Geographic Barriers to Education in Disadvantaged Communities: Evidence from High-School Openings in Israeli Arab Localities

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Background and Motivation

- 36% of youth aged 15-17 worldwide do not attend school (UNESCO, 2018)

- In Israel, high-school dropout is more common today among Arab students, and especially among the Bedouin in the Negev (17% of ages 16-17 do not attend high-school)

- Understanding the root causes of high school dropout is of great interest to policymakers.

- One of the potential challenges to high school attendance is a geographic barrier:
  - lack of access to local school in disadvantaged communities can affect their educational success.

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Outline

1. Previous Literature and Contribution

2. Background: Israeli Arab Education System

3. Data and Research Design

4. Empirical Methodology

5. Results

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Relevant Literature

- Elementary school access (developing countries).
    - Duflo, 2001; Kazianga et al. 2013; Burde and Linden, 2013; Akresh et al, 2018; Mazumder et al. 2021.

- College access (developed countries)
    - Card, 1993; Currie and Morretti, 2003; Cameron and Taber. 2004; Carneiro et al. 2011; Nybom, 2017; Kamhöfer et al., 2018; Mountjoy, 2021.

- Secondary school access in UK, Norway and France
    - Relatively few studies:
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Main Contributions

- My study contributes to the existing literature on *high-school openings* in three key ways:
  - Improved causal analysis (diff-in-diff). Examination of school openings over time in treated vs comparison localities.
  - First study (to the best of my knowledge) to examine also the **long-term** effects of proximity to high-school.
    - Evidence on post-secondary education, employment, earnings, marriage and fertility.
  - Focus on disadvantaged communities with low educational enrollment rates. More similar to less developed countries.
    - High-School completion rates in the treated localities were 41% prior to school openings, while today's OECD average stands at 80%.

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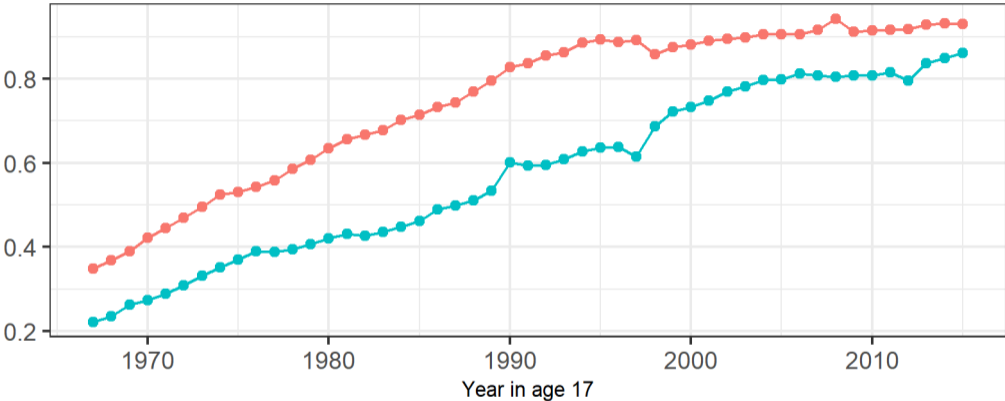
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- During the period of my study, 1972-1995, the number of Arab high schools has changed significantly, from 32 to 106.

- The most important change was in geographic coverage. The percentage of people living in places with high schools increased significantly from about 28% in 1970 to about 92% in 1995.

Share of localities with at least one high-school (Not including Negev Bedouins)

Legend: No Weights — Weighted by population

Outline

Data on School Openings

- Unique data about the historical Arab high schools in Israel, by locality
  - Compiled from several archival paper publications on Israeli schools and localities

- Administrative records in the CBS secure research room on all Israeli Arabs born in 1950-2000.

  - Population register: gender, year of birth, locality of residence, religion, family size. (1995+)

  - Israeli censuses of 1972 and 1983

  - CBS Israeli Education Register: years of education for the individuals and their parents.

  - Earnings and Employment (Israeli Tax Authority): Wage earners in 1983-2019. Linked to individuals in ages 33-35.

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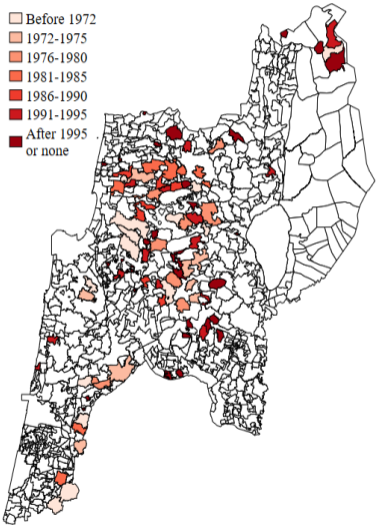
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Research Design

- I exploit variation across localities and years of high-school openings to examine the effects of school proximity on individuals' future outcomes.

- Diff-in-Diff framework: Examine changes in the outcomes of high-school age cohorts, before and after the opening of a local high school, compared to comparison localities where no high-school was opened in those years.

Before 1972
1972-1975
1976-1980
1981-1985
1986-1990
1991-1995
After 1995
or none

Identification assumption

- The identification assumption is that the exact *timing* of local high-school openings across municipalities is uncorrelated with local developments of the outcomes. ("as good as random")

- This is a nontrivial assumption. Perhaps the establishment of a school is endogenous to prior locality-specific trends.

- I find that there are two characteristics that predict high school openings:
  - Population of the locality
  - Compulsory Schooling Laws

Identification assumption

- I will justify the identification assumption by:
  - Applying event-study models to rule out prior-trends

  - Adding municipality-population controls to the regressions.

  - Apply differential cohort effects by the year of Compulsory Schooling implementation.

  - Additional robustness checks

Examining trends

A. Share completed 10th grade — B. Share completed High School

Age in the opening year of high school
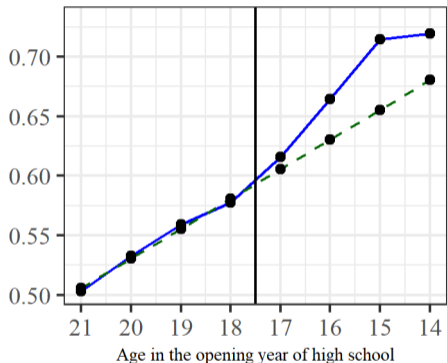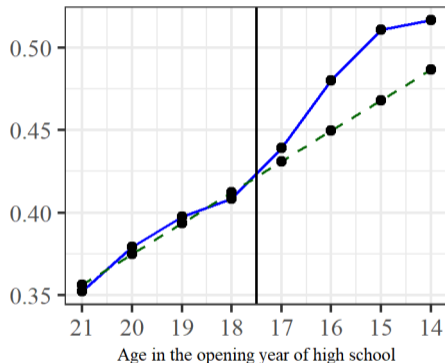
Data — — Linear prediction (pre-trend)

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Empirical Specification

$$y_{ilt} = \alpha + \beta HighSchoolAccess_{lt} + \gamma X_{ilt} + \delta CohortSize_{lt} + \lambda_{crt} + \eta_l + \varepsilon_{ilt}$$

- Where for individual i in birth-year t, in locality l:

  - y_{ilt}: Outcomes

  - $HighSchoolAccess_{lt}$: Dummy indicator for having an high-school in the locality of residence at age 17 or younger.

  - X_{ilt}: Gender, years of education of parents, number of siblings, religion.

  - $CohortSize_{lt}$: Population size of cohort in birth-year t, in locality l. (Polynomial)

  - η_l: Locality fixed effect.

  - λ_{crt}: Cohort effect **or** Cohort-by-region effect (birth-year t) **or** cohort-by-region-by-year of compulsory schooling implementation effect.

  - ϵ_{ilt} :Error term (may be correlated within the same locality over time).

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- **Second Specification:**

$$y_{ilt} = \alpha + \sum_{\tau=13, \tau \neq 18,}^{\tau=21} \beta_{\tau} * \mathbf{HS_{lt}^{\tau}} + \gamma X_{ist} + \delta CohortSize_{lt} + \eta_l + \lambda_{crt} + \theta I(\tau_{tl} < 13) + \mu I(\tau_{tl} > 22) + \epsilon_{ilt}$$

- HS_{lt}^{τ}: indicator equal to 1 if the individual was in age τ when the local high-school was opened, and 0 otherwise.

Outline

Educational Outcomes

Results: Education

	Completed 10th Grade				
	(1)	(2)	(3)	(4)	(5)
High-school access	0.100***	0.103***	0.075***	0.069***	0.070***
	(0.021)	(0.021)	(0.017)	(0.016)	(0.019)
Mean outcome (age 18 in year of HS opening)	0.577	0.577	0.577	0.577	0.577
Individual controls		X	X	X	X
Locality's population (cohort size)			X	X	X
Locality fixed-effect	X	X	X	X	X
Type of cohort fixed-effect	Cohort FE	Cohort FE	Cohort FE	Cohort×region FE	Cohort× region × compulsory schooling year FE
Number of localities	89	89	89	89	89
Number of observations	316,322	316,322	316,322	316,322	316,322

- Preferred estimates show a 7 percentage points (12%) ↑ in the probability of completing 10th grade.

Results: Education

|	Completed High-School (12th Grade)				
	(1)	(2)	(3)	(4)	(5)
High-school access	0.060***	0.073***	0.057***	0.054***	0.055***
	(0.015)	(0.017)	(0.015)	(0.013)	(0.015)
Mean outcome (age 18 in year of HS opening)	0.408	0.408	0.408	0.408	0.408
Individual controls		X	X	X	X
Locality's population (cohort size)			X	X	X
Locality fixed-effect	X	X	X	X	X
Type of cohort fixed-effect	Cohort FE	Cohort FE	Cohort FE	Cohort×region FE	Cohort× region × compulsory schooling year FE
Number of localities	89	89	89	89	89
Number of observations	316,322	316,322	316,322	316,322	316,322

- Preferred estimates show a 5.5 percentage points (13%) ↑ in the probability of completing high-school.

Event Study Results: Education
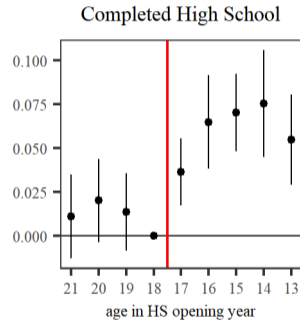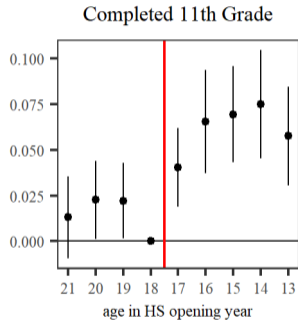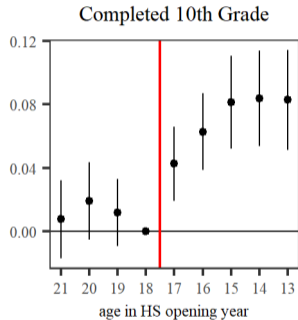
Results: Education, by gender

Dependent Variable	All	Boys	Girls
Completed 10th grade	0.070***	0.061***	0.080***
	(0.019)	(0.018)	(0.023)
	Mean=0.577	Mean=0.648	Mean=0.504
Completed 11th grade	0.054***	0.039***	0.072***
	(0.015)	(0.015)	(0.019)
	Mean=0.449	Mean=0.512	Mean=0.382
Completed 12th grade	0.055***	0.040***	0.071***
	(0.015)	(0.014)	(0.018)
	Mean=0.408	Mean=0.466	Mean=0.348
Number of localities	89	89	89
Number of observations	316,322	163,262	153,060

- Estimated effect is higher for women, especially in the higher grades.

- Women were 7 percentage points (20%) more likely to graduate from high school due to school openings. 4 percentage points increase (9%) for men.

Heterogeneity in the Effect

- Possible heterogeneity in the effect across different types of localities
  - Population Size (large vs small localities)

  - Distance to high school prior to high-school openings

  - Low vs high educational attainment in 1972

  - Low vs high employment rate in 1972 (proxy for socioeconomic status)

  - Low vs high traditionalism (proxy- share of young married individuals)

  - Different religions

Dependent Variable	Completed 10th Grade	Completed 11th Grade	Completed 12th Grade
HS Access			
HS Access × High pop. size			
HS Access			
HS Access × High distance to school prior to local school opening			
HS Access			
HS Access × Druze locality			

Heterogeneity: short-term outcomes

Dependent Variable	Completed 10th Grade	Completed 11th Grade	Completed 12th Grade
HS Access	0.071***	0.066***	0.063***
	(0.013)	(0.015)	(0.016)
HS Access × High pop. size	**0.034**	**0.002**	**0.011**
	(0.023)	**(0.027)**	**(0.024)**
HS Access	0.069***	0.049***	0.048***
	(0.015)	(0.012)	(0.012)
HS Access × High distance **to closest locality with school**	**0.093*****	**0.063****	**0.061****
	(0.030)	**(0.031)**	**(0.030)**
HS Access	0.080***	0.046**	0.045**
	(0.025)	(0.019)	(0.018)
HS Access × Druze locality	**-0.042**	**-0.009**	**-0.011**
	(0.028)	**(0.025)**	**(0.027)**

- No significant heterogeneity in the effect on HS enrollment and completion by pop. size, religion and prior avg. education in the locality.

Heterogeneity: short-term outcomes

Dependent Variable	Completed 10th Grade	Completed 11th Grade	Completed 12th Grade
HS Access			
HS Access × **yrs of educ ≥ median (1972)**			
HS Access			
HS Access × **employment rate≥median (1972)**			
HS Access			
HS Access × **Share married (18-30) ≥median (1972)**			
Mean Outcome			
Number of Observations			
Number of localities			

Heterogeneity: short-term outcomes

Dependent Variable	Completed 10th Grade	Completed 11th Grade	Completed 12th Grade
HS Access	0.081***	0.057***	0.053***
	(0.017)	(0.017)	(0.016)
HS Access ×	**-0.035**	**-0.019**	**-0.018**
yrs of educ ≥ median (1972)	**(0.029)**	**(0.031)**	**(0.033)**
HS Access	0.084***	0.062***	0.055***
	(0.022)	(0.019)	(0.017)
HS Access ×	**-0.031**	**-0.016**	**-0.006**
employment rate≥median (1972)	**(0.038)**	**(0.035)**	**(0.033)**
HS Access	0.064***	0.066***	0.055***
	(0.015)	(0.015)	(0.015)
HS Access ×	**0.034**	**-0.010**	**0.001**
Share married (18-30) ≥median (1972)	**(0.030)**	**(0.026)**	**(0.025)**
Mean Outcome	0.563	0.439	0.400
Number of Observations	300,290	300,290	300,290
Number of localities	76	76	76

- No significant heterogeneity in effect on HS enrollment and completion by education rate, employment rate and traditionalism

Long-term Outcomes

Dependent Variable	All	Men	Women
Years of education ≥ 13 (Post-secondary proxy)			
Years of education ≥ 15 (Academic degree proxy)			
Number of localities Number of observations			

Results: Education, by gender

Dependent Variable	All	Men	Women
Years of education ≥ 13	0.011**	0.007	0.016**
(Post-secondary proxy)	(0.006)	(0.007)	(0.008)
	Mean=0.173	Mean=0.212	Mean=0.132
Years of education ≥ 15	0.012***	0.011**	0.013**
(Academic degree proxy)	(0.004)	(0.005)	(0.007)
	Mean=0.123	Mean=0.147	Mean=0.098
Number of localities	89	89	89
Number of observations	316,322	163,262	153,060

- 1.1 percentage point (6%) ↑ in post-secondary studies.

- 1.2 percentage point (10%) ↑ in completion of 15 years of education (academic degree proxy).

Labor market Outcomes

Baseline Results: Labor

Dependent Variable	All	Men	Women
Total **years** employed in ages 33-35			
Total **months** employed in ages 33-35|			
Average annual wages in ages 33-35			
(Log) Annual wages in ages 33-35			
Number of localities			
Number of observations			

Baseline Results: Labor

Dependent Variable	All	Men	Women
Total **years** employed in ages 33-35	0.012	-0.010	0.039*
	(0.015)	(0.023)	(0.024)
	Mean=1.543	Mean=2.120	Mean=0.936
Total **months** employed in ages 33-35	0.188	-0.177	0.633**
	(0.157)	(0.263)	(0.257)
	Mean=15.156	Mean=21.322	Mean=8.675
Average annual wages in ages 33-35	581	-382	1,617**
	(687)	(1,112)	(668)
	Mean=35,213	Mean=54,983	Mean=14,433
(Log) Annual wages in ages 33-35	0.038**	0.004	0.109**
	(0.019)	(0.018)	(0.046)
	Mean=10.383	Mean=10.724	Mean=9.665
Number of localities	89	89	89
Number of observations	316,322	163,262	153,060

- For women: 0.6 increase in months of work (7%) ↑. 11% increase in earnings ↑.

- For men: no significant effects. (95% confidence: Effect on employment is less that 1.6%, Effect on earnings is less than 3.2%).

Marriage and Fertility Outcomes

Dependent Variable	All	Men	Women
Age of marriage			
Age of having the first child			
Number of localities			

Baseline Results: Marriage and Fertility

Dependent Variable	All	Men	Women
Age of marriage	0.146*	0.070	0.217
	(0.086)	(0.079)	(0.136)
	Mean=22.922	Mean=24.618	Mean=21.047
	N=279,166	N=145,161	N=134,005
Age of having the first child	0.129	0.070	0.176
	(0.088)	(0.074)	(0.138)
	Mean=24.668	Mean=26.374	Mean=22.844
	N=271,461	N=137,736	N=133,725
Number of localities	89	89	89

- Increase in age at marriage by 0.15 years (6.5% of total increase over the study period)

- Increase in the age of the first child is similar in size but not statistically significant

Baseline Results: Marriage and Fertility

Dependent Variable	All	Men	Women
Number of children by age 20			
Number of children by age 35			
Number of children by age 40 Excl. 1979-1983 cohorts)			
Number of localities			

Baseline Results: Marriage and Fertility

Dependent Variable	All	Men	Women
Number of children by age 20	-0.023*	0.001	-0.049**
	(0.013)	(0.005)	(0.022)
	Mean=0.221	Mean=0.041	Mean=0.410
	N=316,322	N=163,262	N=153,060
Number of children by age 35	-0.120**	-0.112**	-0.128**
	(0.052)	(0.046)	(0.064)
	Mean=3.439	Mean=3.209	Mean=3.682
	N=316,322	N=163,262	N=153,060
Number of children by age 40	-0.119**	-0.124**	-0.116
(Excl. 1979-1983 cohorts)	(0.059)	(0.050)	(0.074)
	Mean=4.086	Mean=3.992	Mean=4.188
	N=242,311	N=125,287	N=117,024
Number of localities	89	89	89

- 0.05 ↓ decrease in the number of children by age 20.

- 0.12 ↓ in the number of children by age 35 and 40. About 5.2% of the total decrease in the cohorts of the study (5.2 to 2.9).

- I have also included in my study a special section for the Negev Bedouin , a special segment (10%) of the Arab population that is the most disadvantaged and are also less educated than the rest of the Arabs

- I examine the effect of recent high school openings in Bedouin communities in the Negev during the period 2007-2014

- Remarkably, I find that the effect of high school access on HS graduation for the Bedouin in 2000s-2010s is very similar to the estimated effects of the historical HS openings in 1972-1995 in the main Arab population (5-7 pp, 10-13%)

Baseline Results: Matriculation and Post-Secondary

Dependent Variable	All	Men	Women
Any matriculation diploma	0.067**	0.080***	0.055
	(0.031)	(0.025)	(0.040)
	Mean=0.200	Mean=0.107	Mean=0.297
Uni-eligible matriculation diploma	0.012	0.024**	0.001
	(0.011)	(0.011)	(0.015)
	Mean=0.121	Mean=0.054	Mean=0.191
Number of localities	35	35	35
Number of observations	54,800	27,897	26,903

- Positive effect on Matriculation eligibility, but not on academic post-secondary education

Baseline Results: Crime (Men, Ages 16-18)

Dependent Variable	No. of Criminal Records
Criminal juvenile record (all types)	-0.248*
	(0.124)
	Mean=0.635
Property Offense	-0.219**
	(0.102)
	Mean=0.475
Violent Offense	-0.006
	(0.012)
	Mean=0.054
Security/order offense	-0.075**
	(0.030)
	Mean=0.167
Number of localities	35
Number of observations	27,897

- Significant decline in the number of criminal records. Particularly high decrease in property offenses.

Summarizing robustness trends

- Differential trends or cohort effects by locality size, initial employment rate, initial traditionality.

- Controlling for locality-specific pre-trends.

- Advanced methods for staggered difference-in-differences design (Callaway and Sant'Anna, 2021; Sun and Abraham, 2021).

- Ruling out spillover effects to nearby localities
  - All produce very similar results to the baseline estimates.

- Falsification tests: placebo outcomes (5th-8th grade completion, parental education)
  - Mostly insignificant results.

Summarizing Results

- Opening a high-school in a locality boosts HS enrollment rates and also raises HS completion rates by about 5-7 percentage points (10-13%). The effect is significantly stronger in remote localities with higher distance to places with schools.

- Long term effects:
    - Positive effects on post secondary education and women's employment and earnings.

    - Negative effects on age of marriage and fertility.

- In the Bedouin localities: Significant decrease in juvenile criminal activity

Conclusions

- Proximity to high school matters! Geographic barriers have a significant role, especially for disadvantaged communities with low enrollment rates.

- From a global perspective, improving the supply of secondary schools in poor countries and disadvantaged communities is a positive step toward increasing global high school enrollment.

- From the Israeli perspective, improving high-school proximity for the Negev Bedouin can have potential benefits for society.
  - 30%-40% of Negev Bedouins do not have access to school in their community.

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Thank you!