The Equilibrium Effects of Informed School Choice

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Motivation

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- Poor and less educated families in developing countries may also underestimate the returns to investment in human capital.

  $\Rightarrow$ Less demand for quality can lead to lower investment by parents and in aggregate, by providers of education services.

Information Interventions in Education

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- Returns to levels of education: Jensen (2010); Berry, Coffman, Morales and Neilson (2018) and many others.
- Returns to Major/College: Wiswall and Zafar (2015); Hastings, Neilson and Zimmerman (2015)
- School quality **report cards**:

Individuals Hastings & Weinstein (2008) - RCT, small scale, US school district, right after reform.

Villages Andrabi, Das and Khwaja (2017) - RCT, market level, Pakistan, no prior standardized information.

Null Mizala and Urquiola (2013) in Chile, Gallego and Neilson (2018) in Peru.

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1. Randomized Controlled Trials (RCTs) provide rigourous evidence that interventions change behavior in some cases.
2. Important insights but generally small in scale and generally limited to demand side.
3. Generally not clear what mechanism are most relevant nor how results can be extrapolated.

Limits to what we know for specific policy recommendations

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  Question: How can we move from small scale, positive experimental evidence towards an at scale policy recommendations?

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Paper goal: Empirically implement steps 1,2 and 3b using our own medium sized RCT together with an empirical model of demand and supply to simulate general equilibrium effects of the scaled up implementation.

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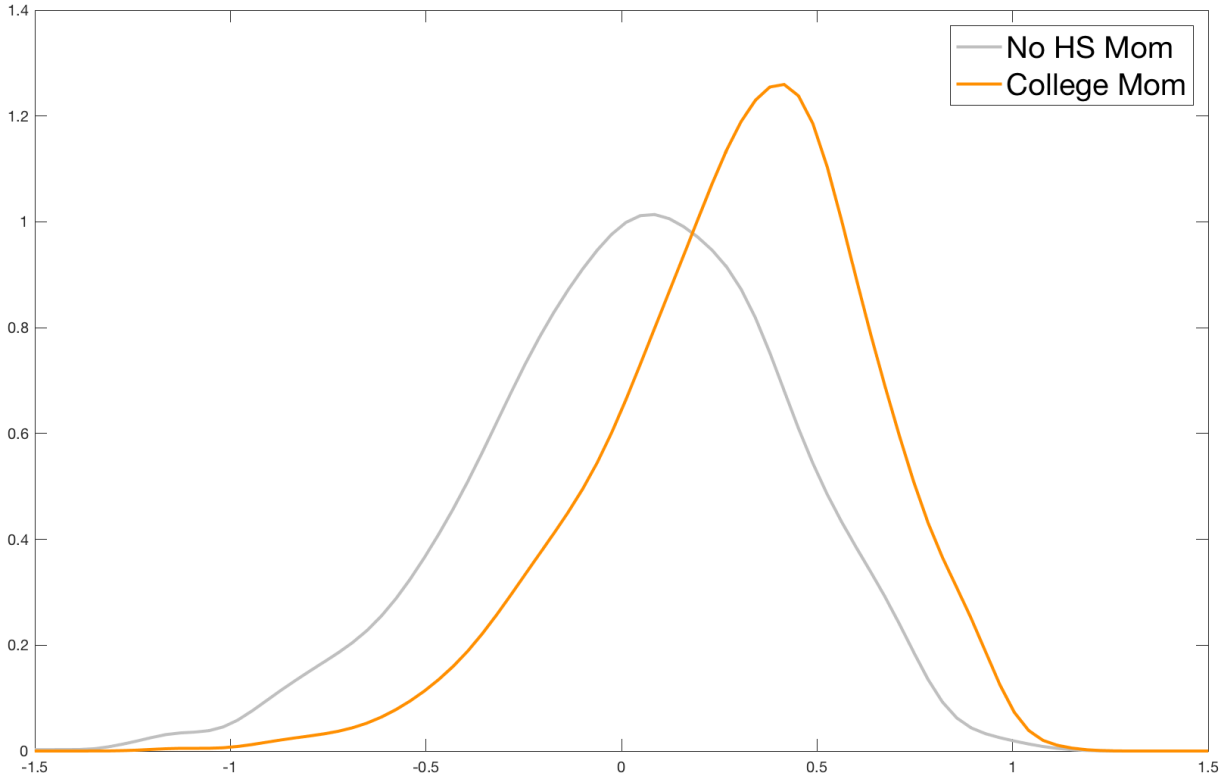
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- Vouchers and current regulation make attending better schools accessible but in the aggregate many poorer low SES students attend low performing and low value added schools.
- Government is interested in promoting information in education markets via *Mas informacion, mejor educacion* program of Minister of Education J. Lavin.

Inequality of School Quality



Causes of Inequality of School Quality in General

- Supply Factors
  1. Price can make higher quality options less attractive.
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- Demand Factors
  1. Information about what schools exist, what their characteristics are.
  2. Information about how important choosing a school can be.
  3. Salience of choice, timing of applications, lack of foresight or other behavioral explanations.

Intervention Parameters

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  $\Rightarrow$ Intervention at **public pre-schools**, during parent-teacher conference.

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  Message Type 1:
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- Space to make open questions about the school choice process.
- Control group had a meeting but only to discuss the end of the school year.


SILVIA ESPEJO
SU HIJO ESTÁ EN 2° BÁSICO


100


¿EN QUE COLEGIO
LO VAS A INSCRIBIR?


¿COMO
LO VAS A ELEGIR?






FÉLIX PALMA
ESTUDIA INGENIERÍA INFORMÁTICA

FÍJATE EN EL PUNTAJE SIMCE

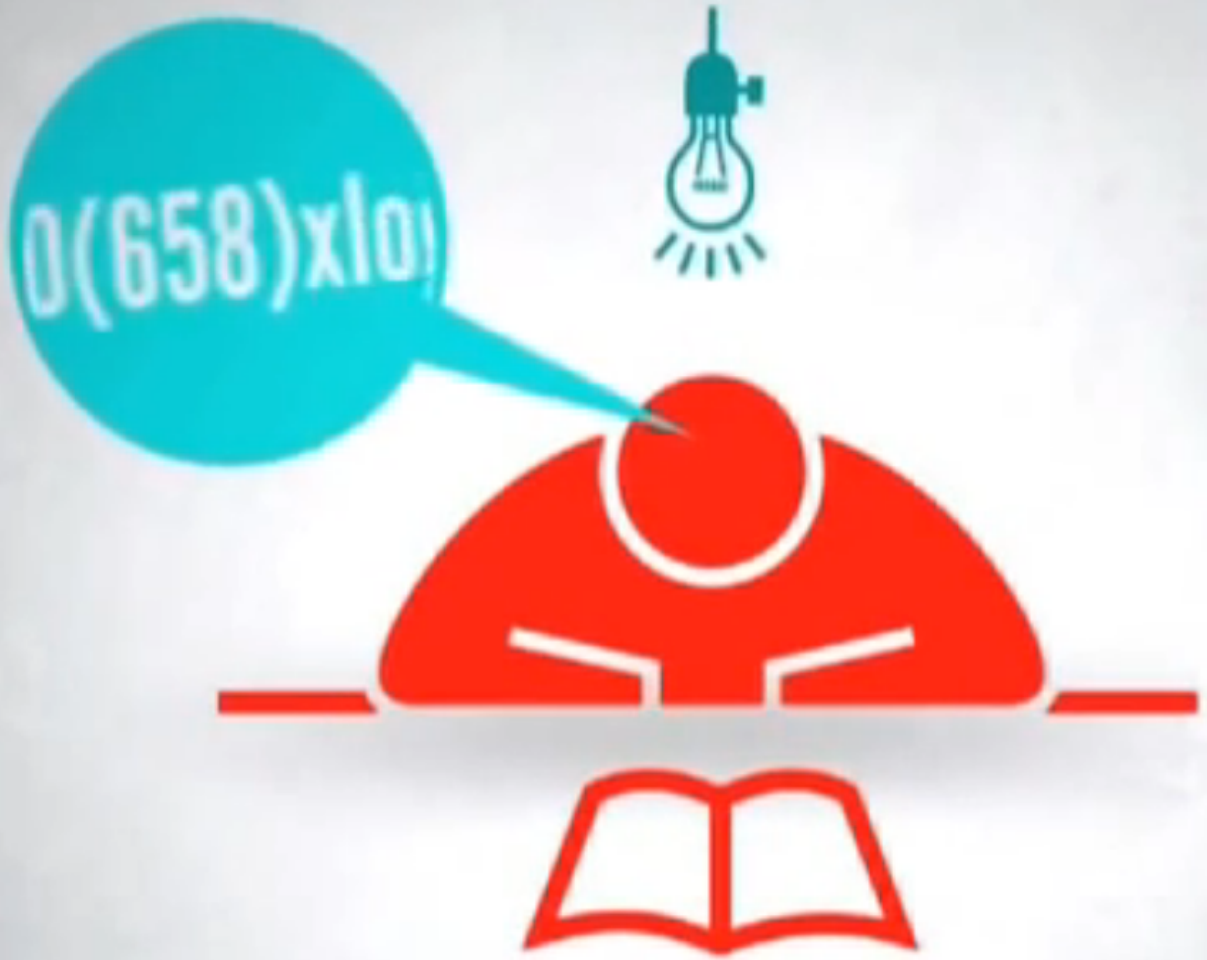



SIMCE
PSU
+ ALTO
+ INGRESO A LA EDUCACIÓN SUPERIOR


CUARTO MEDIO
UNIVERSIDAD


ROSE MARIE ACEVEDO
TRABAJA COMO ASISTENTE COMERCIAL

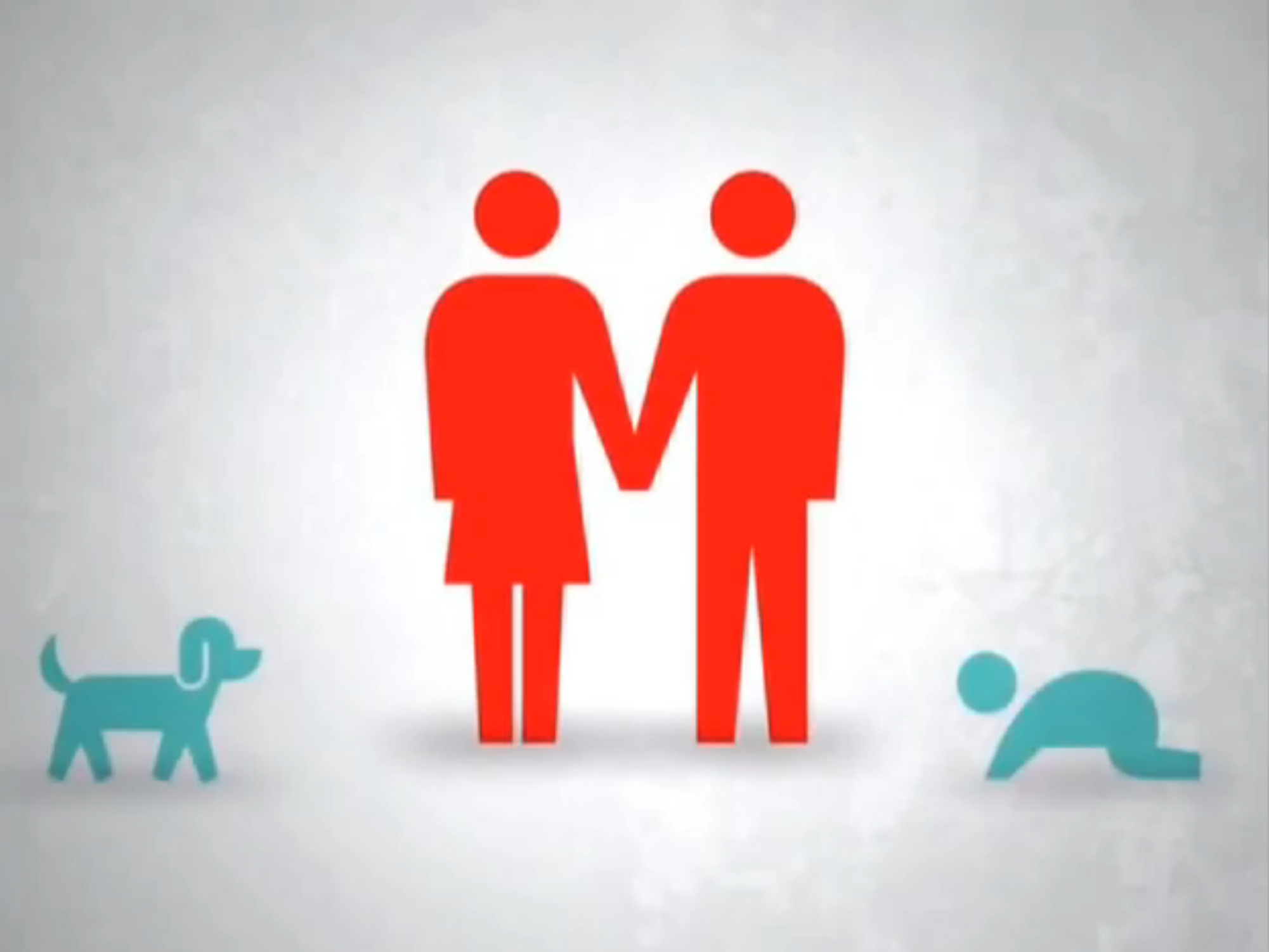

PIENSA EN
SU FUTURO



EDUCACIÓN SUPERIOR

TRABAJO





PARA ELEGIR BIEN
INFÓRMATE Y COMPARA



Report Cards-Front

Cartilla de Apoyo a la Elección de Establecimientos Escolares

Ingreso a EnseñanzaBásica

Jardín Cardenal Caro **2010**

Todos los padres en Chile tienen el derecho de elegir el establecimiento escolaren que estudian sus hijos.
Esta cartilla, dirigida a padres y apoderados, ha sido diseñada para apoyar esta elección.
En esta cartilla encontrará información de los colegios más cercanos al jardín infantil donde asiste su hijo(a).

Para elegir un establecimiento escolar, es bueno fijarse en los resultados **SIMCE** de ese colegio, pues hablan de la calidad de la educación.
También encontrará en esta cartilla información sobre los costos de los colegios, la ubicación del colegio, y otras características.

Ref	Nombre Colegio	Puntaje SIMCE*	Cambio SIMCE**	Precio Mensual Del Colegio***
1	Colegio Rosa Elvira Matte De Prieto	293	7,50	Entre 5.000 y 10.000
2	Colegio Polivalente Don Orione	286	13,75	Entre 10.000 y 20.000
3	Escuela Básica Sol De Chile	261	5,75	Entre 10.000 y 20.000
4	Colegio Polivalente Saint Trinity	250	-8,00	Menos de 5.000
5	Escuela Básica Clara Estrella	250	-26,00	No Cobra Mensualidad
6	Colegio Kennedy	249	13,75	Entre 5.000 y 10.000
7	Escuela Básica Santa Adela	247	-10,25	No Cobra Mensualidad
8	Colegio Adventista Buenaventura	243	-7,50	Menos de 5.000
9	Centro Educacional Sagrado Corazón	243	-17,00	Menos de 5.000
10	Colegio Saint Orland 2	239	1,25	No Cobra Mensualidad
11	Escuela Básica Karol Cardenal De Cracovia	238	0,00	No Cobra Mensualidad
12	Escuela Alicia Ariztía De Silva	235	9,25	No Cobra Mensualidad
13	Escuela Básica Parque Las Américas	235	6,00	No Cobra Mensualidad
14	Colegio Básica Hernán Olguín Maibee	233	-2,75	No Cobra Mensualidad
15	Escuela Básica Las Espigas	232	31,75	No Cobra Mensualidad
16	Liceo Polivalente B 133	232	1,50	No Cobra Mensualidad
17	Escuela Básica Raúl Sáez S.	231	-1,25	No Cobra Mensualidad
18	Escuela Acapulco Dn 582	227	7,25	No Cobra Mensualidad
19	Escuela Básica Bernardo O'Higgins	224	-19,75	No Cobra Mensualidad
20	Escuela Conquistando Futuro	219	-15,00	No Cobra Mensualidad
21	Blue Star College	216	7,50	No Cobra Mensualidad
22	Liceo Tte. 2 Francisco Mery Aguirre	215	-1,00	No Cobra Mensualidad

*Valores promedio de **4° básico de los años 2006 a 2009.**
**Cambio en el puntaje en 2006-2007 y 2008-2009.
***Valores aproximados para el año 2009.

Puntajes **SOBRE el Promedio Nacional.**

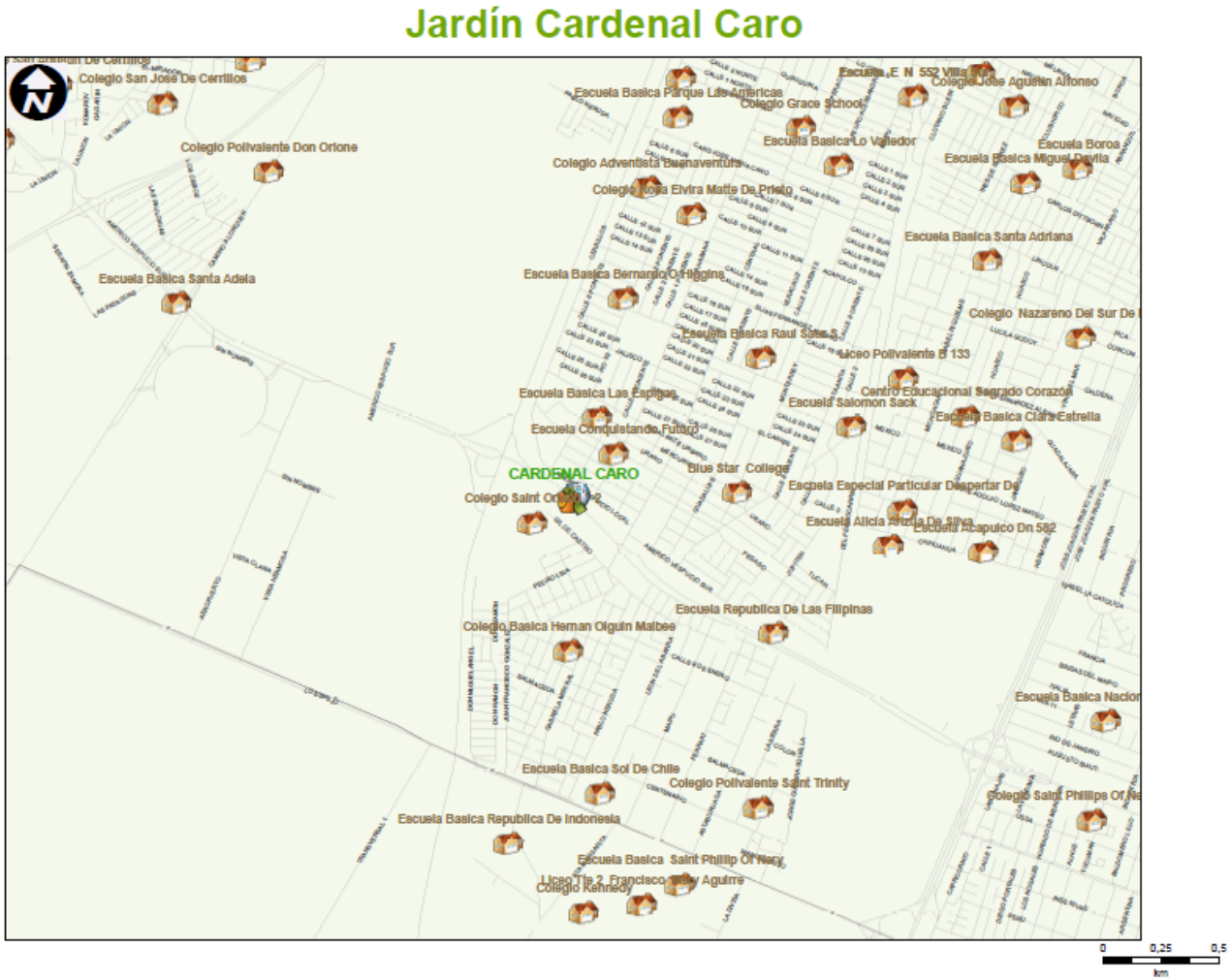
Puntajes **BAJO el Promedio Nacional.**

El Promedio Nacional es de **250 puntos**

Los colegios en los que aparece s/i son aquellos que no tienen la información disponible

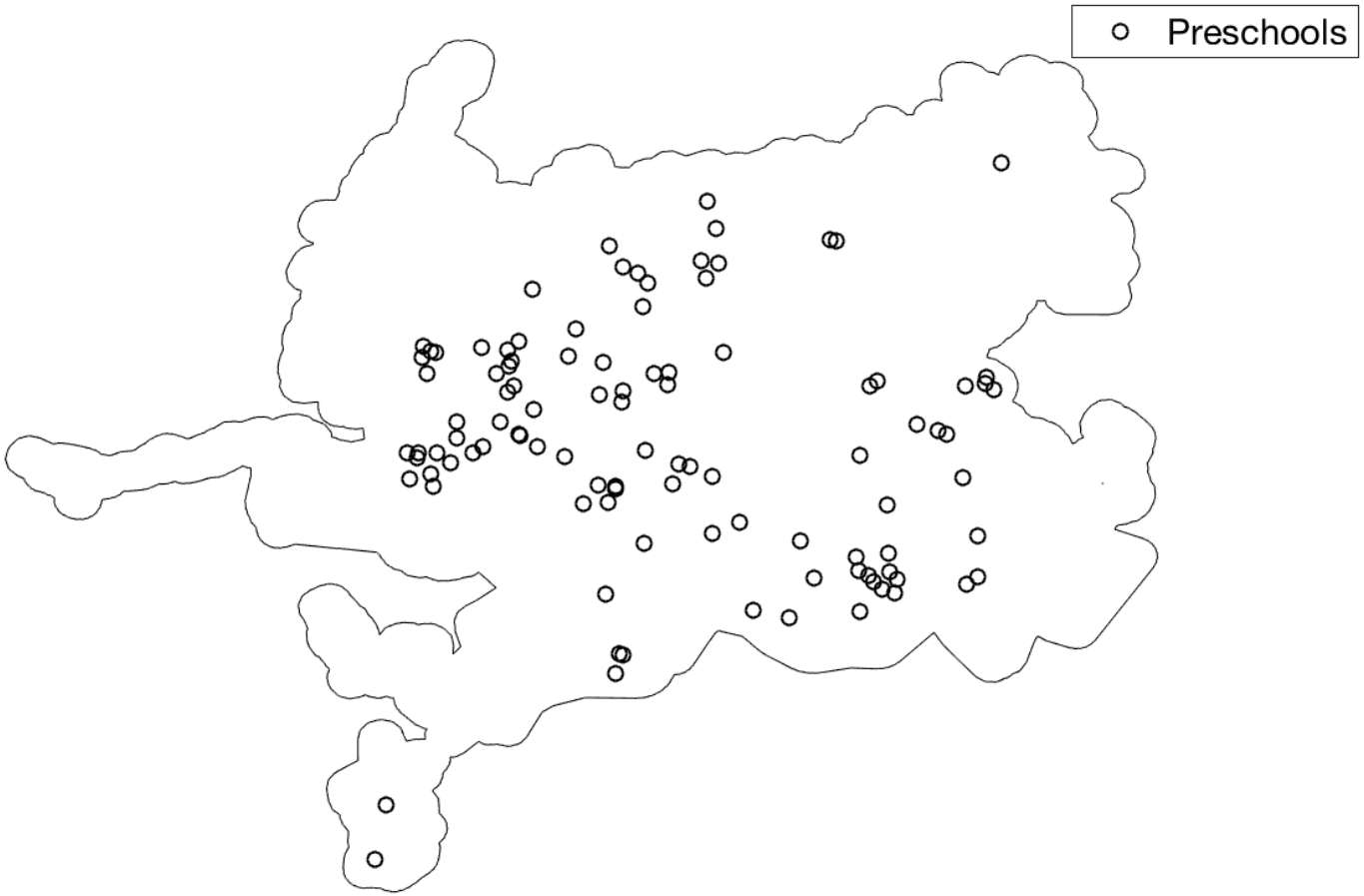
NZA BÁSICA

Map of School Locations



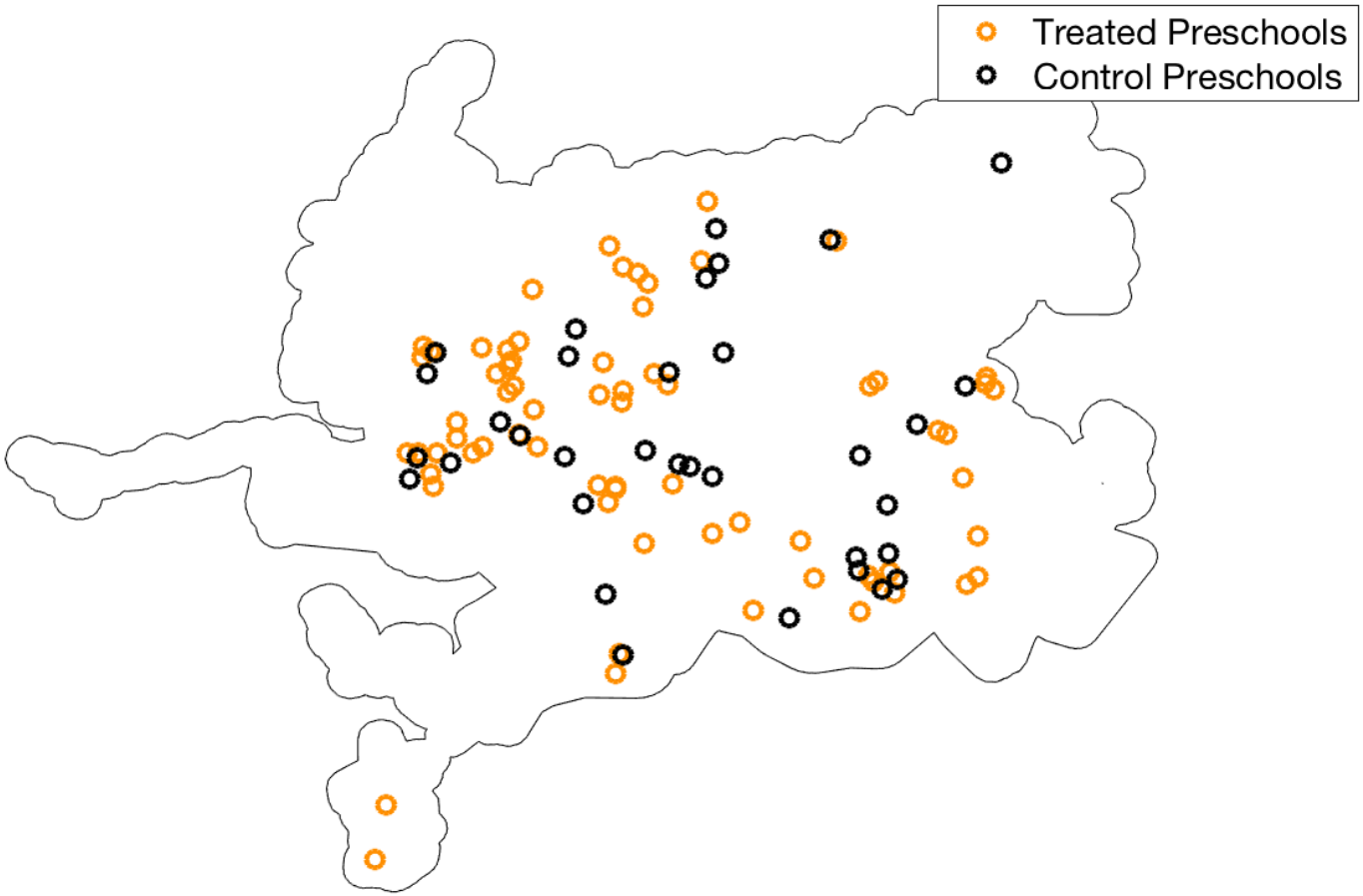
Treatment and control groups for Santiago

Sample Size: 133 preschools across three regions.



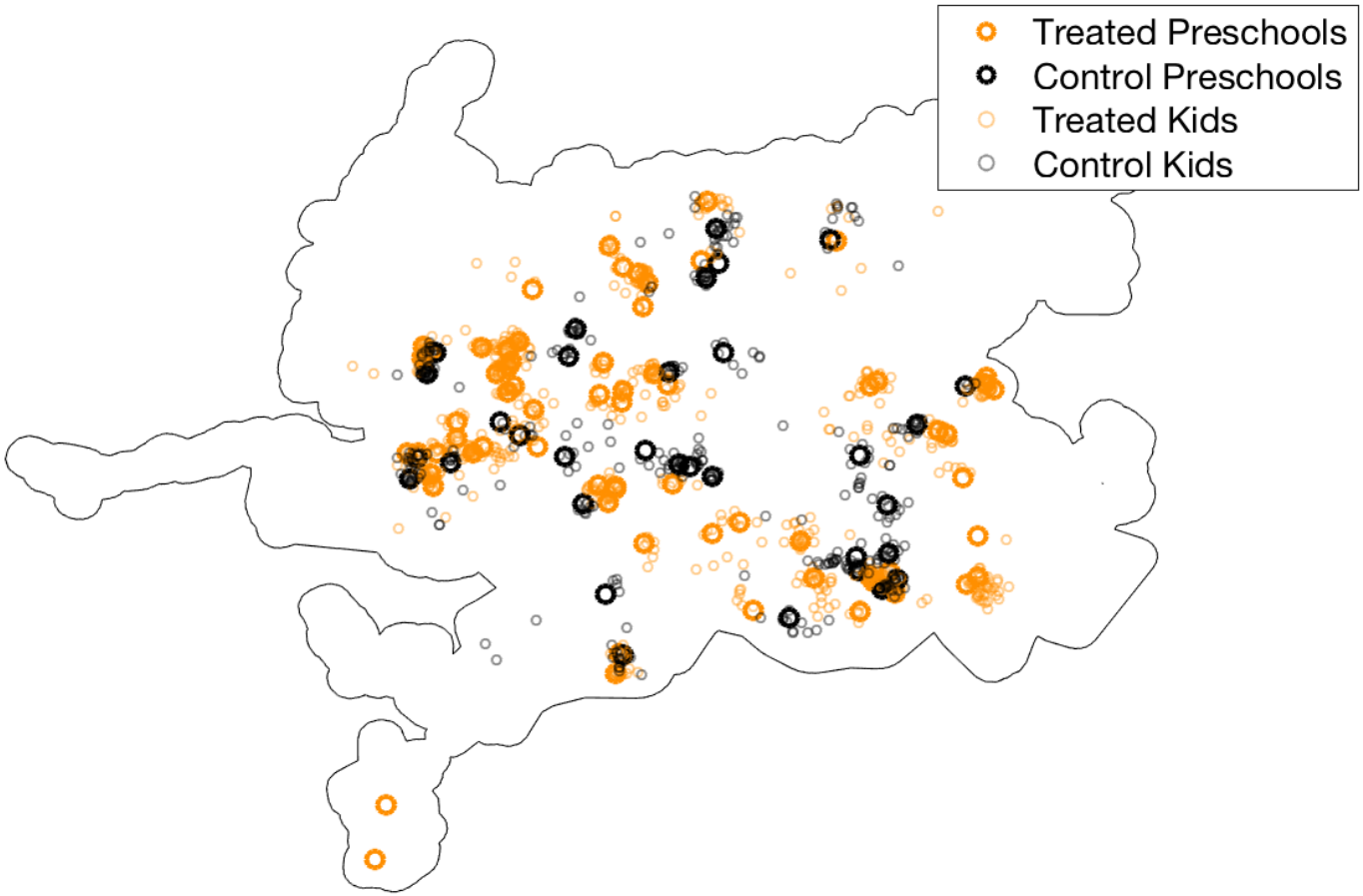
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Balance - Families

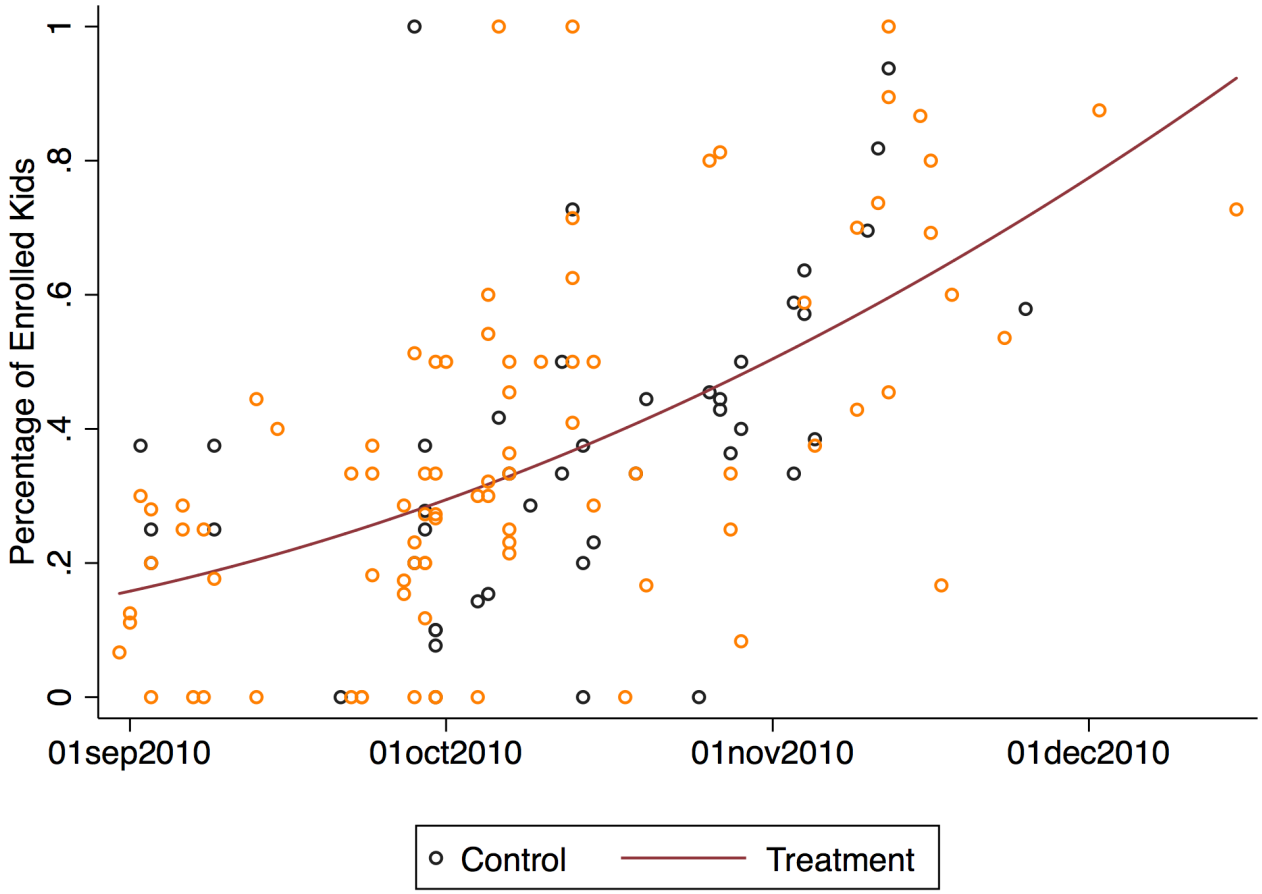
Table: Balance at the Family Level

	Treatment		Constant	
	(1)		(2)	
Enrollment	-1.898	(3.248)	41.467***	(2.530)
Mean attendance	-1.053	(2.430)	28.689***	(1.903)
Mother HE	-0.643	(1.552)	9.495***	(1.320)
Mother HS	-0.915	(2.195)	48.347***	(1.652)
Mother NHS	0.760	(1.010)	7.309***	(0.697)
Q1 Income	0.577	(2.996)	57.970***	(2.348)
Q2 Income	0.288	(2.142)	31.365***	(1.587)
Q3 Income	-1.136	(1.216)	8.752***	(0.930)
Very Poor	0.637	(1.865)	14.947***	(1.406)
Poor	0.083	(2.233)	40.619***	(1.816)

Notes: Column 1 presents the coefficient and standard error for the regression of each variable on treatment. Column 2 presents the coefficient and standard error for the constant term. p-value<10% ** p-value<5% *** p-value<10%.

Implementation Timing

Figure: Percentage of Already Enrolled Kids by Intervention Date



Balance Table

Results on School Choice - Price, Quality and Distance

Table: Effect of Treatment on Price, Quality and Distance

	Price		Quality			Distance
	Positive	OoP	2nd - Lang	4th -Average	Value Added	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Full Sample						
Treatment	0.076**	0.063	0.029	0.027	0.032	0.245
	(0.034)	(0.076)	(0.020)	(0.028)	(0.027)	(0.194)
N obs.	1355	1352	1353	1355	1349	1355
Panel B: Already enrolled						
Treatment	0.000	0.050	-0.018	-0.043	-0.053	-0.265
	(0.057)	(0.154)	(0.039)	(0.047)	(0.050)	(0.375)
N obs.	527	525	527	527	526	527
Panel C: Not enrolled						
Treatment	0.159***	0.104	0.058**	0.070**	0.084**	0.440**
	(0.041)	(0.099)	(0.029)	(0.035)	(0.034)	(0.221)
N obs.	828	827	826	828	823	828
Rand. controls						
Exp. controls	×	×	×	×	×	×

Note: Randomization controls include market characteristics of schools (number and test scores mean, standard deviation and percentiles 25, 50 and 75.). Expanded controls include Mother's education, household information (size, durable goods, owned house), baseline school choice information.

Details

Results on Outcomes: Student Test Scores

Table: Effect of Treatment on Student Test Scores

	Lang - 2nd		Average - 4th		Lang - 4th		Math - 4th	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Full Sample								
Treatment	-0.008	-0.028	0.103*	0.085	0.046	0.021	0.149**	0.137**
	(0.052)	(0.059)	(0.058)	(0.058)	(0.066)	(0.068)	(0.062)	(0.060)
N obs.	1392	1218	1267	1112	1242	1093	1240	1090
Panel B: Enrolled sample								
Treatment	-0.076	-0.110	-0.080	-0.115	-0.102	-0.140	-0.012	-0.036
	(0.110)	(0.109)	(0.103)	(0.107)	(0.120)	(0.126)	(0.111)	(0.115)
N obs.	492	484	450	443	448	441	438	432
Panel C: Not enrolled sample								
Treatment	0.068	0.050	0.232***	0.214***	0.173*	0.136	0.254***	0.257***
	(0.072)	(0.073)	(0.083)	(0.078)	(0.099)	(0.092)	(0.079)	(0.076)
N obs.	761	734	695	669	677	652	682	658
Randomization controls	×		×		×		×	
Expanded controls		×		×		×		×

Note: Randomization controls include market characteristics of schools (number and test scores mean, standard deviation and percentiles 25, 50 and 75.). Expanded controls include Mother's education, household information (size, durable goods, owned house), baseline school choice information.

Accum. VA

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$\Rightarrow$ How do we take these results about average treatment effects and think about potential effects of a scaled up version of the policy?

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2. **Model Demand and Supply:** Exploit the variation from both the administrative data, recent policy changes and the RCT experiment to a estimate a model of demand and supply for schools.
3. **Counterfactuals** Use the model to describe different counterfactual exercises to quantify the effects of a policy that scales up the intervention.

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$$u_{ij} = \delta_j + \beta_i q_j - \alpha_i p_j + \lambda_i D_{ij} + \epsilon_{ij}$$

q_{jt} : Schools value added in terms of test scores.

p_{jt} : Schools price over the voucher.

x_i : Observable child and family characteristics such as mother's education and income.

v_i^q : Unobservable child and family preferences for quality.

loc_i : Location of family.

δ_j : School mean utility.

D_{ij} : Distance from school j to family i.

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$$\alpha_i = \sum_k \alpha_k \cdot \text{Type}_{ik} \qquad \text{and} \qquad \lambda_i = \sum_k \lambda_k \cdot \text{Type}_{ik}$$

$$\beta_i = \sum_k (\beta_k + \phi_k \cdot \text{Treat}_i) \cdot \text{Type}_{ik} + \beta^U v_i^q$$

$$v_i^q \sim N(0, \sigma^q) \qquad score_{ijt} = q_{jt} + X_i\gamma + \nu_{ijt}$$

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Determining the Distribution of School Quality Attended

The market share of a given school j will be :

$$s_j(\mathbf{q}, \mathbf{p}, \boldsymbol{\xi}) \quad = \sum_k^K \sum_n^{N_m} s_{nk}(\mathbf{q}, \mathbf{p}, \boldsymbol{\xi}) \cdot w_k(n) \Pi_k$$

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- Its possible preferences changed but given limits to choices, we see small average ITT effects.

Estimation of School Choice

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We add a second stage of estimation with additional **Experiment Moments** that are produced from the RCT.

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We simulate 1000 samples of unobservables for the experimental sample and use the simulated choices to run regresstions

$$\widetilde{\beta}_s^T = (X'X)^{-1} X'\widetilde{q}_s$$

$$M^{Exp}(\theta) = \frac{1}{N_s} \sum_{s=1}^{N_s} \left(\beta^T - \widetilde{\beta}_s^T \right)$$

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Model needs to replicate the β ITT observed in the experiment.

Table: Demand Model Estimates

Panel A: Demand Parameters	
	Estimate
Quality	
NHS Mom	1.3663***
HS Mom	0.1979***
College Mom	0.5239***
Poor	-0.5815***
Treatment (Mother No HS)	0.5626***
Treatment (Mother HS)	0.3430***
Price	
NHS Mom	-9.899***
HS Mom	-2.8413***
College Mom	-0.0001
Poor	-3.3190***
Treatment (Mother No HS)	9.8990***
Treatment (Mother HS)	2.8413***
Distance	
NHS Mom	-0.9928***
HS Mom	-0.7027***
College Mom	-0.3844***
Poor	-0.2178***
Treatment (Mother No HS)	0.3872***
Treatment (Mother HS)	0.1203***
Sigma Preference - Quality	0.1361***

Note: Estimation integrates over v_i^q using Gauss Hermite quadrature.

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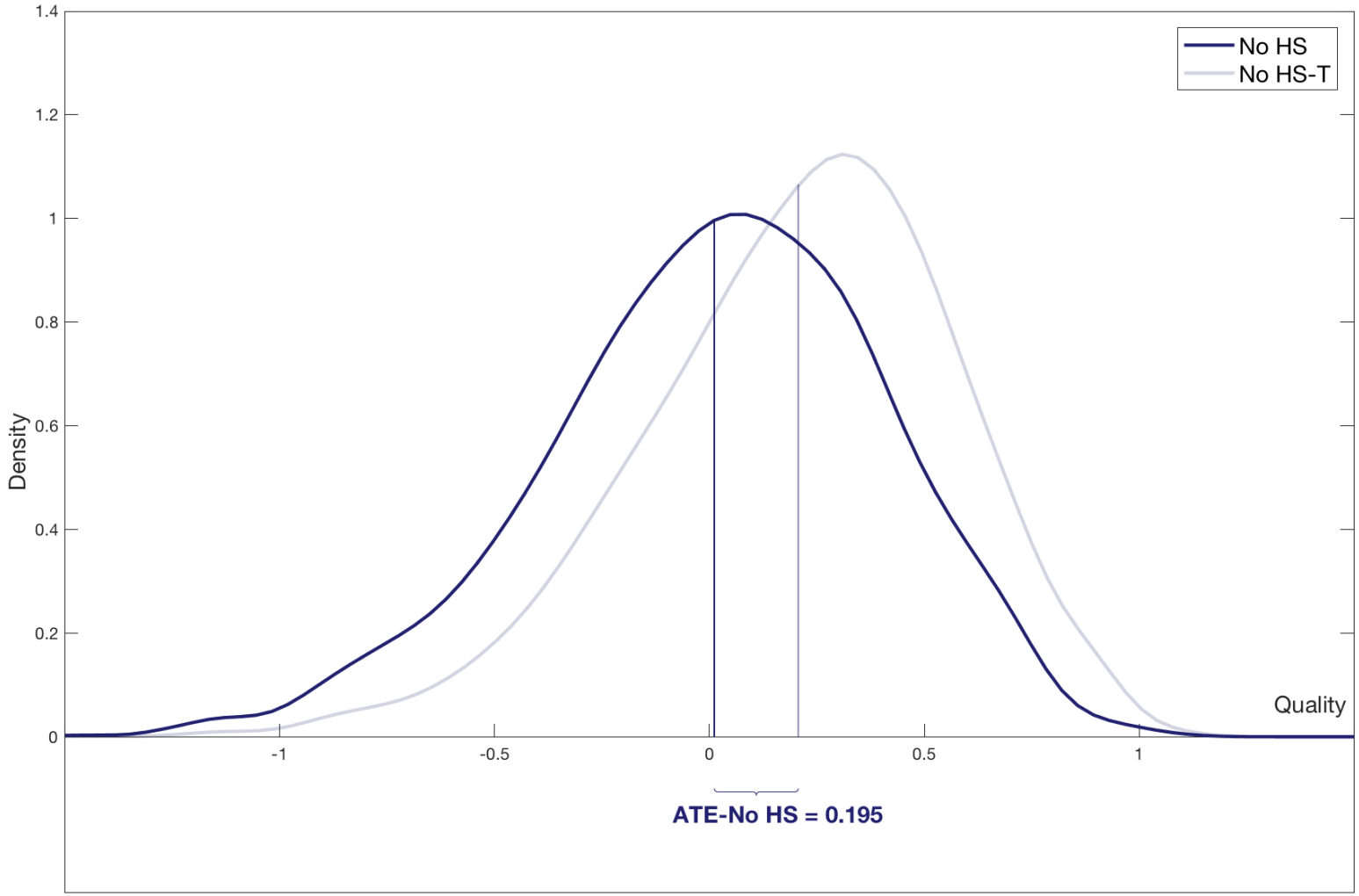
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  - We impose capacity constraints on schools (we the to be assume fixed in the short run)
  - Based on preferences from the model, we simulated rank order lists.
  - We solve excess of demand by using a DA centralized mechanism. This is a reasonable counterfactual, as Chile implementated such admission system in 2017.

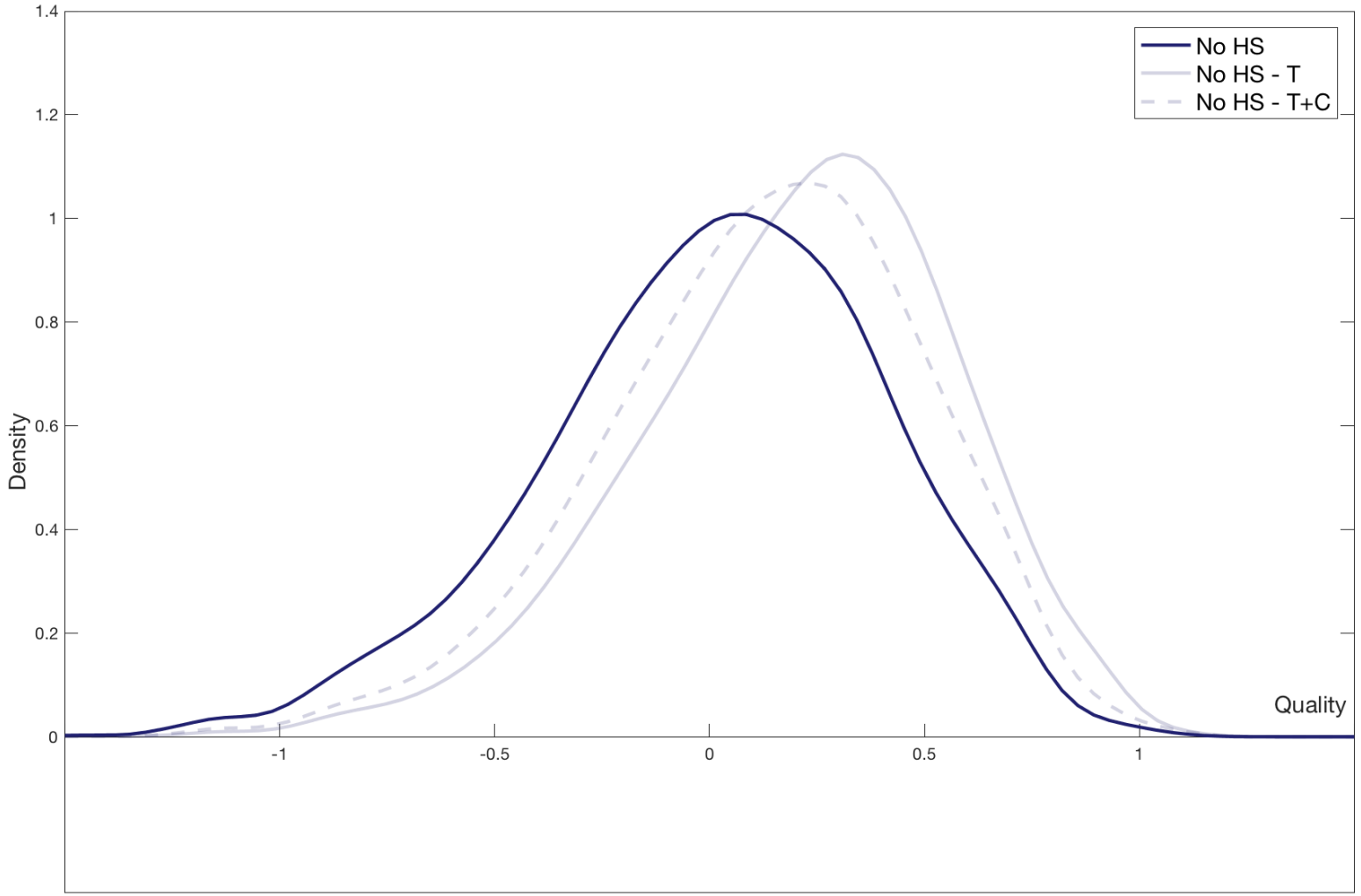
Distribution of School Quality when Policy is Expanded

We can look at the ATE for each type group



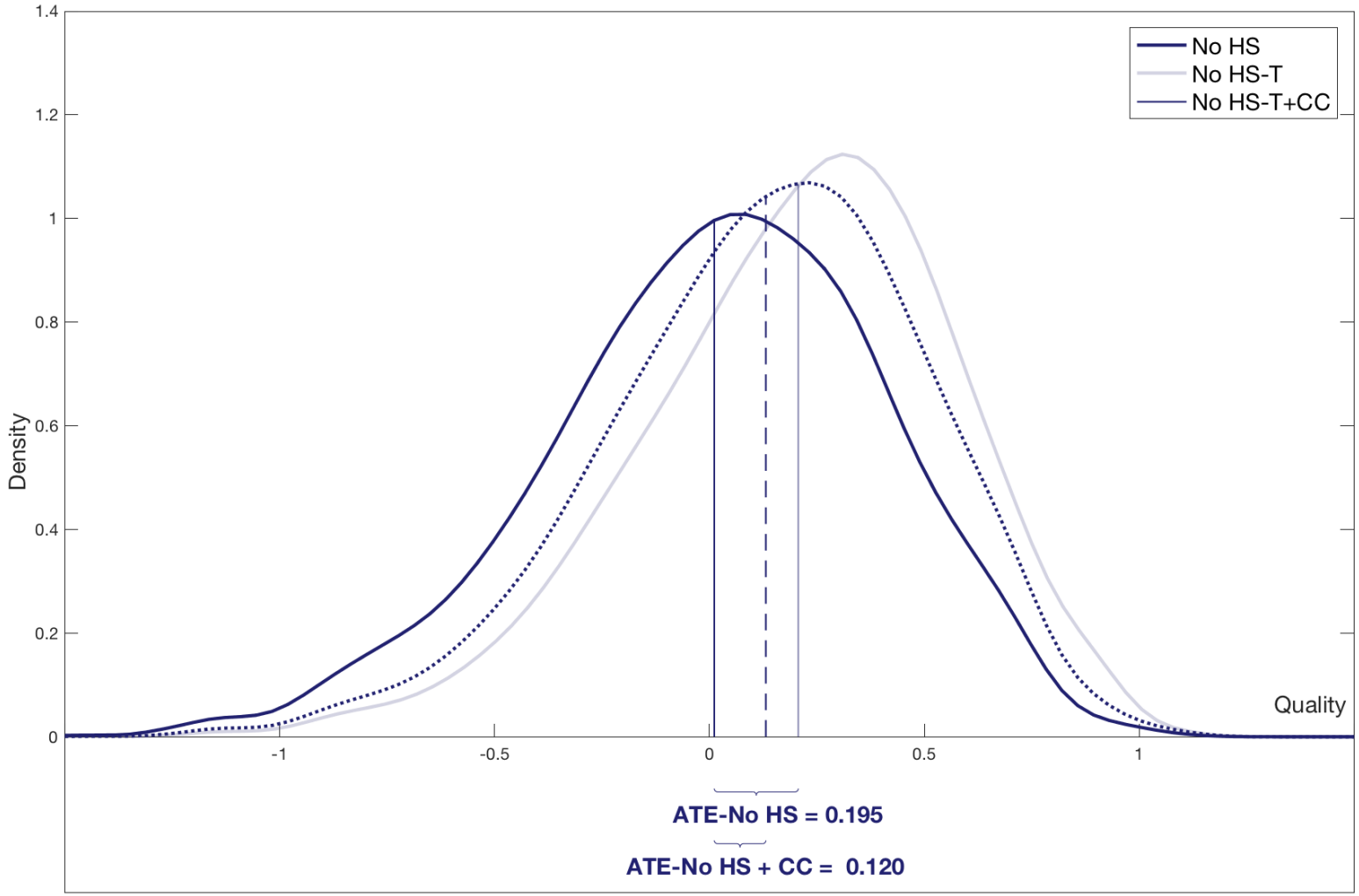
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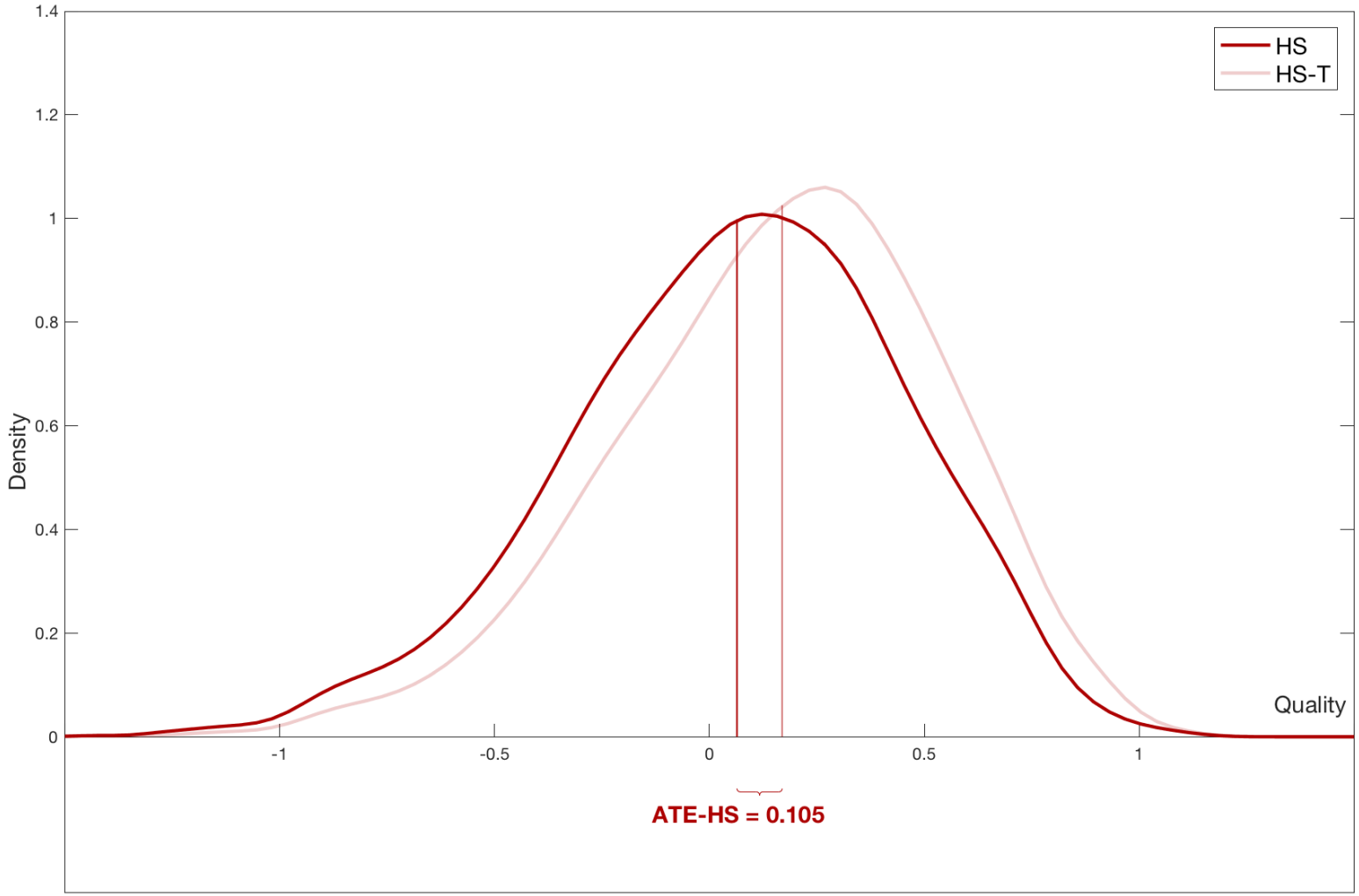
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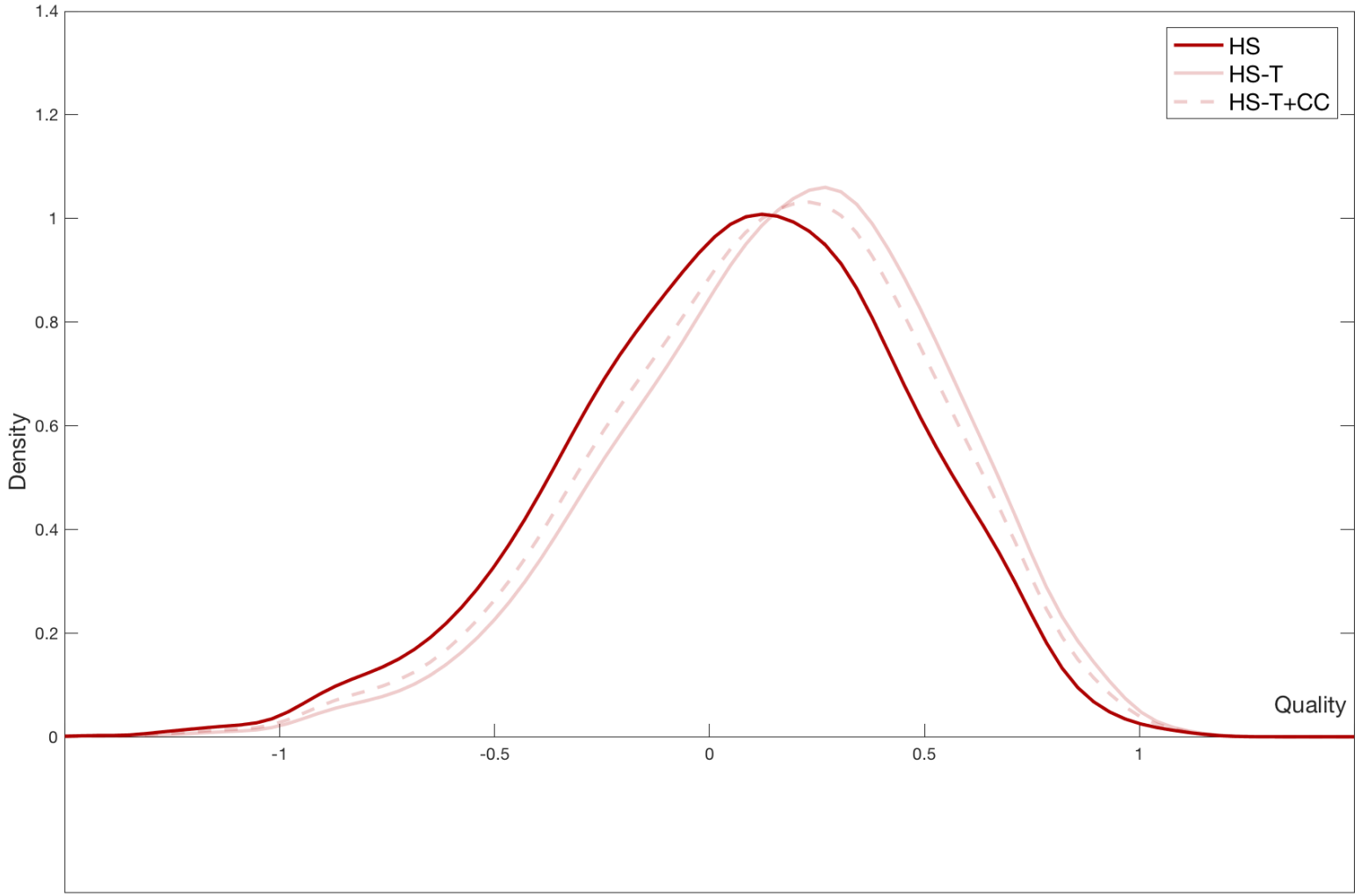
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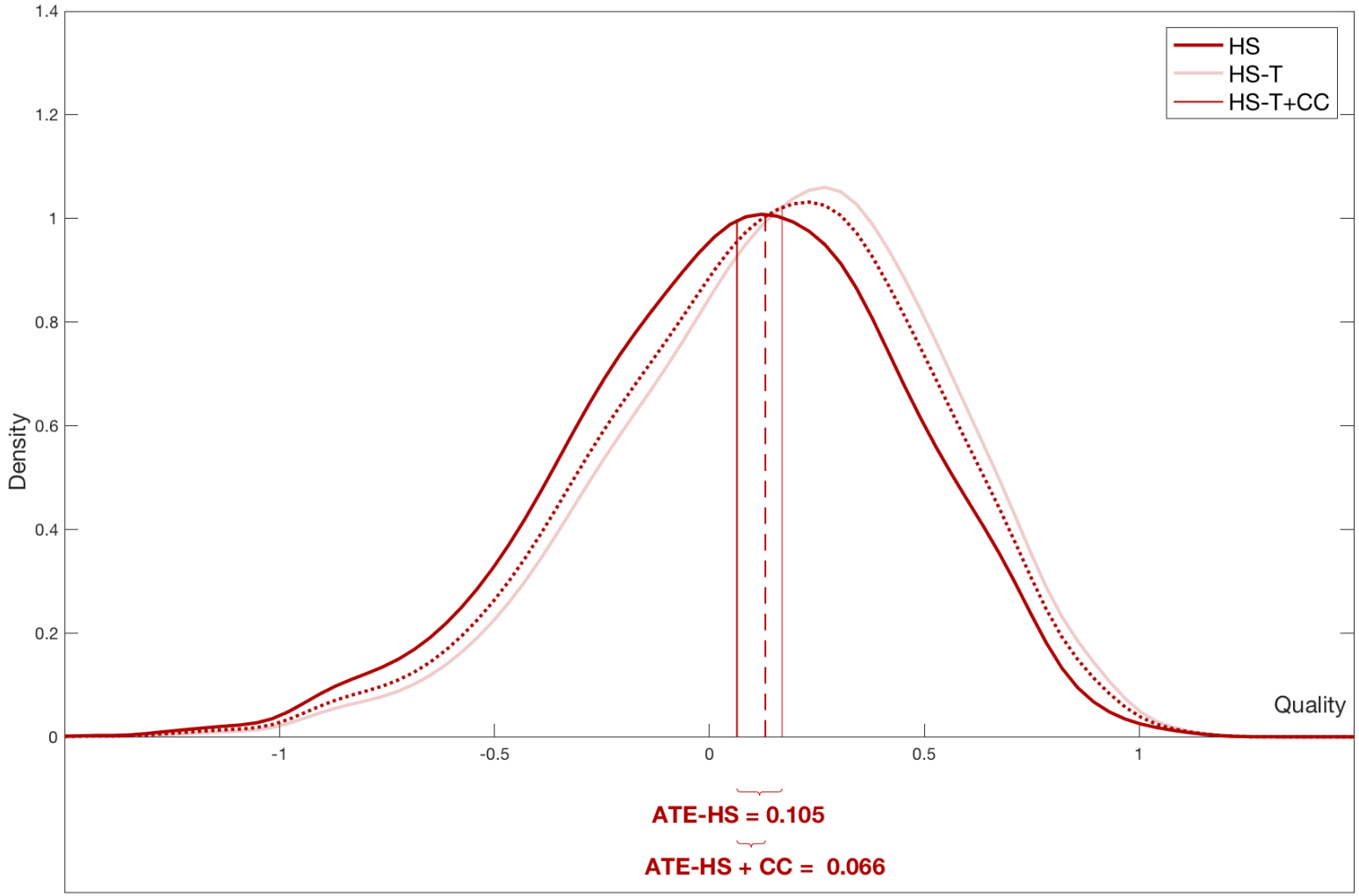
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  1. Many schools are for profit.
  2. Prior work has shown that supply side effects can be important in Chile - Neilson (2014, 2017), and information has supply side well as in other context Andrabi, Das, Kwaja (2017)

Schools as profit maximizing firms

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We model schools behavior as profit maximizing firms to get insights on what their incentives are and how they might change if the policy were to be scaled up.

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$$\frac{\partial \pi_j(\mathbf{q}, \mathbf{p}, \boldsymbol{\xi})}{\partial q_j} = N \frac{\partial s_j(\mathbf{q}, \mathbf{p}, \boldsymbol{\xi})}{\partial q_j} (v + p_j - MC(q_j)) + N s_j(\mathbf{q}, \mathbf{p}, \boldsymbol{\xi}) \cdot \gamma^q = 0 \quad (1)$$

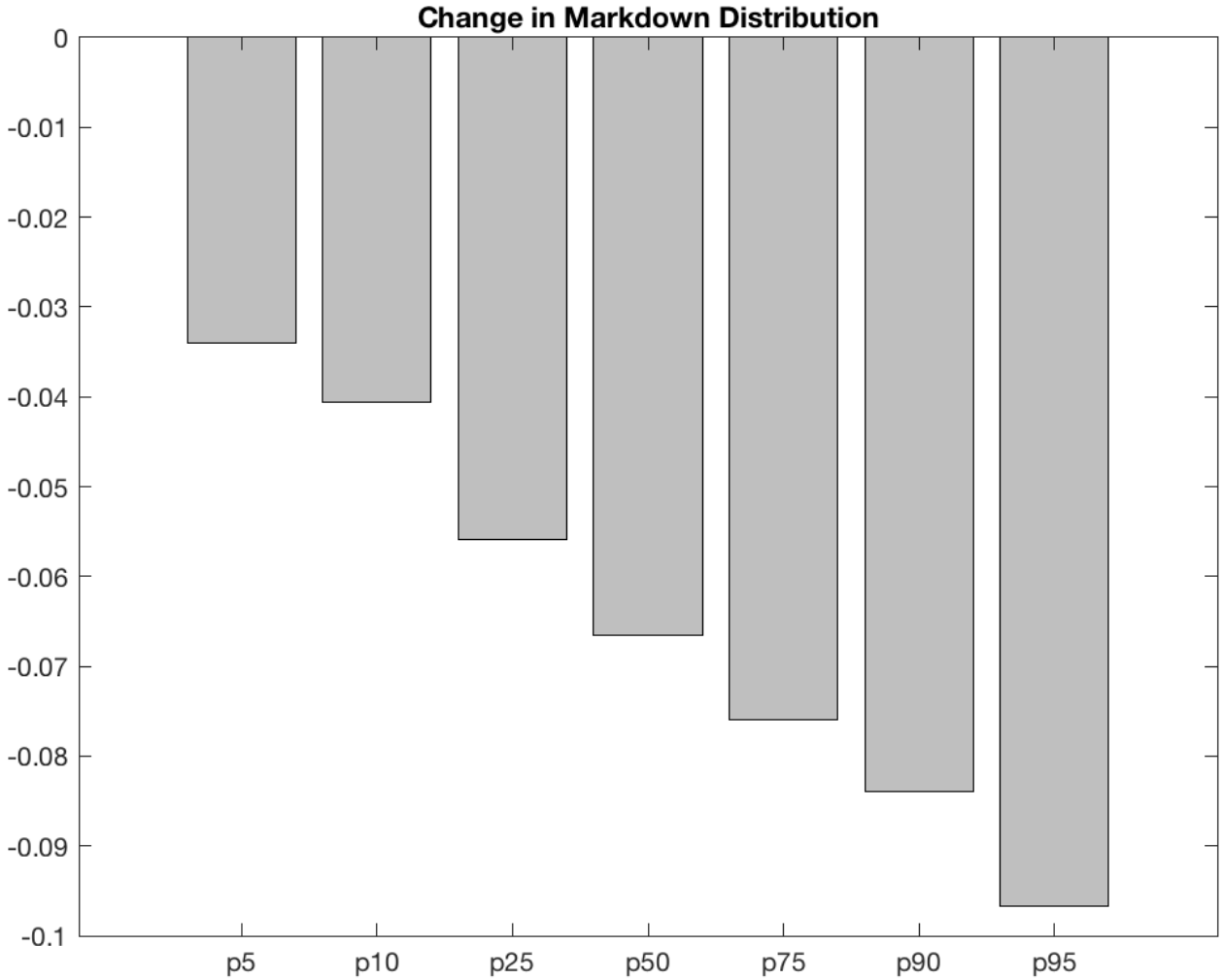
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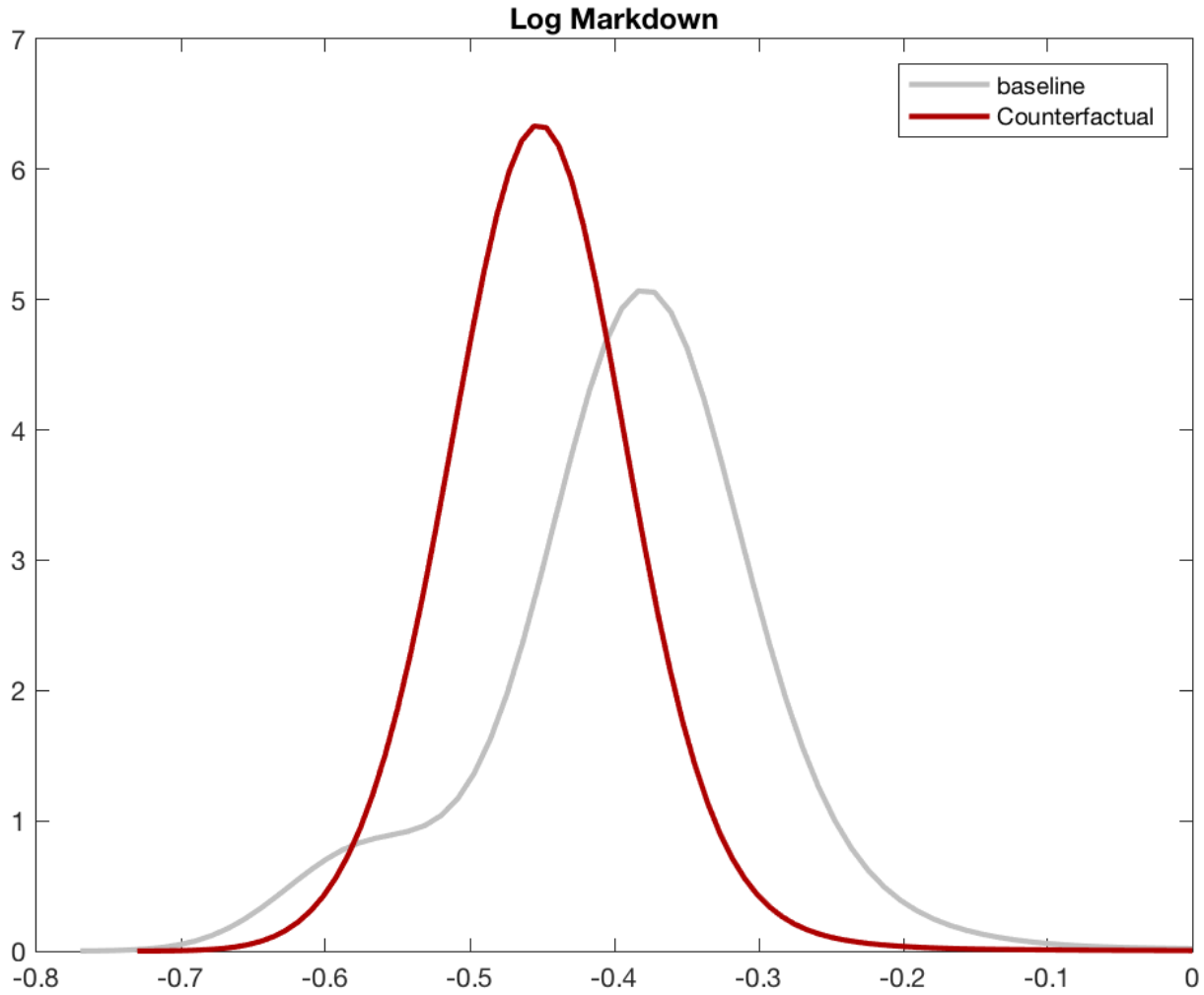
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$$\Rightarrow \quad q_j^* = \left[\frac{v + p_j - \gamma^0}{\gamma^q}\right] - \underbrace{s_j(\mathbf{q}, \mathbf{p}, \boldsymbol{\xi}) \left[\frac{\partial s_j(\mathbf{q}, \mathbf{p}, \boldsymbol{\xi})}{\partial q_j}\right]^{-1}}_{\text{Mark Down}} \tag{2}$$

Mark-down change - Percentiles



Mark-down change - plot



Supply Side Estimation

- Take advantage of variation in policy over time and costs across markets.
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  - Targeted vouchers (choice sets + transfers Details)
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- We exploit the panel nature of the data estimating persistence in marginal costs by firm.

Supply Side Moments for Estimation of Cost Parameters

From the quality FOC (using panel structure):

$$\omega_{jt}^{Q} = \left[\frac{p_{jt} + v_t - \gamma^{l} - \gamma^{q} q_{jt}}{\gamma^{q}}\right] + s_{jt}(\mathbf{q}, \mathbf{p}, \boldsymbol{\xi}) \left[\frac{\partial s_j(\mathbf{q}, \mathbf{p}, \boldsymbol{\xi})}{\partial p_j}\right]^{-1} \tag{3}$$

Supply Estimation and Experimental Results

Table: Supply Model Estimates

	Coef.	Std. Error
γ_I		
Voucher	0.1244	0.0137
Public	0.6482	0.0742
For Profit	0.2466	0.0882
Religious	-0.1035	0.0651
Constant (Mean Market FE)	0.4394	-
γ_q		
Constant (Mean Firm FE)	1.5767	-

Figure: Market Fixed Effects

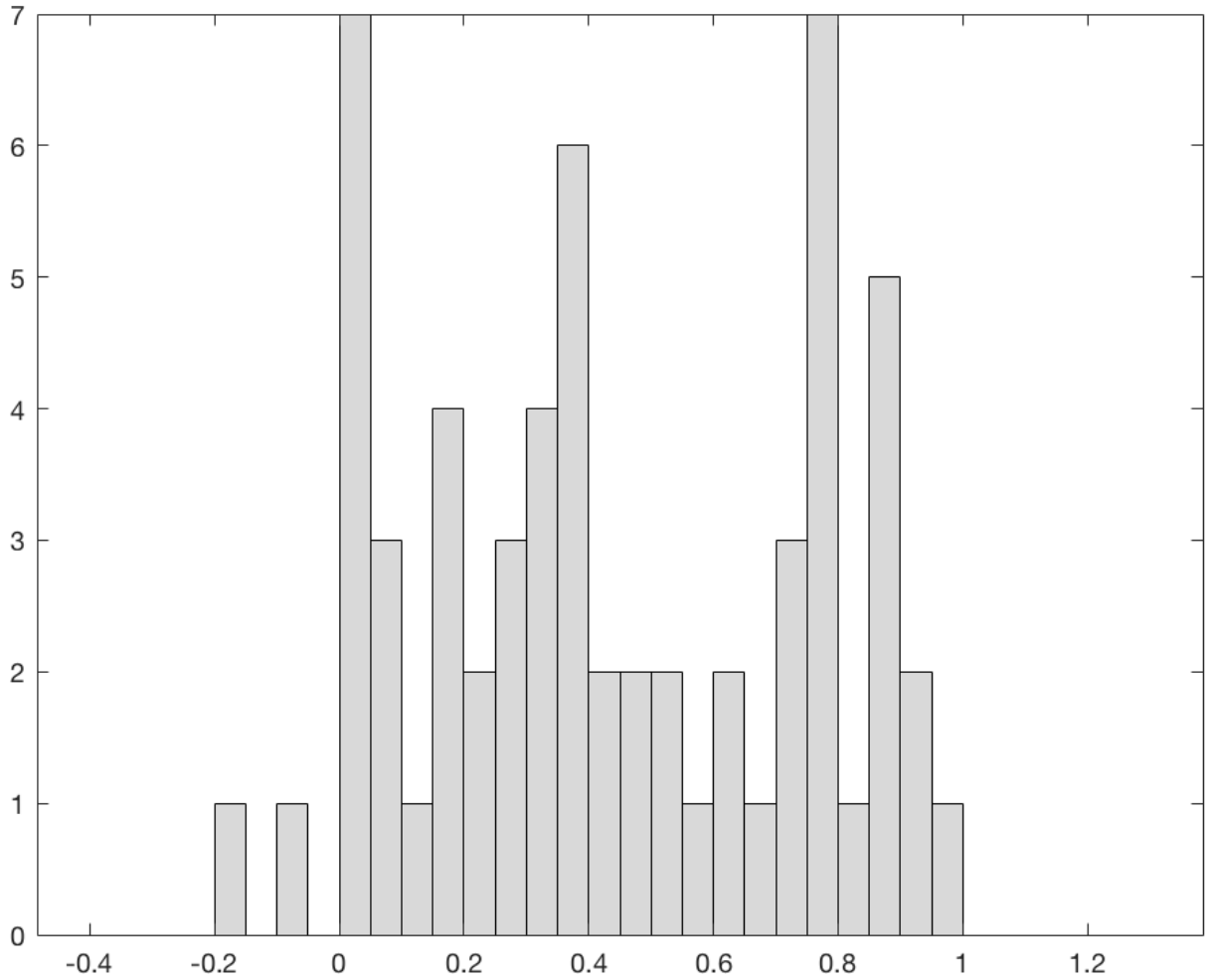
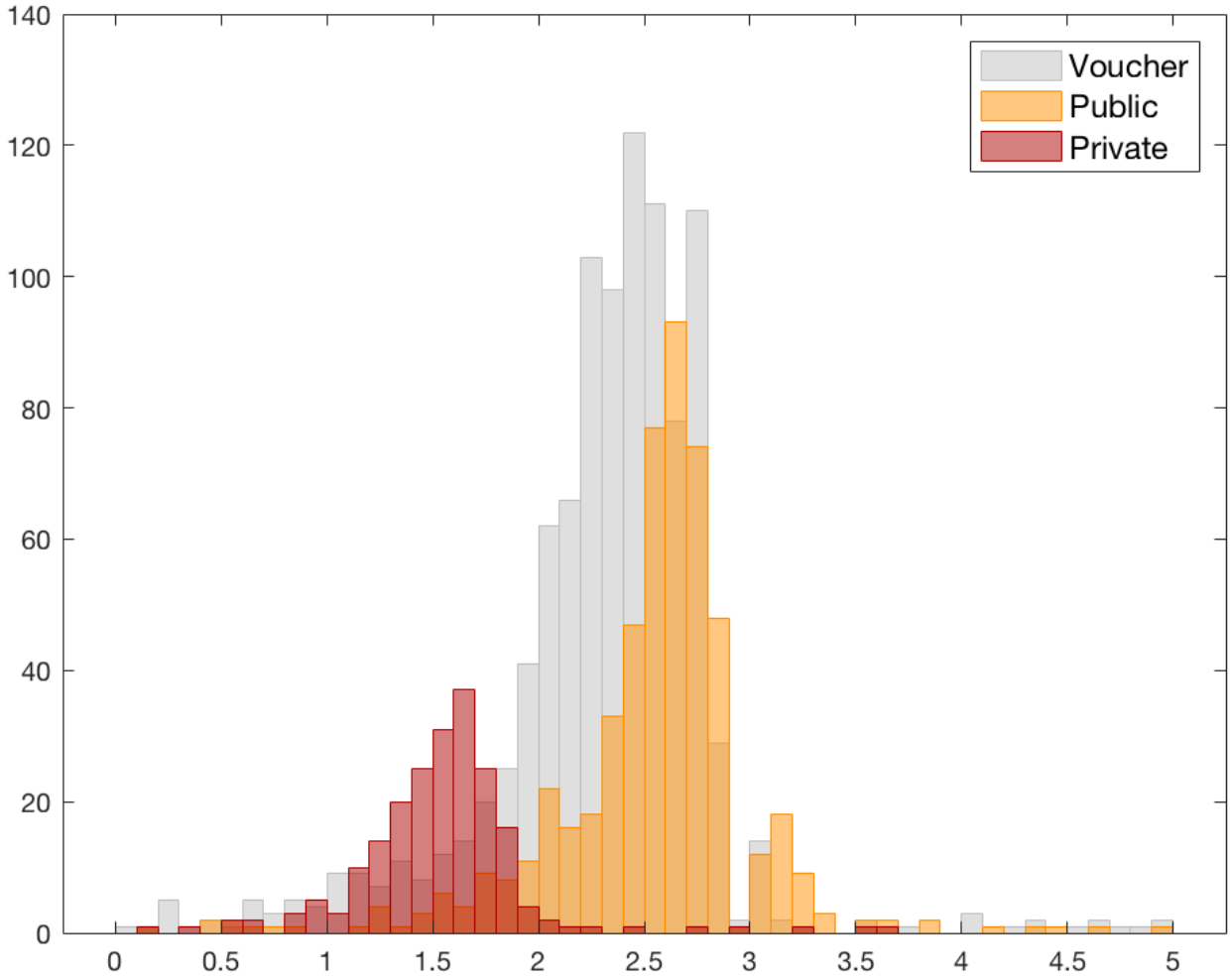
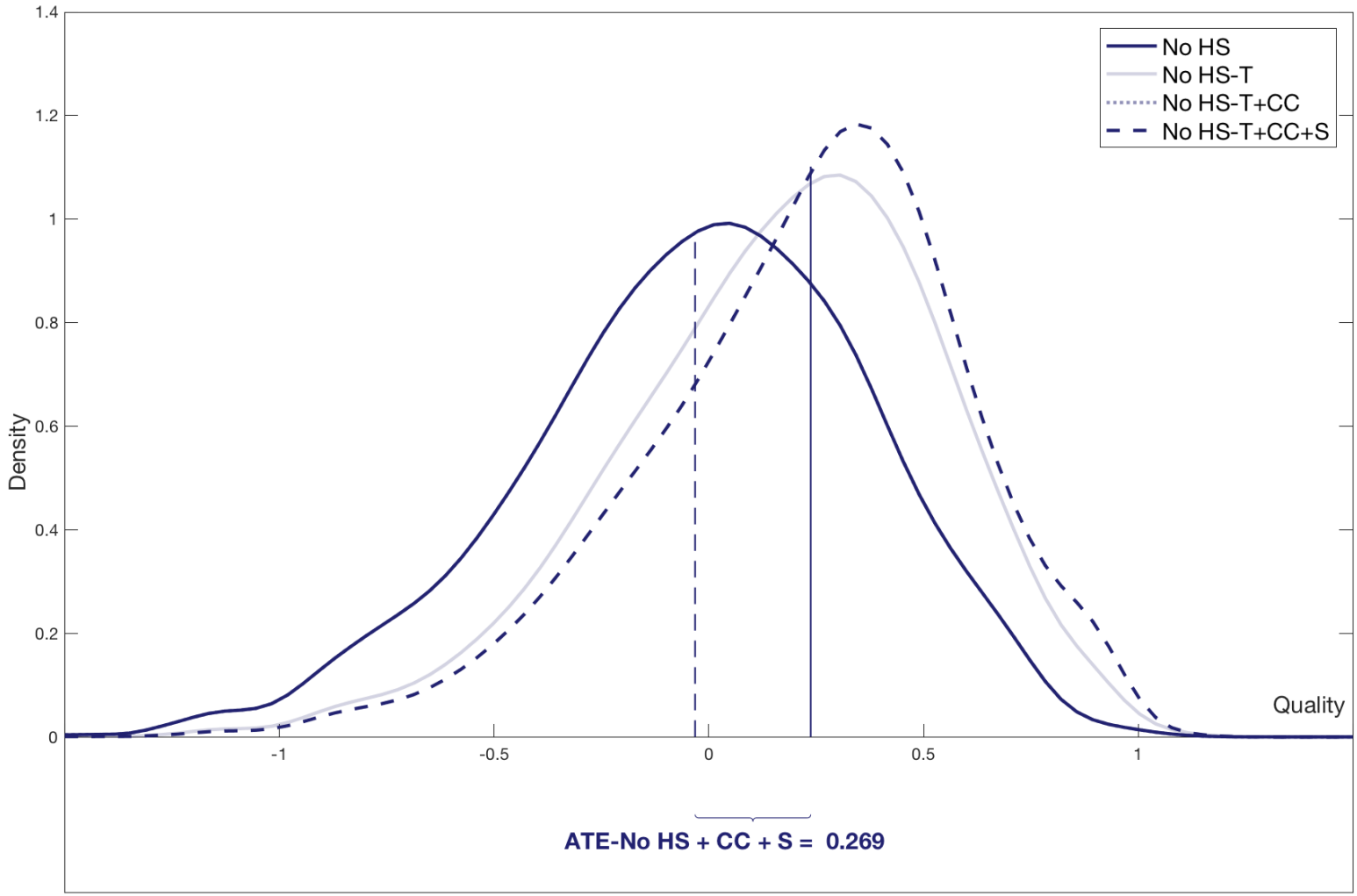


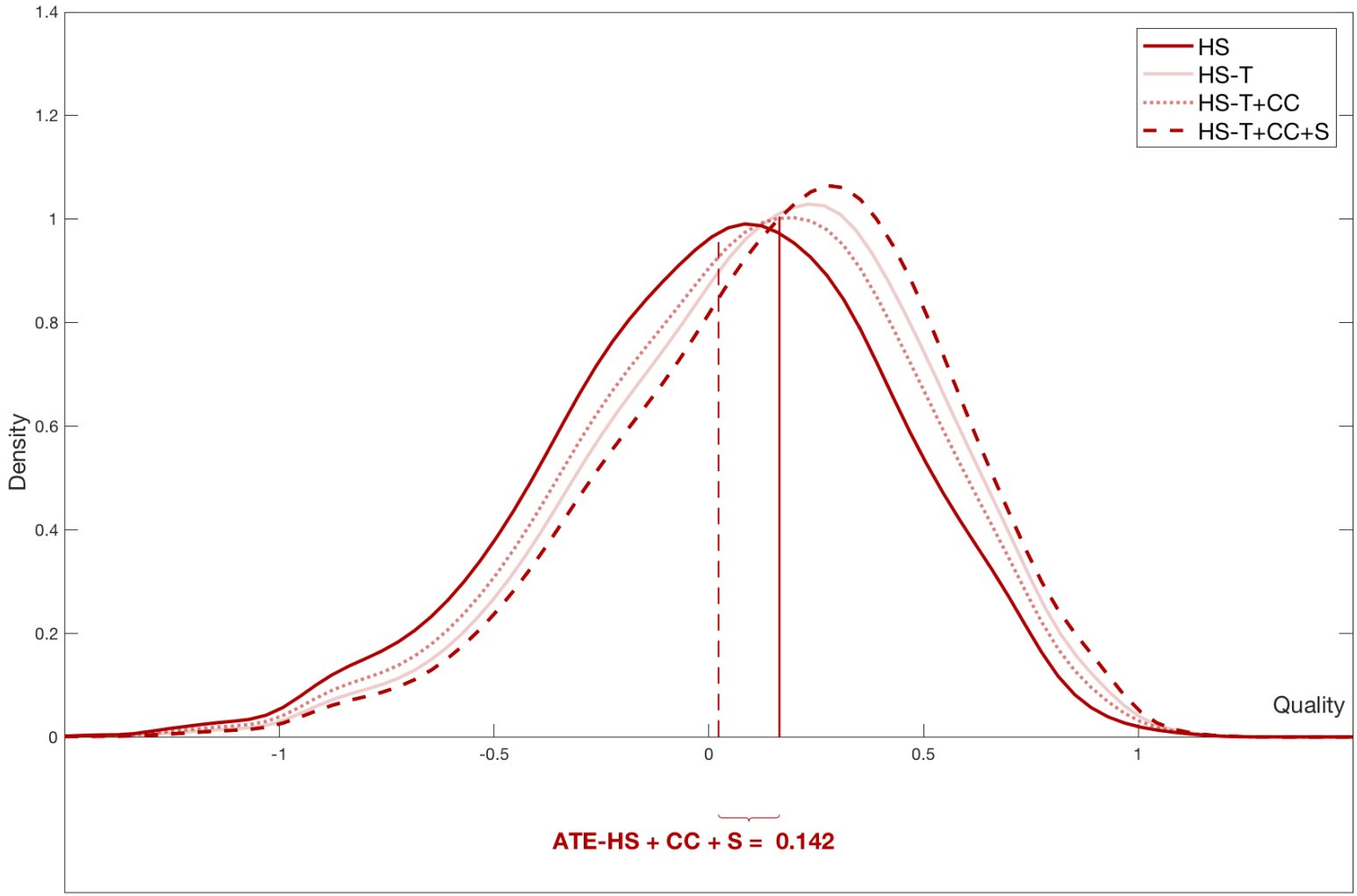
Figure: Firm Fixed Effects



Supply Responses when Policy is Expanded



Supply Responses when Policy is Expanded



Counterfactuals Summary

Table: ATE for Counterfactuals

	Experiment	Model		
	ATE	ATE	ATE+CC	ATE+CC+S
All (No HS, HS and College Mom)	-	0.096	0.061	0.133
No HS Mon	0.125	0.199	0.119	0.269
HS Mom	0.045	0.107	0.066	0.142
College Mom	-	0.000	-0.016	0.017

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4 We provide a range of expected policy effects that take into account past behavior of families and schools

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Now we know what are the main forces affecting scale up and have a quantitative prediction to give policy advice.

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  - Adding supply side model allows for additional feedback effects lifting outcomes for poorest students.
- Getting a clean RCT is hard. Researchers should get the most out of the ones that do work!

Accumulated VA Choice

Table: Effect of Treatment on Accum. VA Choice - 4th

	Accum. VA 1 - Poor		Accum. VA 2 - Poor		Accum. VA 1 - Ever Poor	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Full Sample						
Treatment	0.140	0.119	0.125	0.116	0.140	0.119
	(0.112)	(0.111)	(0.109)	(0.109)	(0.107)	(0.109)
N obs.	1267	1112	1267	1112	1267	1112
Panel B: Enrolled sample						
Treatment	-0.151	-0.088	-0.147	-0.087	-0.137	-0.076
	(0.198)	(0.185)	(0.190)	(0.179)	(0.202)	(0.188)
N obs.	450	443	450	443	450	443
Panel C: Not enrolled sample						
Treatment	0.337**	0.333**	0.329**	0.338**	0.327***	0.329**
	(0.136)	(0.141)	(0.134)	(0.138)	(0.126)	(0.136)
N obs.	695	669	695	669	695	669
Randomization controls	×		×		×	
Expanded controls		×		×		×

Note: Randomization controls include market characteristics of schools (number and test scores mean, standard deviation and percentiles 25, 50 and 75.). Expanded controls include Mother's education, household information (size, durable goods, owned house), baseline school choice information.

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Results on School Choice - Price

Table: Effect of Treatment on Price Chosen

	School Positive Price		OOP Positive Price		OOP Price	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Full Sample						
Treatment	0.070*	0.076**	-0.003	0.005	0.035	0.063
	(0.037)	(0.034)	(0.028)	(0.023)	(0.088)	(0.076)
N obs.	1545	1355	1545	1355	1541	1352
Panel B: Already enrolled						
Treatment	-0.002	0.000	-0.006	-0.012	0.073	0.050
	(0.055)	(0.057)	(0.054)	(0.051)	(0.167)	(0.154)
N obs.	536	527	536	527	534	525
Panel C: Not enrolled						
Treatment	0.157***	0.159***	0.036	0.036	0.104	0.104
	(0.043)	(0.041)	(0.038)	(0.033)	(0.117)	(0.099)
N obs.	861	828	861	828	860	827
Randomization controls	×		×			
Expanded controls		×		×		

Note: Randomization controls include market characteristics of schools (number and test scores mean, standard deviation and percentiles 25, 50 and 75.). Expanded controls include Mother's education, household information (size, durable goods, owned house), baseline school choice information.

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Results on School Choice - Test Scores

Table: Effect of Treatment on Test Scores Chosen - All

	Language 2nd		Average 4th		4th Lang		4th Math	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Full Sample								
Treatment	0.016	0.029	0.026	0.027	0.027	0.027	0.025	0.028
	(0.023)	(0.020)	(0.030)	(0.028)	(0.030)	(0.027)	(0.031)	(0.030)
N obs.	1543	1353	1545	1355	1545	1355	1545	1355
Panel B: Enrolled sample								
Treatment	-0.015	-0.018	-0.034	-0.043	-0.016	-0.026	-0.051	-0.060
	(0.042)	(0.039)	(0.050)	(0.047)	(0.047)	(0.044)	(0.055)	(0.054)
N obs.	536	527	536	527	536	527	536	527
Panel C: Not enrolled sample								
Treatment	0.050*	0.058**	0.066*	0.070**	0.051	0.054	0.081**	0.087**
	(0.028)	(0.029)	(0.034)	(0.035)	(0.033)	(0.033)	(0.037)	(0.039)
N obs.	859	826	861	828	861	828	861	828
Randomization controls	×		×		×			
Expanded controls		×		×		×		

Note: Randomization controls include market characteristics of schools (number and test scores mean, standard deviation and percentiles 25, 50 and 75.). Expanded controls include Mother's education, household information (size, durable goods, owned house), baseline school choice information.

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Results on School Choice - Value Added

Table: Effect of Treatment on Value Added Chosen

	VA 1 - Poor		VA 2 - Poor		VA 1 - Ever Poor	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Full Sample						
Treatment	0.031	0.033	0.027	0.032	0.028	0.030
	(0.028)	(0.028)	(0.027)	(0.027)	(0.027)	(0.028)
N obs.	1538	1349	1538	1349	1545	1355
Panel B: Enrolled sample						
Treatment	-0.069	-0.051	-0.071	-0.053	-0.070	-0.052
	(0.053)	(0.050)	(0.051)	(0.050)	(0.053)	(0.051)
N obs.	535	526	535	526	536	527
Panel C: Not enrolled sample						
Treatment	0.083**	0.084**	0.081**	0.084**	0.080**	0.083**
	(0.033)	(0.035)	(0.033)	(0.034)	(0.031)	(0.033)
N obs.	856	823	856	823	861	828
Randomization controls	×		×		×	
Expanded controls		×		×		×

Note: Randomization controls include market characteristics of schools (number and test scores mean, standard deviation and percentiles 25, 50 and 75.). Expanded controls include Mother's education, household information (size, durable goods, owned house), baseline school choice information.

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Balance - Enrolled

Table: Balance for Being Enrolled at Baseline

	Enrolled		Constant	
	(1)		(2)	
Panel A: SES characteristics				
Household size	-0.035	(0.108)	4.927***	(0.081)
Durable goods	0.382***	(0.116)	4.461***	(0.080)
Owns Dwelling	0.047	(0.031)	0.343***	(0.019)
Mother head of hh	0.001	(0.030)	0.832***	(0.014)
Mother NHS	-0.010	(0.022)	0.192***	(0.016)
Mother HS	-0.039	(0.025)	0.391***	(0.019)
Mother HE	0.007	(0.019)	0.836***	(0.016)
Poor	-0.013	(0.016)	0.895***	(0.011)
Another child in primary	0.010	(0.029)	0.405***	(0.018)
Panel B: Birth characteristics				
Gestation Weeks	-0.019	(0.094)	38.751***	(0.056)
Birth Weight	-3.982	(25.338)	3,342.137***	(15.176)
Mother's Age	0.329	(0.364)	25.332***	(0.232)
Father's Age	-1.646	(1.217)	36.472***	(0.933)
Marital Status	-0.021	(0.023)	1.735***	(0.014)
Doctor	-0.011	(0.024)	0.333***	(0.015)
Hospital	0.014*	(0.008)	0.959***	(0.006)
Number of Children	0.102	(0.087)	1.871***	(0.035)

Notes: Column 1 presents the coefficient of the regression each variable on an indicator for being

Results on School Choice - Distance

Table: Effect of Treatment on Distance Traveled

	Distance Traveled	
	(1)	(2)
Panel A: Full Sample		
Treatment	0.370*	0.245
	(0.198)	(0.194)
N obs.	1545	1355
Panel B: Already enrolled		
Treatment	-0.087	-0.265
	(0.384)	(0.375)
Panel c: Not enrolled		
Treatment	0.520**	0.440**
	(0.207)	(0.221)
N obs.	861	828
Randomization controls	×	
Expanded controls		×

Note: Randomization controls include market characteristics of schools (number and test scores mean, standard deviation and percentiles 25, 50 and 75.). Expanded controls include Mother's education, household information (size, durable goods, owned house), baseline school choice information.

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