our fixed effects. Therefore, we also add control variables at the city level that vary over time, interacted with $female_i$: median income, average education, average female labor force participation, and average number of households working in agriculture.

We estimate Eq. 1 using a linear probability model. Our sample includes the cohorts of individuals who are between 17 and 22 years of age in 2012, i.e. individuals who were born between 1990 and 1995. We choose individuals born in 1990 as our benchmark (excluded) cohort. While it would be customary to choose as excluded cohort the one of individuals born in 1992, i.e. individuals born the year before the individuals affected by the policy, this cohort is likely not a good comparison group in our setting. First,

men and women of this cohort could be affected differently by the policy changes in 2011, i.e. universities starting to reserve seats for the two genders separately. Second, also individuals born in 1992 and 1991 could be potentially affected by the 2012 policy, as it is possible that the same policy also had an impact the admissions of students who retake the *konkur* or those who apply to Bachelor programs after a two-year Associate degree. Therefore, we focus on the 1990 cohort as our benchmark.[29] We do not select individuals who are born earlier because there have been several changes to the education system and labor market policies in previous years, which may make these cohorts less comparable to younger students.

Furthermore, we restrict the sample to the individuals who are at least 19 years of age at the time of the interview, and whose education is above middle or high school, depending on the specification. To account for the potential correlation of observations within a geographical area and within a cohort, we cluster standard errors by cohort and city.

4.2 Triple difference specification: gender differences across cohorts and cities

In our triple difference strategy, our main independent variables of interest are triple interactions of the *female* dummy, the cohort dummies and a measure of exposure to the policy at the city level.

We construct two main indexes of exposure to the policy at the city level that aim at capturing the intensity of the treatment (see Section 4.3). The first one is based on the change in the share of seats that are open for women in between 2011 and 2012. The second one, relies on the change in the share of programs that are available for women. As noted in Section 2.3, it was between these two years that the availability of both seats and courses for women decreased the most.

[29] Results are very similar when using other cohorts as benchmarks.

We estimate the following regression equation using the linear probability model:

$$Y_{ickt} = \sum_{k=1}^{K} \beta_k Restrictions2012_c \times cohort_k \times female_i + \alpha_1 X_{ict} + \alpha_2 X_{ict} \times female_i + \alpha_3 Z_{ct} \times female_i + \gamma_{ck} + \lambda_{kf} + \delta_{cf} + \theta_{ft} + \eta_{ct} + \zeta_{kt} + \epsilon_{ickt}, \quad (2)$$

where $Restrictions2012_c$ is one of the measure of restrictions described above. One potential concern is that the implementation of the restrictions at the city level may not be exogenous: for instance, the restrictions may be more likely to be implemented in more conservative areas, and more conservative individuals may make different choices regarding education, marriage, and labour market (our outcomes). If we do not control for this, our estimates may be capturing the effect of this potential omitted variable. Therefore, to capture possible omitted variables, in addition to controlling for household and city characteristics that vary over time, we add fixed effects for city-cohort (γ_{ck}), cohort-gender (λ_{kf}), city-gender (δ_{cf}), city-year (η_{ct}), gender-year (θ_{ft}), cohort-year (ζ_{kt}). The sample restrictions are the same as in the baseline specification, and standard errors are clustered by cohort and city.

4.3 City-level measures of restrictions

For our triple difference estimations, we construct two sets of measures of exposure to the policy at the city-level: the first set is based on the allocation of seats. If the share of seats that are reserved for women decreases in city c, this is a clear sign that the universities in this location have overall favored men over women and therefore a suitable treatment variable. However, many universities kept the overall share of seats reserved for women constant, but limited the choice of subjects for women or imposed strict gender segregation by having men and women attend different programs in the same field. This is better captured by the share of programs open to women, on which will be based our second set of exposure measures. Compared to the restrictions measured via seats, the index based on the share of programs is therefore better able to capture any potential mismatch between programs and students. In our empirical results, we will thus always show results both for seats and programs.

Our main variables of interest will be two indexes, one based on the change in the

share of seats between 2011 and 2012 and one based on the change in share of programs. The indexes take integer values between -2 and 2 based on the intensity of the exposure to the policy in each city. For cities that do not have any university, we consider the restrictions in the share of seats or programs accessible to women in the closest city (this is defined based on the distance between the centroids of each city).[30]

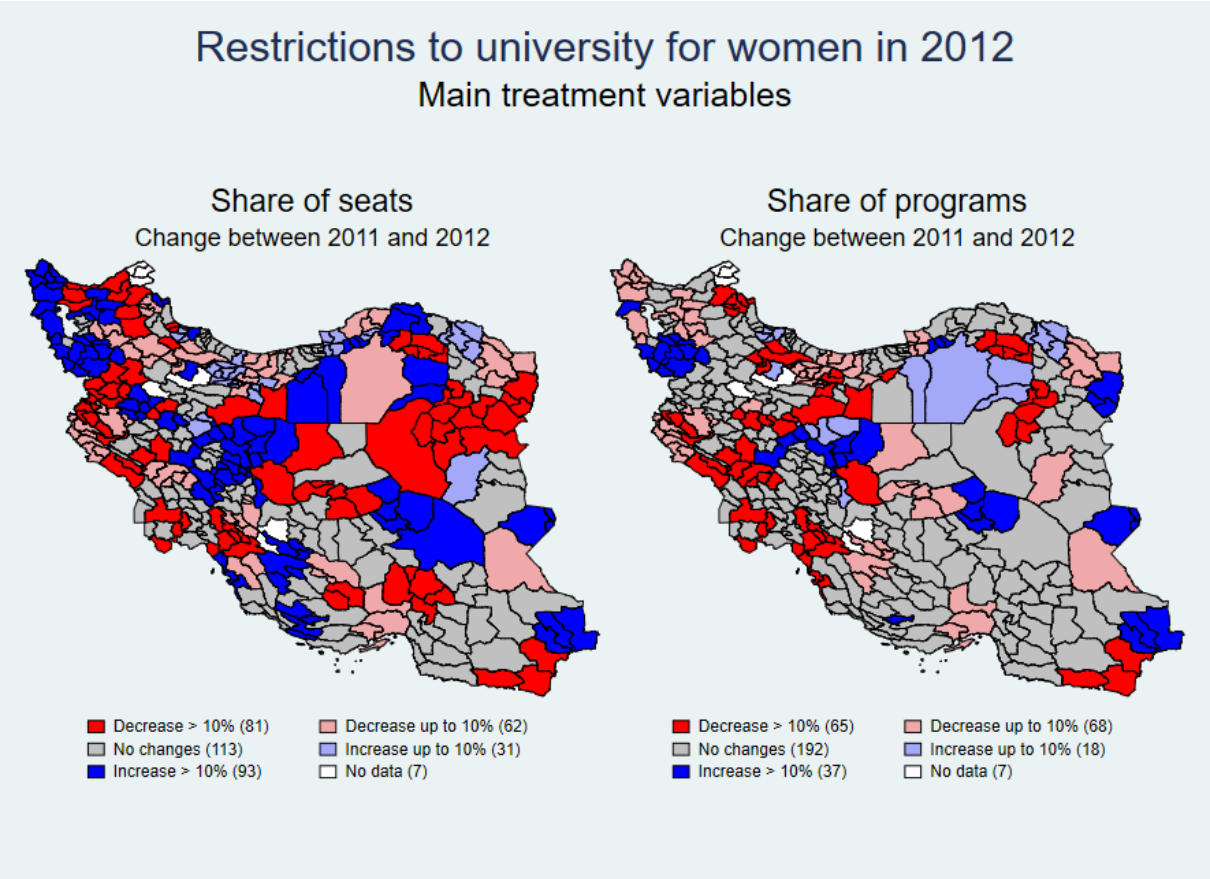
The values are assigned as follows: 2 if in a city (or in the closest city) the share of seats (programs) available to women between 2011 and 2012 decreases by more than 10%; 1 if the share of seats (programs) available to women between 2011 and 2012 decreases by less than 10%; 0 if no change; -1 if the share of seats (programs) available to women between 2011 and 2012 increases by less than 10%; -2 if the share of seats (programs) available to women between 2011 and 2012 increases by more than 10%. Figure 9 shows these two main restriction measure. Whereas the percentage changes in seats and programs are highly correlated across cities (0.78), the correlation between our two indexes is 0.46. Notably, we see a number of cities experiencing an increase in the share of seats available for women in 2012.

A possible concern is that cities that experienced restrictions in the access to university for women between 2011 and 2012 had already experienced restrictions to some extent in the previous year. To address this concern, we investigate whether there is a correlation between the change in the share of seats open for women in each city between 2010-2011 and 2011-2012. Figure 10 shows that there is no positive correlation between the two measures, but we observe a negative correlation. This may be explained by the fact that in 2011 several universities started to list seats for women and men separately, most often with half of the total number of seats available for each gender. For a few smaller cities, it seems that their reduced allocation of seats to women in 20122 was not to the satisfaction of the universities and the number of seats increased again substantially in 2012. Otherwise we see that it is mainly universities that did not implement any split of seats in 2011 that now also followed this rule in 2012 leading to a decrease in seats open for women. We also find no positive correlation when looking at the change in the share of programs instead of seats between 2010-2011 and 2011-2012 (Figure B.5).

Our measures of exposure to the policy at the city level are based on the assumption that students are more likely to attend universities that are geographically closer to them.

[30] In robustness checks we also consider a degree of restriction of zero for cities that do not have any university. Results are reported in Table **??**.

Figure 9: Spatial distributions of restrictions

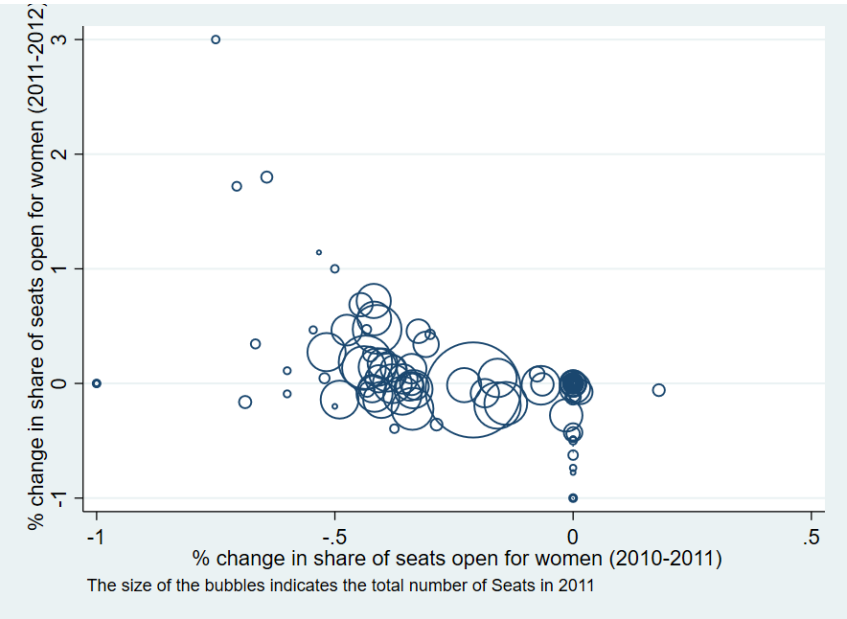


Notes: Own calculations. Data comes from the University coursebooks published by the Iranian Ministry of Education (2010-2014).

If this were not the case, our measures at the city level would not have any bite. We can indirectly test this assumption by investigating the characteristics that affect the probability of an individual enrolling in a Bachelor degree; in particular, we are interested in whether distance to the closest city that has a university has an impact on the probability of attending university. Table B.2 shows that distance has a negative and significant effect on the probability of studying at the Bachelor level. A plausible explanation for this result is that the effect of distance on university attendance reflects students' preferences to attend universities that are close by.[31] In the last column of Table B.2 we show that the importance of living close to a university remains also after 2011. While the interaction of the distance to university with the dummy post 2011 is positive and significant, indicating that students in more recent years are more willing to travel longer distances

[31] We also find that other characteristics, i.e. living in an urban area, education of household head and household income (and their interactions with the *female* dummy variable) have an impact on the probability of enrolling in a Bachelor degree. We include these variables as controls in our regression.

Figure 10: Pre-trend of treatment



Notes: Data from University coursebooks published by the Iranian Ministry of Education (2010-2012).

to university, there is no variation across gender. Women after the implementation after the policy were thus no more likely to attend universities further away relative to men.

5 Results

5.1 Gender Differences Across Cohorts

In this section we report results from our double difference specification (Eq. 1), where we compare the education outcome of all men and women across the birth year cohorts 1990 to 1995.[32] As detailed in Section 2.4, we expect a negative impact of the policy on university attendance for women who are likely to apply to university in 2012, i.e. women belonging to the cohort born in 1993. However, older cohorts, particularly those of individuals born in 1991 and 1992, could also be affected. In order to also allow potential effects for older cohorts (1991 and 1992), we use as our benchmark the cohort of individuals born in 1990.[33]

We show results on two different samples. Our main sample includes only individuals with at least some high school education. This sample thus only considers individuals who could potentially take the *konkur* and be affected by university policies. The second sample is larger and includes also individuals that have only middle school education. This allows for spillovers to individuals with lower education levels and some general equilibrium effects. Further, given that the share of high school graduates increases steadily, including lower middle school keeps the relative share of individuals for every cohort in the sample more stable. For the triple difference estimations, the larger sample is particularly interesting also in order to have sufficient observations per city in order to identify the treatment effect by city.

Figure 11 depicts the coefficients of the cohort dummies interacted with the female dummy variable. The dependent variable measures whether an individual is, or has ever been, enrolled at university. Only the coefficient of the 1993 cohort dummy×female is negative and significant at the 10% level. Results for the different specifications and samples thus confirm that the ratio of women compared to men studying at university is much lower for the 1993 cohort. The probability of studying for women compared to men is about 4 percentage point lower for this cohort compared to the 1990 cohort. For

[32] Full regression results are reported in Table C.1 in the Appendix.

[33] As explained in Section 4, using the 1992 cohort as a benchmark could be problematic. Even though in theory the 1992 cohort would be the best comparison group, this cohort was the first to face explicit gender quotas in the university coursebooks. Hence, the 1992 cohort is not a very well suited comparison group.

all other birth cohorts the likelihood of studying is similar to the one of 1990.[34]

5.2 Gender differences across cohorts and cities

5.2.1 Education

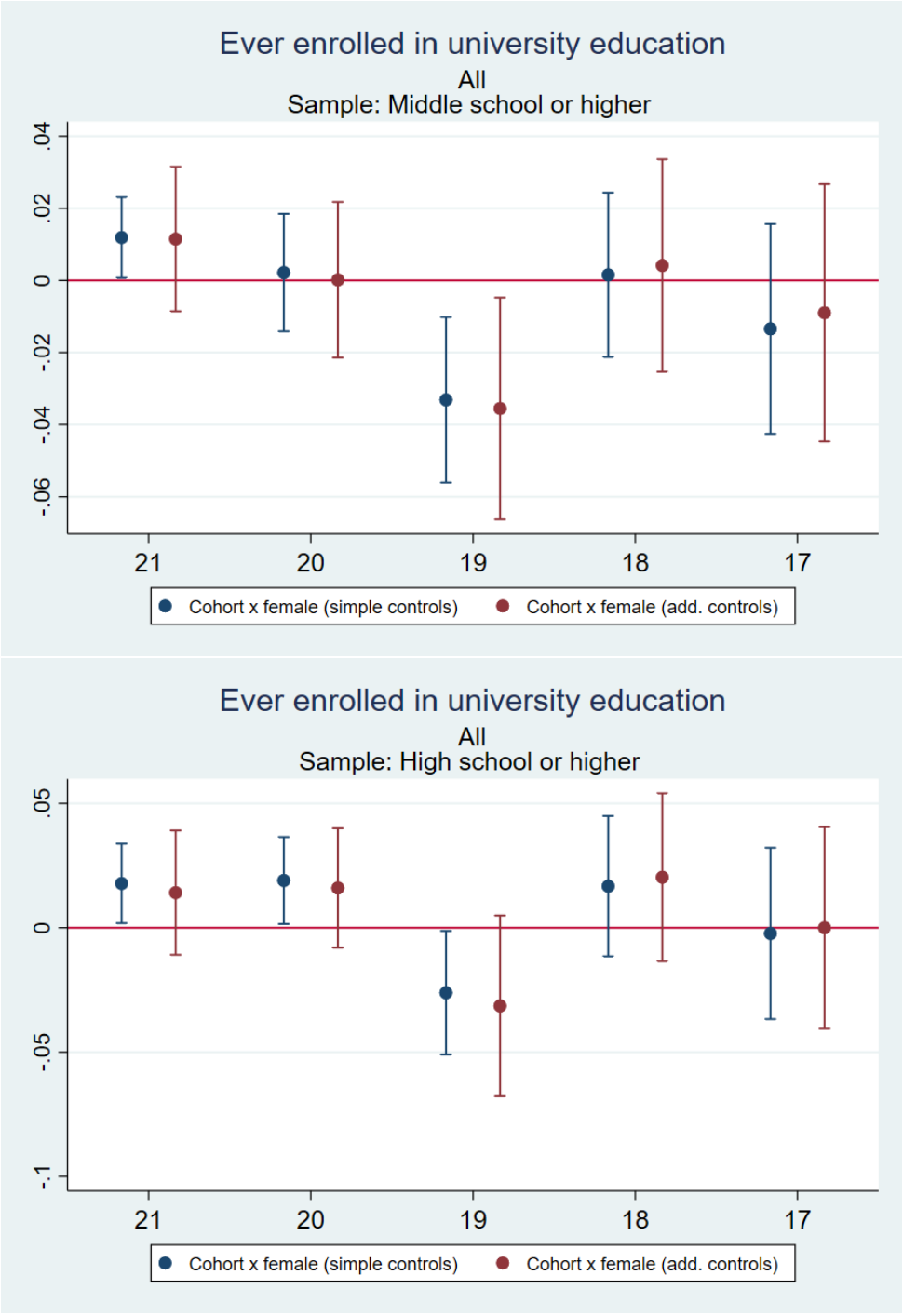
Before we present the results of our triple difference specification (Eq. 2), we first show in Figure 12 results using a simple measure for university restrictions: a dummy variable indicating whether individuals live in a city where there were restrictions to university admissions (either via a reduced share of seats or a reduced share of programs) for women in 2012. The figure reports the coefficients of the restriction variable interacted with a dummy for female and with a dummy for the birth year of the individual.

The reported coefficients show for each cohort whether women in cities with restrictions in 2012 were less likely to study with respect to men. The upper part of the figure includes all individuals who have at least lower secondary education, while the lower part only includes students who have at least higher secondary education and thus have the option to take the *konkur* and apply to university. The upper part of Figure 12 shows indeed a negative and significant effect of the restrictions in the number of programs on the probability of women having at least secondary schooling ever being enrolled at university. This means that women who were 19 years old in 2012 and live in targeted cities were significantly less likely to study at university compared to women in the reference cohort, and compared to men in the same cohort. The coefficient indicates a decrease in the probability of studying for women compared to men of about 5 percentage points. The lower part of the figure on the sample of high school students only shows a very similar picture, however the coefficients for the cohort of interest are not statistically significant.

Figure 13 shows the results of estimating our preferred specification, which uses as treatment variables the indexes measuring the degree of restrictions in terms of seats or programs. We see a negative effect for the 19 years old individuals in both the upper and the lower graph, significant at least at the 10% level. However, we also observe a negative impact of the reduction of seats for women who were 18 and 20 in 2012 (significant at 10% in both samples), albeit smaller. For the older cohort, this might reflect the fact

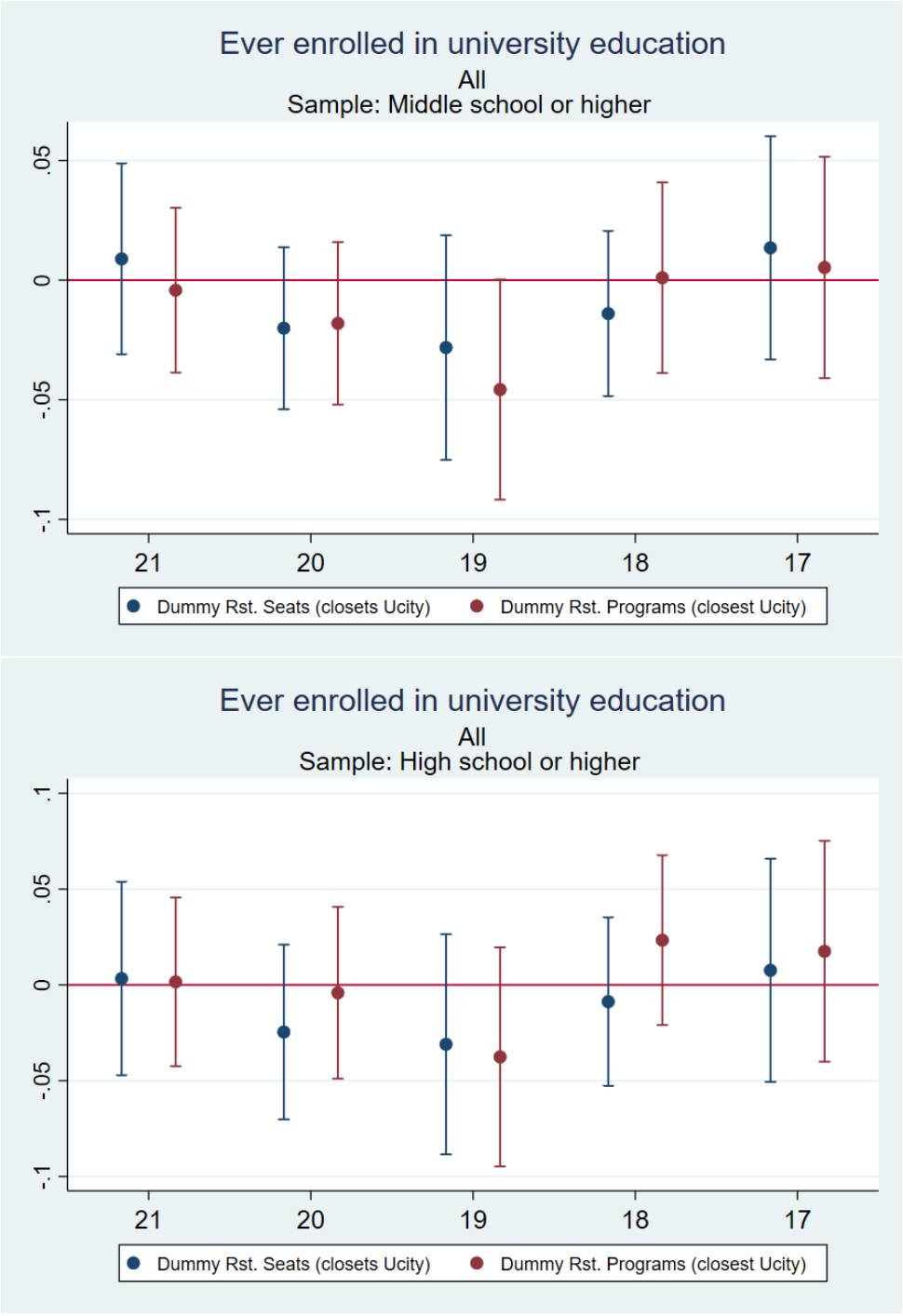
[34]Section A in the Appendix shows and discusses the results of performing a robustness check where we split the cohort by the semester in which they are interviewed. This strategy allows us to use more precise information about the age of individuals.

Figure 11: Gender differences in university enrolment across cohorts



Notes: The horizontal axis indicates the individual's age in 2012. The lines represent 95% confidence intervals. Regression results are based on Eq. 1 and reported in Table C.1 in the Appendix. The sample includes individuals born between 1990 and 1995, are at least 19 years old at the age of the interview.

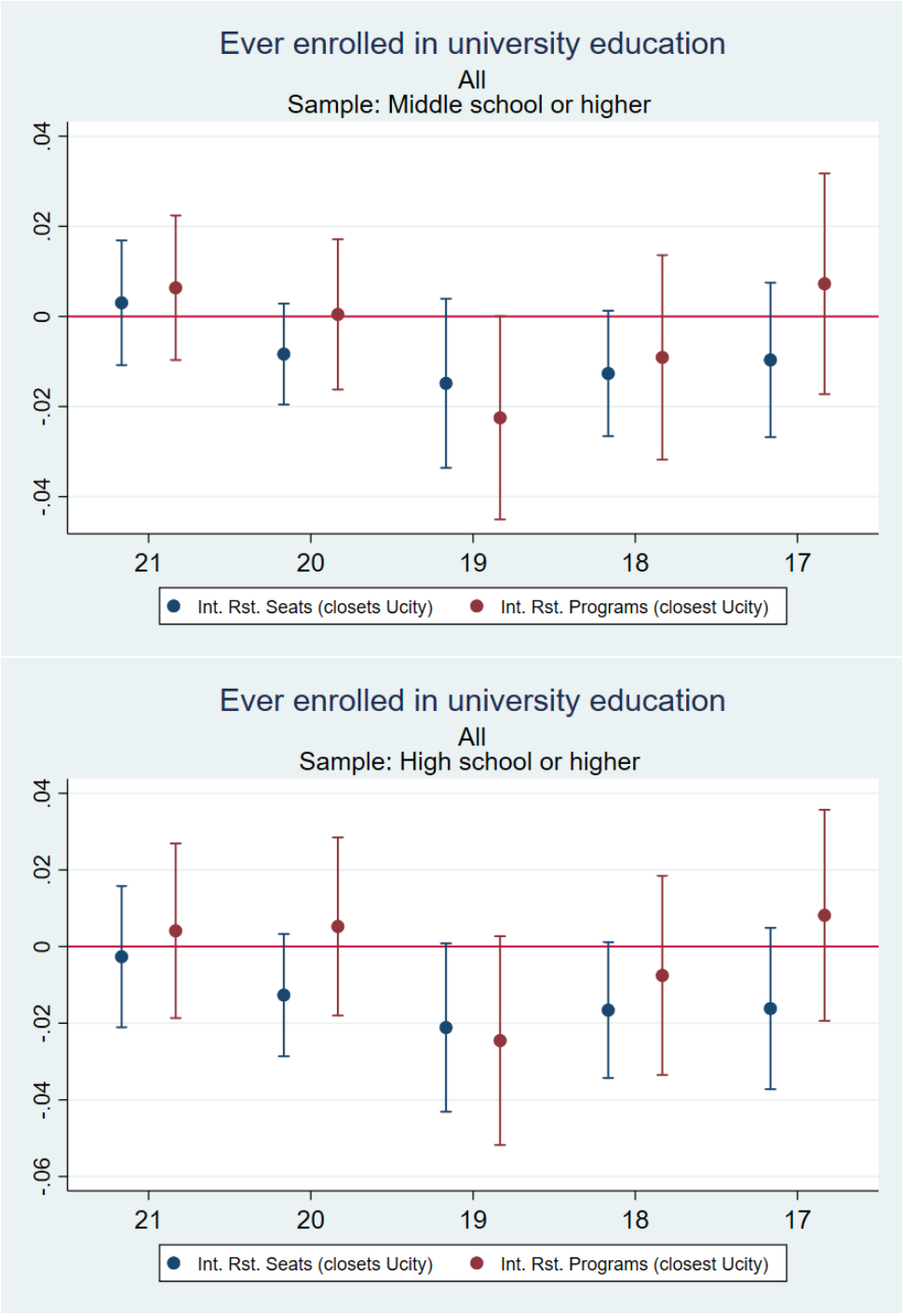
Figure 12: Benchmark I - Dummies for restricted city



Notes: The horizontal axis indicates the individual's age in 2012. The lines represent 95% confidence intervals. Regression results are based on Eq. 2 and reported in Table C.2 in the Appendix. The sample includes individuals born between 1990 and 1995, and are at least 19 years old at the age of the interview.

that some individuals study for the university entrance examination for an additional year, while others apply for a Bachelor degree after obtaining an Associate degree. The younger cohort might instead be discouraged by the restrictions from pursuing higher education.

Figure 13: Benchmark II - Intensity of treatment



Notes: The horizontal axis indicates the individual's age in 2012. The lines represent 95% confidence intervals. Regression results are based on Eq. 2 and reported in Table **??** in the Appendix. The sample includes individuals born between 1990 and 1995 and who are at least 19 years old at the age of the interview. The sample "Middle school or higher" includes 99,999 observations. The sample "High school or higher" includes 76,654 observations.

5.2.2 Robustness checks on education outcomes

One potential concern of our empirical strategy is that our measures of restrictions may capture the effect of university policies from other years or differences in regional characteristics. To address this concern, we conduct several robustness checks. Notably, we undertake a set of regressions in the spirit of placebo tests. First, we construct the same indexes of restrictions used in the previous section, but for the other years (2011 and 2013). Second, we control for local restrictions for men.

In Table 5 we add to our main specification the interactions of cohort and gender with the restriction measures for 2011 and 2013. While the coefficient of the 2012 policy on 19 years old women remains negative, of high magnitude and significant throughout all specifications, none of the other restriction measures have a robust negative and significant coefficient. This is in line with our expectations. In 2013 much less restrictions where imposed and thus much less impact is expected. Moreover, students had more time to adapt to the restrictions and find alternative programs to join. Also, some of these later adjustments could also be expected to reflect some adjustment to gender-specific demand for certain programs by students.

Possibly more concerning is that in 2011 university coursebooks started reporting seats split by gender. If those universities that split seats were also more likely to restrict seats in 2012, our estimates may actually capture the effect of the policy the year before, as some 19 years old in 2012 could have applied to university already in 2011. If the 2011 policies was actually harmful to female students then our results might actually be capturing the impact of this policy, and not the 2012 changes. However, we would expect the 2011 policy to be less harmful than the 2012 policy for female students. Overall, women were a majority of university students before the policy, so splitting seats in equal number for the two genders in all fields would create a disadvantage for women. However, while women would be harmed in some disciplines, they might obtain an advantage in others. If demand across gender for different programs is not balanced, then splitting seats in equal number will lead to a de facto restriction for the gender that normally filled more than 50% of the seats. Thus, women would be more disadvantaged then men in some fields such as medicine, where women were a majority, and they would be more advantaged in others, such as the prestigious and male dominated engineering programs (the most affected by the 2012 restrictions).[35] Table 5 shows that the coefficients for the

[35] Another argument why the 2011 split of seats is less likely to lead to lower enrolment is that the total

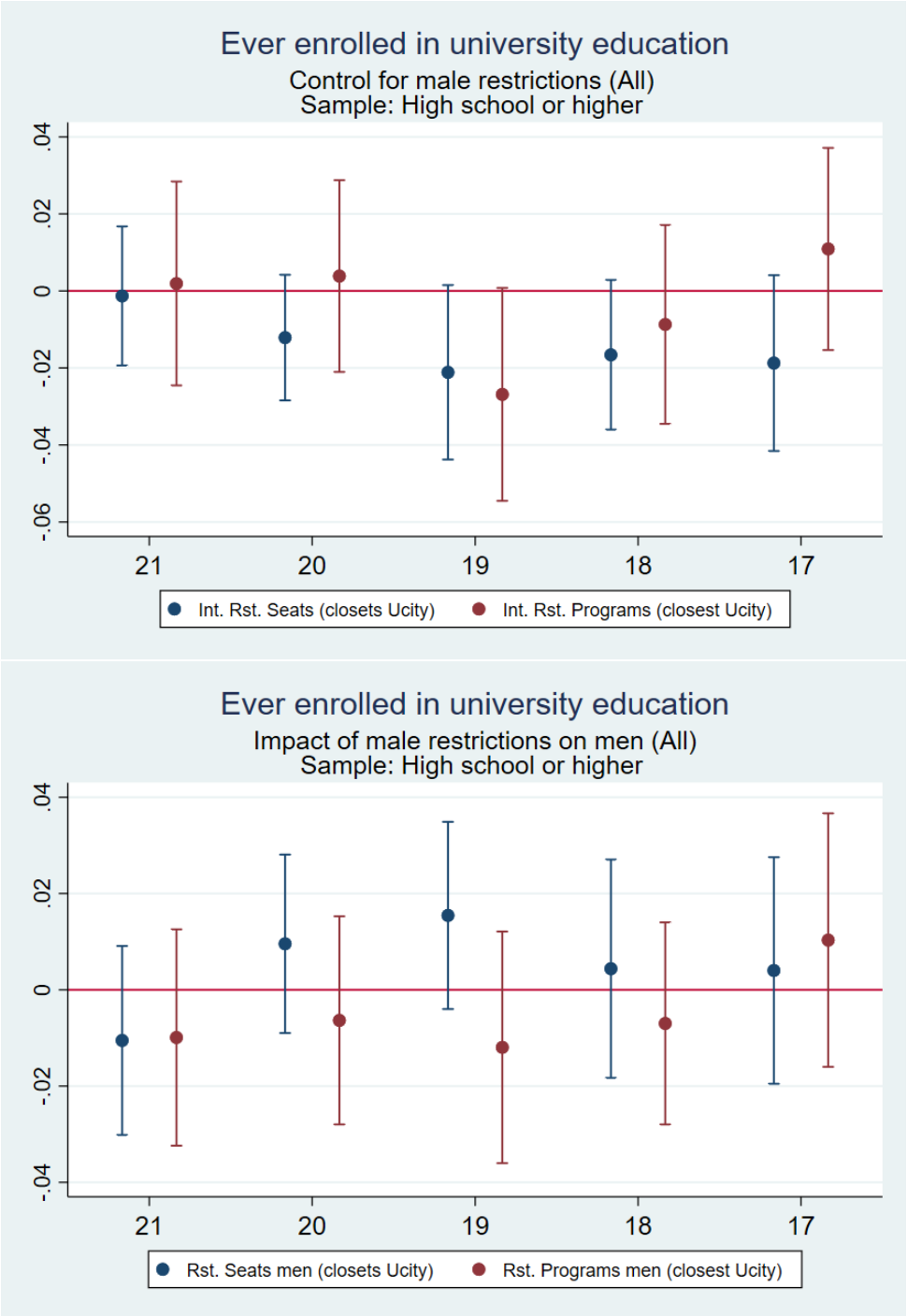
2011 policy are mostly not significant. If anything, they suggest that indeed the split of seats has lead to a relatively stronger enrolment of women compared to men in 2011, as can be seen by the positive and significant coefficient of the 20 years old in Column 1 and 3. This is the cohort that was most likely to have applied to university in 2011 and be affected by this change in the admission criteria.

In a second robustness check, we take into account the restrictions in 2012 for men. Also men faced some restrictions in certain fields and cities, although to a much lower extent compared to women. We construct the change between 2011 and 2012 in the share of seats (or programs) that are open to men. The two restriction measures for men and women are positively correlated, especially for the measure using the share of seats. This is because several universities that did not have gendered restrictions in 2011 decided to list seats by gender in 2012, thus reducing significantly the share of seats open to both gender. Therefore, it is possible that our measures for restrictions for female are partly reflecting simply the gender segregation policies and not necessarily a discrimination of women in particular. To ensure that this in not driving our previous results, we estimate our benchmark specification while controlling also for cohort-gender-male restrictions interactions (upper part of Figure 14). Results are virtually unchanged, indicating that restrictions to men are not driving our results.

In the bottom part, we repeat the exercise, but now focus on the impact of restrictions for female and male students on men. Can we see that men in cities that saw a decrease in the share of seats or programs for men have also been facing some disadvantage? We interact here the city-specific restriction measures for both men and women with cohort dummies and a male dummy. Our variables of interest now are the restrictions for male students. The lower part of Figure 14 shows that there is no negative effect of the restrictions based on programs for any of the male cohorts in our sample and that the measures based on restrictions of seats have a rather positive effect - opposite to what we see for female students. This reflects that the restrictions for men were overall few and that therefore the 2012 policy had no detrimental effect on enrolment for men.

number of programs remained overall relatively stable. Thus, students could still fill in more or less the same preference list compared to the previous years.

Figure 14: Robustness check: Impact of restrictions for men on university enrolment



Notes: The horizontal axis indicates the individual's age in 2012. The lines represent 95% confidence intervals. Regression results are based on Eq. 2, where the restrictions measures reflect changes in the number of seats and programs for men between 2011 and 2012. The restriction variables are interacted with cohort and male dummies. The sample includes individuals born between 1990 and 1995, and who are at least 19 years old at the age of the time of the interview. The sample "High school or higher" includes 76,654 observations.

Table 5: Robustness check: adding changes in admission in 2011 and 2013

	(1)	(2)	(3)	(4)
	Ever enrolled in university			
Sample:	Middle school		High school	
Restrictions:	Seats	Programs	Seats	Programs
21 (2012 policy)	0.002	0.008	-0.004	-0.001
	(0.006)	(0.007)	(0.009)	(0.010)
20 (2012 policy)	-0.008	0.005	-0.013^{c}	0.004
	(0.004)	(0.009)	(0.006)	(0.012)
19 (2012 policy)	-0.022^{b}	-0.023^{c}	-0.028^{b}	-0.028^{c}
	(0.007)	(0.011)	(0.008)	(0.013)
18 (2012 policy)	-0.014^{c}	-0.011	-0.016^{c}	-0.016
	(0.006)	(0.012)	(0.007)	(0.013)
17 (2012 policy)	-0.011	0.016	-0.017^{c}	0.010
	(0.006)	(0.013)	(0.008)	(0.015)
21 (2011 changes)	0.004	-0.004	0.004	-0.011
	(0.009)	(0.010)	(0.010)	(0.013)
20 (2011 changes)	0.026^{b}	0.010	0.029^{b}	0.004
	(0.007)	(0.009)	(0.009)	(0.013)
19 (2011 changes)	-0.018^{c}	-0.002	-0.010	0.004
	(0.008)	(0.008)	(0.011)	(0.010)
18 (2011 changes)	0.004	0.005	0.010	0.007
	(0.008)	(0.008)	(0.010)	(0.009)
17 (2011 changes)	0.019^{c}	-0.003	0.022^{c}	-0.014
	(0.009)	(0.009)	(0.011)	(0.011)
21 (2013 changes)	-0.001	0.007	0.004	-0.004
	(0.006)	(0.009)	(0.008)	(0.011)
20 (2013 changes)	-0.006	0.010	-0.004	0.005
	(0.005)	(0.010)	(0.007)	(0.014)
19 (2013 changes)	-0.019^{c}	0.006	-0.016	-0.003
	(0.008)	(0.012)	(0.009)	(0.012)
18 (2013 changes)	-0.006	-0.003	0.006	-0.018
	(0.007)	(0.012)	(0.008)	(0.012)
17 (2013 changes)	-0.014	0.026	-0.011	0.019
	(0.008)	(0.014)	(0.009)	(0.010)
R^2	0.207	0.207	0.207	0.207
Observations	71375	71375	56639	56639

Notes: All regressions include cohort-city, gender-city, cohort-gender, city-year, gender-year and cohort-year fixed effects. All columns include individual and city level controls. Standard errors are clustered at the city and cohort level and reported in parentheses. ^{a}, ^{b} and ^{c} indicate significance at the 1%, 5% and 10% level. The sample includes individuals born between 1990 and 1995 and who are at least 19 years old at the age of the interview.

5.2.3 Labor market and marriage outcomes

The next step is to examine whether the decreased university enrolment for women had an impact on labor market and marriage outcomes. The overall effect of the 2012 educational policy on female labor force participation and employment rate is ex-ante unclear. On the one hand, young individuals who do not get a seat at university may directly join the labor force, leading to a higher probability of young women entering the labor force and being employed. On the other hand, in Iran this might not necessarily be the case, as in Iran, especially for women, a university degree is considered essential for employers. Thus, not having a bachelor degree might harm their chances on the labor market.

Furthermore, as after the policy competition to enter university for women is higher, those women who do obtain a seat at a public university are likely more skilled and might perform better at university, and in turn in the labor market. At the same time, due to the policy there is higher chance of a mismatch between students preferences and programs. The reduced set of choice might have led many (female) students to enroll in programs that they are less passionate about, which may have a negative effect on their performance and decrease their motivation to search for a job in the corresponding fields. Also, by restricting access to prestigious fields such as engineering, which is generally highly valued by Iranian employers, women have a lower chance of finding a job of their liking.

A related question is therefore what are the job prospects for students who managed to enroll in university. We might observe that women born in 1993 who attend university do actually have a relative advantage in the labor market, as increased competition for the seats would lead only the best women to attend university. Further, the relatively lower number of women studying might allow a higher share of graduating women to find a job. Alternatively, the mismatch created by the unexpected change in the number of seats and programs available might lead to worse labor market outcomes for female university students of this cohort.

To answer these questions, we use two different samples. First, we rely on a bigger sample where we include all students who have at least high school education. This sample includes all students who could potentially attend university but not necessarily did so (either because they didn't apply or didn't get their application accepted). Second, we reduce the sample to only individuals who have ever been enrolled at university. This sample is much smaller and coefficients are likely to be much noisier. However, analyzing

this sample allows us to see whether any potential effects that we observe in the first sample are driven by those who did manage to get into university, and if there is any possible mismatch. Thus, the reduced sample gives a better picture on the differential job opportunities for female and male university students of the 1993 cohort.

We first analyze the impact of the policy on three labour market variables variables: i) participation in the labor force ii) being employed for a wage[36] iii) being unemployed. As youth unemployment is very high in Iran, and not being able to study, or studying a less prestigious subject, might lead to individuals entering the labor force by being unemployed. We also consider labor force participation as outcome variable, as female labor force participation in Iran hovers only around the 10%. The decision of whether or not to join the labor force can thus be expected to be an important margin of adjustment. Many women, once they have finished their education, do not search for a job and thus do not enter the labor force at all.

The graphs in Figure 15 are based on estimates of the triple difference regression (Eq. 2) using the three different outcome variables. The results for the sample on high school educated individuals and the smaller sample on university educated individuals are presented side by side. Our estimates of the impact of the policy on labor force participation (upper graph) show a negative and significant effect for the 1993 cohort when using the measure of restrictions based on seats, meaning that women are less likely to participate in the labor force in cities where the decrease in seats for women was larger. This result holds also for women with a university degree.[37]

We also observe a negative and significant impact of the policy on the probability of women being employed for a wage for the cohort of interest (middle graph). For the bigger sample, this effect is also present for the cohort of individuals who were 20 in 2012, which again could capture individuals who delayed the entrance examination, or possibly individuals who are entering university after an Associate degree. However, for the sample

[36]This is to distinguish from those who declare that they are working but are not paid for their work. These individuals are mainly women from rural households, who are more likely to work on family farms and businesses.

[37]We observe in several graphs also significant effects for the 17 years olds. However, when it comes to labor market outcomes, we have to treat these results with caution. While these students may have been discouraged from studying by the past policies, the interpretation of these effects is not straightforward. In fact, for this cohort we only observe individuals who are relatively young: these individuals would start university in 2014, and we only observe individuals up to 2019. If women were more likely than men to continue with a MA degree or less likely to have finished their BA degree within the standard 4 year period, this could also lead to the observed significant effects.

of university students only, we see a strong negative effect only for the 19 years old. The effect is particularly pronounced for the restriction measure based on programs. Limiting accesss to the prestigious programs resulted in a disadvantage for women in the labor market, even for those who were able to attend university. This can be interpreted as a negative impact of the policy on employment due to a mismatch between students and programs.

It is interesting to note that for these two labor market outcomes the change in the share of seats appears to be driving the results, rather than the change in the share of programs. This is consistent with competition at the entry exam being stronger because of the policy, and therefore many students not being able to enter university and therefore having a disadvantage in the labor market. Nevertheless, for individuals who attended university, the choice of the program also mattered for the chances of being employed for a wage.

Finally, the bottom graph of Figure 15 does not show any significant effect on unemployment. This suggests that individuals who are unable to get a job because of the policy tend to drop out of the labor force.

To complete the picture, in Figure 16 we examine the impact of the policy on the marriage market. Our aim is to investigate whether due to the policy women have an increased probability to marry at a young age. Therefore, we consider as outcome variable the probability of being married at the age of 20.[38] We notice a positive and significant effect for women in the cohort of interest in cities that are most affected by the policy, when measuring restrictions with changes in programs. We observe however no significant effect for women that did enrol in university. These results suggest that the young women affected by the policy are more likely to marry young if they cannot enroll at university.

Overall, our results of the impact of the policy on the labor and marriage markets are consistent with those women who cannot study deciding to get married and start a family instead of entering the labor market.

[38]For these regressions, we include individuals aged 19 and 20. This is because the HIES does not provide the date at which individuals get married, but only inform about the current status. As women marry overall quite young in Iran, using our full sample, which includes women up to the age of 28 at the time of the interview, would not be suitable to analyze whether women marry at a young age.

5.2.4 Testing for a heterogeneous impact of the policy: Urban versus Rural

In Iran, the differences between urban and rural areas in terms of income, education and employment remain very high. Each city (*shahrestan*) contains an urban and a rural part. The HIES surveys consists of about 50% rural and 50% urban households. In this section, we split our sample between these two subgroups and test whether the policy had a differential effect for individuals from urban and rural areas.

It is not obvious ex-ante whether individuals in rural or urban areas would be more affected by the policy under study. On the one hand, one can expect a stronger impact for rural households: these households are less likely to have the means to pay for a dormitory, which would result in rural students being more likely to study at universities in the same city or at a relatively short distance. This would make restrictions for women at universities close by more salient for rural students. Furthermore, financial constraints and longer commuting time may also make private universities, which are concentrated in urban areas, a less attractive alternative for students from rural areas.

On the other hand, the effect could be stronger for urban students, for whom going to university is often easier due to short commuting and more financial resources. However, students who do not perform well in the entrance exam, or are not highly motivated, might be unwilling to move and only interested in joining a nearby faculty that is convenient to reach. Also, many families might only allow daily commuting and might not be in favor of their children moving to another city for financial or cultural reasons, especially if it is to study a less prestigious subject. Thus, restrictions to local universities could lead to especially low university attendance rates for female students from urban areas, in particular for those marginal students who would only attend university if it were easy to do so.

In Figure 17 we show the results of our triple difference specification with the treatment intensity variable at the city level, this time splitting the sample between urban and rural households. While the number of observations in each regression is now reduced, for the urban sample we can still observe a negative and significant effect of the policy for women compared to men in the cohort of interest, when considering the treatment intensity variable based on restrictions to seats (a negative but not significant at the 5% level is found also for the 1992 and 1994 cohort). For the rural sample, we cannot detect any effect on enrolment. This suggests that the policy had a larger impact on education on

urban individuals. Students from rural households are overall less likely to study as it is more costly for them. For those who do plan to study, the marginal cost of going to a university further away may then be lower.

Next, we analyze the effects of the policy on labor market outcomes for rural and urban individuals separately. We rely again on two samples for each group: the sample with individuals with high school or higher and one with individuals who have all (some) university education.

Figure 18 presents the results for labor force participation. As in the aggregate sample, we observe a negative and significant effect of restrictions based on seats in the urban sample. This suggests that the decrease in labor force participation for women compared to men due to the 2012 education policy is driven by urban individuals. However, in urban areas the effect is concentrated in the sample including all individuals with high school. When considering only university students, there is no significant effect on labor force participation. The picture is very different for the individuals from rural areas, where we find a negative and significant effect on labor force participation the both 1993 and 1994 cohorts when considering the sample of individuals who attended university. This indicates that the restricted choice of programs may have led to a mismatch for rural households, as in rural areas female university graduates may have more difficulties finding suitable jobs (e.g. government jobs).

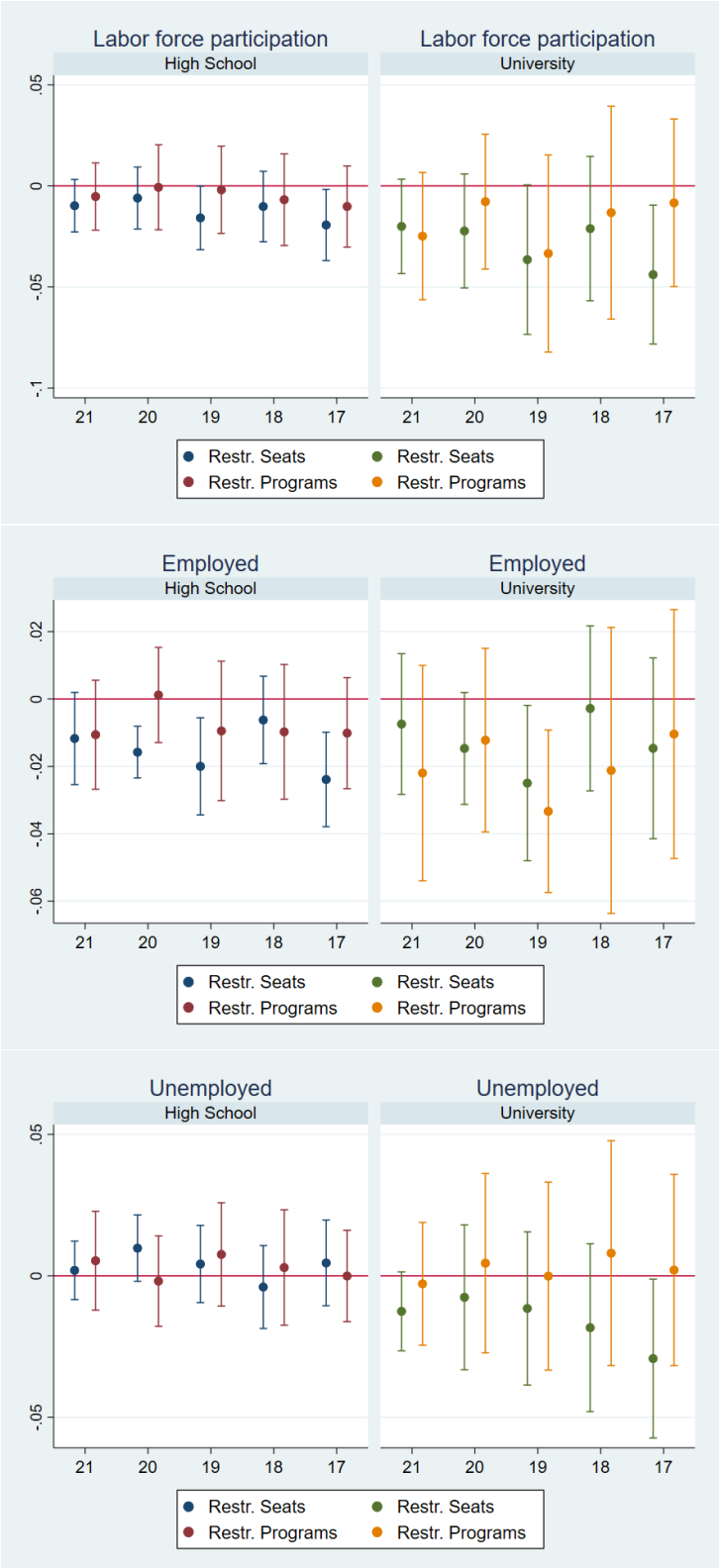
Figure 19 shows the results for employment. Here results for both rural and urban are very much in line with the aggregate results. For both urban and rural university students, women of the 1993 cohort are less likely to be employed for a wage when the choice of programs was restricted in the nearby universities.

Finally, Figure 20 shows the impact of the policy on the probability of being unemployed. We only see a negative effect of being unemployed for university students in rural areas. However, as observed in the two previous figures, lower unemployment is not a consequence of higher employment numbers, but rather a lower labor force participation.

Finally, we analyze the effects on the probability of being married at 20 years of age. Figure 21 shows again the results for the two samples. However, given that we limit here the sample to only 19 and 20 years old individuals, for the rural households we have too few observations to estimate the coefficients of the policy by cohort (only about 500 individuals in total). We thus can only obtain reliable results for the sample that

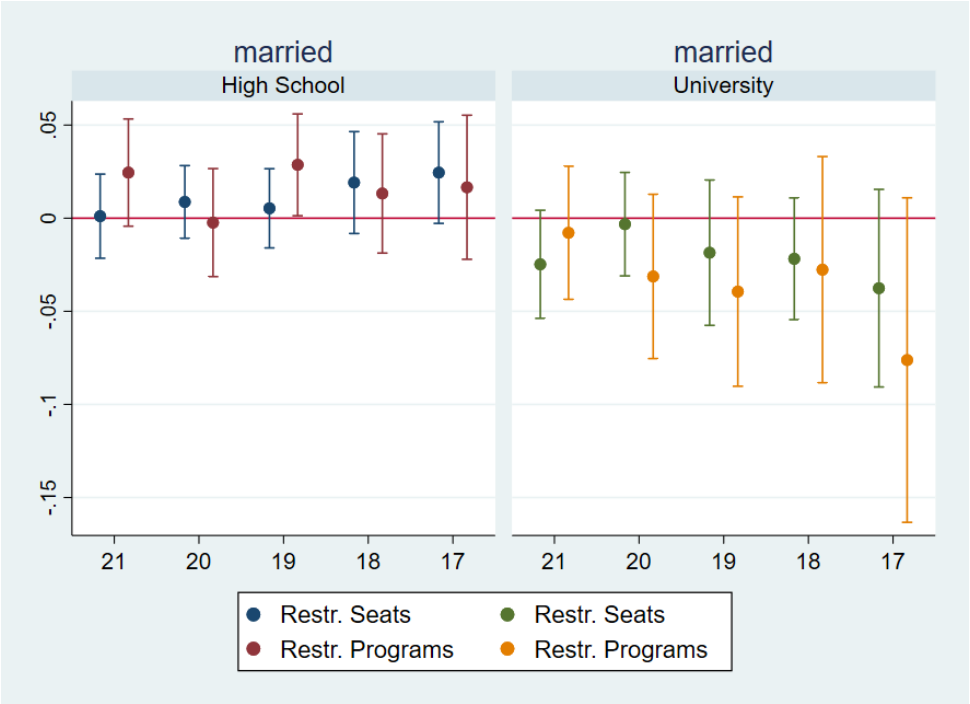
includes individuals with high school education. The results suggest no effect on the urban sample, but a large positive effect for women on the probability of being married in the rural sample for the 1993 and 1994 cohort. This possibly suggests an effect of the university restrictions on the age of marriage in rural areas that goes beyond the cohort of interest: the restrictions might have discouraged also the younger cohort of women from attending good programs, encouraging them to attend less demanding degrees instead and marry earlier.

Figure 15: Labor market outcomes - Intensity of treatment



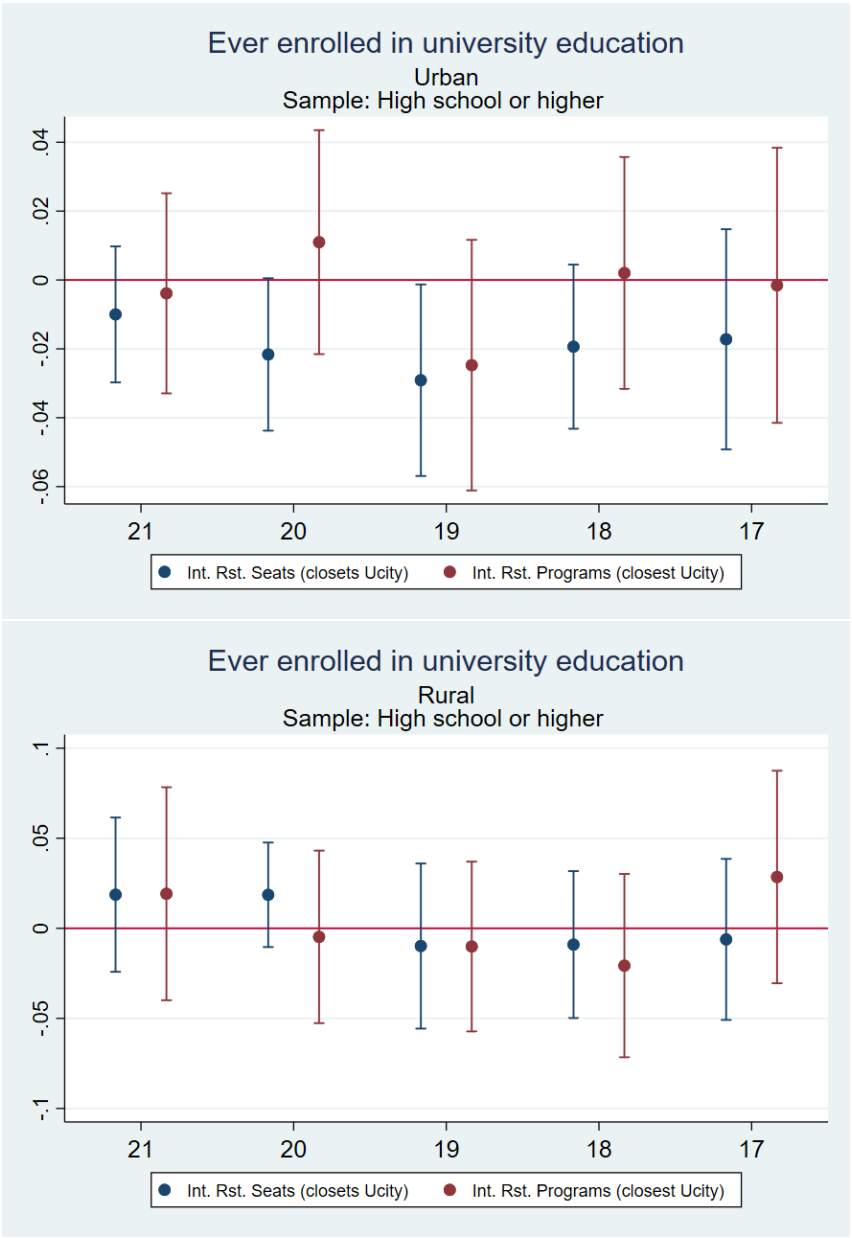
Notes: The horizontal axis indicates the individual's age in 2012. Regression results are based on estimating Eq. 2. The lines represent 95% confidence intervals. The sample includes individuals born between 1990 and 1995 and who are at least 19 years old at the time of the interview. The sample "High school or higher" includes 76,654 observations. The sample "University education" includes 38117 observations.

Figure 16: Marriage market outcome



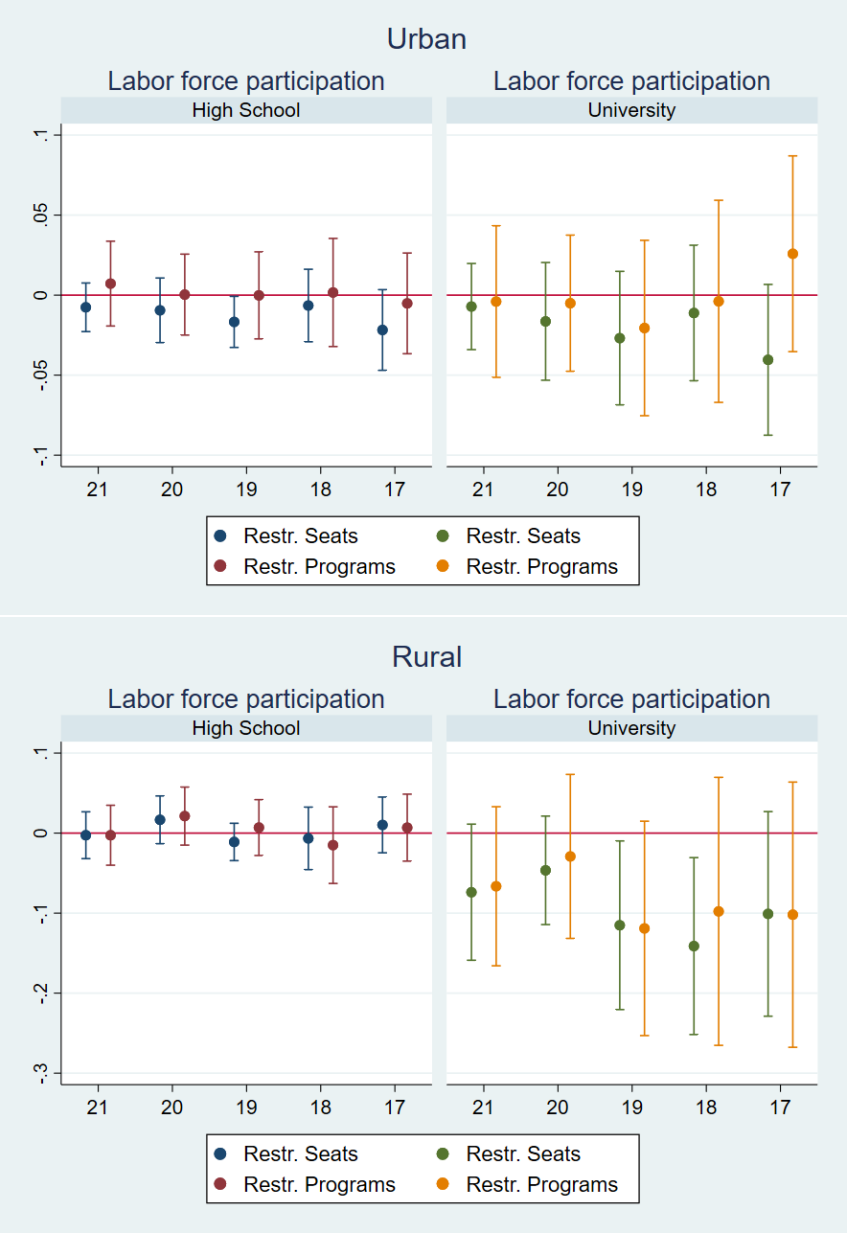
Notes: The horizontal axis indicates the individual's age in 2012. Regression results are based on estimating Eq. 2. The lines represent 95% confidence intervals. The sample includes individuals born between 1990 and 1995, are 19 or 20 years old at the time of the interview. The sample "High school or higher" includes 21,208 observations. The sample "University education" includes 8,508 observations.

Figure 17: Education outcomes - Intensity of treatment



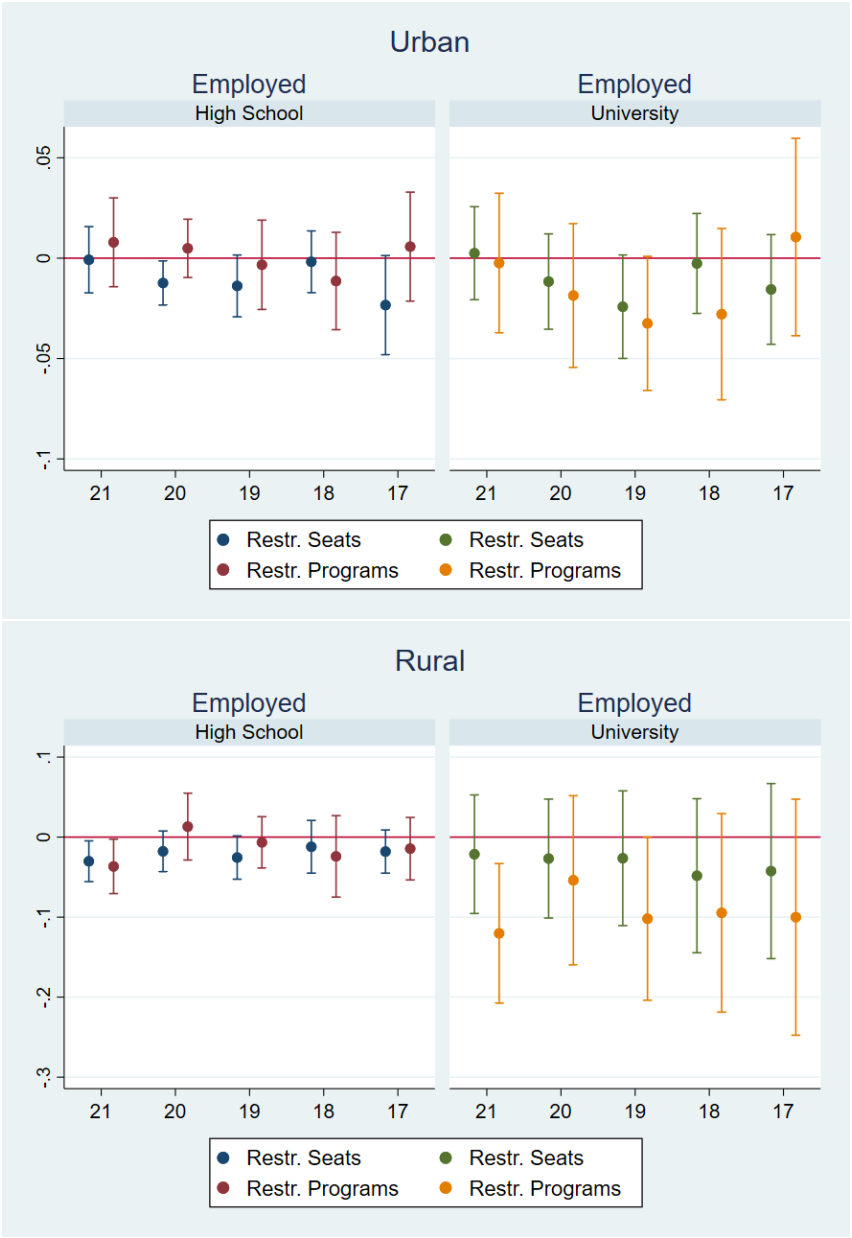
Notes: The horizontal axis indicates the individual's age in 2012. Regression results are based on Eq. 2, splitting the sample between urban (figure above) and rural (figure below) individuals. The sample includes individuals born between 1990 and 1995, are at least 19 years old at the time of the interview.

Figure 18: Labor force participation - Intensity of treatment



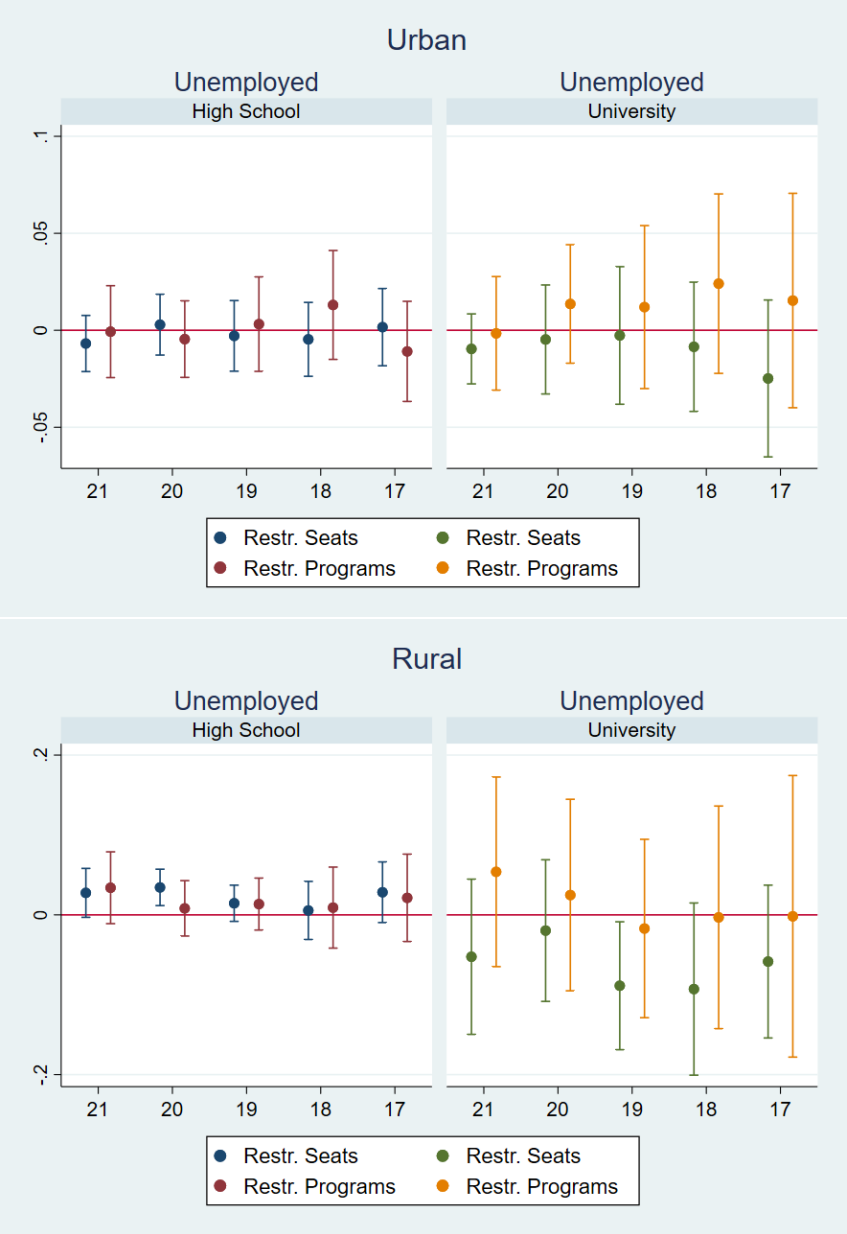
Notes: The horizontal axis indicates the individual's age in 2012. Regression results are based on Eq. 2, splitting the sample between urban (figure above) and rural (figure below) individuals. The sample includes individuals born between 1990 and 1995, are at least 19 years old at the time of the interview.

Figure 19: Employment for a wage - Intensity of treatment



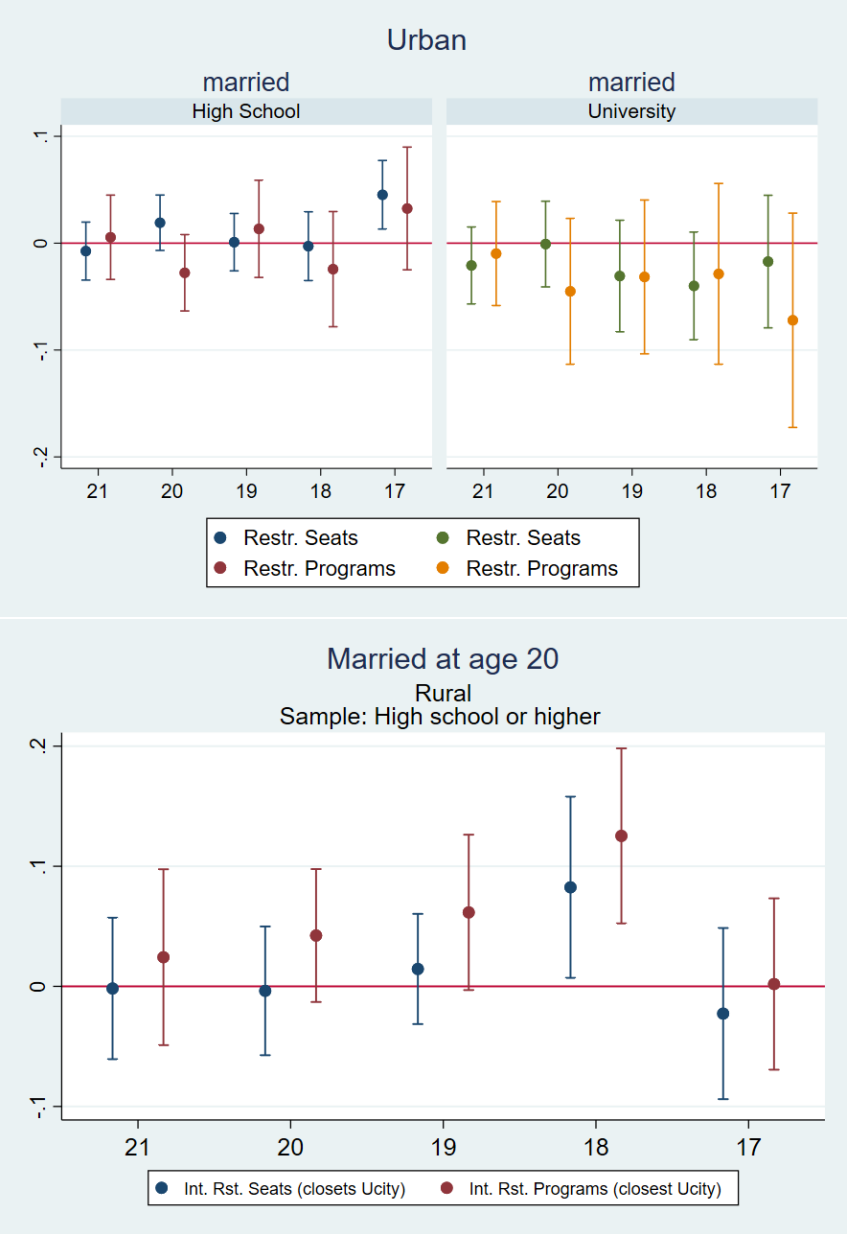
Notes: The horizontal axis indicates the individual's age in 2012. The thick bars show the estimated coefficient on the Treatment variable $Restrictions2012_c$ on reporting to have ever been enrolled at university for BA degree or higher. The lines represent 95% confidence intervals. Regression results are based on Eq. 2, splitting the sample between urban (figure above) and rural (figure below) individuals. The sample includes individuals born between 1990 and 1995, are at least 19 years old at the time of the interview.

Figure 20: Unemployment - Intensity of treatment



Notes: The horizontal axis indicates the individual's age in 2012. The thick bars show the estimated coefficient on the Treatment variable $Restrictions2012_c$ on reporting to have ever been enrolled at university for BA degree or higher. The lines represent 95% confidence intervals. Regression results are based on Eq. 2, splitting the sample between urban (figure above) and rural (figure below) individuals. The sample includes individuals born between 1990 and 1995, are at least 19 years old at the time of the interview.

Figure 21: Marriage market outcomes - Intensity of treatment



Notes: The horizontal axis indicates the individual's age in 2012. The thick bars show the estimated coefficient on the Treatment variable $Restrictions2012_c$ on reporting to have ever been enrolled at university for BA degree or higher. The lines represent 95% confidence intervals. Regression results are based on Eq. 2, splitting the sample between urban (figure above) and rural (figure below) individuals. The sample includes individuals born between 1990 and 1995, are at least 19 years old at the time of the interview.

6 Conclusion

This paper investigates the effect of a higher education policy that imposed restrictions on women's admissions to public university in specific Bachelor programs in 2012. The restrictions reduced the share of seats and programs that women could apply to, particularly in popular and prestigious fields such as engineering. For identification, we exploit the differential impact of the policy across cohorts and cities. Our findings suggest that this policy had a negative effect on university attendance for women in affected cohorts in restricted cities. This effect is particularly strong for women from urban households. Furthermore, we show that the effect of the restrictions to higher education for women extends to the labor and marriage markets. We find an adverse impact on women's labor force participation and probability to be employed for a wage, and a positive effect on women's probability to be married at the age of 20.

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A Robustness checks with semi-cohorts

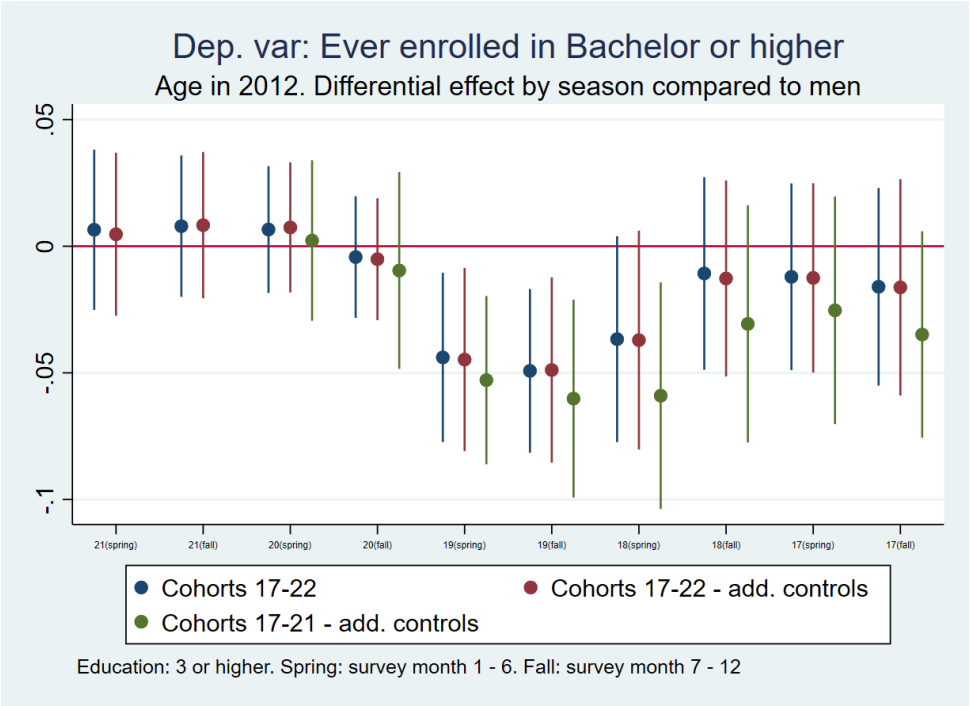
One drawback of the HIES is that it does not contain information on the exact birth date of respondents, but only record the age at the time of the interview. Thus, in our main analysis, we simply consider that everybody who was 19 at the moment of the 2012 interview was born in 1993. However, it is possible that some individuals who were 19 at the time of the interview were born in 1992. This is particularly likely for those who have been interviewed in the first few months of the year. To get a more precise estimation of the age of individuals we divide the yearly sample into two. The interviews of the HIES take place throughout the year and the month of interview is recorded. Individuals who declare to be 19 and are interviewed in the first six month of the year are on average older than the individuals who declare to be 19 and are interviewed in the second half of the year. The month of the interview thus allows us to distinguish between individuals that are 19 years old in the first half (spring) and those who are 19 in the second half (fall) of the year.[39]

If the policy was effective, we expect a lower probability of studying at university for women who are entering university in the fall 2012. Students who were 19 in the fall were thus those most likely to have applied to university during the summer of 2012. However, students who were 19 already in spring 2012 are more likely to have graduated from high school in the previous year. Those individuals might still be affected by the policy if they had spent an additional year to prepare for the *konkur*. A similar argument holds for students who declared to be 18 in 2012: those who were interviewed in spring 2012 and declare to be 18 were highly likely to apply to university in the summer, while students who are 18 in the fall 2012 are more likely to be in their last year of high school in 2012 an thus shouldn't be affected directly by the changes in university admissions in 2012.

Hence, we allow our main independent variables of interests to vary by the semester in which they are interviewed ($cohort_k \times female_i \times spring_t$ and $cohort_k \times female_i \times fall_t$). As this strategy uses more precise information about the age of the individual, it can result in a better identification of the effects of the policy under study. In fact, we can more easily rule out other macroeconomic factor that could influence university attendance differently by gender for that specific age group. Results by semester are shown in Figure A.1. We

[39]The New Year according to the Persian calendar is in March. Spring thus refers to March to August. The start of the academic year (September) is at the beginning of the seventh month according to the Persian calendar.

Figure A.1: Gender differences in university enrolment across semesters

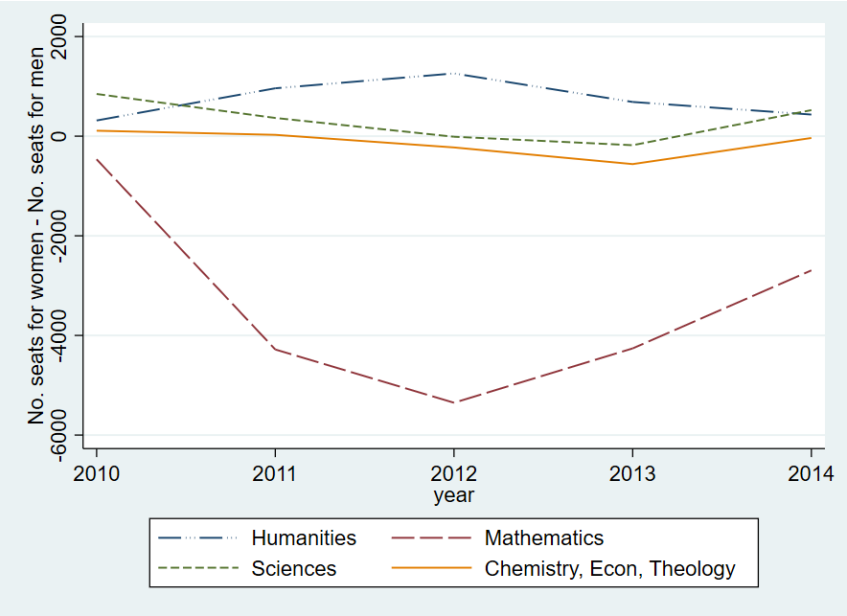


Notes: The horizontal axis indicates the individual's age in 2012 and the season of the interview. The lines represent 95% confidence intervals. Regression results are based on Eq. 1. In addition, season-cohort-city, season-female and season-year fixed effects are included. The sample includes individuals born between 1990 and 1995, are at least 19 years old at the age of the interview.

notice that student who have been 19 in fall 2012 are the ones on which the policy had the strongest impact, and we also observe a negative effect for students that are 18 in the spring 2012, as we would expect if the policy had an impact on university attendance for women. We also see an effect for individuals who declared to be 19 years old in the spring. This can be explained with the fact that some of these students may have spent one more year studying for the university entrance examination; an alternative explanation is that these students are affected by the 2011 policy imposing equal quotas for men and women. We do not observe any effect for students who were 18 in the fall 2012, and thus too young to be affected by the 2012 changes in the admission policies.

B Additional Figures and Tables

Figure B.1: Differences in abolute number of seats females vs males - by field



Notes: Data from University coursebooks published by the Iranian Ministry of Education (2010-2014).

Figure B.2: Regional variation in higher education

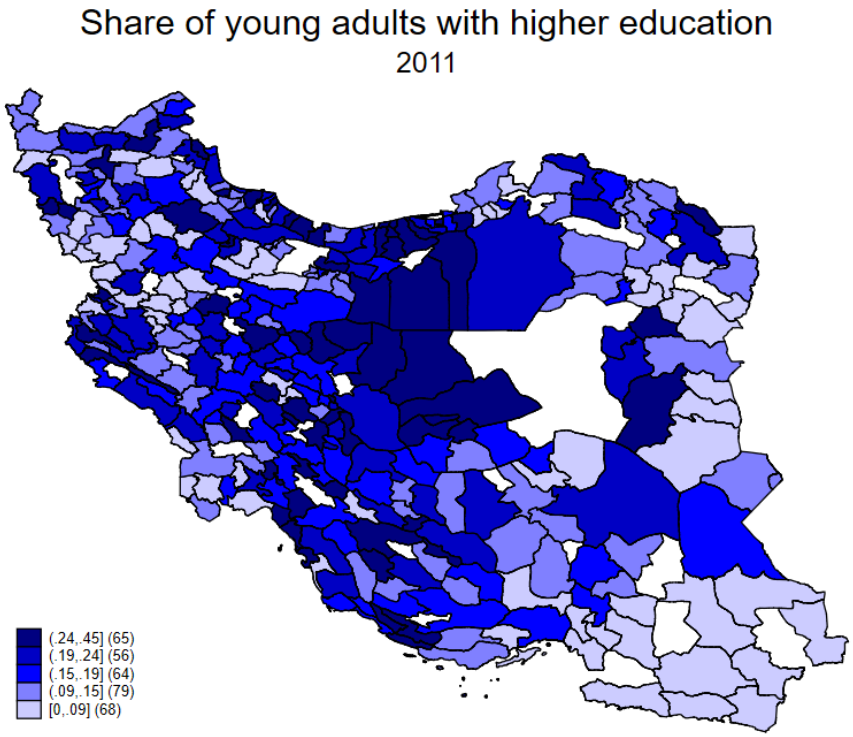
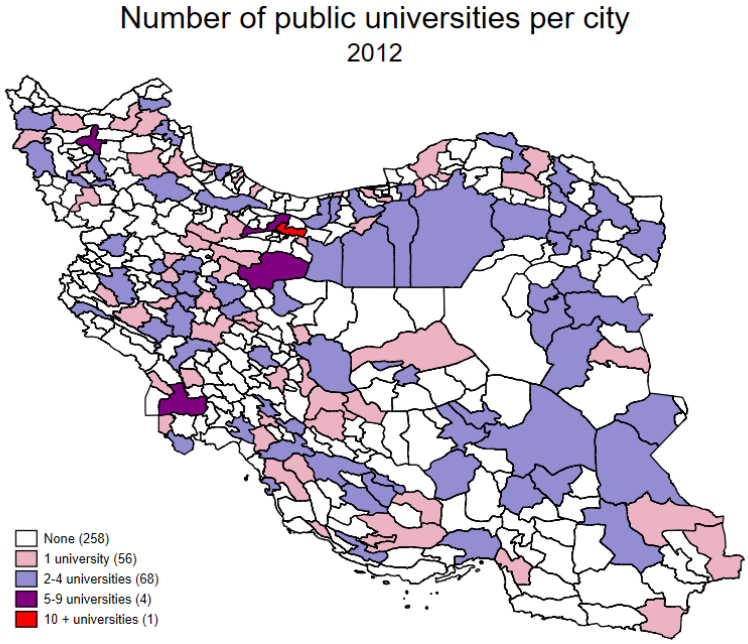
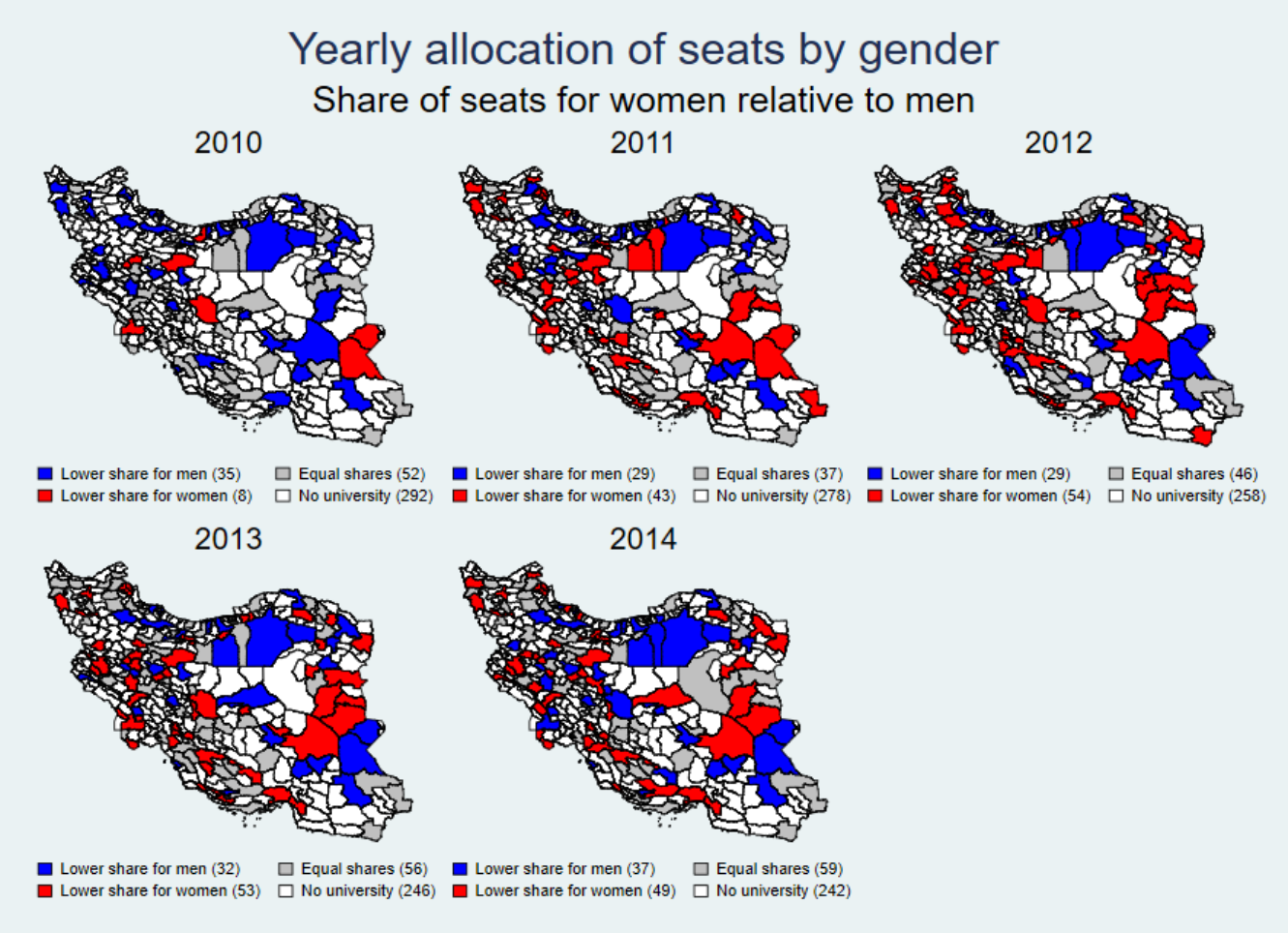


Figure B.3: Spatial distributions of public universities



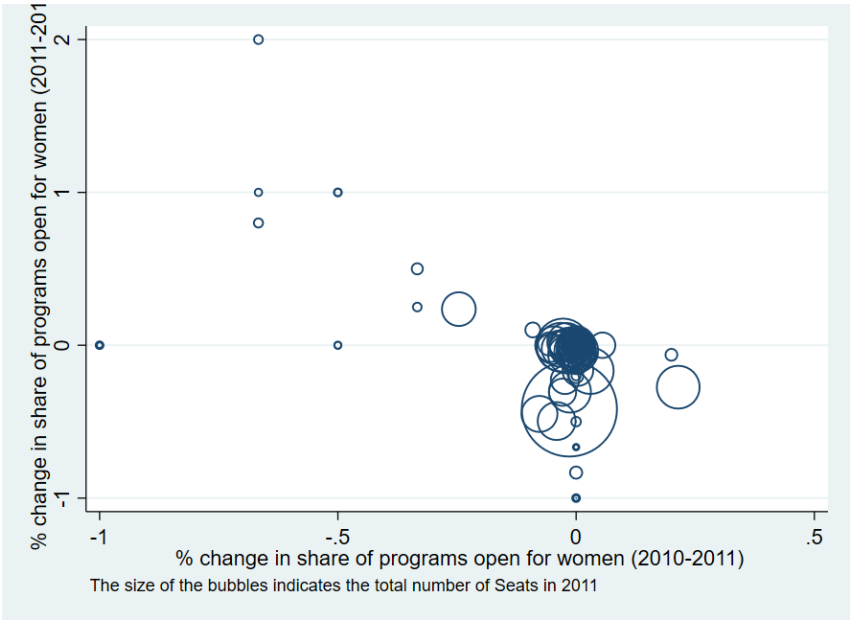
Notes: data from the University coursebooks published by the Iranian Ministry of Education (2012).

Figure B.4: Spatial distributions of restrictions



Notes: Data from the University course books published by the Iranian Ministry of Education (2010-2014). Seats are aggregated at the *shahrestan* level. The numbers in parentheses indicate the number of cities (*shahrestan* that are in the corresponding category. The share of seats open to men (women) is calculated as the number of seats in the city which are either reserved for men (women) or which are not allocated by gender, divided by the total number of programs offered to new BA students in that year.

Figure B.5: Pre-trend of treatment



Notes: data from University coursebooks published by the Iranian Ministry of Education (2010-2012).

Table B.1: Main study fields for university education in 2010

	Males	Females	Total
Educational Science	27	71	98
Arts and Humanities	71	193	264
Social sciences and Journalism	82	172	254
Business and Administrative Sciences	313	477	790
Experimental sciences and Mathematics	131	222	353
Engineering, Manufacturing and Production	568	262	830
Agriculture, Forestry, Fishing and Veterinary	59	89	148
Health	23	79	102
Services	14	22	36

Source: Iran Labour Force Survey 2010. This table contains only individuals from the 2010 survey round who are currently studying at university level (BA or MA) in 2010. In this survey, individuals are asked in which field they study or have graduated. Here, we show the 9 biggest categories.

Table B.2: Individual determinants of university education

	(1) BA_degree	(2) BA_degree	(3) BA_degree	(4) BA_degree	(5) BA_degree
University city (2011)		0.027^{b}			
		(0.008)			
Dist. to next university city			-0.003^{b}	-0.004^{b}	-0.004^{b}
			(0.001)	(0.001)	(0.001)
Dist. university city × female				0.001	0.001
				(0.002)	(0.002)
Dist. university city × post					0.002^{c}
					(0.001)
Dist. university city × female × post					-0.002
					(0.002)
Urban	0.060^{a}	0.059^{a}	0.060^{a}	0.060^{a}	0.060^{a}
	(0.008)	(0.007)	(0.008)	(0.008)	(0.008)
Urban × female	-0.078^{a}	-0.078^{a}	-0.078^{a}	-0.078^{a}	-0.078^{a}
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Education of HH head	0.064^{a}	0.064^{a}	0.064^{a}	0.064^{a}	0.064^{a}
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Education of HH head × female	-0.021^{a}	-0.021^{a}	-0.021^{a}	-0.021^{a}	-0.021^{a}
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Income quantile of HH	-0.024^{a}	-0.024^{a}	-0.024^{a}	-0.024^{a}	-0.024^{a}
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Income quantile of HH × female	0.003	0.003	0.003	0.003	0.003
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
	province-cohort, province-female, province-year and cohort-female FE				
N	42564	42564	42564	42564	42564
r2	0.144	0.145	0.144	0.144	0.144

Standard errors in parentheses

Controls: individual and city-year. Standard errors are clustered at the cohort-city level.

^{c} p¡0.1, ^{b} p¡0.05, ^{a} p¡0.01

C Regression Tables

Table C.1: Gender differences in university enrolment across cohorts

	(1) BA_degree	(2) BA_degree	(3) BA_degree	(4) BA_degree
Sample:	Middle school		High school	
Age in 2012: 21 × female	0.012^{b}	0.011	0.018^{b}	0.014
	(0.004)	(0.008)	(0.006)	(0.010)
Age in 2012: 20 × female	0.002	0.000	0.019^{b}	0.016
	(0.006)	(0.008)	(0.007)	(0.009)
Age in 2012: 19 × female	-0.033^{b}	-0.036^{b}	-0.026^{b}	-0.031^{c}
	(0.009)	(0.012)	(0.010)	(0.014)
Age in 2012: 18 × female	0.002	0.004	0.017	0.020
	(0.009)	(0.011)	(0.011)	(0.013)
Age in 2012: 17 × female	-0.013	-0.009	-0.002	-0.000
	(0.011)	(0.014)	(0.013)	(0.016)
Urban	0.087^{a}	0.089^{a}	0.069^{a}	0.073^{a}
	(0.009)	(0.009)	(0.009)	(0.009)
HH size	0.009^{a}	0.006^{b}	0.008^{a}	0.006^{c}
	(0.002)	(0.002)	(0.002)	(0.002)
Education of HH head	0.067^{a}	0.067^{a}	0.056^{a}	0.056^{a}
	(0.003)	(0.003)	(0.003)	(0.003)
Income quantile of HH	-0.028^{a}	-0.027^{a}	-0.029^{a}	-0.028^{a}
	(0.002)	(0.002)	(0.002)	(0.002)
Urban × female	-0.085^{a}	-0.081^{a}	-0.078^{a}	-0.073^{a}
	(0.006)	(0.007)	(0.007)	(0.008)
HH size × female	0.027^{a}	0.032^{a}	0.028^{a}	0.033^{a}
	(0.003)	(0.004)	(0.004)	(0.005)
Education of HH head × female	-0.024^{a}	-0.023^{b}	-0.022^{a}	-0.020^{b}
	(0.005)	(0.006)	(0.005)	(0.005)
Income quantile of HH × female	0.003	0.002	0.001	0.000
	(0.005)	(0.005)	(0.004)	(0.004)
R^2	0.167	0.207	0.159	0.208
Observations	74997	74969	59348	59309

Notes: Col 1 and 2 correspond to the upper graph and Col 3 and 4 correspond to the lower graph in Figure 11. Col 1 and 3 include cohort, gender, city-year, gender-year and cohort-year fixed effects. Col 2 and 4 include cohort-city, gender-city, city-year, gender-year and cohort-year fixed effects. All columns include additional controls: Median income$_{cy}$, Average education$_{cy}$ Mean female labor force participation$_{cy}$, Mean Nb of households working in agriculture$_{c}y$, month of interview fixed effects, nb of times the household appears in the surveys fixed effects. Standard errors are clustered at the city and cohort level and reported in parentheses. ^{a}, ^{b} and ^{c} indicate significance at the 1%, 5% and 10% level.

Table C.2: Gender differences in university enrolment across cohorts

	(1) BA_degree	(2) BA_degree	(3) BA_degree	(4) BA_degree
Sample:	Middle school		High school	
Restrictions:	Seats	Programs	Seats	Programs
Age in 2012: 21 × female × Restr.	0.003	0.006	-0.003	0.004
	(0.005)	(0.006)	(0.007)	(0.009)
Age in 2012: 20 × female × Restr.	-0.008	0.000	-0.013^{c}	0.005
	(0.004)	(0.006)	(0.006)	(0.009)
Age in 2012: 19 × female × Restr.	-0.015^{c}	-0.022^{c}	-0.021^{c}	-0.025^{c}
	(0.007)	(0.009)	(0.009)	(0.011)
Age in 2012: 18 × female × Restr.	-0.013^{c}	-0.009	-0.017^{c}	-0.008
	(0.005)	(0.009)	(0.007)	(0.010)
Age in 2012: 17 × female × Restr.	-0.010	0.007	-0.016	0.008
	(0.007)	(0.010)	(0.008)	(0.011)
R^2	0.206	0.206	0.207	0.207
Observations	73471	73471	58278	58278

Notes: Col 1 and 2 correspond to the upper graph and Col 3 and 4 correspond to the lower graph in Figure 13. All regressions include cohort-city, gender-city, cohort-gender, city-year, gender-year and cohort-year fixed effects. All columns include individual and city level controls. Standard errors are clustered at the city and cohort level and reported in parentheses. ^{a}, ^{b} and ^{c} indicate significance at the 1%, 5% and 10% level.