

# Black Gold and Dull Minds? The Impact of Hydrocarbon Exploration Announcements on Education in Colombia

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[https://github.com/polanco-jaime/black\\_gold\\_and\\_dull\\_minds](https://github.com/polanco-jaime/black_gold_and_dull_minds)

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# Why This Study Matters

- There are more than 65,000 oil fields around the world, in Colombia:.
  - ▶ Today Colombia has 157 gas and oil fields (128 produce gas and 146 produce oil).
  - ▶ Colombia is the fourth largest oil producer in South America, after Venezuela, Brazil, and Ecuador.
  - ▶ Colombia is the fifth largest natural gas producer in South America, after Venezuela, Argentina, Bolivia, and Peru.
  - ▶ The oil and gas industry accounts for about 3% of Colombia's GDP and employs about 100,000 people.
- The literature on oil and gas industry highlights a mixed impact on education. <sup>1</sup>
- In Colombia, the effect of each stage on education has not yet been evidenced. But Since 2012:
  - ▶ 985 schools have been affected
  - ▶ 120260 students in elementary school have been affected<sup>2</sup>.
  - ▶ 95190 students in secondary school have been affected <sup>3</sup>.

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<sup>1</sup> While the presence of oil fields may negatively affect education (Farzanegan and Thum (2018) , Marchand and Weber (2018) , (Farzanegan, 2017) , Genareo (2018) , Zuo, Schieffer, and Buck (2019) ), oil revenues have the potential to positively impact education by providing funding for improving its quality and promoting human capital development ( Maciel (2021) , Kumar (2017)).

<sup>2</sup> 2.46% of all students in elementary school

<sup>3</sup> 2.28% of all students in secondary school

# Problem Statement.

## Research question : 1

What is the impact of hydrocarbon exploration announcements on dropout rates and academic performance in Colombia?

Hypothesis 1: Households believe that Hydrocarbon exploration will increase future income, thus households change their behavior related to education by expectations.

$$HEA^4 \Rightarrow \underbrace{\uparrow E[w_h]}_{\text{expected family income}} \Rightarrow \underbrace{\Delta F, \Delta S_t}_{\text{Family's and Student's attributes}} \Rightarrow \underbrace{\Delta s}_{\text{Student's studying time}}$$

<sup>4</sup>Where HEA is the Hydrocarbon Exploration Announcements

- Contribute to the literature on natural resource, evaluating the impact of expected hydrocarbon exploitation on human capital accumulation.
- We provide empirical evidence of the effect of the announcement of hydrocarbon exploration on the following variables:
  - ▶ Schooling decisions.
  - ▶ Student mobility.
- Software: Python framework designed to facilitate the calculation of geographic distances for economic researchers. [View on GitHub](#)

## What will we find in this presentation?

The following effects result from changes in future income expectations by Oil Exploration Announcements:

- Dropout rate for students in elementary school decreases
- Dropout rate for students in secondary school increases
- Dropout rate in elementary decreases significantly more in males than in females
- The relative effect in elementary school is around -35%, while in secondary school is around 74%
- The dropout rate in secondary school is related to information from the National Statistics Department in Colombia, where students over 10 years of age in rural areas become the population of working age.

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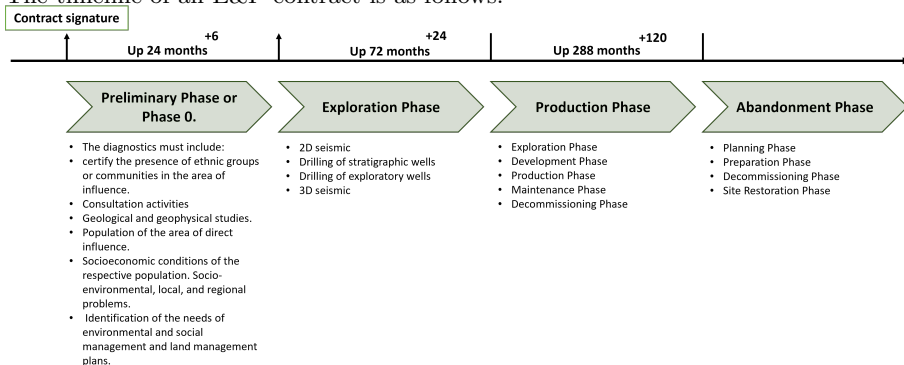


# Exploration and Production (E&P) Contract in Colombia

- Overview of the Colombian oil and gas industry and the importance of E&P contracts for investment and development.
- Contract Details: Key terms and conditions of the E&P contract, including:
  - ▶ Area of exploration and production
  - ▶ Duration of the contract
  - ▶ Company's obligations (seismic studies, drilling, environmental impact assessments)
  - ▶ Royalties and taxes to be paid to the Colombian government
  - ▶ Dispute resolution procedures

# The context of hydrocarbon exploitation in Colombia.

The timeline of an E&P contract is as follows:

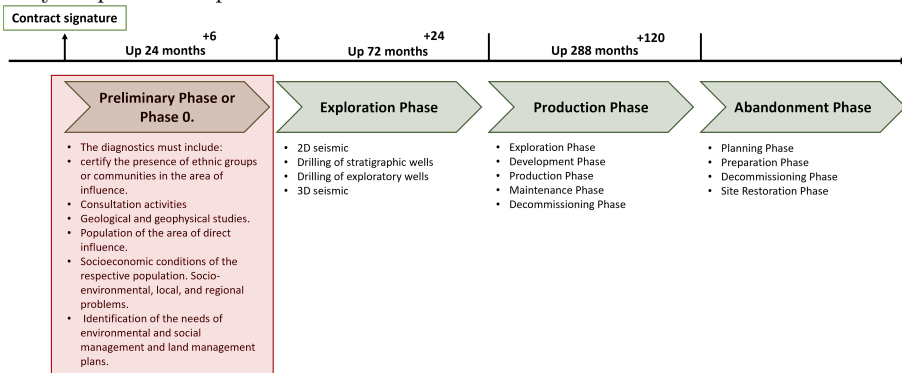


## Key Points:

- The auction is conducted with incomplete and imperfect information. Nothing assures the bidder that he will find oil or gas.
- The existence of oil under the earth is exogenous to the educational level.

# The context of hydrocarbon exploitation in Colombia.

Why is special this phase?:



- This phase does not include contractual investments.
- All signed contracts complete the phase 0.
- The communities are informed of the details of exploration in the prior consultation.
- Prior consultations allow the community to be informed about future investments

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## Related Literature

In this section, we review the literature on various topics related to the impact of different factors on behavior and Education.

- Income expectations and behavior: households adjust their consumption plans based on their income forecasts, and often underestimate their future incomes.<sup>5</sup> . [see more!](#)
- Income expectations and schooling: Income expectations may play a role in the decision to attend college, but the findings are mixed and may be influenced by gender and cultural factors.<sup>6</sup> [see more!](#)
- Income changes: A \$1,000 increase in annual income raises young children's achievement by 5%-6% of a standard deviation<sup>7</sup>. [see more!](#)
- Oil exploration and production: Intensive drilling activities have been found to decrease enrollment, Offshore oil and gas production can have mixed impacts on social institutions, which may impact academic performance.<sup>8</sup> . [see more!](#)
- External infrastructure interventions: School facilities, libraries, and new schools can improve learning, enrollment, and student outcomes<sup>9</sup>. [see more!](#)


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<sup>5</sup> Authors: Das 1997, Roth 2017, and Roth 2018

<sup>6</sup> Authors: Rouse 2004, Bosworth 1985, Beffy 2012, Smith 1990

<sup>7</sup> Authors: Duncan 2011, Dahl 2008

<sup>8</sup> Authors: Zuo 2019, Laska 1993

<sup>9</sup> Authors: Barrett 2018, Fisher 2001, Cuesta 2016, and Belmonte 2020 

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# Model for Educational Outcome

We assume that the educational outcome,  $Y$ , is a function of the student's family attributes,  $F$ , the student's attributes,  $St$ , and the educational institution's attributes,  $Sc$ . Specifically, we assume that<sup>10</sup>:

$$Y = f(F, St, Sc) + \epsilon$$

where  $\epsilon$  is a random error term.

What happens when the income expectations of the students' families change, or the motivation of the students changes?

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<sup>10</sup>Hanushek (1979); Vignoles, Levacic et al. (2000); Todd and Wolpin (2003); Meyer and Nascimento (2008)

# Model for Study Time

We assume that the amount of study time,  $S$ , is a function of the student's family income,  $I_F$ , and the student's own personal characteristics,  $St$ . Specifically, we assume that: [see more!](#)

$$S = g(I_F, St) + \eta$$

where  $\eta$  is a random error term.



## Model for Family Income

We assume that family income,  $I_F$ , is a function of the parents' education,  $E_P$ , the parents' income,  $I_P$ , and the parents' involvement in the student's education,  $Inv_P$ . Specifically, we assume that the family income for students of elementary school is not related to Student's Personal Characteristics (pupils doesn't have incomes) while students of secondary students can help improve parents' income. Then we assume: Model for Family Income of students in elementary school:

$$I_F = h(E_P, I_P, Inv_P) + \nu$$

Model for Family Income of students in secondary school:

$$I_F = h(E_P, I_P, Inv_P, St) + \nu$$

where  $\nu$  is a random error term.

## Model for Student's Personal Characteristics

We assume that the student's personal characteristics,  $St$ , are a function of the student's intelligence,  $I_S$ , motivation,  $M_S$ , and study habits,  $H_S$ . Specifically, we found that <sup>11</sup>  $St$  in elementary school is related to  $I_F$  while in secondary school this relation is weaker ( $\alpha \gg \beta$ ). Then we assume:

Model for Student's Personal Characteristics in elementary school:

$$St = j(I_S, M_S, H_S, \alpha I_F) + \mu$$

Model for Student's Personal Characteristics in secondary school:

$$St = j(I_S, M_S, H_S, \beta I_F) + \mu$$

For simplicity  $\beta$  is 0

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<sup>11</sup>Steinmayr et.al 2019; Harris, D. N. 2010

# Model for Change in Study Time with Respect to Family Income

To see how the amount of study time changes with respect to family income in elementary and secondary school, we need to take the derivative of  $S$  with respect to  $I_F$  separately for both models.

Taking the derivative of  $S$  with respect to  $I_F$ , we get:

$$\frac{dS}{dI_F} = \frac{\partial g}{\partial I_F} + \frac{\partial g}{\partial St} \frac{dSt}{dI_F}$$

## Elementary School Students

To obtain an extreme result, we assume that family income for elementary school students is not related to the student's personal characteristics, we have:

$$\frac{\partial g}{\partial St} \frac{dSt}{dI_F} = 0$$

Thus, the derivative simplifies to:

$$\frac{dS}{dI_F} = \frac{\partial g}{\partial I_F}$$

## Model for Change in Study Time with Respect to Family Income

To see how the amount of study time changes with respect to family income in elementary and secondary school, we need to take the derivative of  $S$  with respect to  $IF$  separately for both models. Taking the derivative of  $S$  with respect to  $IF$ , we get:

$$\frac{dS}{dI_F} = \frac{\partial g}{\partial I_F} + \frac{\partial g}{\partial St} \frac{dSt}{dI_F}$$

### Secondary School Students

Since we assume that family income for secondary school students can help improve parents' income, we have:

$$\frac{\partial g}{\partial St} \frac{dSt}{dI_F} > 0$$

Thus, the derivative simplifies to:

$$\frac{dS}{dI_F} = \frac{\partial g}{\partial I_F} + \frac{\partial g}{\partial St} \frac{dSt}{dI_F} > \frac{\partial g}{\partial I_F}$$

# Model for Change in Study Time with Respect to Family Income

In summary we have:

Change in Study Time with Respect to Family Income of Students in Elementary School:

$$\frac{dS}{dI_F} = \frac{\partial g}{\partial I_F}$$

Change in Study Time with Respect to Family Income of Students in Secondary School:

$$\frac{dS}{dI_F} > \frac{\partial g}{\partial I_F}$$

This means that the effect of family income on study time is likely to be stronger for secondary school students than for elementary school students.

$$\underbrace{\uparrow \Delta F}_{\text{Student's family attributes}} \Rightarrow \underbrace{\Delta s}_{\text{Student's studying time}}$$

$$\text{where: } \Delta s_{\text{secondary}} > \Delta s_{\text{Elementary}}$$

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The existence of oil under the earth is exogenous to the educational level. Finding oil is a random treatment to those who live above the new oilfield.

### Analysis 1.0

\* If potential outcomes are random, then randomized experiments imply:

$$E[Y_i | HEA = 1] - E[Y_i | HEA = 0] =$$

$$E[Y_i(1) | HEA = 1] - E[Y_i(0) | HEA = 0] =$$

$$E[Y_i(1) | HEA = 1] - E[Y_i(0) | HEA = 1] + \text{Bias}$$

$$\text{Bias is Zero } E[Y_i(0) | HEA = 1] - E[Y_i(0) | HEA = 0]^a$$

\* Under randomization, all characteristics (observed or unobserved) will be similar between control and treatment units.  $\Rightarrow$

$$\tau_{ATE} = \tau_{ATE_T} = E[Y_i(1) - Y_i(0)] = E[Y_i(1) - Y_i(0) | \text{Exploration} = 1]$$

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<sup>a</sup>HEA is the Hydrocarbon Exploration Announcements

The existence of oil under the earth is exogenous to the educational level. Finding oil is a random treatment to those who live above the new oilfield.

### Analysis : Assumption 1.

conditional Local Geographic Treatment Ignorability (Keele and Titiunik 2016):

$$Y_{i1}, Y_{i0} \perp\!\!\!\perp T_i | d_i < D$$

The potential outcomes of individual  $i$  are independent of treatment  $T_i$  conditional on being in close neighborhood to the border, with  $d_i$  being the (shortest) distance to the border and  $D$  a specified maximum distance to the border



## Empirical framework

The existence of oil under the earth is exogenous to the educational level. Finding oil is a random treatment to those who live above the new oilfield.

The exploration areas auctioned in an EP contract are created based on mining geological conditions at depths of more than three thousand feet. This implies that these areas do not overlap with other administrative geographies.

### Analysis : Assumption 2.

Compound Treatment Irrelevance Assumption (Keele and Titiunik 2016):

Let  $G$  be the set of all administrative geographies. Then, the statement can be written mathematically as follows:

$$\nexists B \subseteq AT, \forall G \in G \setminus \{AT\} : B \subseteq G.$$

This means that there is no subset  $B$  of  $AT$  that is also a subset of any other geography  $G$  in  $G$  except for  $AT$  itself. In other words, the border between  $B$  and  $AT$  is unique and does not overlap with any other area.

## Empirical framework

The existence of oil under the earth is exogenous to the educational level. Finding oil is a random treatment to those who live above the new oilfield.

### Analysis : Assumption 2.

Compound Treatment Irrelevance Assumption (Keele and Titiunik 2016):



The existence of oil under the earth is exogenous to the educational level. Finding oil is a random treatment to those who live above the new oilfield.

### Analysis : Assumption 3.

Naive distance (Keele and Titiunik 2016):

Assume that the  $Pr(T_i = 1) = 1$  for all  $i$  such that coordinates  $s_i \in A^T$  and when  $Pr(T_i = 0) = 1$  for all  $i$  such that coordinates  $s_i \in A^c$  then we assume a discontinuity is sharp. Then:

$$\tau(b) = E[Y_{i1} - Y_{i0}] \therefore$$

$$\tau(b) \forall b \in \beta \Rightarrow$$

$$\tau(b^n) = \tau(b^q) \forall b^n \in \beta, b^q \in \beta$$

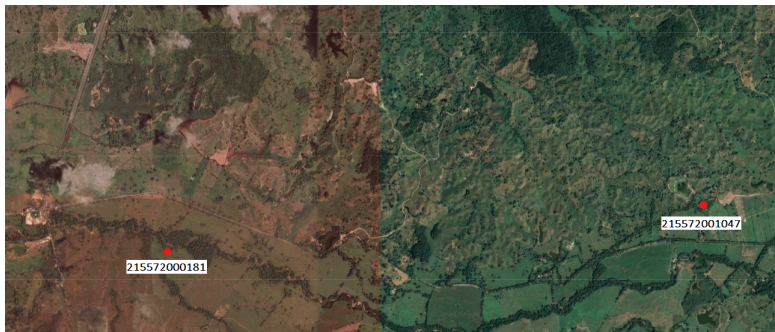
Perpendicular euclidean distance to the boundary does not mask important heterogeneities.

## Empirical framework

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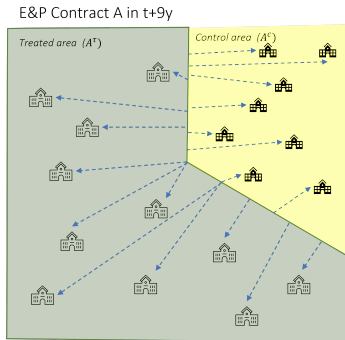
### Analysis : Assumption 3.

Naive distance (Keele and Titiunik 2016):



Perpendicular euclidean distance to the boundary does not mask important heterogeneities.

# Geographic Regression Discontinuity (GRD) Design



$$Y_i = \alpha + \beta_1 \cdot X_i + \beta_2 \cdot Di + \varepsilon_i$$

where:

- $Y_i$  is the outcome variable for school  $i$
- $X_i$  is the running variable (Distance of the school  $i$  to threshold)
- $D = 1$  if the school  $i \in A^T$
- $X_i$  is a set of covariates that may affect the outcome variable
- $\alpha, \beta_1, \beta_2$ , and  $\eta$  are parameters to be estimated
- $\varepsilon_i$  is an error term.

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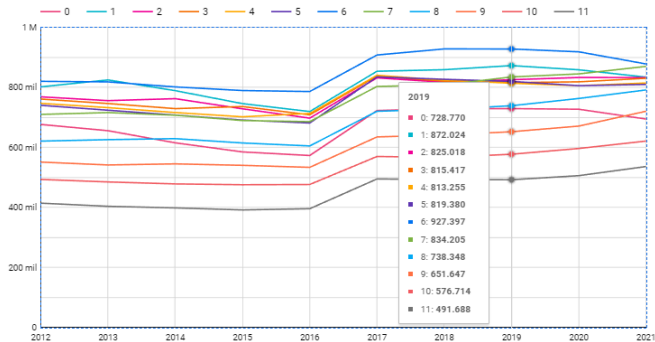
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The data used for the develop of this research are:

- SIMAT from 2012 - 2020
- E&P contracts in Colombia from 2012-2020 (ANH)
- Georeferenced base of school location (DANE)

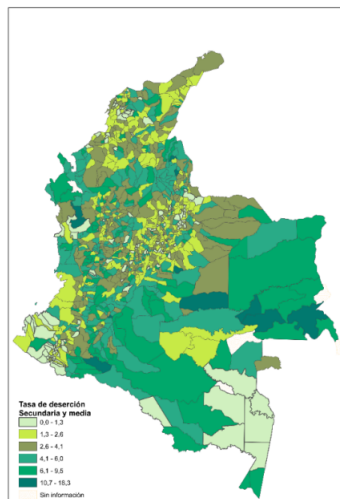


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Dropout rate, Data Ministry of Education, 2018. Map prepared by LEE.





# Data

The data used for the develop of this research are:

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Statistical significance from:  $Variable_i = \alpha_i + \beta \cdot Treat_i \varepsilon_i$

**Table:** Descriptive statistics of the control and treatment group

| Variable              | Treated<br>Mean | Control<br>Mean | Difference      | $Pr(>  t )$ |
|-----------------------|-----------------|-----------------|-----------------|-------------|
| Outcomes              |                 |                 |                 |             |
| Female Dropout Rate   | 0.04 (0.11)     | 0.05 (0.13)     | -0.01 (-0.018)  | 0           |
| Male Dropout Rate     | 0.05 (0.12)     | 0.07 (0.14)     | -0.011 (-0.017) | 0           |
| Dropout Rate          | 0.17 (0.26)     | 0.2 (0.28)      | -0.028 (-0.014) | 0           |
| Female Dropout $T_2$  | 0.08 (0.13)     | 0.08 (0.15)     | -0.006 (-0.014) | 0.065       |
| Male Dropout $T_2$    | 0.09 (0.15)     | 0.11 (0.18)     | -0.015 (-0.024) | 0           |
| Dropout $T_2$         | 0.3 (0.34)      | 0.32 (0.34)     | -0.024 (0.001)  | 0.003       |
| Covariates            |                 |                 |                 |             |
| Age                   | 13.31 (24.4)    | 13.56 (29.87)   | -0.245 (-5.47)  | 0.693       |
| Medium Economic Level | 0.04 (0.13)     | 0.02 (0.08)     | 0.022 (0.047)   | 0.62        |
| Low Economic Level    | 0.86 (0.24)     | 0.9 (0.2)       | -0.04 (0.042)   | 0.44        |
| Frac. Subsidized      | 0.53 (0.2)      | 0.53 (0.21)     | -0.005 (-0.01)  | 0.259       |
| Frac. Repeaters       | 0.53 (0.2)      | 0.53 (0.21)     | -0.005 (-0.01)  | 0.259       |
| Frac. New Students    | 0.53 (0.2)      | 0.53 (0.21)     | -0.005 (-0.01)  | 0.259       |
| Frac. Male            | 0.53 (0.2)      | 0.53 (0.21)     | -0.005 (-0.011) | 0.26        |
| Frac. Female          | 0.47 (0.2)      | 0.47 (0.21)     | 0.005 (-0.011)  | 0.26        |
| Robustness            |                 |                 |                 |             |
| Emigrated Out         | 0.23 (0.28)     | 0.23 (0.29)     | -0.006 (-0.012) | 0.332       |
| Immigrated            | 0 (0)           | 0 (0)           | 0 (0)           | 0.118       |
| Emigrated             | 0 (0)           | 0 (0)           | 0 (0)           | 0.108       |
| N Treated             | 4636            |                 |                 |             |
| N Control             | 3097            |                 |                 |             |

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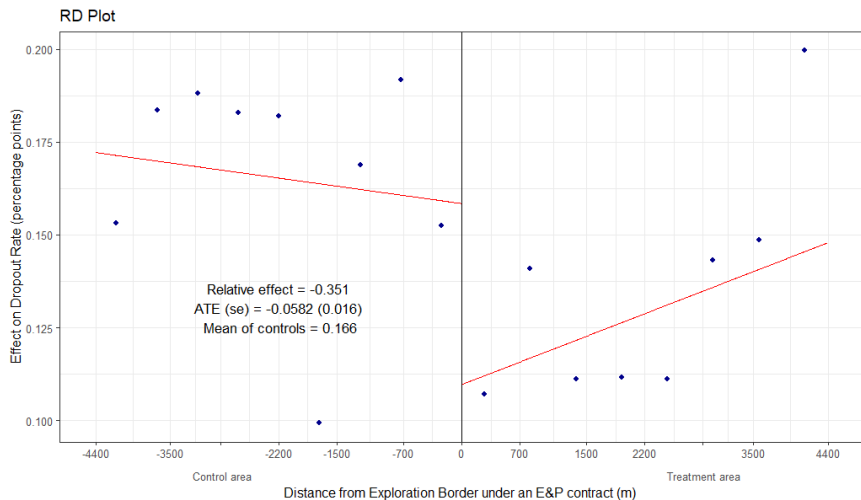
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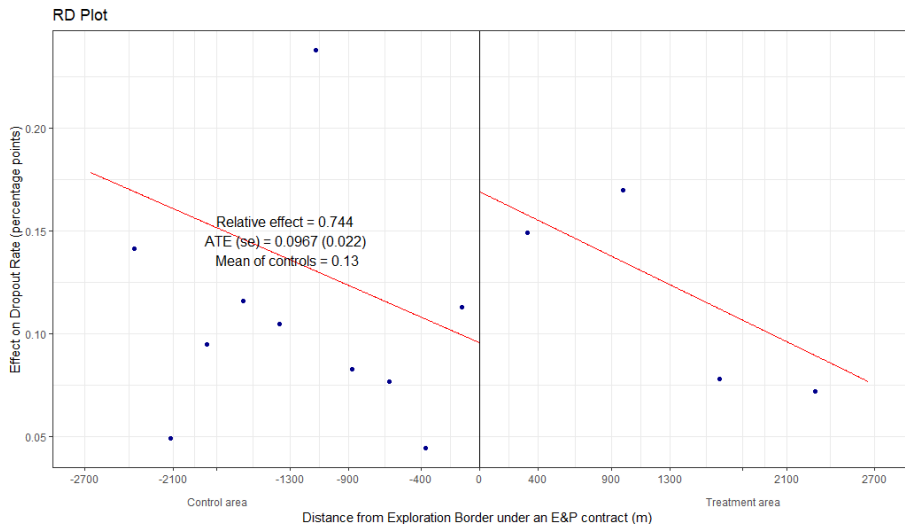
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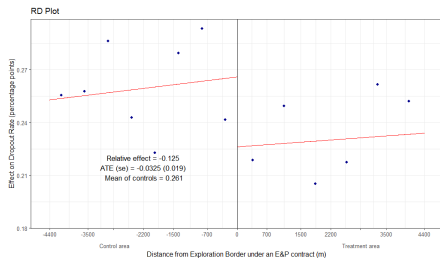
# General Result in Elementary School: 1y after treatment



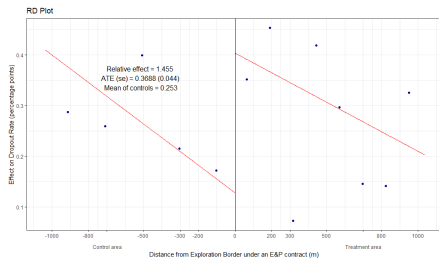
# General Result in Secondary School: 1y after treatment



# General Result: 2y after treatment



(a). Dropout rate 2y after treatment in Elementary school



(b). Dropout rate 2y after treatment in Secondary school

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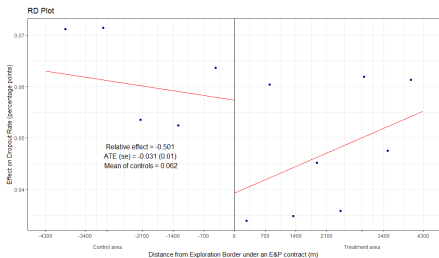
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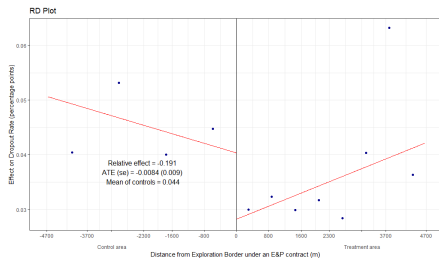
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# Dropout in Elementary School by Gender

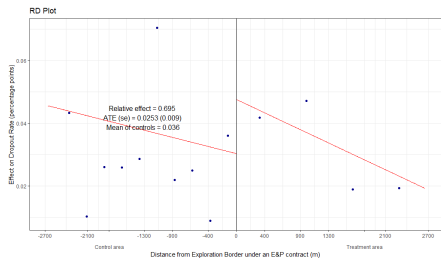


(a). Dropout of Males in Elementary School

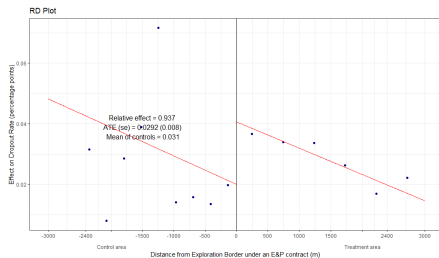


(b). Dropout of Females in Elementary School

# Dropout in Secondary School by Gender



(a). Dropout of Males in Secondary School



(b). Dropout of Females in Secondary School



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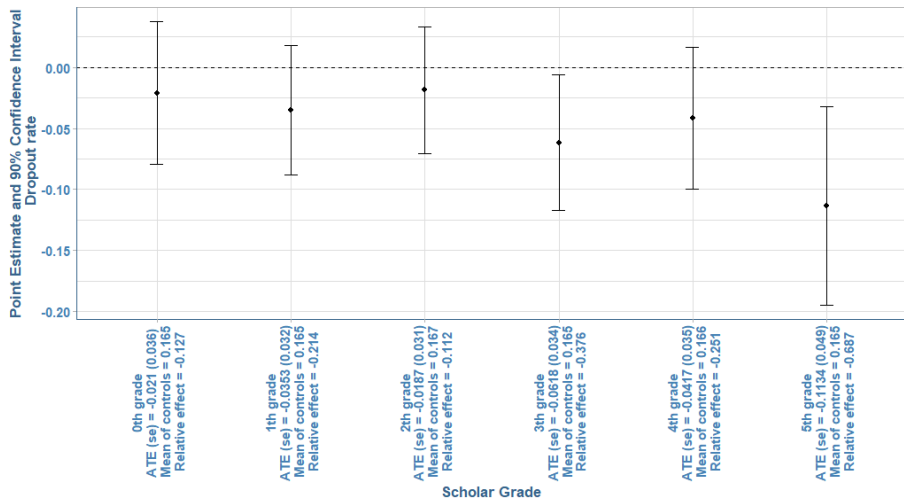
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- **Heterogeneities by grade**
- Heterogeneities by gender and grade

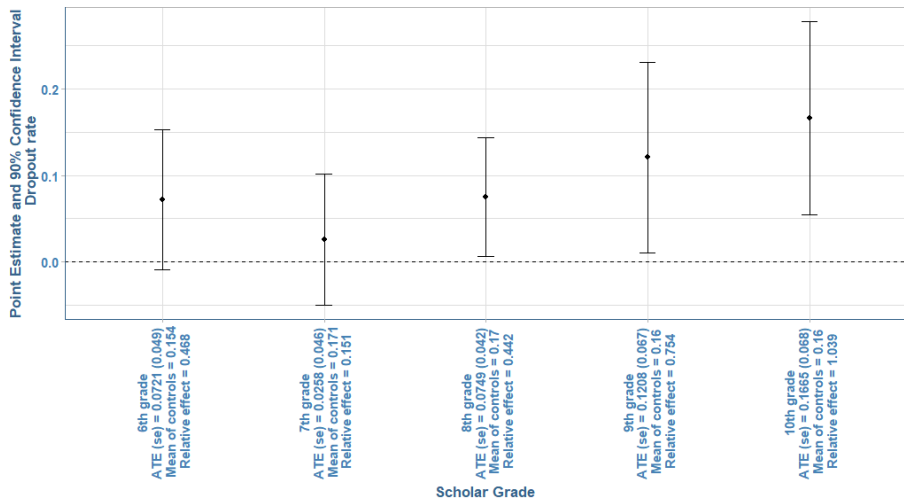
## 3 Falsification Tests and Robustness Check

- Falsification Tests
  - General Bandwidth sensibility by gender
  - General Bandwidth sensibility by gender
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# General Inference by Grade in Elementary School



# General Inference by Grade in Secondary School



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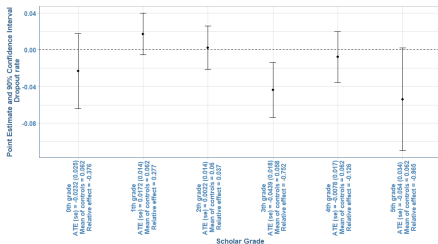
## 2 Results

- General Result
- Heterogeneities by gender
- Heterogeneities by grade
- Heterogeneities by gender and grade

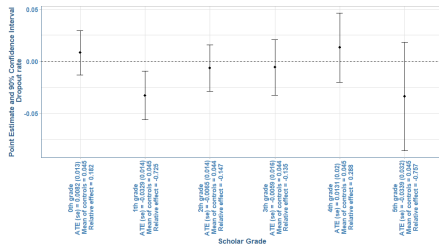
## 3 Falsification Tests and Robustness Check

- Falsification Tests
  - General Bandwidth sensibility by gender
  - General Bandwidth sensibility by gender
- Robustness check
  - Control and treated schools differ systematically in this covariate?
  - General Bandwidth sensibility by gender
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# Dropout in Elementary School by Gender and grade (1Y)

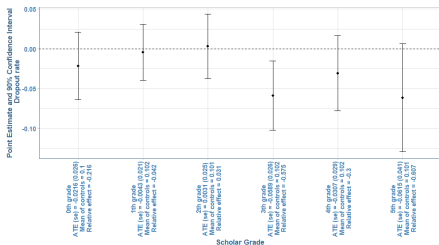


(a). Dropout of Males in Elementary School

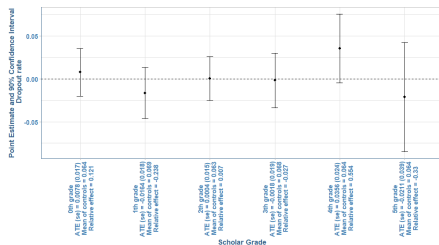


(b). Dropout of Females in Elementary School

# Dropout in Elementary School by Gender and grade (2Y)

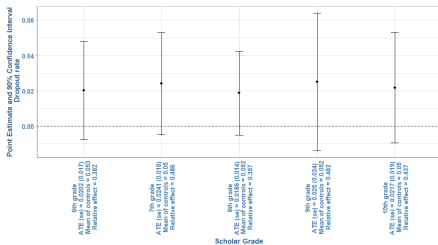


(a). Dropout of Males in Elementary School

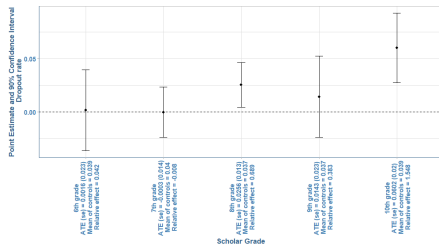


(b). Dropout of Females in Elementary School

# Dropout in Secondary School by Gender and Grade (1Y)

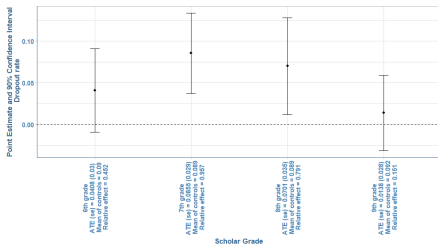


(a). Dropout of Males in Secondary School

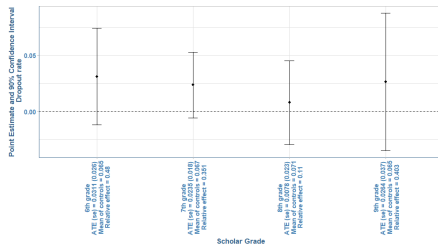


(b). Dropout of Females in Secondary School

# Dropout in Secondary School by Gender and Grade (2Y)



(a). Dropout of Males in Secondary School



(b). Dropout of Females in Secondary School



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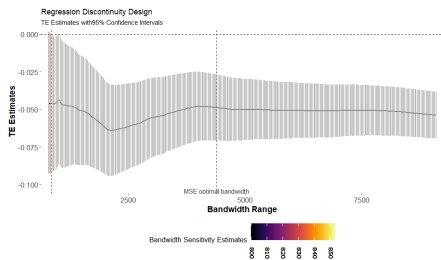
## 2 Results

- General Result
- Heterogeneities by gender
- Heterogeneities by grade
- Heterogeneities by gender and grade

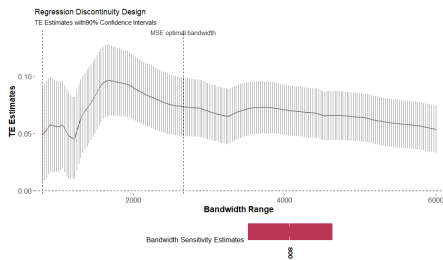
## 3 Falsification Tests and Robustness Check

- **Falsification Tests**
  - General Bandwidth sensibility by gender
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# General Bandwidth sensibility test

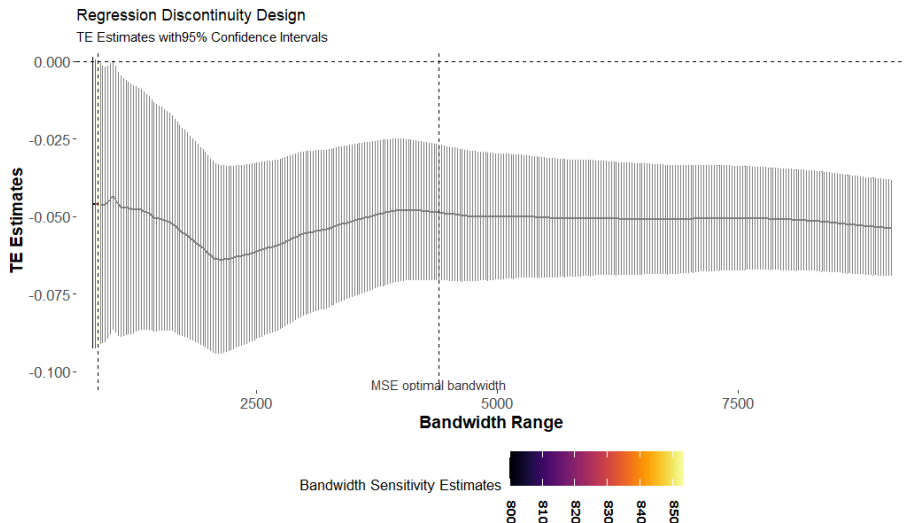


(a). Bandwidth sensibility test of students in Elementary School

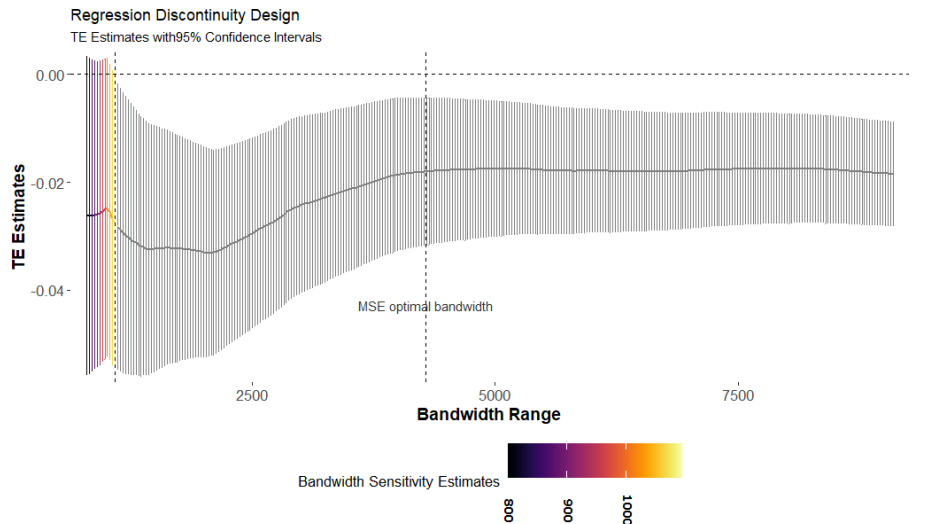


(b). Bandwidth sensibility test of students in Secondary School

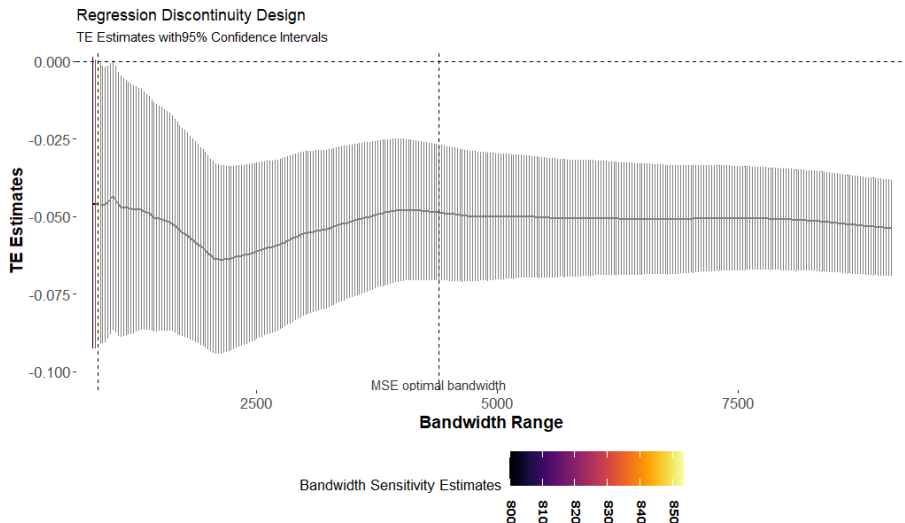
# General Bandwidth sensibility test in Elementary School



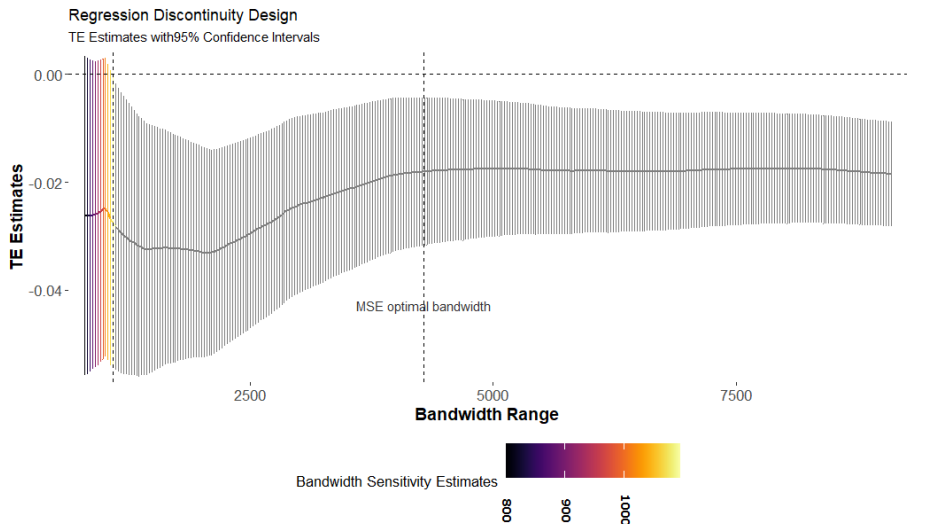
# Bandwidth sensibility test of males in Elementary School



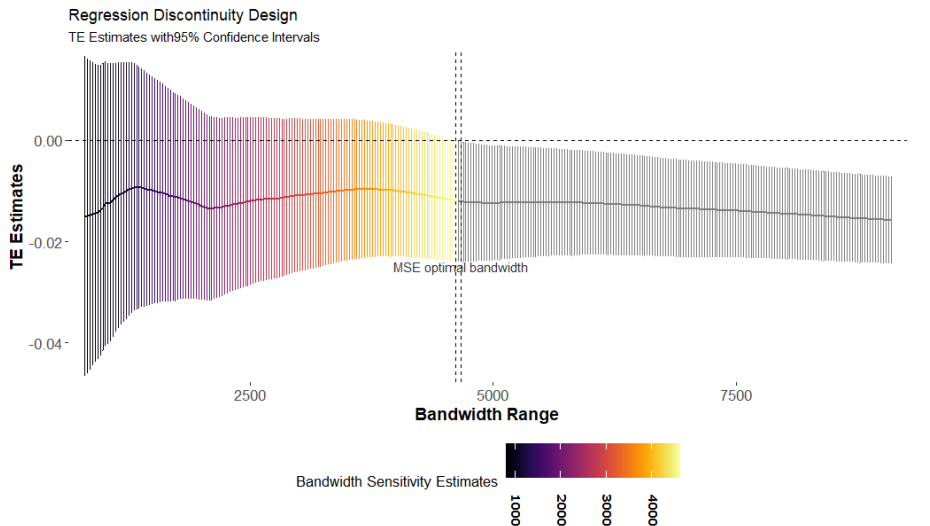
# General Bandwidth sensibility test in Elementary School



# Bandwidth sensibility test of males in Elementary School



# Bandwidth sensibility test of females in Elementary School



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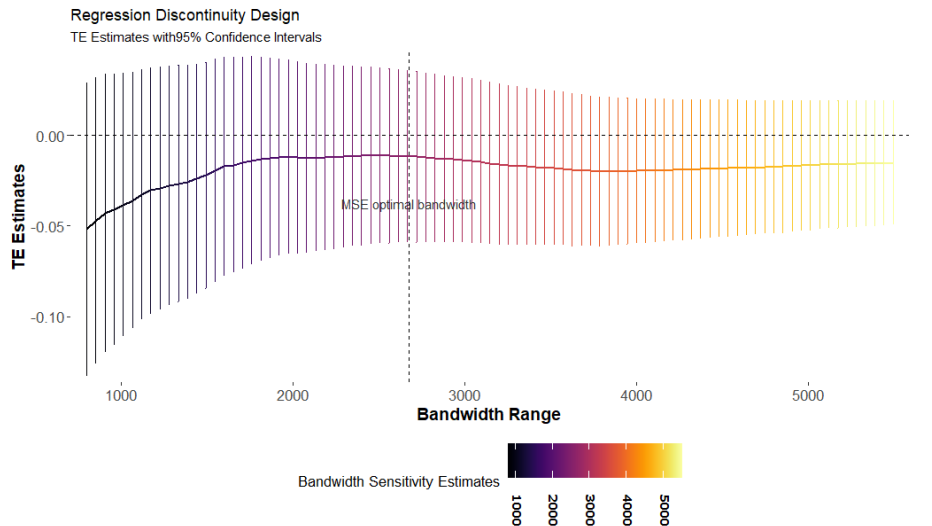
- General Result
- Heterogeneities by gender
- Heterogeneities by grade
- Heterogeneities by gender and grade

## 3 Falsification Tests and Robustness Check

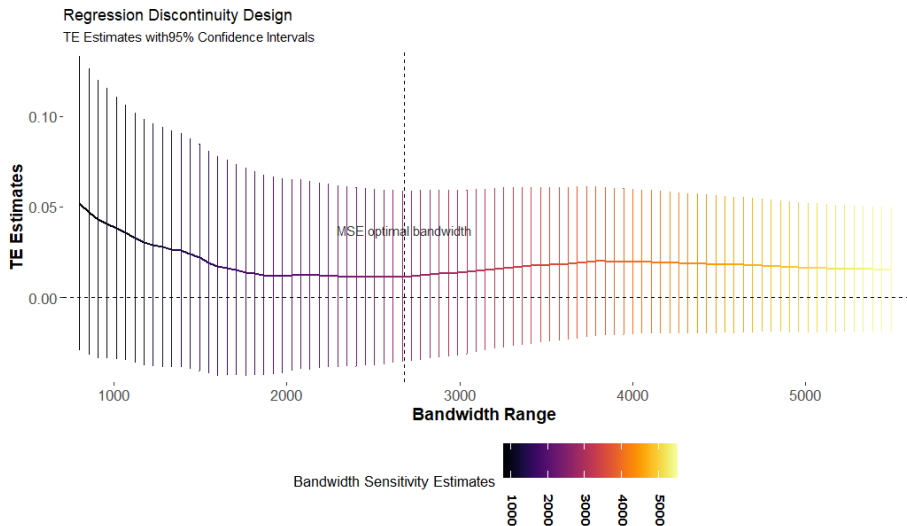
- Falsification Tests
  - General Bandwidth sensibility by gender
  - General Bandwidth sensibility by gender
- Robustness check
  - Control and treated schools differ systematically in this covariate?
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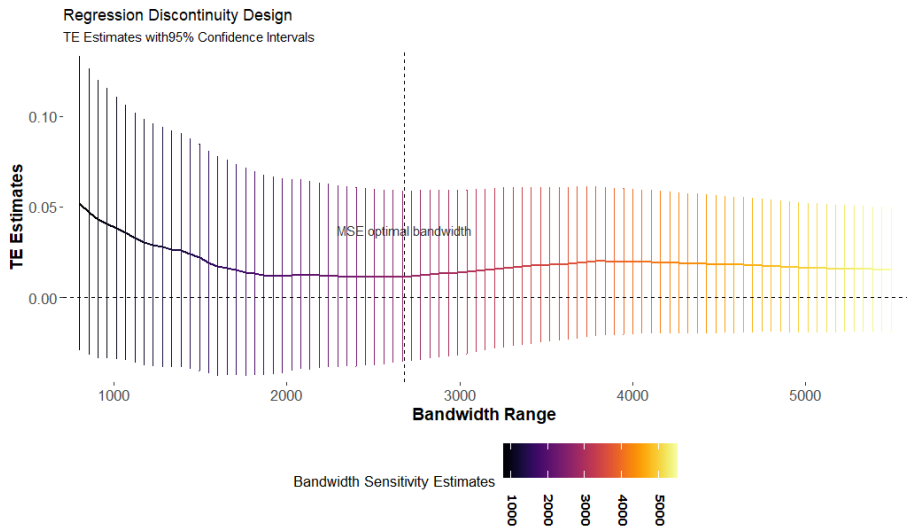
# Control and treated schools differ by FRAC FEMALE



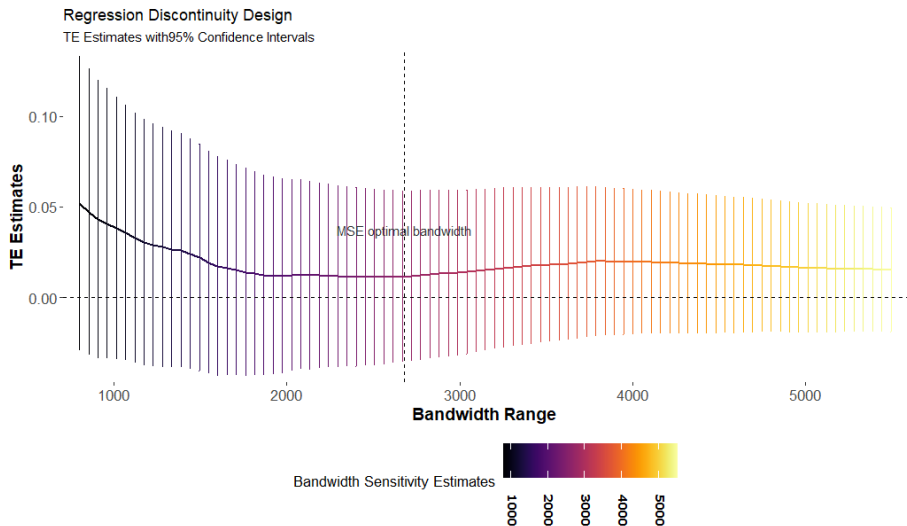
# Control and treated schools differ by FRAC MALE



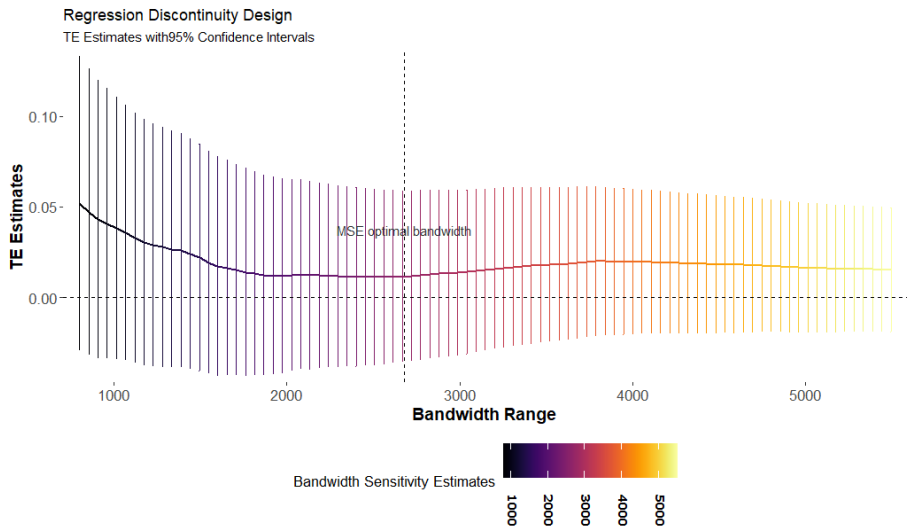
# Control and treated schools differ by FRAC NEW STUDENTS



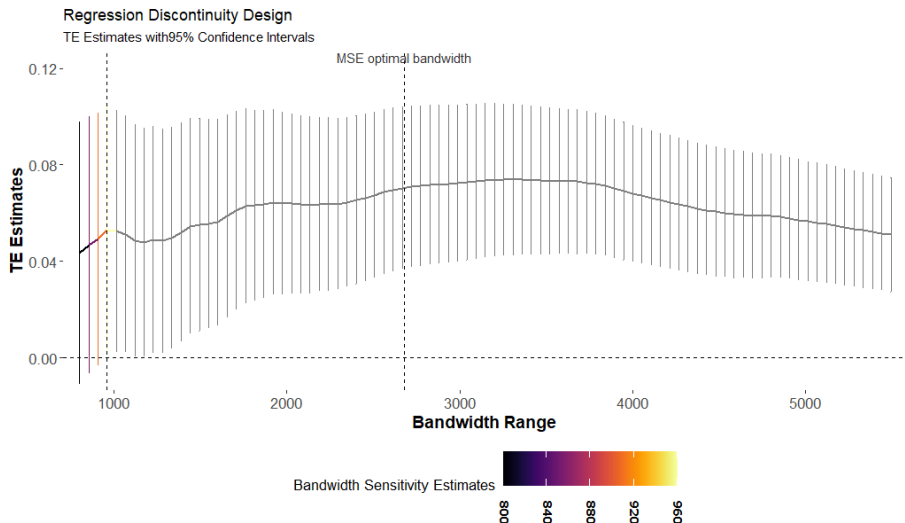
# Control and treated schools differ by FRAC REPEATERS



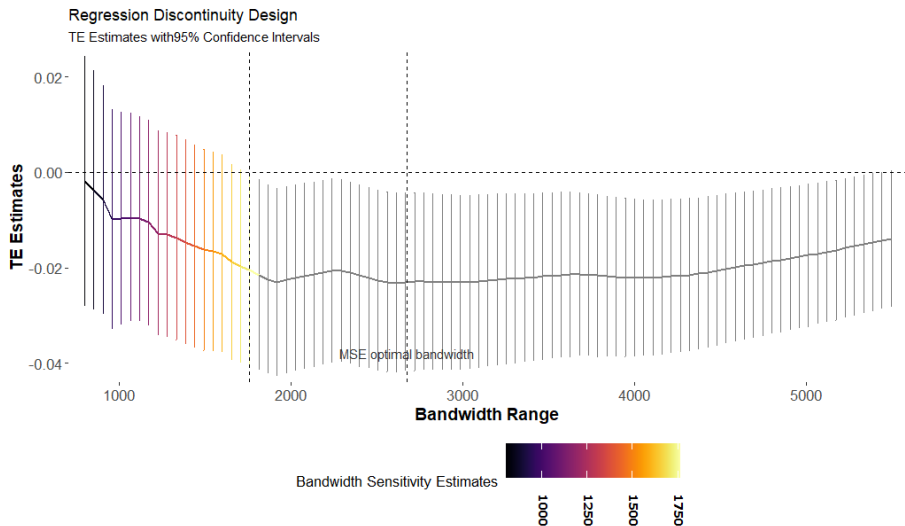
# Control and treated schools differ by FRAC SUBSIDIZED



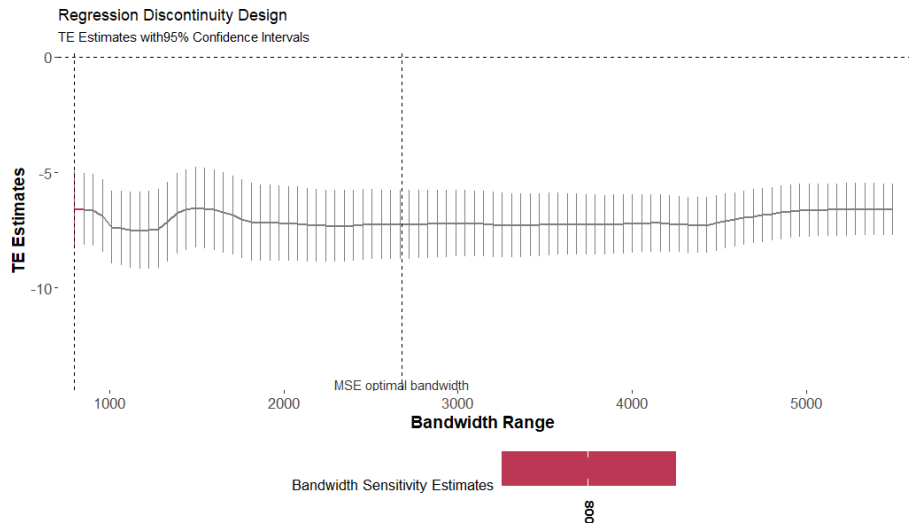
# Control and treated schools differ by LOW ECONOMIC LEVEL



# Control and treated schools differ by MEDIUM ECONOMIC LEVEL



# Control and treated schools differ by AGE





# General estimates in elementary school

| Method         | Coef.  | Std. Err. | z      | P>  z | [95% C.I.]      |
|----------------|--------|-----------|--------|-------|-----------------|
| Conventional   | -0.049 | 0.011     | -4.357 | 0.000 | [-0.071,-0.027] |
| Bias-Corrected | -0.058 | 0.011     | -5.204 | 0.000 | [-0.080,-0.036] |
| Robust         | -0.058 | 0.016     | -3.606 | 0.000 | [-0.090,-0.027] |

**Note:** The analysis is based on a sample of 5158 observations, with 3157 located within the area of exploration announcement ( $A^T$ ) and 2001 located near the border but outside the area of exploration ( $A^c$ ). We employ a Triangular kernel and the variance-covariance matrix estimator is computed with nearest neighbor variance estimator for heteroskedasticity-robust. The global polynomial fit in  $A^T$  and  $A^c$  is of order 1, the bandwidth where the global polynomial fit is of 4395.556 meters.. We estimate all coefficients using conventional, bias-corrected, and robust estimators, and we cluster standard errors at the school level.

# General dropout rate of males in elementary school

| Method         | Coef.  | Std. Err. | z      | P>  z | [95% C.I.]      |
|----------------|--------|-----------|--------|-------|-----------------|
| Conventional   | -0.049 | 0.011     | -4.357 | 0.000 | [-0.071,-0.027] |
| Bias-Corrected | -0.058 | 0.011     | -5.204 | 0.000 | [-0.080,-0.036] |
| Robust         | -0.058 | 0.016     | -3.606 | 0.000 | [-0.090,-0.027] |

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# General dropout rate of females in elementary school

| Method         | Coef.  | Std. Err. | z      | P>  z | [95% C.I.]      |
|----------------|--------|-----------|--------|-------|-----------------|
| Conventional   | -0.049 | 0.011     | -4.357 | 0.000 | [-0.071,-0.027] |
| Bias-Corrected | -0.058 | 0.011     | -5.204 | 0.000 | [-0.080,-0.036] |
| Robust         | -0.058 | 0.016     | -3.606 | 0.000 | [-0.090,-0.027] |

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# Conclusions

## 4 Appendix

- Literature Review

# Literature Review: Do changes in income expectations lead to changes in behavior?

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- Households update their income forecast and adjust consumption plans accordingly. (Das 1997, Roth 2017 and Roth 2018 ) found that households underestimate their future incomes,
- Jappelli 2009: Further research is needed to more fully understand the relationship between income expectations and behavior.
- Armantier 2011: Survey respondents act on inflation expectations, irrationals have lower education and financial literacy.
- Das 1999: Respondents form rational expectations, reported expectations are best future predictions.

## Literature Review: How do income expectations affect the decision to attend college?

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- ▶ There is a weak link between expectations and realizations among low-income (particularly minority) youth. (Rouse, 2004)
- ▶ Unrealistic expectations regarding their futures may explain the weak link between expectations and realizations among low-income (particularly minority) youth. (Rouse, 2004)
- ▶ Income expectations play a small role in university choice, while non-pecuniary factors are major determinants. (Delavande and Zafar, 2014, 2019)
- ▶ Lower-income students are more likely to be restricted in their postsecondary opportunities due to their perceptions of college costs. (Paulsen and St. John, 2002)
- ▶ Labor market prospects play a small role in university choice in some countries, such as Pakistan, while nonpecuniary outcomes, such as the school's ideology, are the major determinants. (Delavande and Zafar, 2019)
- ▶ Poor individuals require higher expected returns to be induced to attend college than individuals from rich families. (Kaufmann, 2014)
- ▶ Nonpecuniary factors are a key determinant of schooling choices. (Befy et al., 2012)
- ▶ Students from different race and income groups respond differentially to aid packages in their application and enrollment decisions depending on their levels of aid expectations. (Kim et al., 2009)



# Literature Review: What is the effect of income changes on academic performance?

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[return to the Model for Study Time!](#)

- Duncan 2011: A \$1,000 increase in annual income raises young children's achievement by 5%-6% of a standard deviation.
- Dahl 2008: A \$1,000 increase in income raises math and reading test scores by 6% of a standard deviation in the short-run.
- Chmielewski 2016: US income achievement gap larger than other countries.
- Carlisle 2015: Socioeconomic segregation, school funding, teacher expectations, and academic climate affect academic achievement.

# Literature Review: What is Impact of Oil exploration and production on academic performance?

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- Laska 1993: Offshore oil and gas production has both positive and negative impacts on social institutions, which may impact academic performance.
- Zuo 2019: Intensive drilling activities decreased grade 11 and 12 enrollment, suggesting a negative impact of oil production on academic performance.
- Akinwale 2020: Low level of interactions between indigenous firms in oil industry and university in Nigeria may impact academic performance.
- Kharaka 2005: Oil production can cause local detrimental impacts to soils, surface and groundwaters, and ecosystems, which may impact academic performance.
- Perry 2012:

# Literature Review: What is the impact of external infrastructure interventions on schooling decisions?

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- Barrett 2018: School facilities affect children's learning outcomes.
- Fisher 2001: School infrastructure affects student outcomes and behavior.
- Cuesta 2016: School libraries and new schools improve learning and enrollment.
- Belmonte 2020: Investment in school infrastructure affects students' achievement.

| Variable          | level      | mean.of.treated | mean.of.control | Difference      |
|-------------------|------------|-----------------|-----------------|-----------------|
| FEMALE DROPOUT T2 | Secondary  | 0.12 (0.13)     | 0.12 (0.14)     | 0.002 (-0.011)  |
| MALE DROPOUT T2   | Secondary  | 0.13 (0.12)     | 0.13 (0.15)     | -0.003 (-0.025) |
| DESERTO T2        | Secondary  | 0.48 (0.38)     | 0.47 (0.38)     | 0.014 (0.005)   |
| FEMALE DROPOUT T1 | Secondary  | 0.07 (0.11)     | 0.08 (0.12)     | -0.003 (-0.012) |
| MALE DROPOUT T1   | Secondary  | 0.08 (0.11)     | 0.08 (0.12)     | -0.002 (-0.018) |
| DESERTO T1        | Secondary  | 0.28 (0.34)     | 0.28 (0.34)     | 0.002 (0)       |
| EDAD              | Secondary  | 32.9 (31.2)     | 32.01 (35.72)   | 0.891 (-4.515)  |
| FRAC ESTRATO 3 4  | Secondary  | 0.06 (0.15)     | 0.02 (0.09)     | 0.036 (0.067)   |
| FRAC ESTRATO 1 2  | Secondary  | 0.86 (0.22)     | 0.9 (0.17)      | -0.046 (0.043)  |
| FRAC SUBSIDIADO   | Secondary  | 0.51 (0.11)     | 0.51 (0.14)     | -0.004 (-0.026) |
| FRAC REPITENTE    | Secondary  | 0.51 (0.11)     | 0.51 (0.14)     | -0.004 (-0.026) |
| FRAC NUEVO        | Secondary  | 0.51 (0.11)     | 0.51 (0.14)     | -0.004 (-0.026) |
| FRAC MALE         | Secondary  | 0.51 (0.11)     | 0.51 (0.14)     | -0.004 (-0.026) |
| FRAC FEMALE       | Secondary  | 0.49 (0.11)     | 0.49 (0.14)     | 0.004 (-0.026)  |
| FEMALE DROPOUT T2 | Elementary | 0.06 (0.13)     | 0.07 (0.15)     | -0.008 (-0.017) |
| MALE DROPOUT T2   | Elementary | 0.08 (0.16)     | 0.1 (0.18)      | -0.019 (-0.025) |
| DESERTO T2        | Elementary | 0.23 (0.3)      | 0.27 (0.3)      | -0.033 (-0.008) |
| FEMALE DROPOUT T1 | Elementary | 0.03 (0.11)     | 0.05 (0.13)     | -0.011 (-0.02)  |
| MALE DROPOUT T1   | Elementary | 0.05 (0.12)     | 0.06 (0.14)     | -0.014 (-0.017) |
| DESERTO T1        | Elementary | 0.13 (0.22)     | 0.17 (0.24)     | -0.037 (-0.025) |
| EDAD              | Elementary | 13.59 (19.55)   | 13.98 (26.07)   | -0.388 (-6.523) |
| FRAC ESTRATO 3 4  | Elementary | 0.03 (0.12)     | 0.01 (0.08)     | 0.017 (0.039)   |
| FRAC ESTRATO 1 2  | Elementary | 0.86 (0.25)     | 0.9 (0.21)      | -0.038 (0.041)  |
| FRAC SUBSIDIADO   | Elementary | 0.53 (0.22)     | 0.54 (0.23)     | -0.006 (-0.009) |
| FRAC REPITENTE    | Elementary | 0.53 (0.22)     | 0.54 (0.23)     | -0.006 (-0.009) |
| FRAC NUEVO        | Elementary | 0.53 (0.22)     | 0.54 (0.23)     | -0.006 (-0.009) |
| FRAC MALE         | Elementary | 0.53 (0.22)     | 0.54 (0.23)     | -0.006 (-0.009) |
| FRAC FEMALE       | Elementary | 0.47 (0.22)     | 0.46 (0.23)     | 0.006 (-0.009)  |