Banning women from STEM: evidence from Iran

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This paper

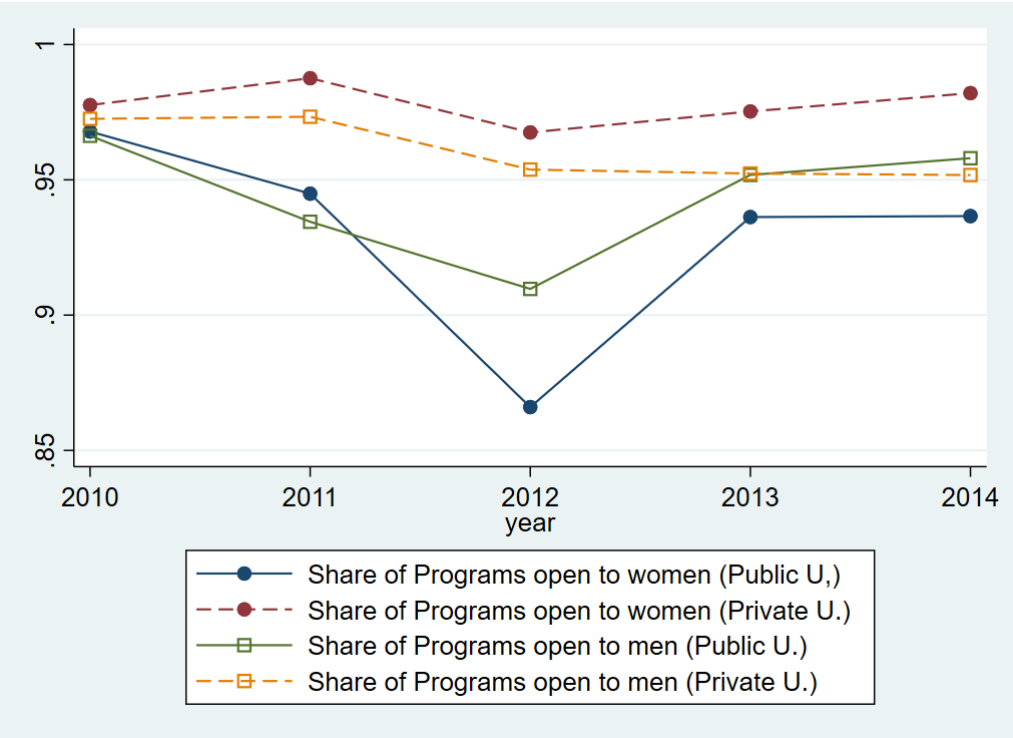
- Study impact of 2012 policy imposing restrictions to higher education for women in Iran, affecting 30% of public universities
  - **women excluded** entirely from specific programs
  - stricter quotas for women for certain programs
    $\Rightarrow$ decrease in share of programs and seats for women, particularly in prestigious programs such as **engineering**
- Outcomes: university education, marriage and labor market outcomes
- Identification: exploit differential exposure to the policy across cohorts, regions and gender

Literature and contribution

- Comprehensive analysis of impact of restrictions to higher education for women, considering impact on education, marriage and labor market
  - Moeeni and Wei (2022) study impact of unobserved skills on labor market using the same policy
- **Affirmative action** in higher education: impact on minorities, disadvantaged groups (e.g. Arcidiacono and Lovenheim, 2016; Bagde et al., 2016; Bertrand et al., 2010; Khanna, 2020)
  - this policy restricts **choice set** for women, favoring all men at direct cost of women

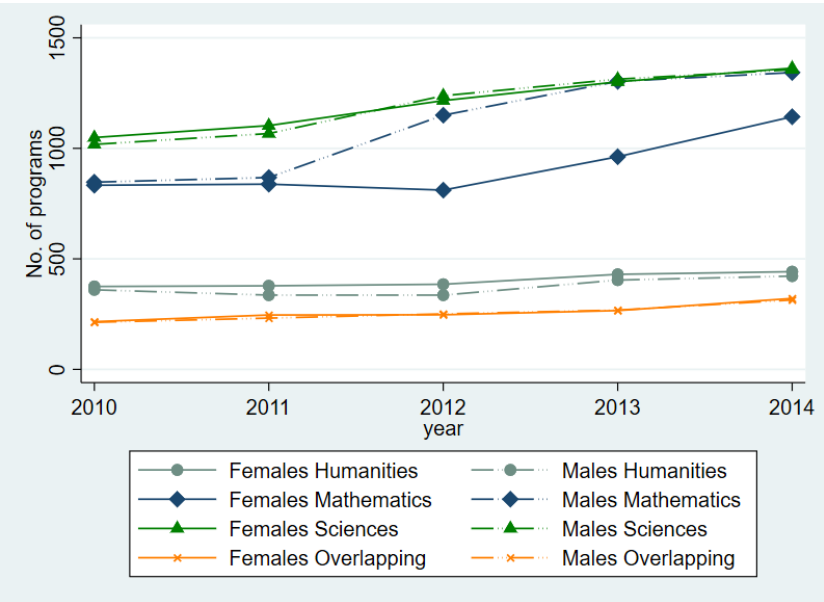
Restrictions in public universities

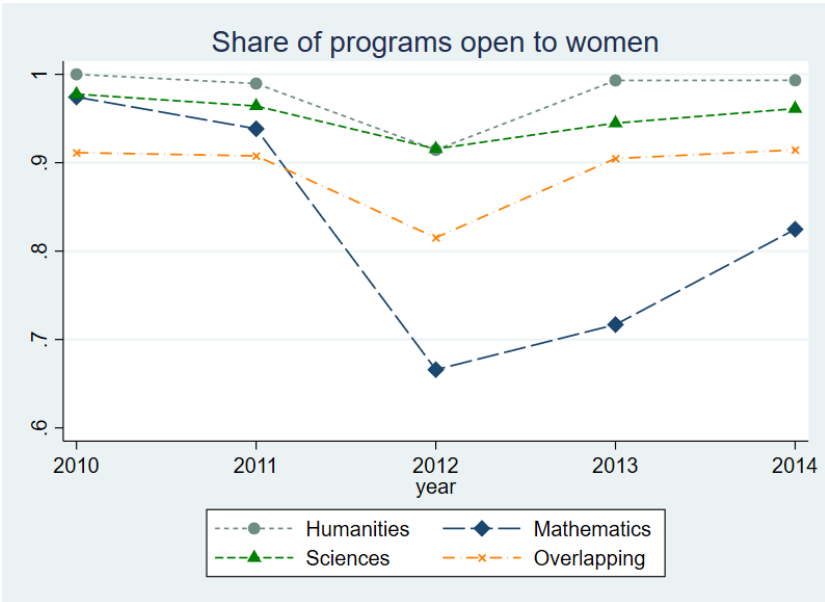
- Policy announced after national entrance exam
- Aim of the policy: reduce competition for men in engineering programs and redirect women towards traditional subjects
- 'Wish list' of programs had to be handed in two weeks later



Share of programs open to women and men by field

- Students can only apply to programs corresponding to their *konkur* (Maths, Sciences or Humanities), except for few "overlapping" subjects (chemistry, economics, theology) → students from all three *konkur* can apply to these programs.





Notes: Own calculations. Data from 2010-2014 University coursebooks

Potential effects on university education

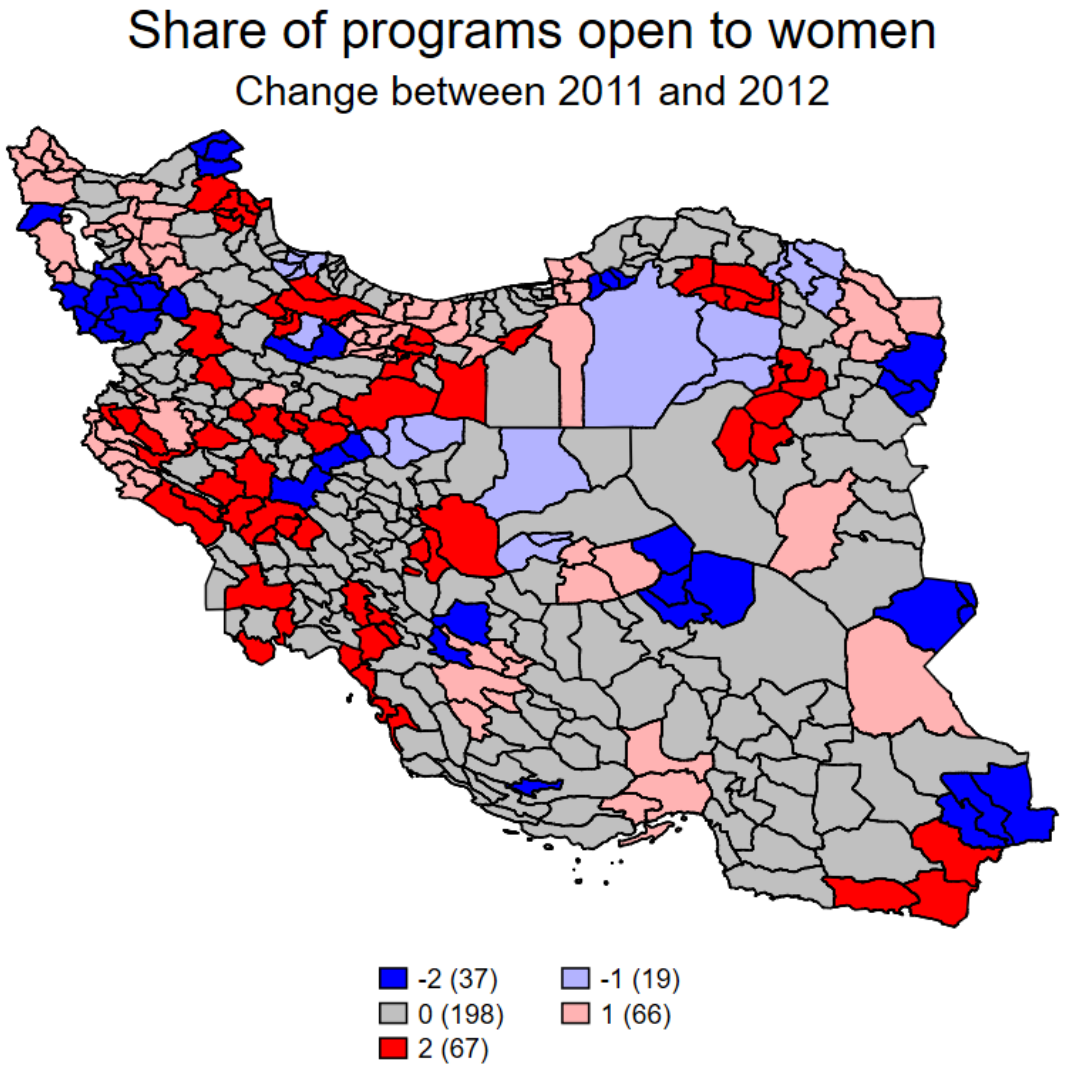
- **Decrease in university attendance** of women vs men:
  1. Mechanical effect through decrease in share of seats
  2. **Unexpected shock decreasing set of choices**, directly affecting university applications
     - Strong preferences for universities close by (Ekbatani, 2021).
     - Little time to consider new options
- **Allocation of students to programs**:
  - fewer women compared to men would study engineering
  - trickle down effects to other disciplines (e.g. overlapping subjects)
- **Two reasons why we may find no effect:**
  - no restrictions in private universities
  - possibility to delay university

Data

- Household Income Survey: repeated cross section for years 2008-2020; 23,000-40,000 households per year
  - individual characteristics (age, gender, education, marital status, composition of household), employment, income
  - location: city (334 cities in 2012)

- Course book data: data on all programs and seats offered in the fields of Mathematics, Sciences and Humanities for years 2010-2014.

Regional variation: Local restrictions R_c^{2012}



Notes: Own calculations. Data from 2010-2014 university coursebooks

Empirical specification: Triple difference

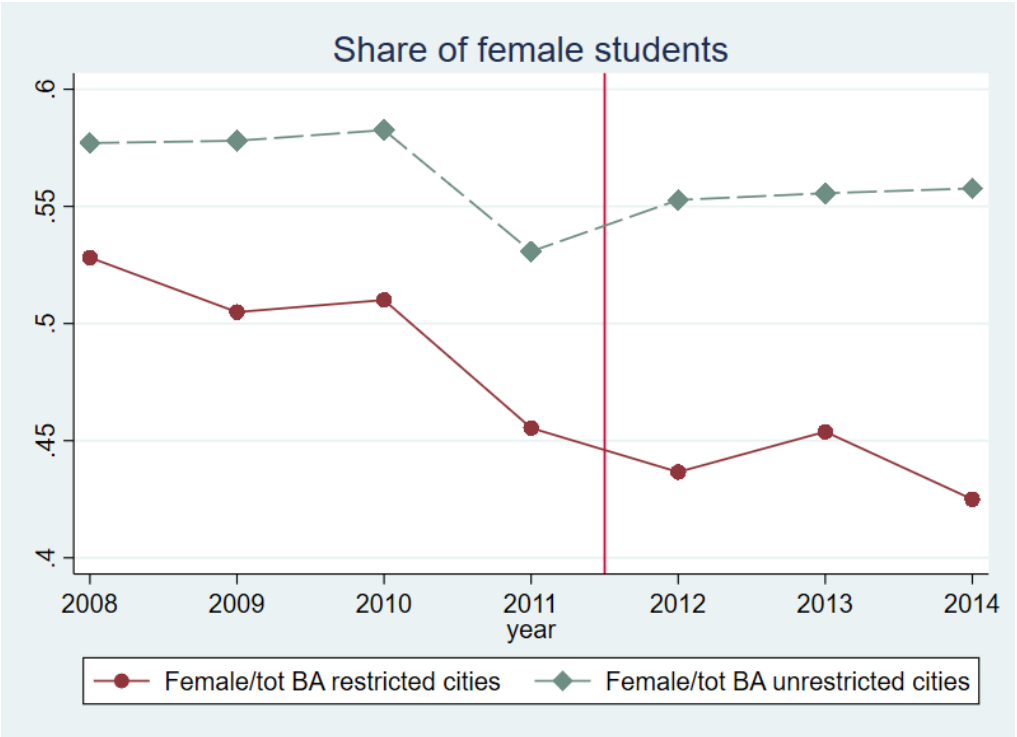
$$Y_{ickt} = \sum_{k=1}^{K} \beta_k R_c^{2012} \times cohort_k \times female_i + \alpha_1 X_{it} + \alpha_2 X_{it} \times female_i$$
$$+ \sum_{k=1}^{K} \alpha_3 Z_c \times cohort_k \times female_i + \gamma_{cf} + \lambda_{kc} + \chi_{pkf} + \tau_{pkt} + \zeta_{pft} + \epsilon_{ickt}$$

- R_c^{2012}: intensity index of restrictions at city level
- Birth cohorts k: age 17-24 at time of policy (born 1988 - 1995). Affected cohort: 1993
- Household controls: X_{it} (urban, hh with at least high school edu)
- City controls: Z_c (changes in admissions, seats for women, segregation, conservative votes)
- FE: city-gender (γ_{cf}), cohort-city (λ_{kc}), **province-cohort-gender** (χ_{pkf}), province-cohort-year (τ_{pkt}), province -gender-year (ζ_{pft})

Student statistics

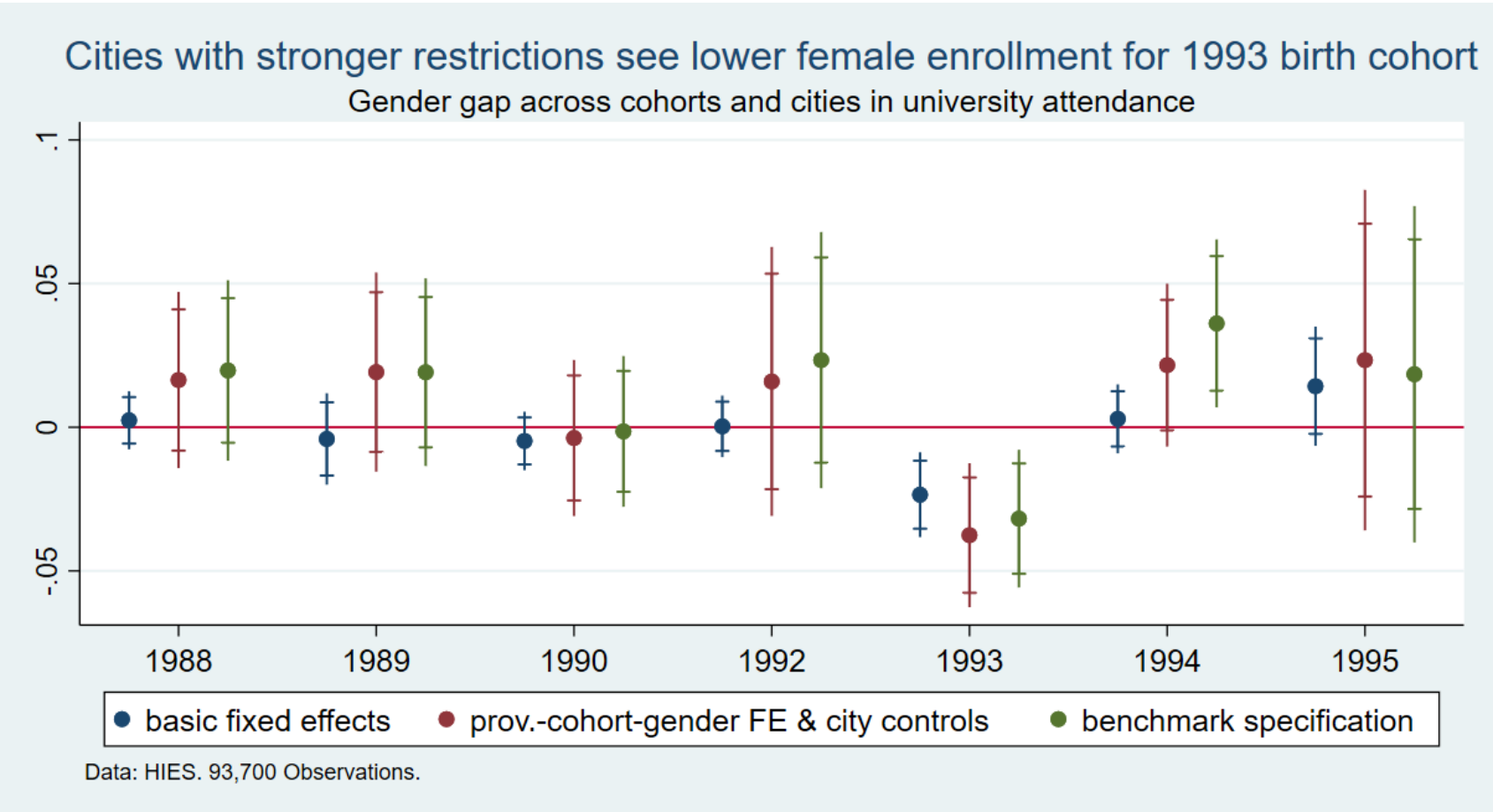
Descriptives

Figure: Enrollment in Bachelor degrees in public universities in cities with and without restrictions

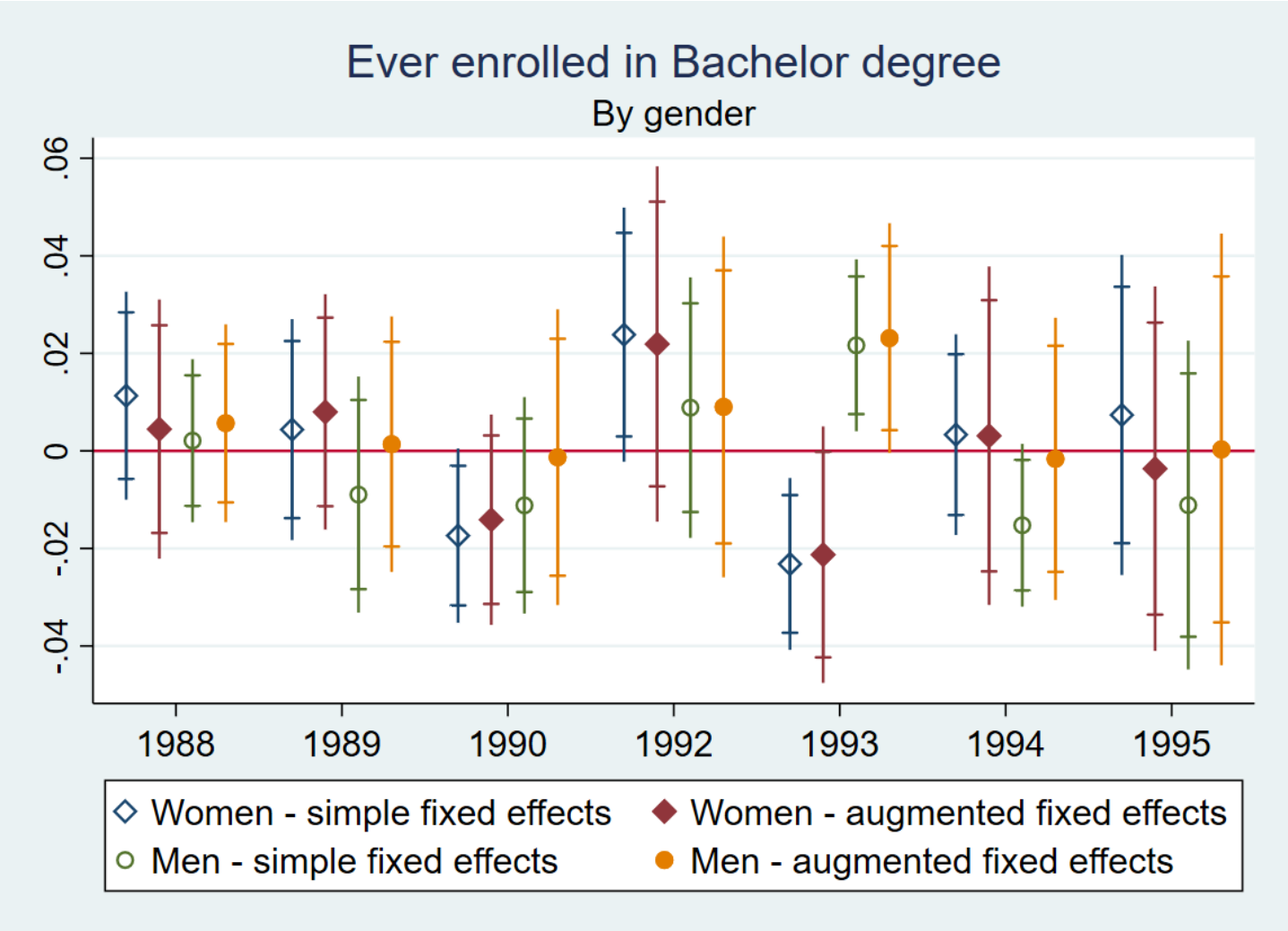


Source: own elaboration on the Student Statistics released by the Iranian Ministry of Education.

University attendance

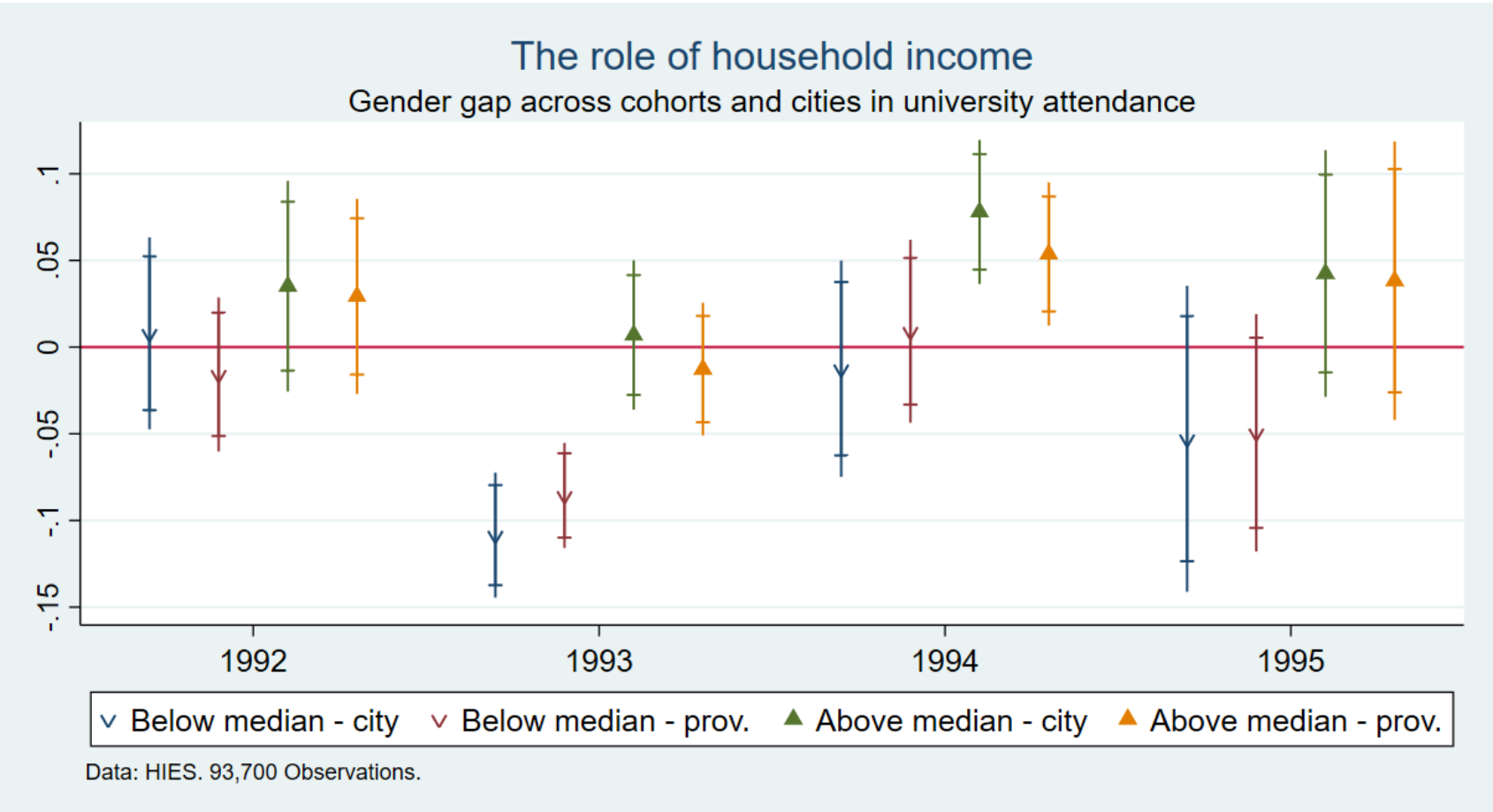


University attendance: by gender

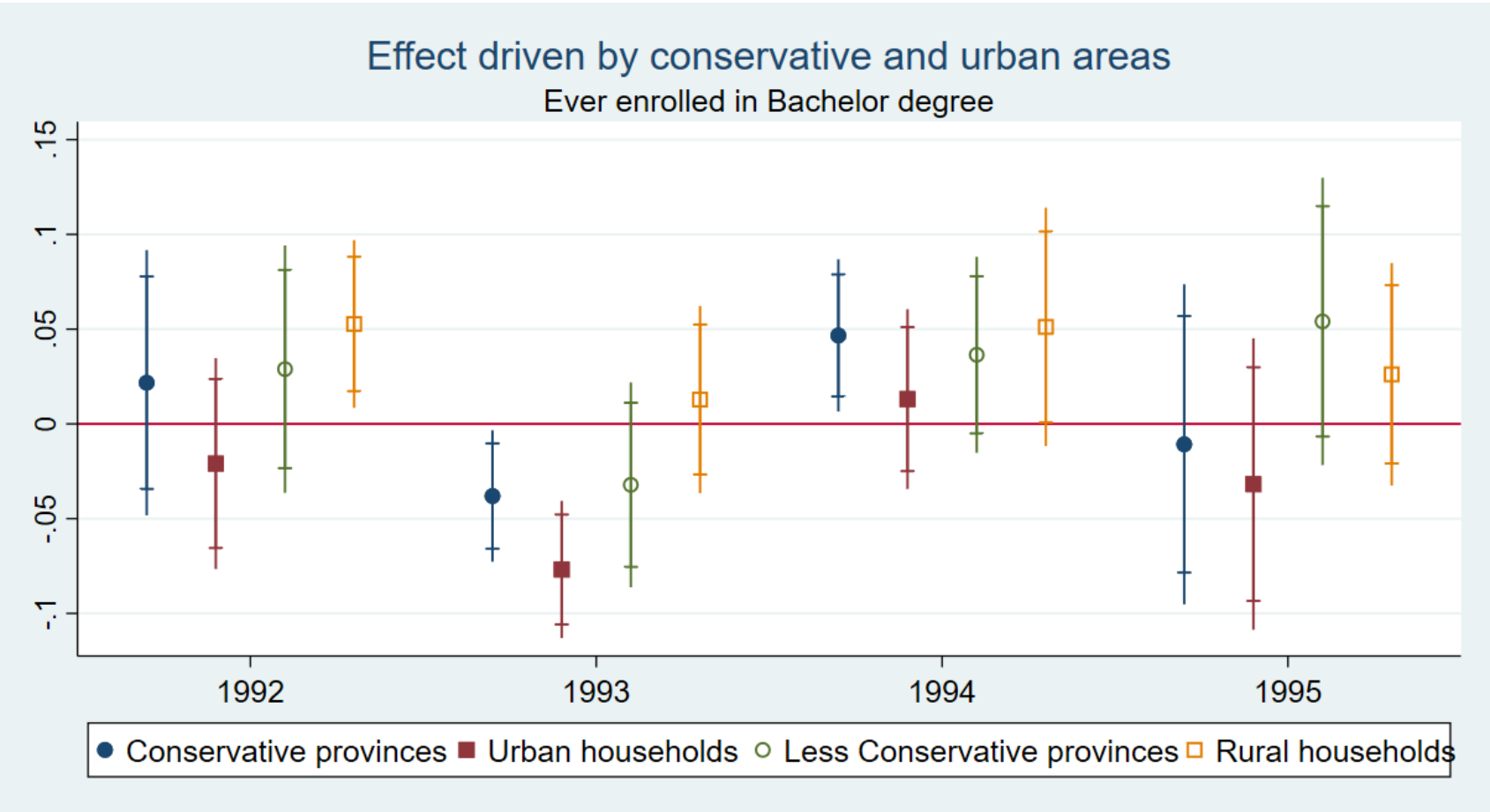


- Gender gap driven by - effect on women and + effect on men.

Heterogeneous impact I



Heterogeneous impact II



Marriage at a young age

Women only

Table: Women married at young age

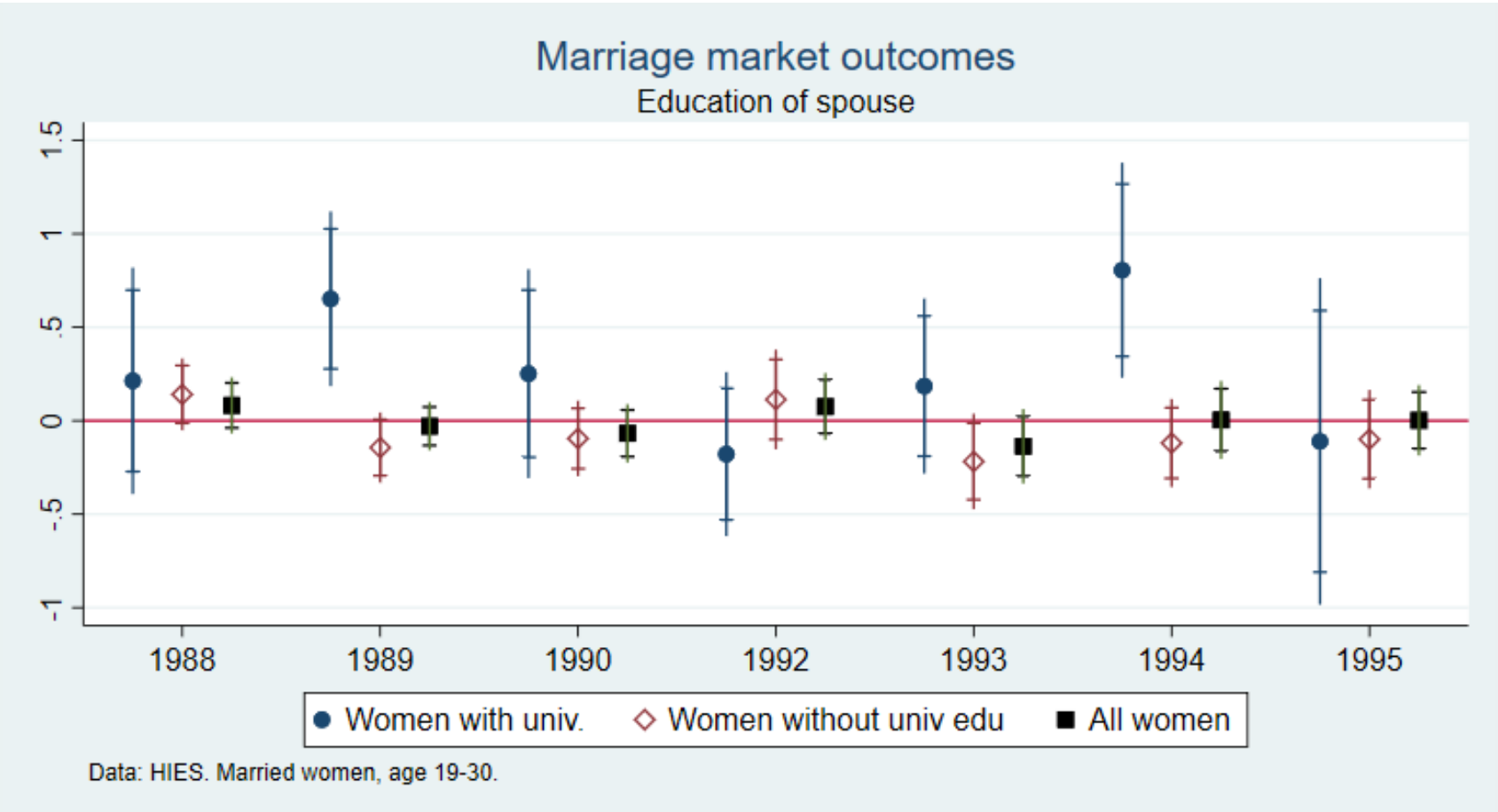
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	All women			With university edu.			No university edu		
Dep. variable:	Being married								
Age group:	19-21	19-23	19-28	19-21	19-23	19-28	19-21	19-23	19-28
$R_c^{2012} \times Cohort_i = 1992$	-0.037	-0.010	-0.034^b	-0.090^c	-0.001	-0.048^b	-0.034	0.004	0.001
	(0.027)	(0.015)	(0.013)	(0.043)	(0.021)	(0.015)	(0.039)	(0.024)	(0.017)
$\mathbf{R_c^{2012} \times Cohort_i = 1993}$	-0.094^b	-0.045^b	-0.050^a	-0.069	-0.096^a	-0.083^a	-0.134^b	-0.051^c	-0.050^b
	(0.028)	(0.014)	(0.011)	(0.058)	(0.027)	(0.018)	(0.042)	(0.023)	(0.016)
$R_c^{2012} \times Cohort_i = 1994$	-0.022	-0.008	0.002	0.060	-0.012	-0.001	-0.034	0.018	0.026
	(0.025)	(0.023)	(0.012)	(0.068)	(0.036)	(0.019)	(0.044)	(0.024)	(0.019)
$R_c^{2012} \times Cohort_i = 1995$	-0.034	-0.008	-0.014	-0.032	0.001	-0.038	-0.035	-0.001	0.012
	(0.044)	(0.017)	(0.014)	(0.080)	(0.038)	(0.026)	(0.052)	(0.028)	(0.018)
Controls	Individual and city controls (X_{it} & Z_{ck})								
Fixed effects	F_{pk} & F_{ct}								
Observations	16,571	26,069	44,990	4,786	9,078	17,472	10,894	15,863	26,074
R^2	0.217	0.212	0.248	0.336	0.292	0.305	0.276	0.286	0.333
No. of Cities	379	391	401	289	360	395	369	383	400

Sample: HIES 2008-2021. Women of birth cohorts 1989-1995. ^{a}, ^{b} and ^{c} denote significance at the 1, 5, and 10 percent levels, respectively.

Marriage: Match quality

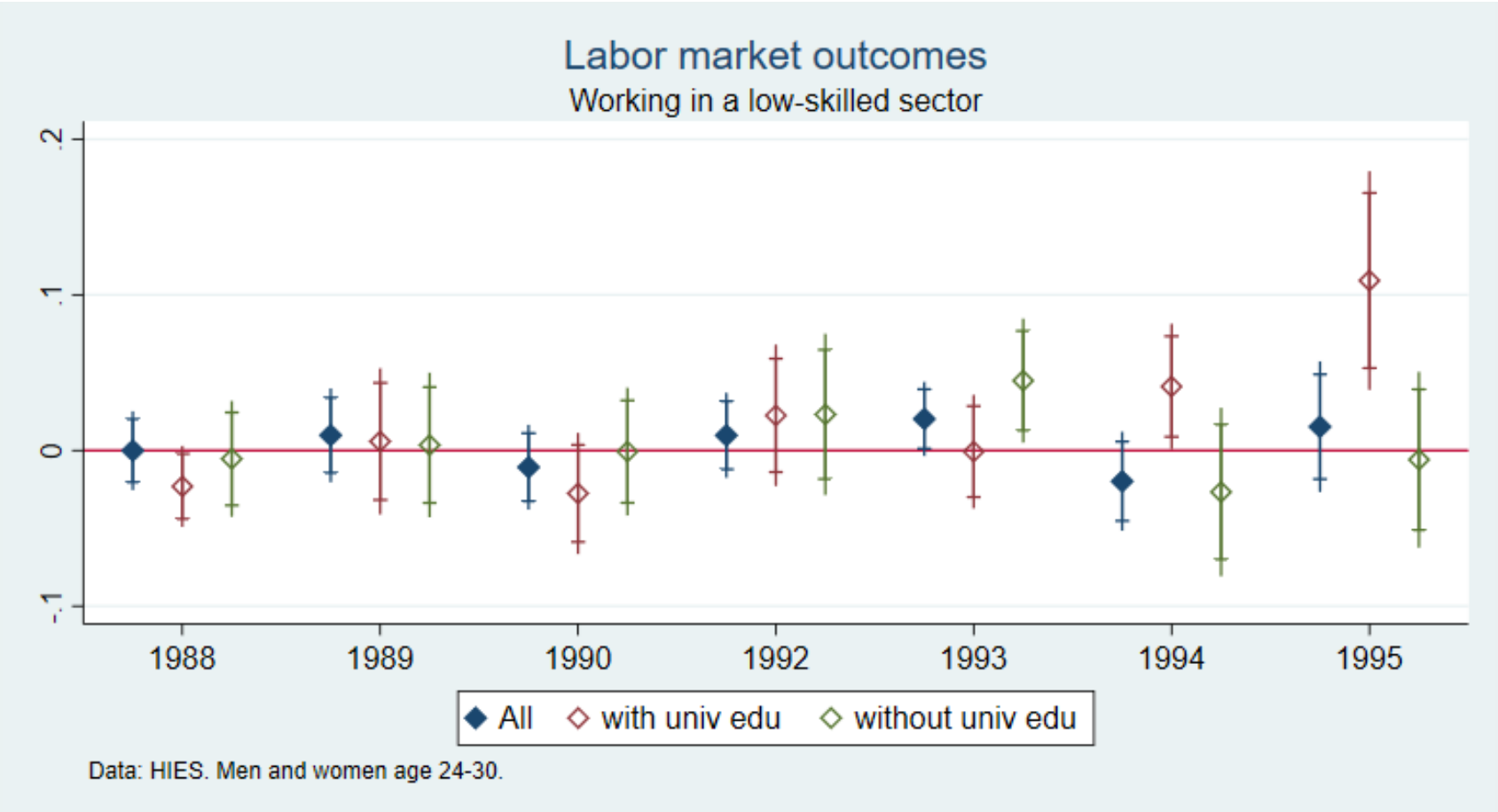
Women only

- Husbands of women born 1993 have lower level of education



Labor market

- Both men and women are more likely to be employed
- Women are more likely to work in low skilled jobs



Takeaways

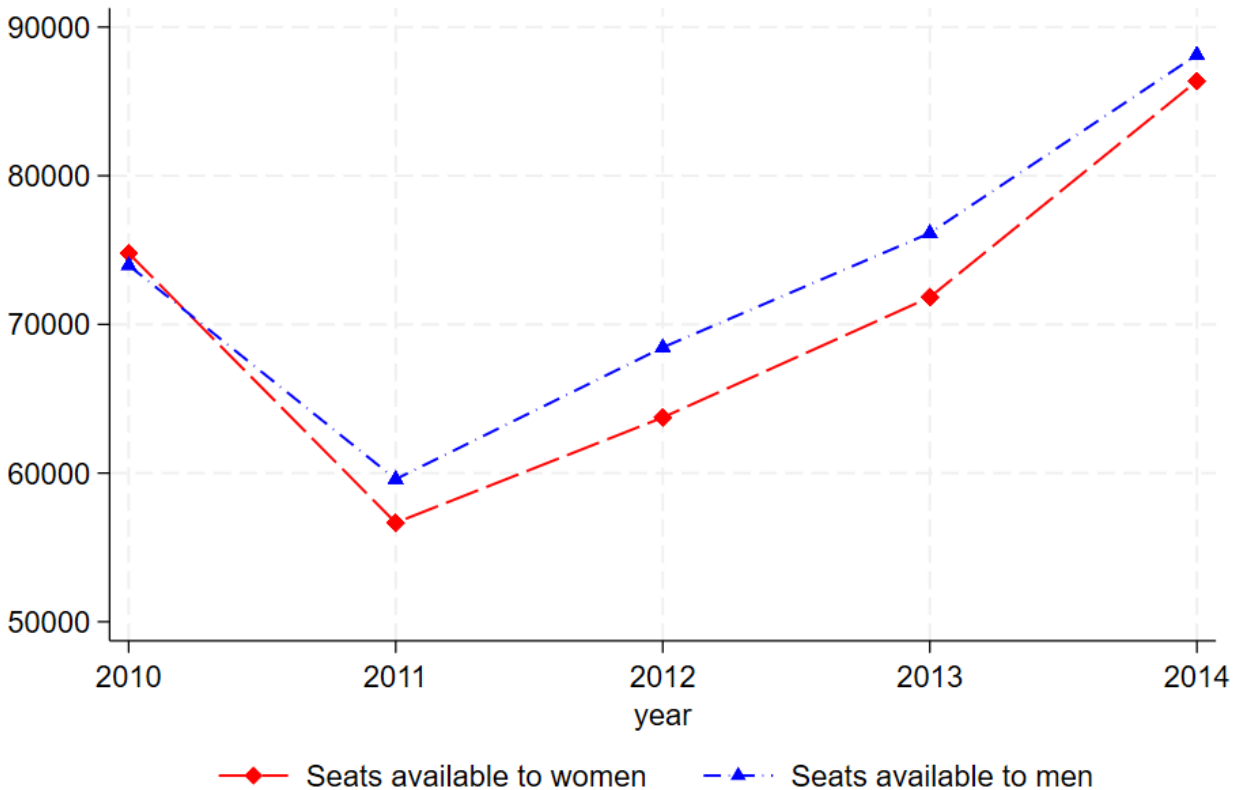
- Strong **negative effect on university education for women relative to men**, larger in areas with more intense restrictions $\Rightarrow$ **regional gender inequalities** in education
  - Driven by poorer women not being able to join university

- Unintended consequences of the policy on marriage and labor market:
  - **Negative impact on marriage** for women $\rightarrow$ lower probability of marrying young and lower match quality
  - Positive impact on women's employment $\rightarrow$ work more in low skill sectors

Thank you!

Total seats by gender

- 2011: seats listed for men and women separately



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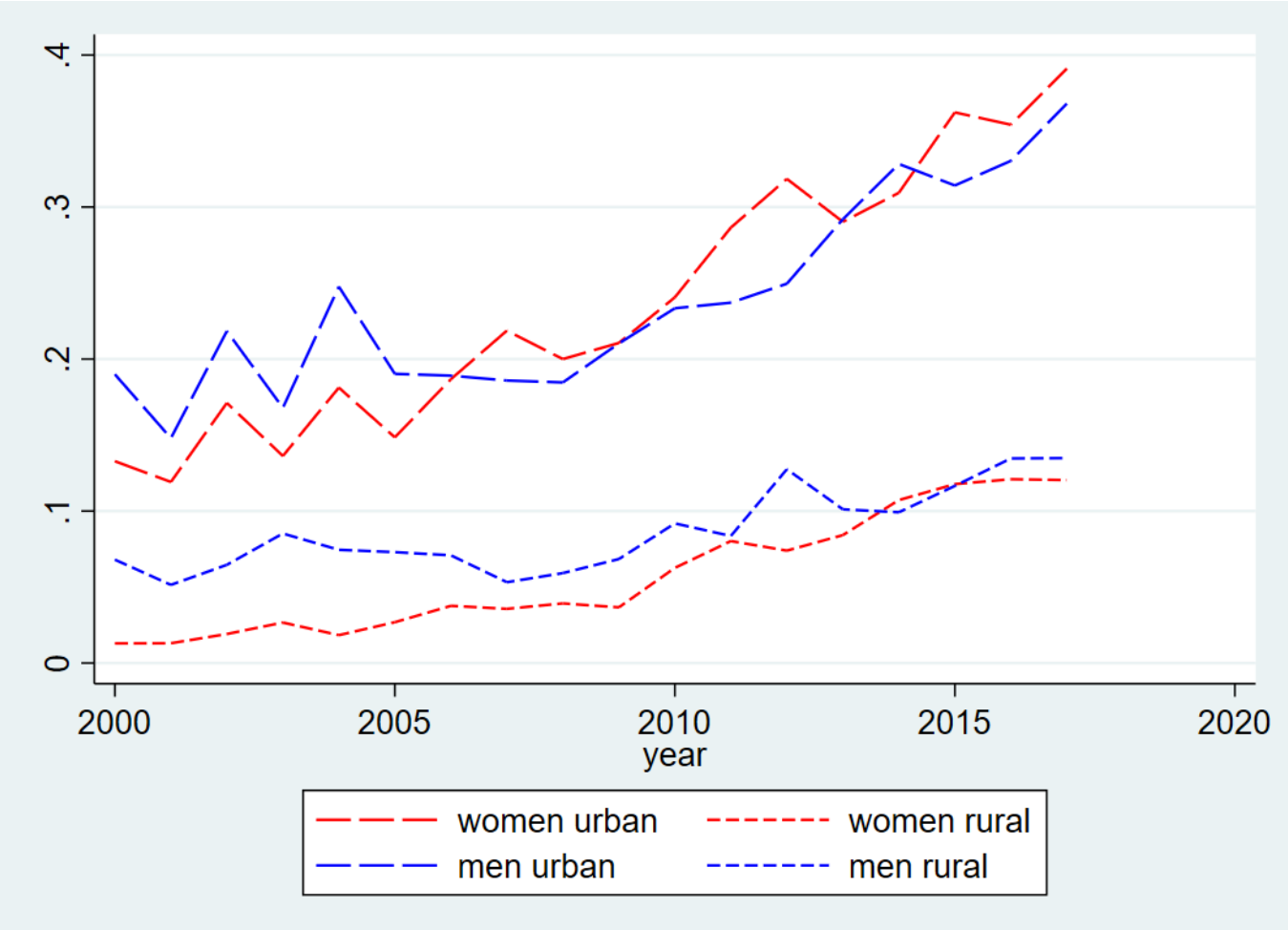
Share with Post-Secondary Education at Age 30



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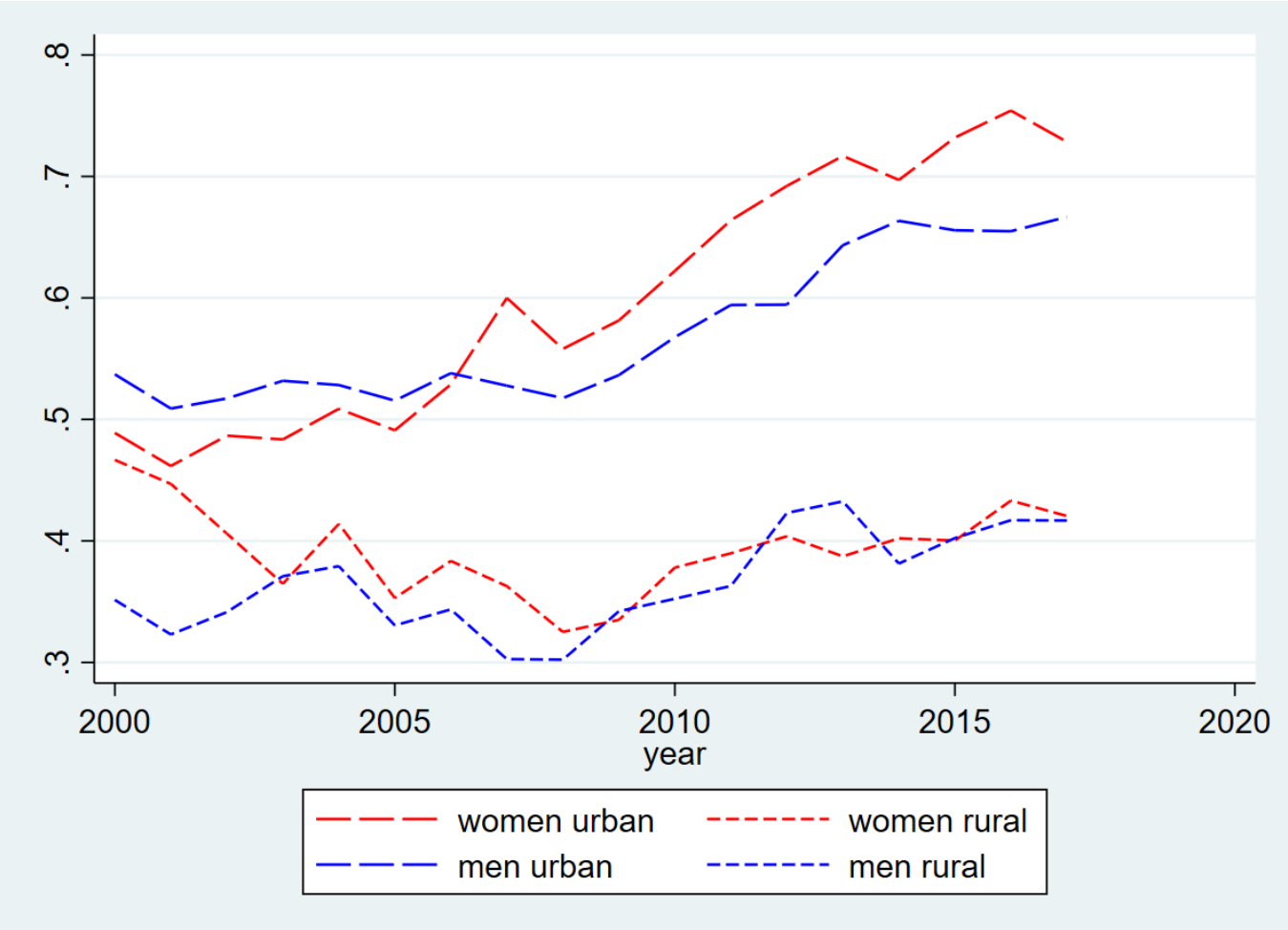
Share with at Least a High School Degree at Age 30



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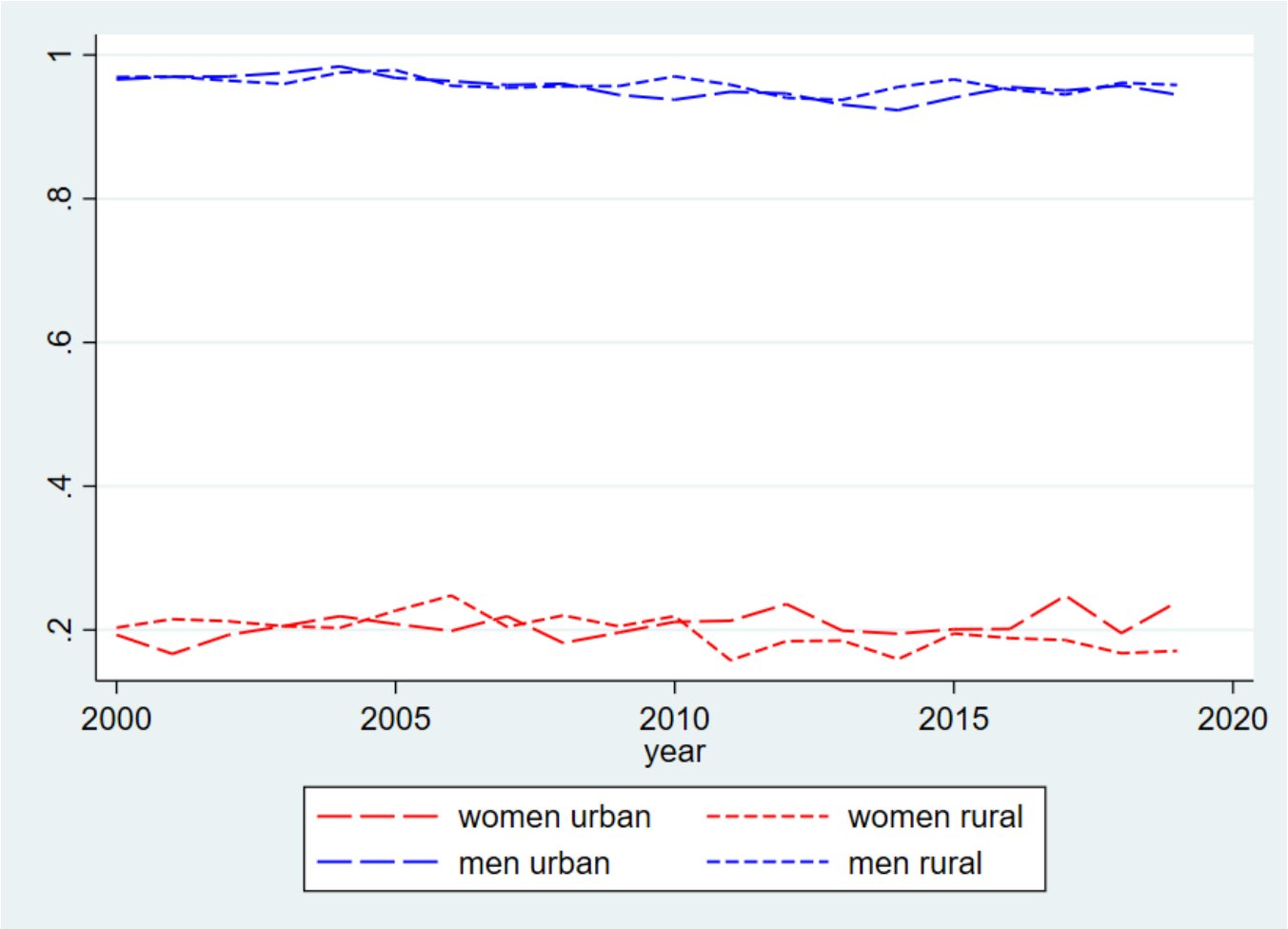
Labour Force Participation at Age 30 - urban rural divide



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Labour Force Participation by Education at Age 30

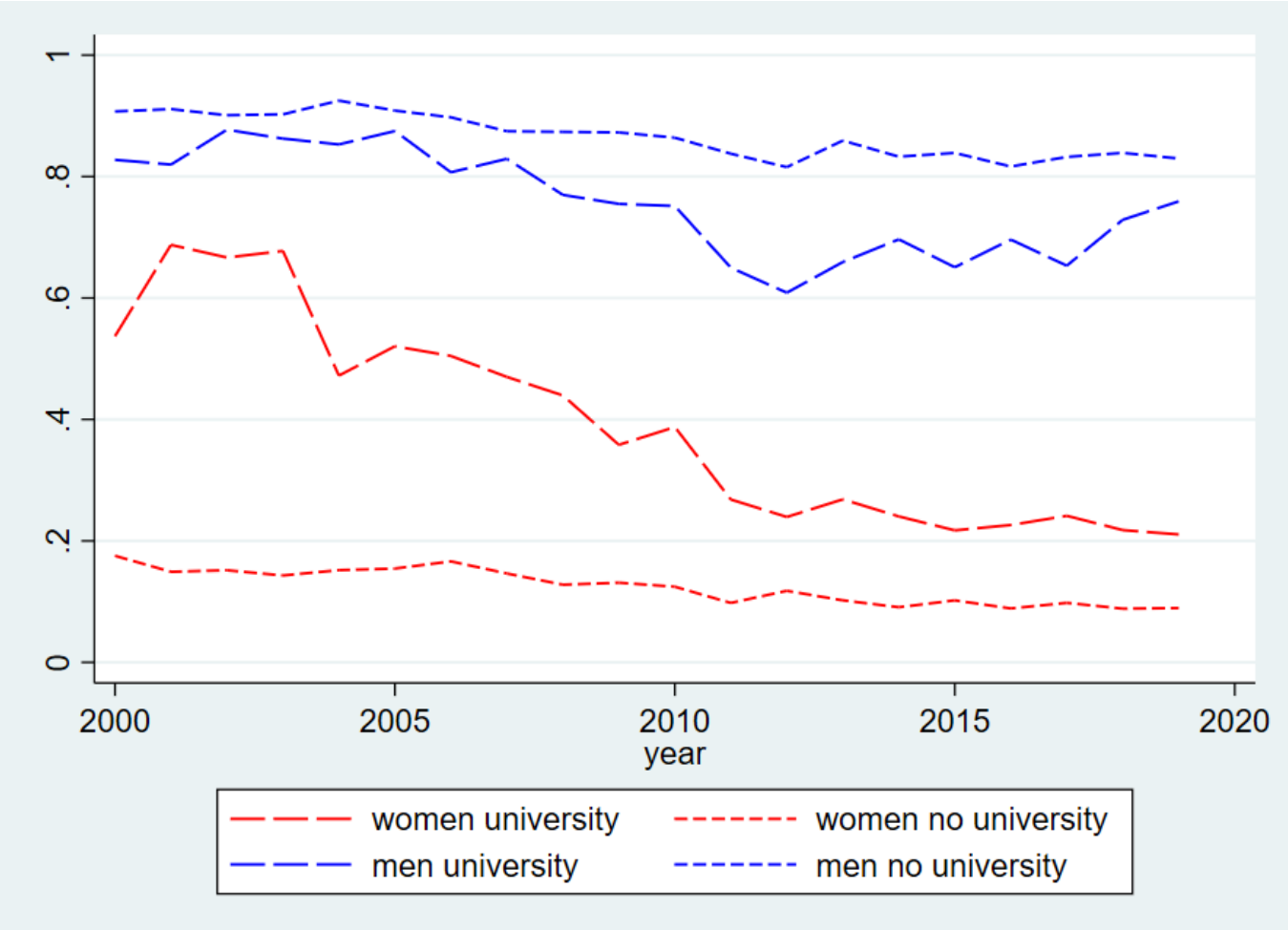

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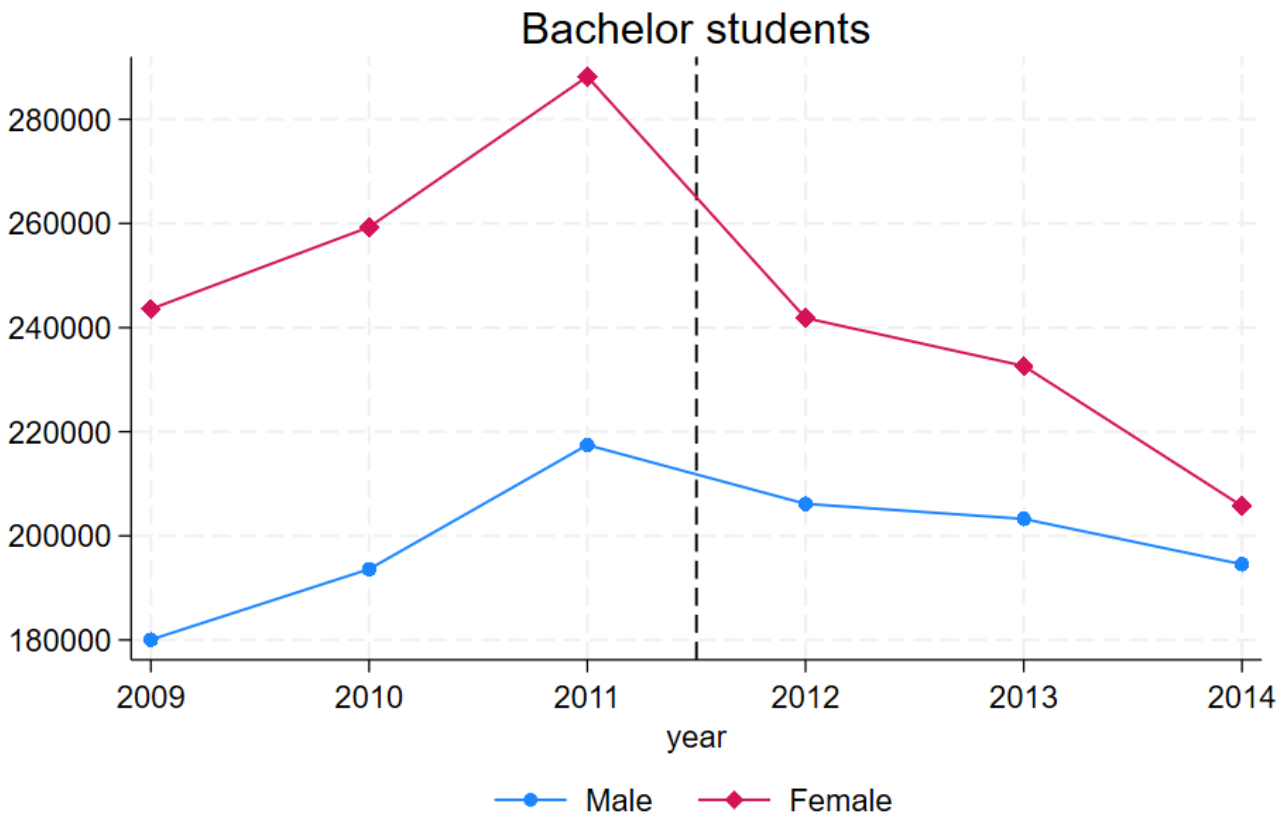
Figure: Total number of students enrolled in Bachelor degrees by gender



Note: This graph shows the number of students newly enrolled in Bachelor degrees by gender. The data is from the Student Statistics released by the Iranian Ministry of Education. The graph excludes Islamic Azad University.

Parallel trends: yearly changes 2008-2011 back

	Unrestricted cities	Restricted cities	Diff	SE	p-value	Obs
		Panel A: Full sample				
Female	0.002	-0.003	0.005	0.023	0.820	954
Urban	0.007	-0.017	0.024	0.021	0.255	954
Highest level of education	0.147	0.086	0.061	0.079	0.442	954
Ever enrolled in university	0.023	0.015	0.008	0.017	0.623	954
Married	-0.013	-0.030	0.017	0.023	0.460	954
Employed for a wage	-0.022	-0.016	-0.006	0.023	0.782	954
Labor force participation	-0.007	-0.001	-0.006	0.023	0.794	954
Income quantile of household	-0.010	-0.003	-0.007	0.061	0.906	634
		Panel B: Women				
Ever enrolled in university	0.034	0.016	0.019	0.023	0.412	845
Employed for a wage	-0.018	-0.007	-0.011	0.022	0.606	845
Labor force participation	-0.002	0.006	-0.008	0.027	0.773	845
Married	-0.018	-0.038	0.020	0.031	0.521	845
		Panel C: Men				
Ever enrolled in university	0.022	0.021	0.002	0.021	0.943	825
Employed for a wage	-0.033	-0.042	0.009	0.028	0.735	825
Labor force participation	-0.013	-0.020	0.008	0.020	0.698	825
Married	-0.026	-0.020	-0.006	0.029	0.825	825

Table: Robustness checks: Additional controls and fixed effects

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	Ever enrolled in a Bachelor program					
	Vote share	Ind. controls	City-year FE		Urban-year FE	
$R_c^{2012} \times f_i \times Cohort_i = 1992$	0.024	0.019	0.020	0.023	0.016	0.017
	(0.019)	(0.019)	(0.022)	(0.021)	(0.018)	(0.020)
$\mathbf{R_c^{2012} \times f_i \times Cohort_i = 1993}$	-0.033^b	-0.037^a	-0.034^b	-0.029^c	-0.038^b	-0.035^b
	(0.010)	(0.010)	(0.013)	(0.013)	(0.011)	(0.014)
$R_c^{2012} \times f_i \times Cohort_i = 1994$	0.035^b	0.031^b	0.022	0.031^c	0.034^b	0.027
	(0.013)	(0.012)	(0.014)	(0.015)	(0.014)	(0.016)
$R_c^{2012} \times f_i \times Cohort_i = 1995$	0.016	0.015	0.020	0.021	-0.001	0.002
	(0.025)	(0.025)	(0.029)	(0.029)	(0.022)	(0.027)
$Conserv_c^{2009} \times f_i \times Cohort_i = 1993$	-0.115^b					
	(0.046)					
Controls	Individual and city controls (X_{ift} & Z_{cfk})					
Addintional ind. controls (X_{ift})		Yes				
F_{cf}, F_{pkf} & F_{kc}	Yes	Yes	Yes	Yes	Yes	Yes
F_{pkt} & F_{pft}	Yes	Yes		Yes		
F_{upkt} & F_{upft}					Yes	Yes
City-year fixed effects (F_{ct})			Yes	Yes		Yes
Observations	93,700	93,696	93,545	93,545	93,691	93,535

Table: Robustness of sample: The impact of local restrictions on enrollment in university

	(1)	(2)	(3)	(4)	(5)
Dependent variable:	Ever enrolled in a Bachelor program				
	Excluding Tehran	Excl. cities new openings	Include small cities	Age 22-28 at interview	Birth cohorts 1991-1995
$R_c^{2012} \times f_i \times Cohort_i = 1992$	0.026	0.030	0.022	0.026	0.027
	(0.019)	(0.023)	(0.019)	(0.026)	(0.019)
$\mathbf{R_c^{2012} \times f_i \times Cohort_i = 1993}$	-0.028^b	-0.047^a	-0.031^b	-0.029^c	-0.030^b
	(0.009)	(0.011)	(0.010)	(0.014)	(0.010)
$R_c^{2012} \times f_i \times Cohort_i = 1994$	0.039^b	0.025	0.036^b	0.031	0.037^b
	(0.011)	(0.016)	(0.012)	(0.018)	(0.013)
$R_c^{2012} \times f_i \times Cohort_i = 1995$	0.021	0.016	0.017	0.055^c	0.017
	(0.024)	(0.030)	(0.024)	(0.028)	(0.024)
Controls	Individual and city controls (X_{ift} & Z_{cfk})				
Fixed effects	F_{cf}, F_{ck}, F_{pkf}, F_{pkt} & F_{pft}				
Observations	88,032	85,620	94,118	59,361	52,150
R^2	0.148	0.149	0.150	0.155	0.161
No. of Cities	386	358	423	401	401

Notes: R denotes the restriction measure by city. c stands for city, k for birth cohort, i for individual, f for gender, p for province, and t refers to the year of the survey. *Sample*: HIES 2008-2021. Col 1 to 4: Birth cohorts 1989-1995. Col 5: Birth cohorts 1991-1995. Col 1-3 and 5: Individuals age 19 to 28 at time of interview. Col 4: Individuals age 22 to 28 at time of interview. *Individual controls:* Urban residence and presence of another household member with education above lower middle school and their interactions with gender. *City controls*: Interactions of the cohort dummies and gender with i. the number of seats for women in city c in the academic year a, ii. the share of local courses that have a gender quota in city c for the academic years 2010 to 2014,

Table: Alternative indicators for local restrictions

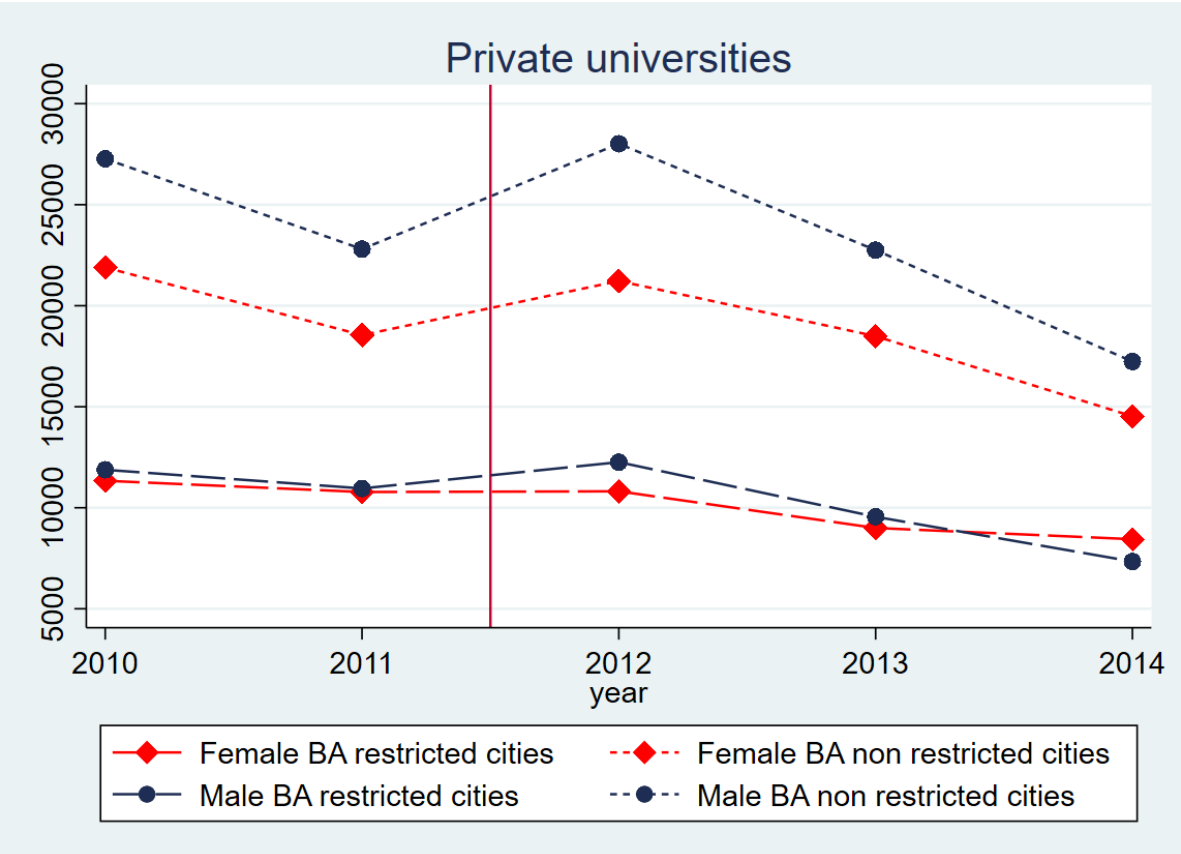
	(1)	(2)	(3)	(4)	(5)
Dependent variable:	Ever enrolled in a Bachelor program				
Indicator	Dummy indicator	Continuous variable	Exclude small programs	Programs within 80 km	Programs within 60 km
$R_c^{2012} \times f_i \times Cohort_i = 1992$	0.025	-0.058	0.025	0.021	0.043^c
	(0.031)	(0.122)	(0.019)	(0.016)	(0.019)
$\mathbf{R_c^{2012} \times f_i \times Cohort_i = 1993}$	-0.056^b	-0.371^a	-0.031^b	-0.027^c	-0.053^b
	(0.018)	(0.072)	(0.011)	(0.013)	(0.017)
$R_c^{2012} \times f_i \times Cohort_i = 1994$	0.043^c	0.096	0.036^b	-0.016	-0.039^b
	(0.022)	(0.085)	(0.013)	(0.016)	(0.016)
$R_c^{2012} \times f_i \times Cohort_i = 1995$	0.040	-0.298^c	0.021	0.053^b	0.065^b
	(0.038)	(0.141)	(0.025)	(0.019)	(0.023)
Controls	Individual and city controls (X_{ift} & Z_{cfk})				
Fixed effects	F_{cf}, F_{ck}, F_{pkf}, F_{pkt} & F_{pft}				
Observations	93,700	81,258	93,700	93,700	93,700
R^2	0.148	0.150	0.148	0.148	0.148
No. of Cities	401	337	401	401	401

Notes: R denotes the restriction measure by city. c stands for city, k for birth cohort, i for individual, f for gender, p for province, and t refers to the year of the survey. *Sample:* HIES 2008-2021. Birth cohorts 1989-1995, individuals age 19 to 28 at time of interview. *Individual controls:* Urban residence and presence of another household member with education above lower middle school and their interactions with gender. *City controls*: Interactions of the cohort dummies and gender with i. the number of seats for women in city c in the academic year a, ii. the share of local courses that have a gender quota in city c for the

Table: Alternative indicators for local restrictions - Changes in shares of seats open to women

	(1)	(2)	(3)	(4)
Dependent variable:	Ever enrolled in a Bachelor program			
Indicator	Seats in closest uni. city			
$R_c^{2012} \times f_i \times Cohort_i = 1992$	0.001	0.001	0.003	-0.003
	(0.005)	(0.007)	(0.008)	(0.009)
$\mathbf{R_c^{2012} \times f_i \times Cohort_i = 1993}$	-0.011^a	-0.022^a	-0.022^a	-0.017^c
	(0.003)	(0.006)	(0.006)	(0.007)
$R_c^{2012} \times f_i \times Cohort_i = 1994$	0.006	0.005	0.005	0.001
	(0.004)	(0.005)	(0.006)	(0.008)
$R_c^{2012} \times f_i \times Cohort_i = 1995$	0.001	-0.002	-0.001	-0.003
	(0.004)	(0.008)	(0.010)	(0.012)
Individual controls (X_{ift})	Yes	Yes	Yes	Yes
$\sum_k Seg.^a_c \times f_i \times cohort_k$		Yes	Yes	Yes
$\sum_k R^a_c \times f_i \times cohort_k$		Yes	Yes	Yes
$\sum_k Coursesf.^a_c \times f_i \times cohort_k$			Yes	Yes

Figure: Number of students enrolled in Bachelor degrees in private universities by gender in cities with and without restrictions



Notes: Number of students enrolled in Bachelor degrees in private universities by gender in cities with and without restrictions to admissions for women.

Main study fields in 2010 (before restrictions)

	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

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