Approximating The Equilibrium Effects of Informed School Choice

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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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- 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 (tba) in Peru.

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

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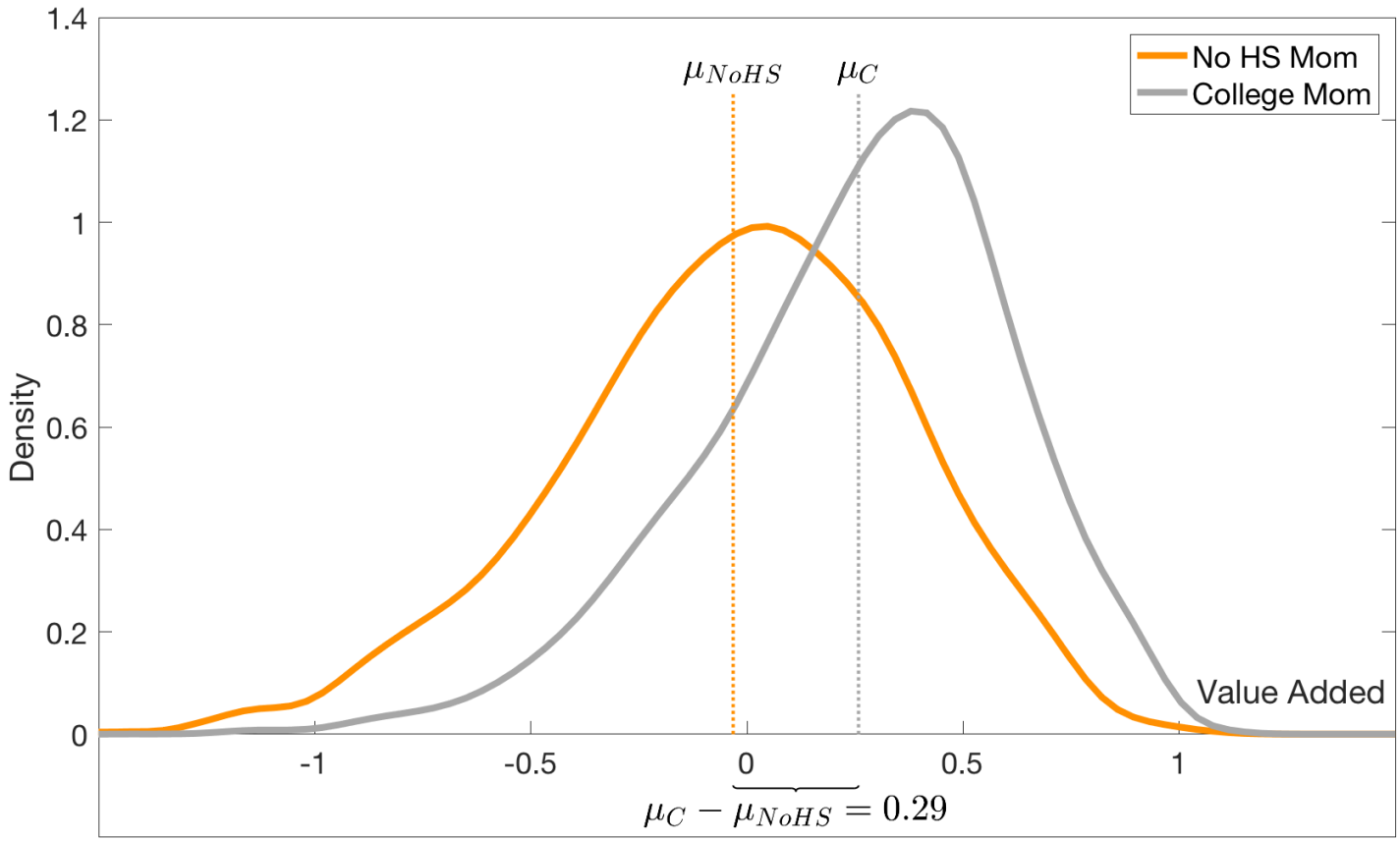
- Vouchers and current regulation make attending better schools accessible but in the aggregate many poorer low SES students attend low performing and low value added schools.
- Government is interested in promoting information in education markets via *Mas informacion, mejor educacion* program of Minister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

Inequality of School Quality



Teachers VA

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

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- An informative report card with emphasis on location, price and test scores.
- A motivational video was shown with emphasis on the importance of the choice.
- 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.

Choosing a School Carefully is Important

Think of your child's future.

Think of your child's education.

Think of your child's future job.

High average return to attending college.

Choosing a School Carefully is Important

Silvia searched carefully for a school that was good for her son.

Felix went to a good school and now is in college.

Rose Marie went to a good school, now is working at a bank.

Personalized Informative Card : Local Options

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
23	Escuela Salomon Sack	215	8,00	No Cobra Mensualidad
24	Escuela Básica Lo Valledor	212	24,25	No Cobra Mensualidad
25	Escuela Republica De Las Filipinas	206	-18,25	No Cobra Mensualidad
26	Escuela Especial Particular Despertar De	204	s/i	No Cobra Mensualidad
27	Escuela Básica Saint Phillip Of Nery	202	-10,50	Menos de 5.000
28	Escuela Básica Republica De Indonesia	200	-16,75	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.**

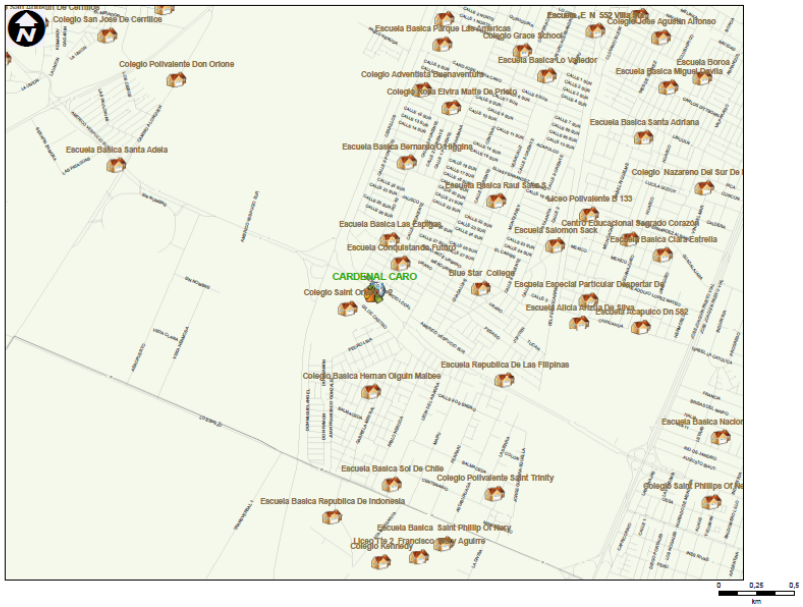
Puntajes **BAJO el Promedio Nacional.**

El Promedio Nacional es de **250 puntos**

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

INGRESO A ENSEÑANZA BÁSICA

Jardín Cardenal Caro



Treatment and control groups for Santiago

Sample Size: 133 preschools across three regions.

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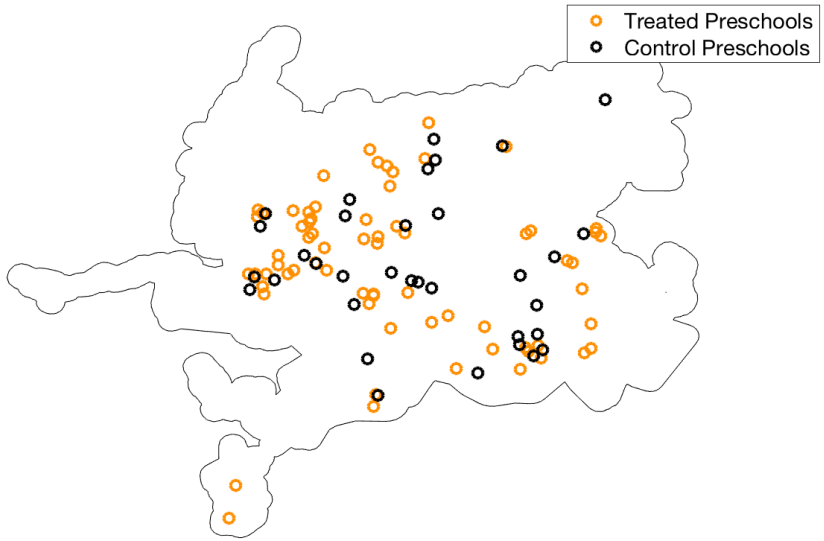

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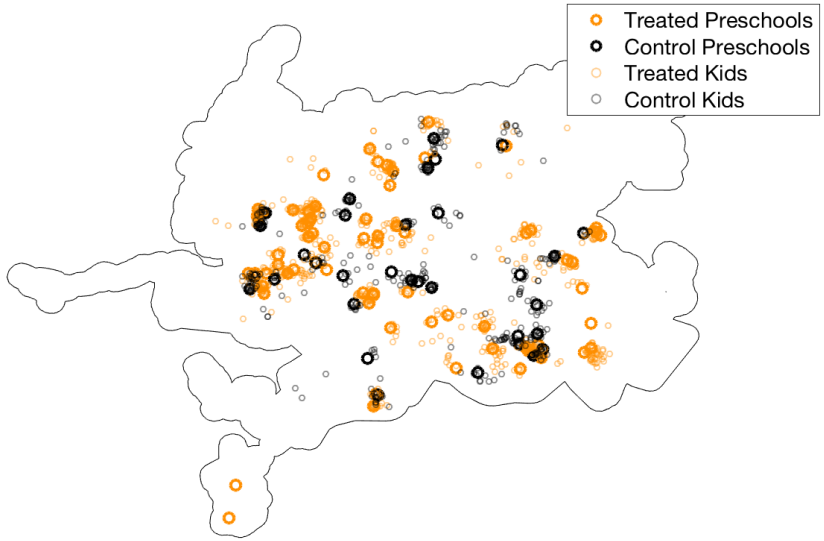

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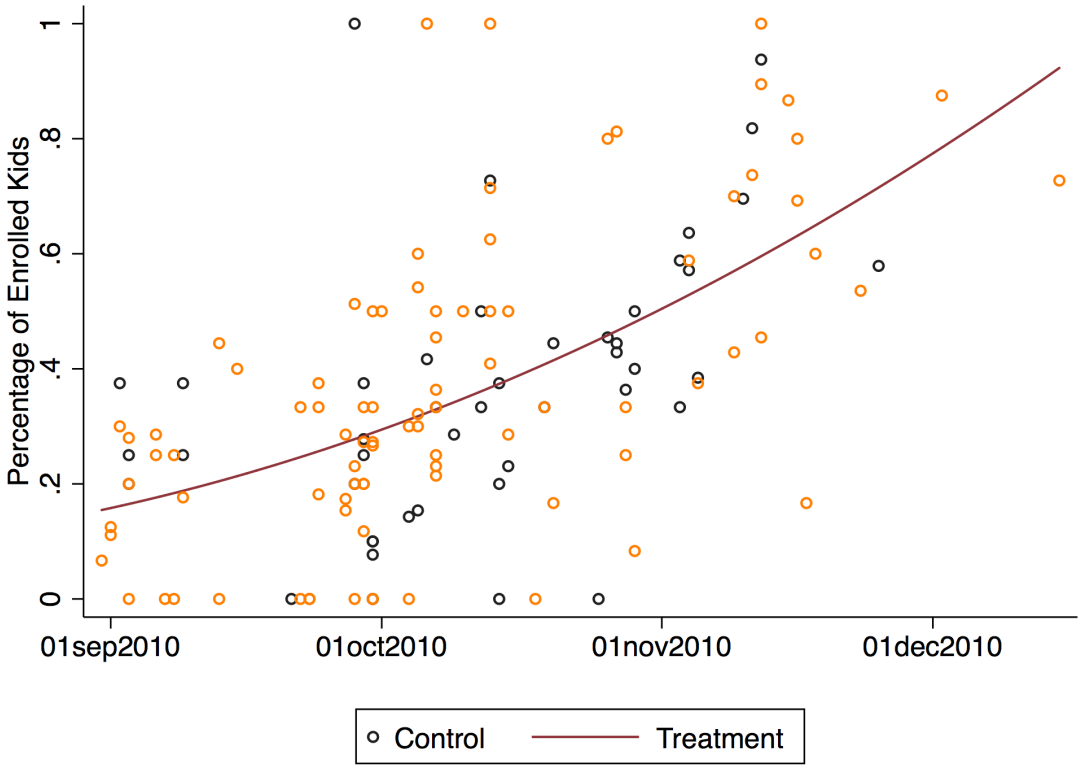
Timing: Visited preschools over three months.



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Results on School Choice and Outcomes

			Characteristics of Chosen Schools				Student Own Test Scores	
	Distance	Price > 0	Lang 2nd	Lang 4th	Math 4th	VA	Lang 4th	Math 4th
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Full Sample								
Treatment	0.1371**	0.0438	0.0108	0.0107	0.0147	0.0274	0.0617	0.1298**
	(0.0595)	(0.0354)	(0.0224)	(0.0275)	(0.0293)	(0.0273)	(0.0612)	(0.0556)
N obs.	1,378	1,775	1,758	1,752	1,752	1,752	1,443	1,442
Panel B: Already enrolled								
Treatment	-0.0843	0.0091	-0.0123	-0.0097	-0.0348	-0.0320	-0.1247	-0.0635
	(0.1234)	(0.0522)	(0.0430)	(0.0489)	(0.0570)	(0.0496)	(0.1211)	(0.1036)
N obs.	487	596	589	590	590	590	506	495
Panel C: Not enrolled								
Treatment	0.2390***	0.1198***	0.0591**	0.0377	0.0658*	0.0718**	0.2163**	0.2210***
	(0.0658)	(0.0399)	(0.0268)	(0.0323)	(0.0386)	(0.0345)	(0.0898)	(0.0723)
N obs.	780	975	967	961	961	962	772	779

Note: Randomization controls are used, which include market characteristics of schools (number and test scores mean, standard deviation and percentiles 25, 50 and 75.). Column (1) restrcits observations to students travelling less than 4 km. Value Added in column (6) corresponds to version 4 in Appendix Table 3.

Summary of RCT Results

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$\Rightarrow$ How do we take these results small scale ATE and think about potential policy effects of a scale up?

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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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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.

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

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

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

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Consumers also vary by their unobservable preference for school quality v_i^q.

Determining the Distribution of School Quality Attended

The market share of a given school j will be :

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

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

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We combine **aggregate**, **IV** and **micro moments** from administrative data in estimation following the literature. Berry (1994), BLP (1995), Petrin (2002), BLP (2004), and for this setting see Neilson (2017).

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We combine **aggregate**, **IV** and **micro moments** from administrative data in estimation following the literature. Berry (1994), BLP (1995), Petrin (2002), BLP (2004), and for this setting see Neilson (2017).

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

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To generate these moments we map observations in the experimental sample to nodes on the map and types.
We simulate 1000 samples of unobservables for the experimental sample and use the simulated choices to run regresstions

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

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

Summary of Moments

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Experiment moments : $\overline{M^T} = M(\theta, T)$
Model needs to replicate the β ITT observed in the experiment. Moments

Table: Demand Model Estimates

φ_k^q - Weight on Quality	
Quality	1.37†
Mother HS	1.57†
Mother College	1.89†
Poor Household	-0.58†
Treated Mother No HS	0.58†
Treated Mother hspace	0.22†
φ_k^p - Weight on Price	
Mother No HS	-9.89†
Mother HS	-2.84†
Mother College	-0.01†
Poor Household	-3.31†
Treated Mother No HS	7.74†
Treated Mother HS	1.01†
φ_k^d - Weight on Distance	
Mother No HS	-0.99†
Mother HS	-0.70†
Mother College	-0.38†
Poor Household	-0.21†
Treated Mother No HS	0.44†
Treated Mother HS	0.35†
σ - Quality	0.13†

Note: † indicates significance at 0.01 confidence level.

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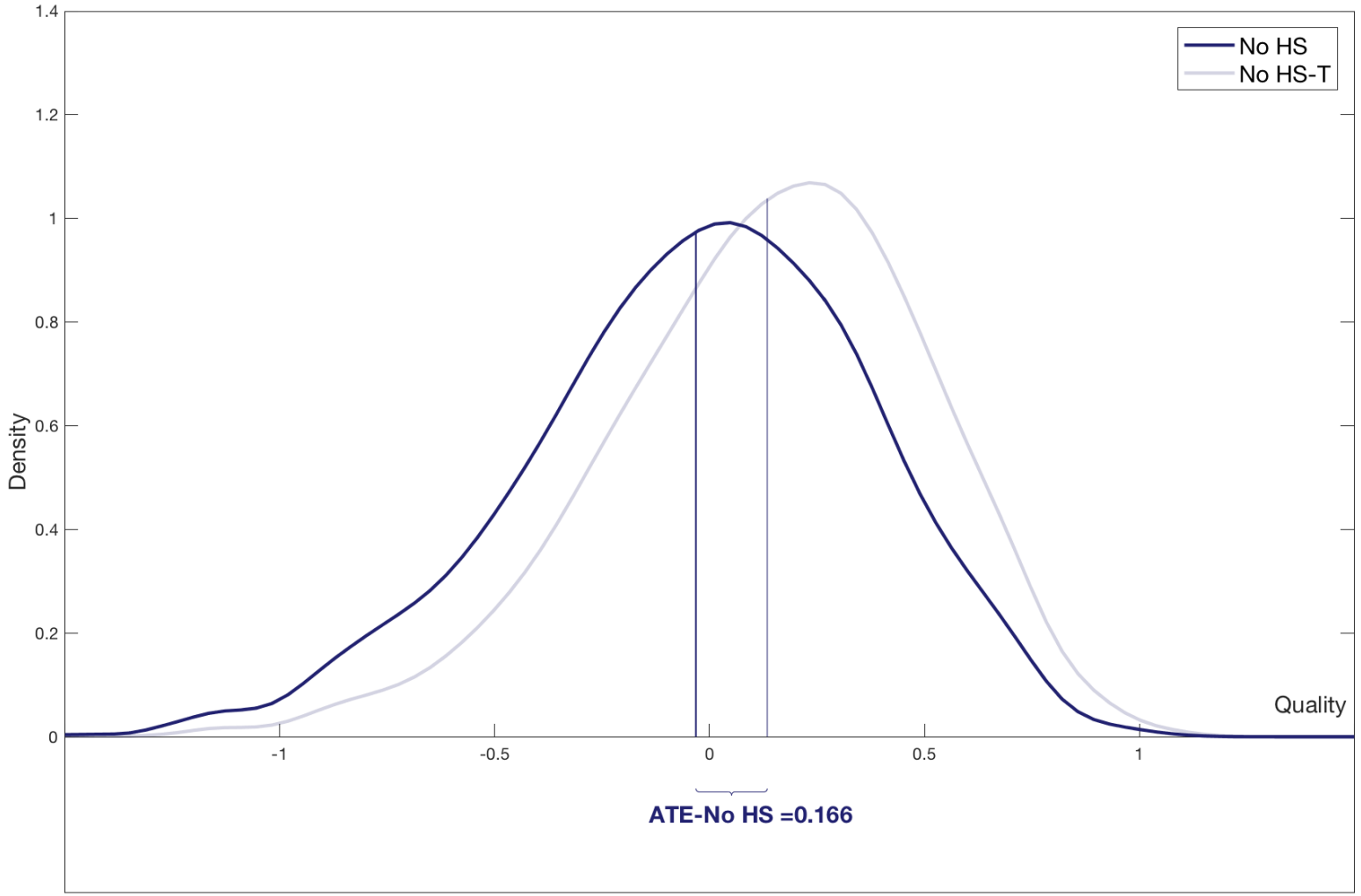
  - Based on preferences from the model, we simulated rank order lists.
  - We solve excess of demand by using a DA centralized mechanism. This is a reasonable counterfactual, as Chile implementated such admission system in 2017.

Distribution of School Quality when Policy is Expanded

We can look at the ATE for each type group



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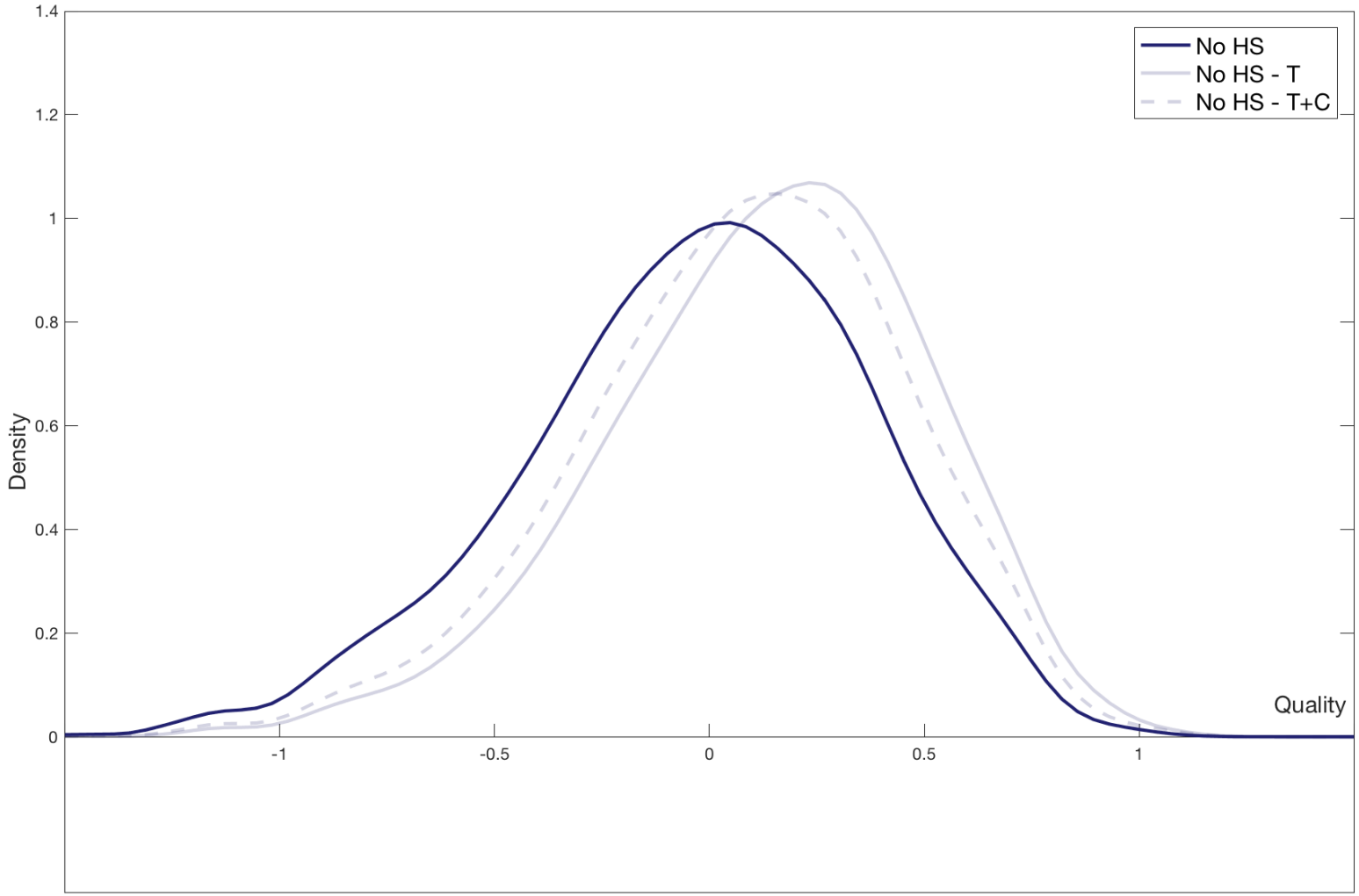

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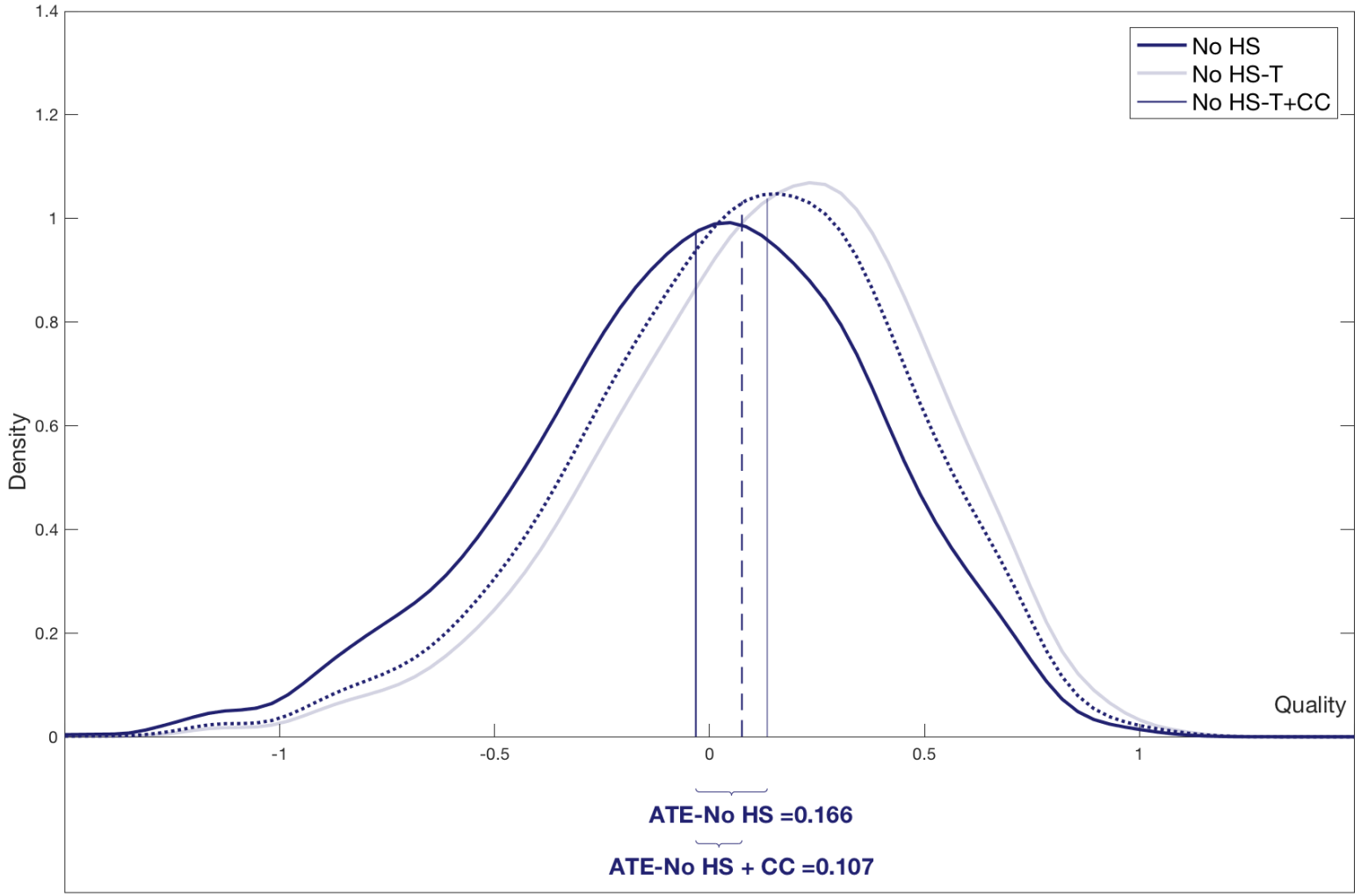

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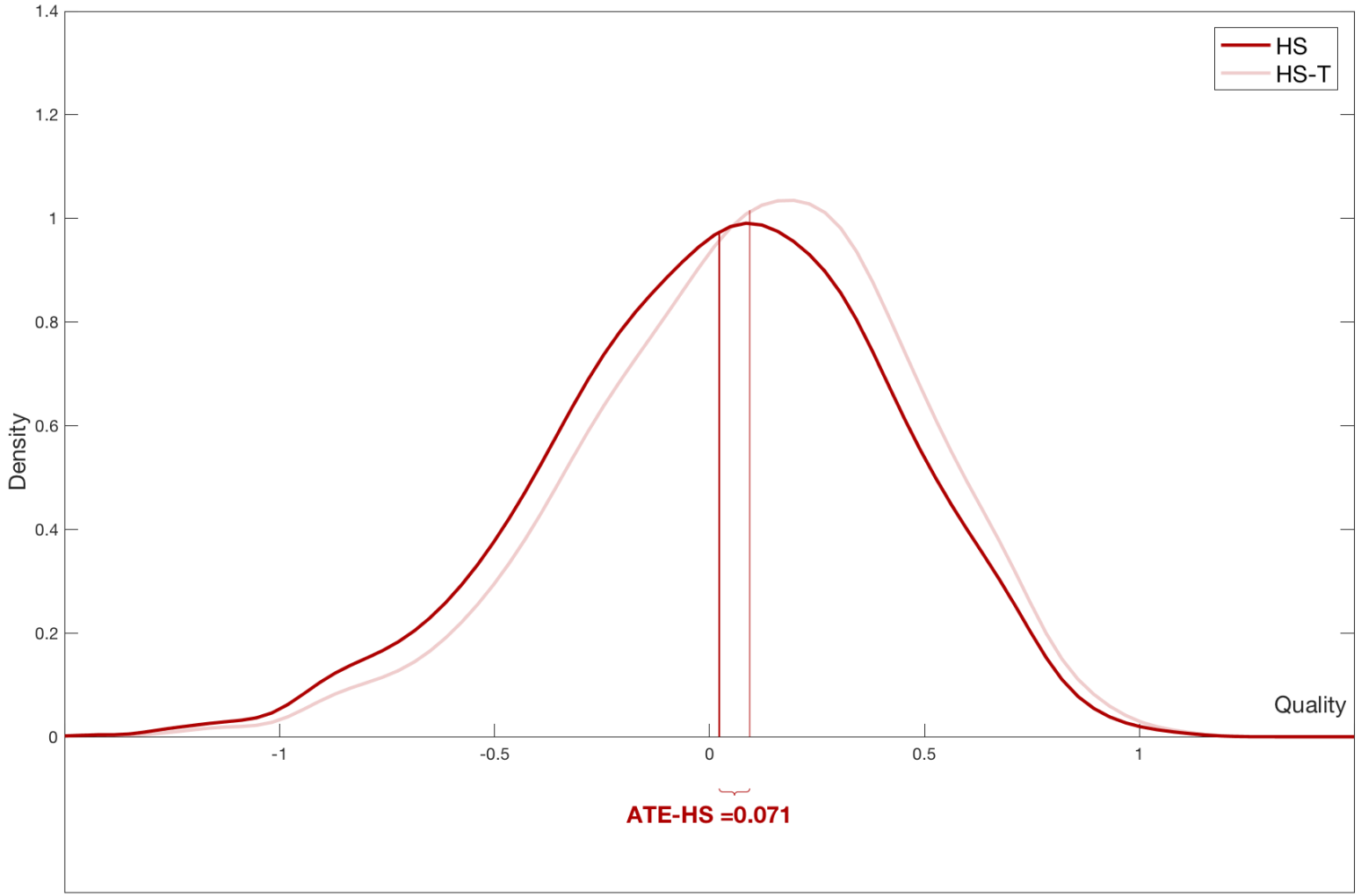

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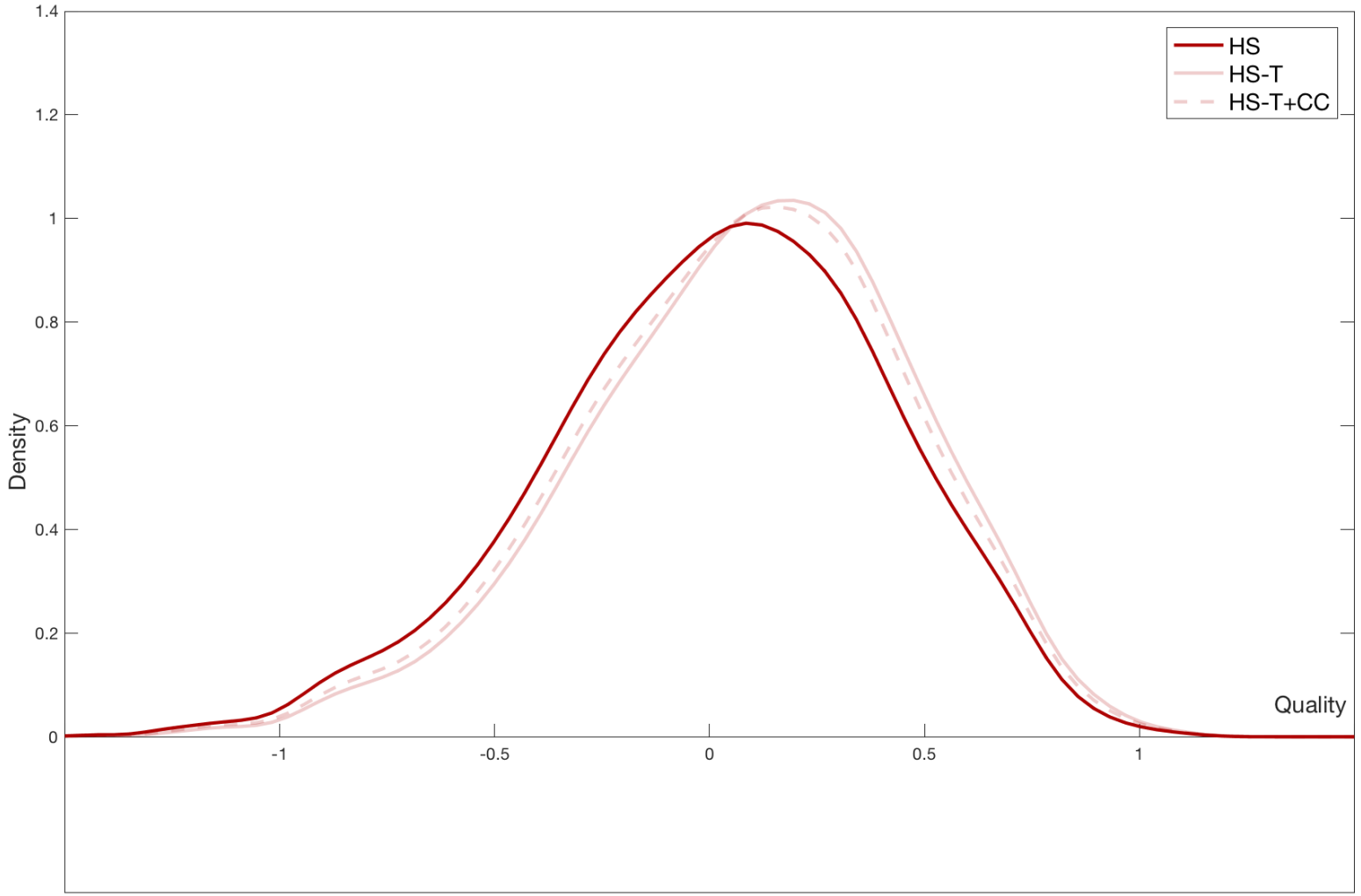

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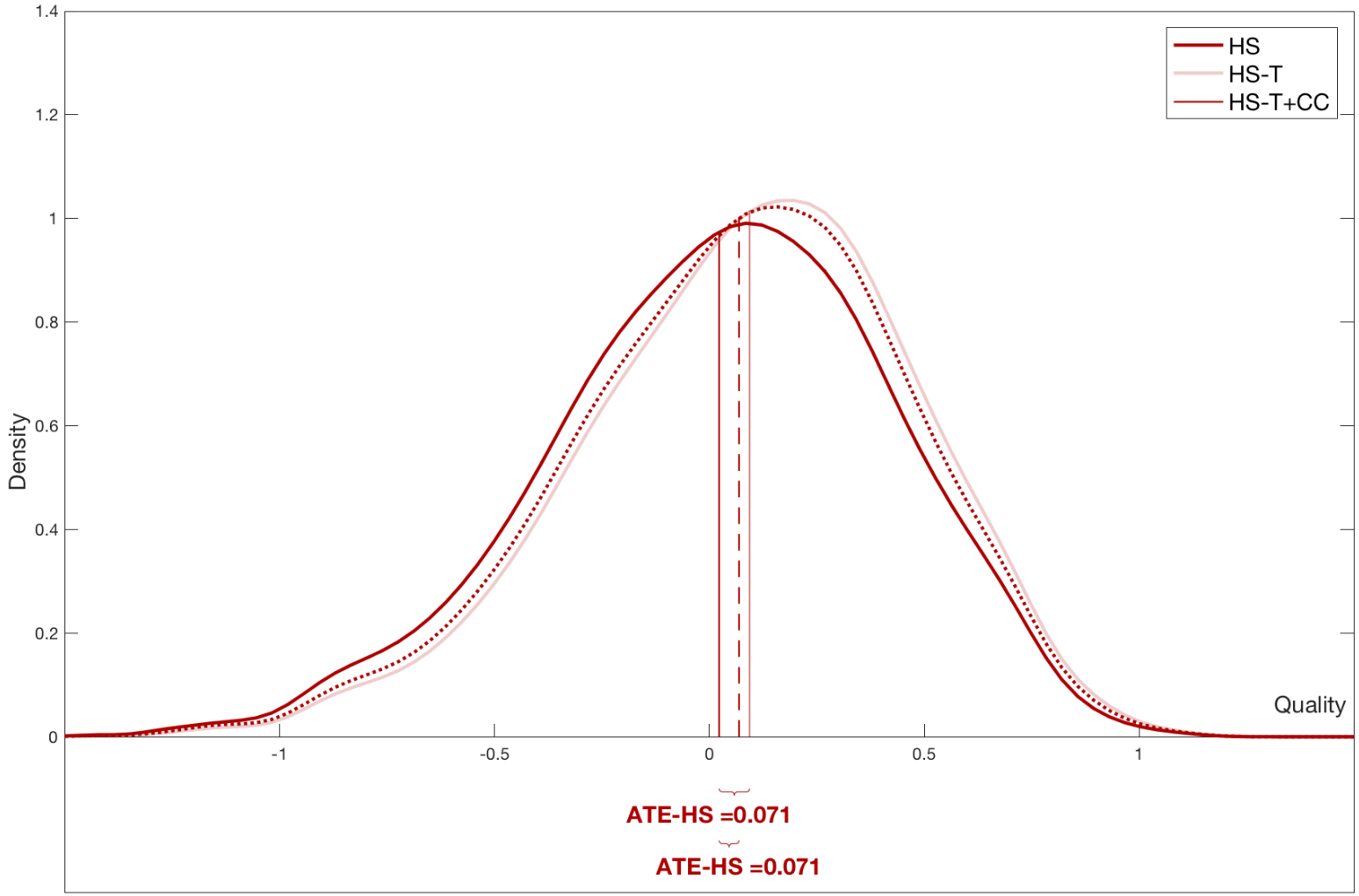

Supply Side Considerations

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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, Khwaja (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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$$\pi_j(\mathbf{q}, \mathbf{p}, \boldsymbol{\xi}) = N \underbrace{\left(\sum_k^K \sum_n^{N_m} s_{nk}(\mathbf{q}, \mathbf{p}, \boldsymbol{\xi}) w_k(n) \Pi_k \right)}_{s_j} \left(v + p_j - MC(q_j)\right) - F_j$$

First Order Conditions : Quality

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

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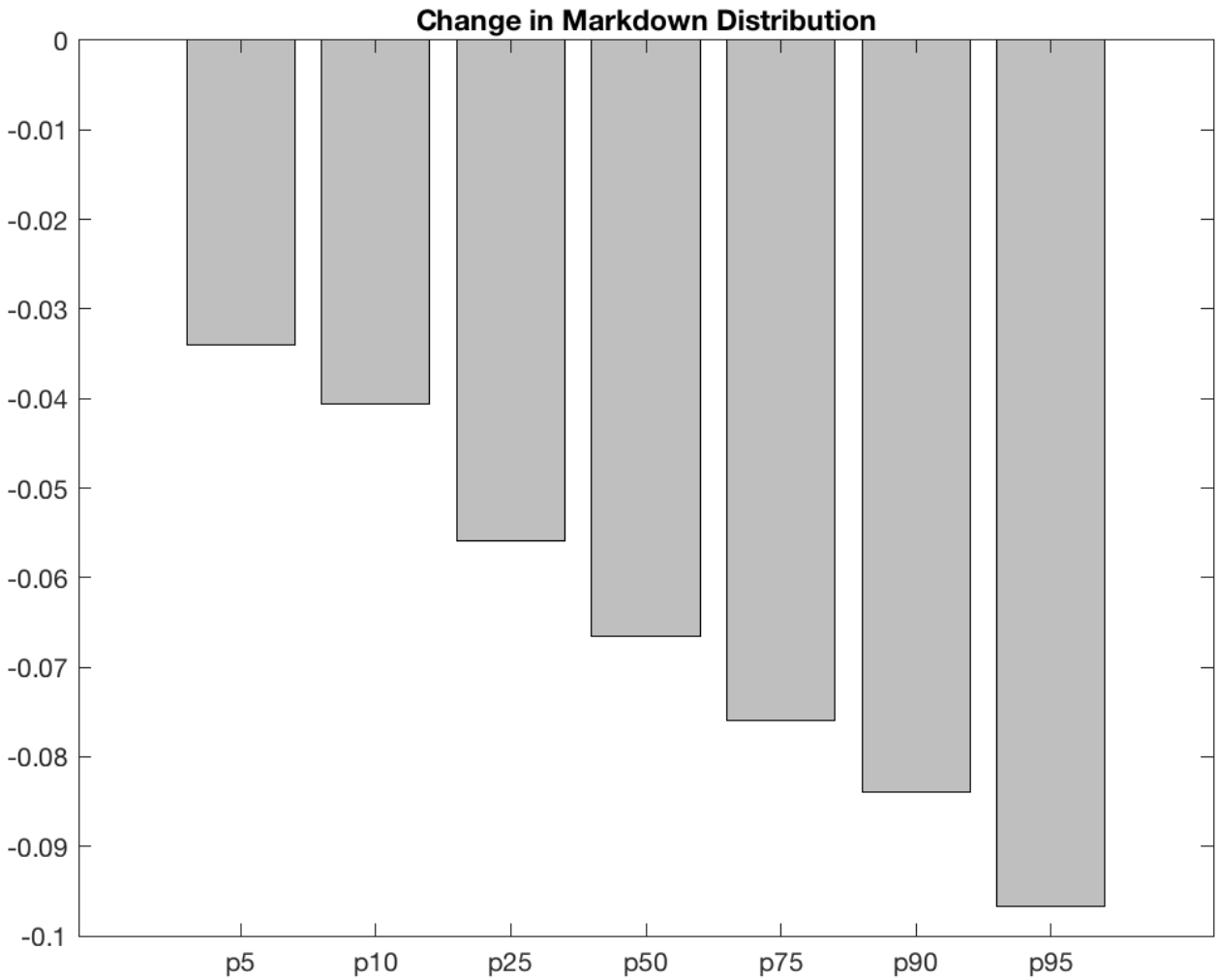
$$q_{jt}^* = \left[\frac{v + p_{jt} - \sum_l \gamma_l w_{jt}^l}{\gamma_q + \omega_{jt}} \right] - \underbrace{s_{jt}(\mathbf{q},\mathbf{p},\boldsymbol{\xi}) \left[\frac{\partial s_{jt}(\mathbf{q},\mathbf{p},\boldsymbol{\xi})}{\partial q_{jt}} \right]^{-1}}_{\text{Quality Mark Down}} \quad (2)$$

Mark-down change - Percentiles



Supply Side Estimation

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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

- We get an expression for the cost unobservable rearranging the quality FOC
- We explit the panel structure of the data
- We decompose the unobservable $\omega_{jt} = \overline{\omega_j} + \Delta\omega_{jt}$
  - A school-specific fixed component $\overline{\omega_j}$
  - A time-school-specific component $\Delta\omega_{jt}$

$$\Delta\omega_{jt} = \frac{v + p_{jt} - \sum_l \gamma^l w_{jt}^l}{\left[q_{jt}^* + s_{jt}(\mathbf{q}, \mathbf{p}, \boldsymbol{\xi}) \left[\frac{\partial s_{jt}(\mathbf{q}, \mathbf{p}, \boldsymbol{\xi})}{\partial q_{jt}} \right]^{-1} \right]} - \gamma^q - \overline{\omega_j} \tag{3}$$

- We make this expression orthogonal to the instruments.

Supply Estimation and Experimental Results

Table: Supply Model Estimates

	Coef.	Std. Error
γ_I		
Voucher	0.44	0.13
Public	0.74	0.23
For Profit	0.16	0.09
Religious	-0.15	0.05
Constant (Mean Market FE)	0.27	-
γ_q		
Constant (Mean Firm FE)	0.31	-

Figure: Market Fixed Effects

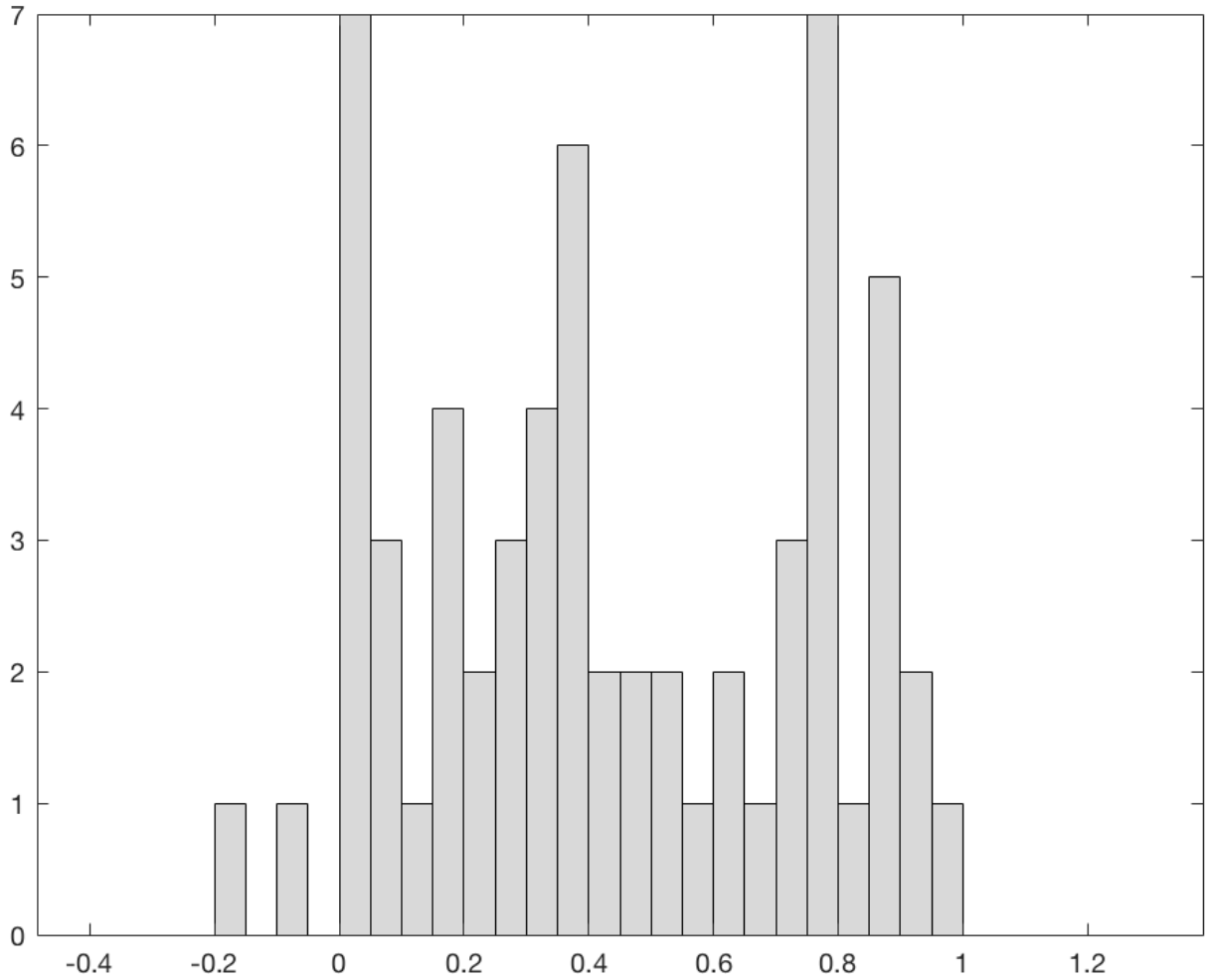


Figure: Firm Fixed Effects

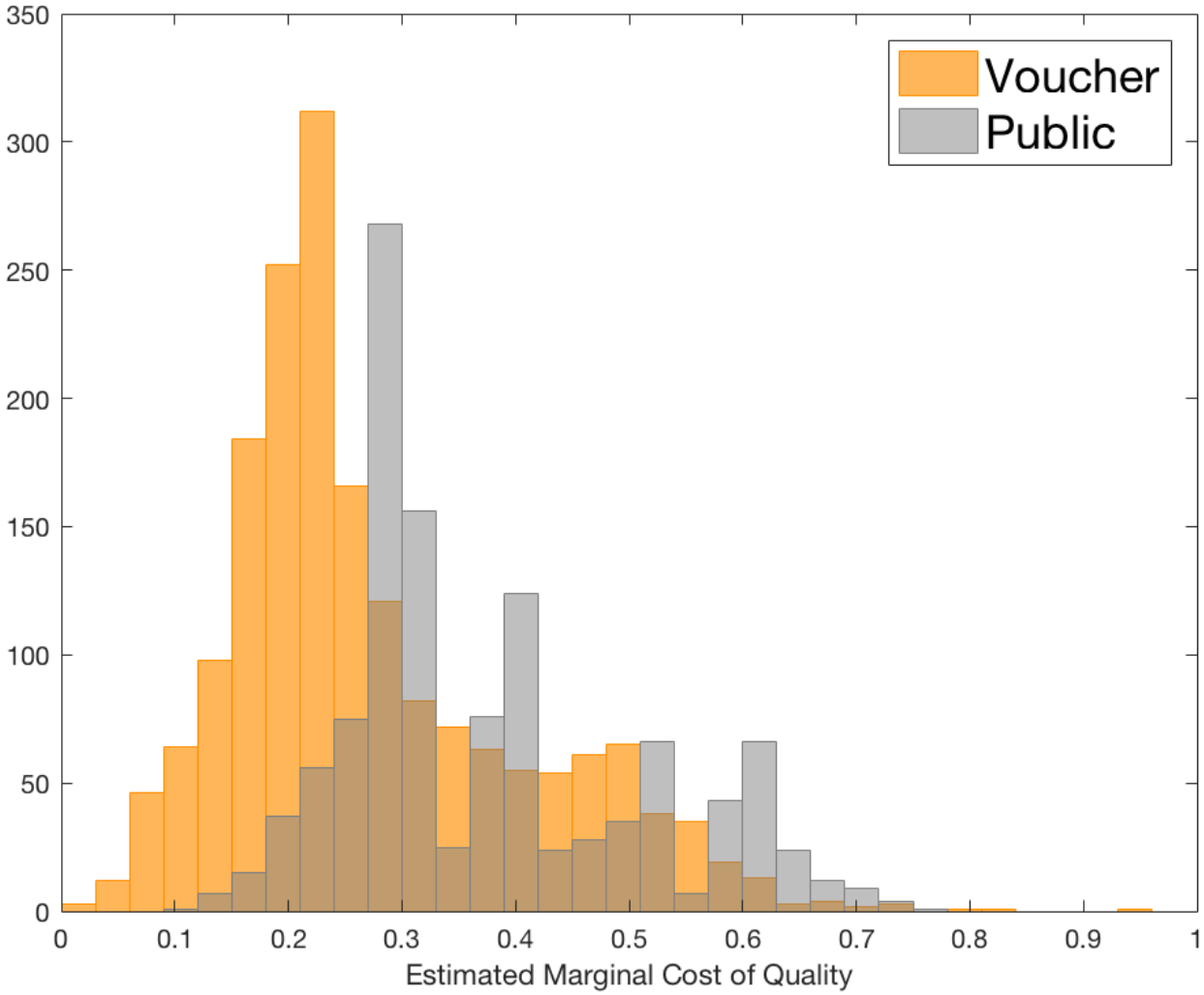
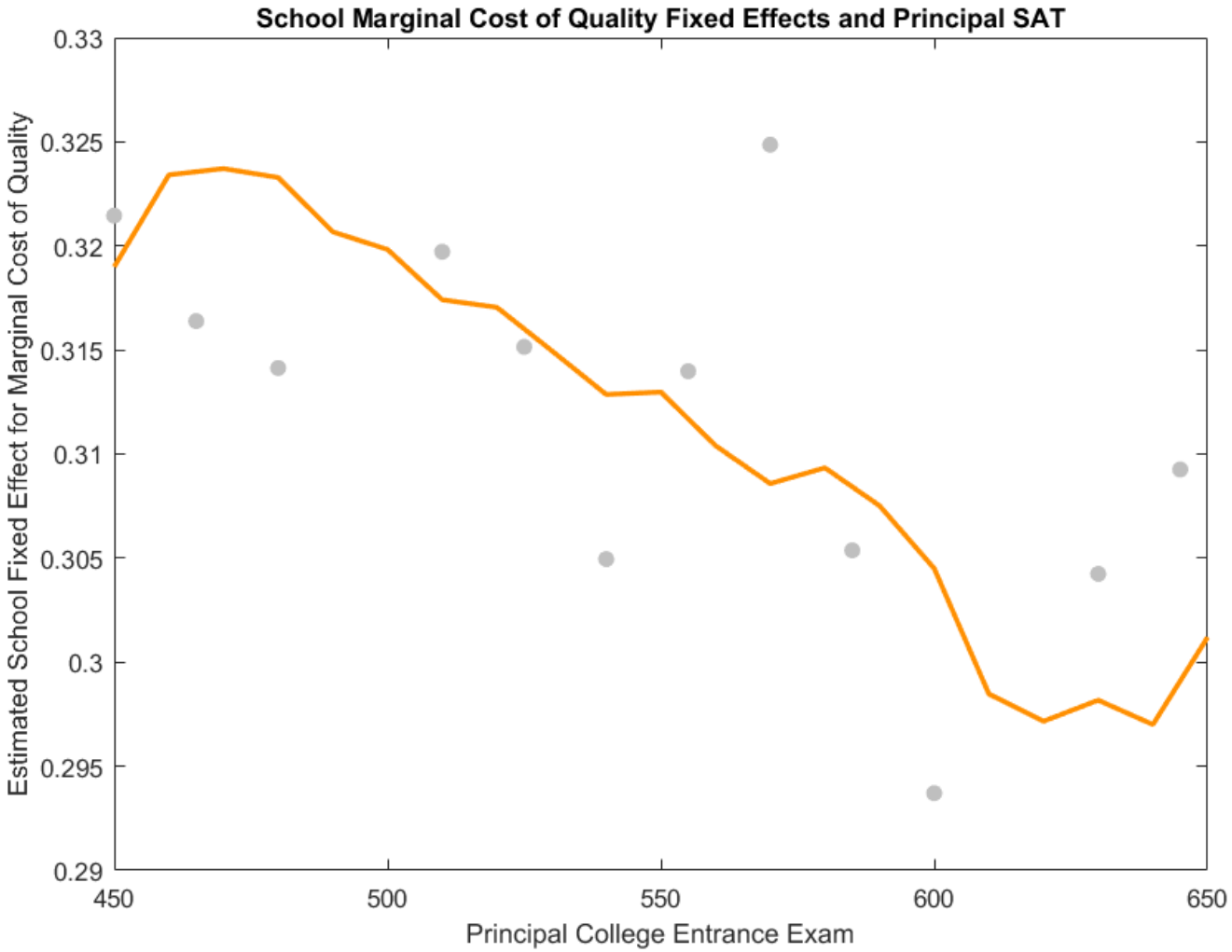
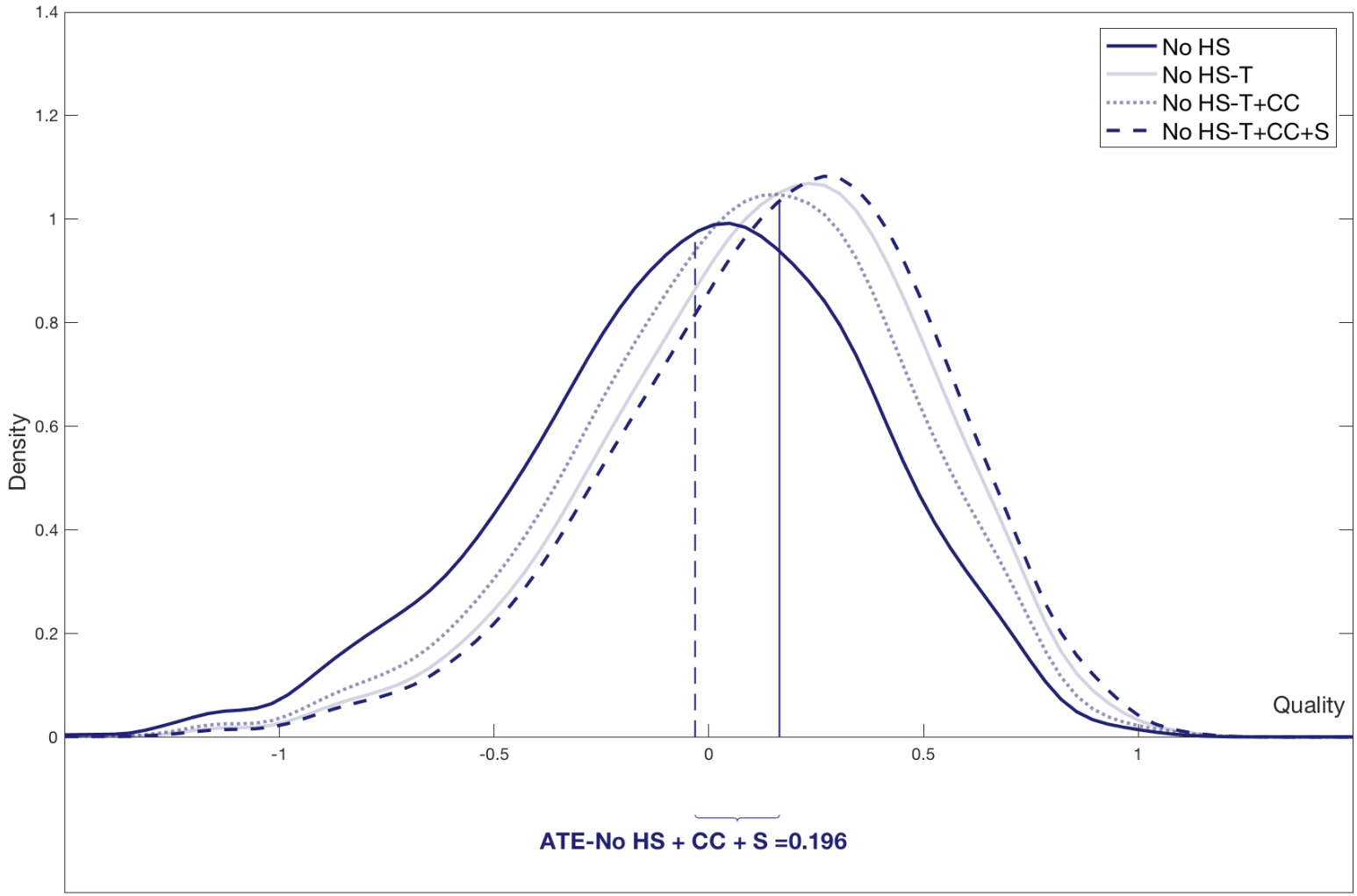


Figure: Firm Fixed Effects and Principal Human Capital



Supply Responses when Policy is Expanded



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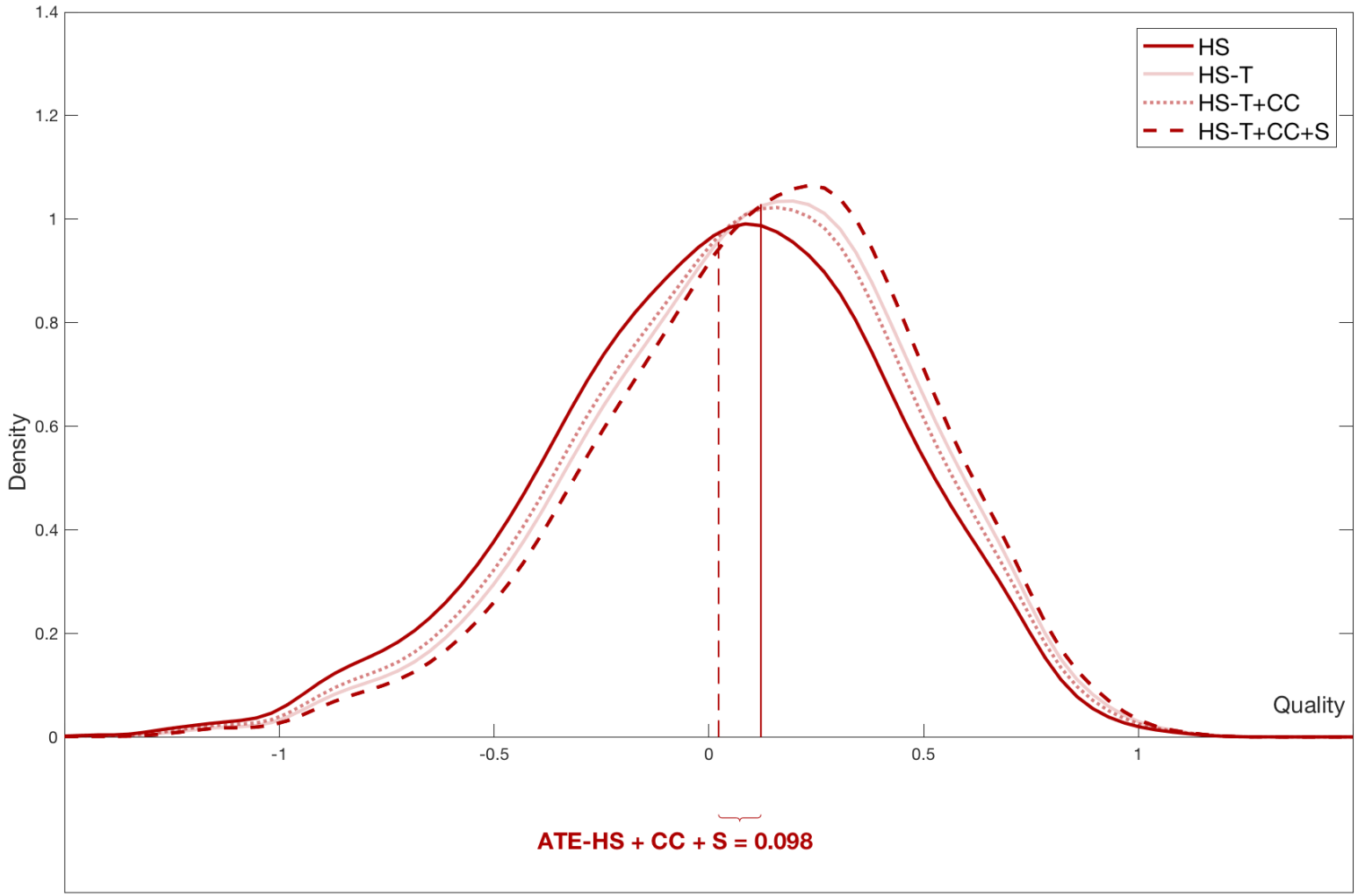

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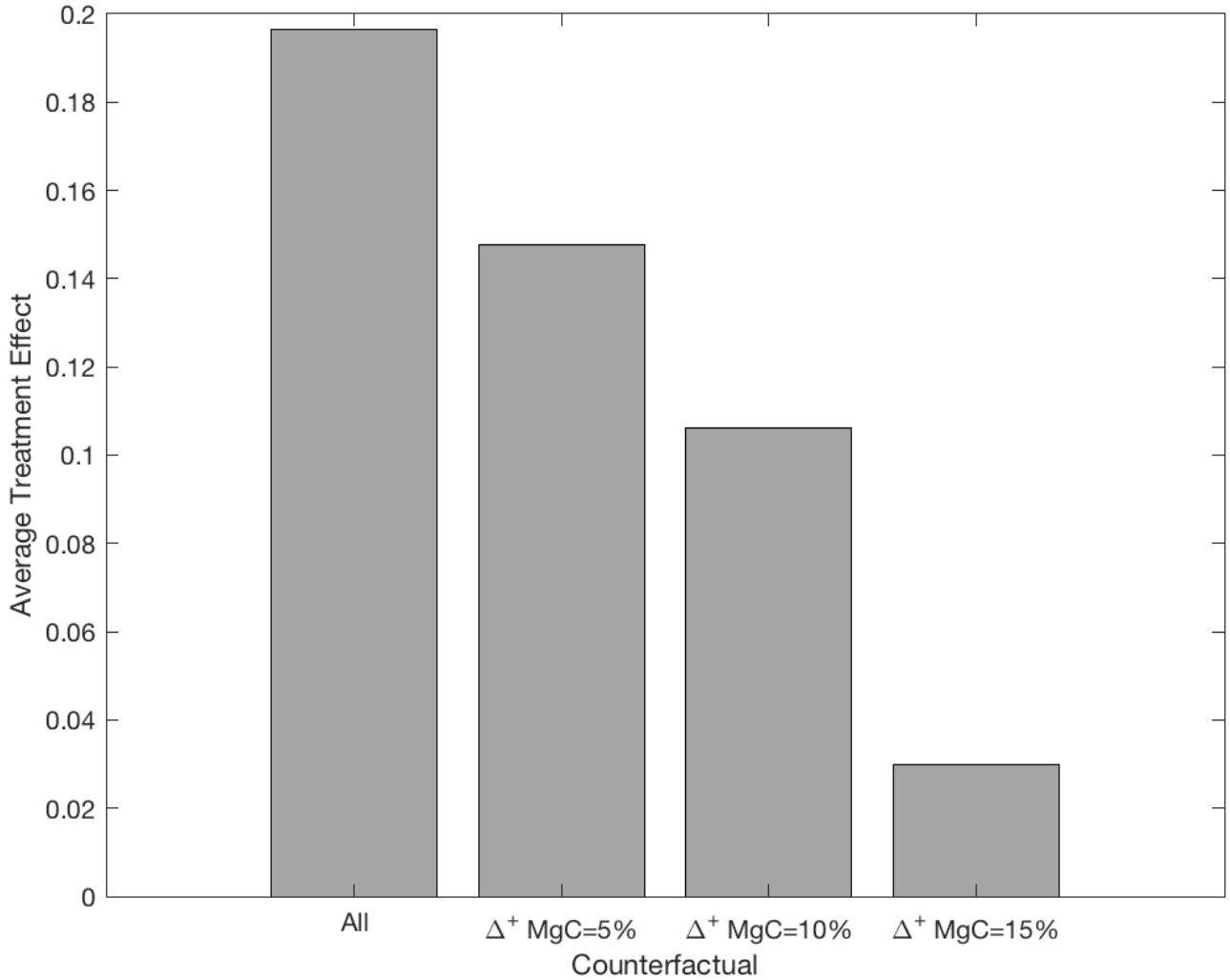

Counterfactuals Summary

Table: ATE for Counterfactuals

	Experiment	Model						
	ATE	Base	CC	CC+S (All)	CC+S (noPub)	$\Delta^{+}5\%$	$\Delta^{+}10\%$	$\Delta^{+}15\%$
All	-	0.0756	0.0464	0.1013	0.0449	0.0770	0.0569	0.0193
No HS Mon	0.1210	0.1662	0.1072	0.1964	0.0817	0.1477	0.1061	0.0299
HS Mom	0.0560	0.0709	0.0463	0.0985	0.0600	0.0721	0.0518	0.0150
College Mom	-	0.0000	-0.0168	0.0127	0.0126	0.0110	0.0080	0.0060

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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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  - Incorporates the choice environment explicitly.
  - Can be used to study equilibrium effects of sorting and incentives for the supply side.
  - 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.

Back to Results

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.

Back to Results

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 - Families

Table: Balance at the Family Level

	T-C		Mean Control	
Enrollment	-1.9	(3.2)	41.5	(2.5)
Mean attendance	-1.1	(2.4)	28.7	(1.9)
Mother HE	-0.6	(1.5)	9.5	(1.3)
Mother HS	-0.9	(2.1)	48.3	(1.6)
Mother NHS	0.8	(1.0)	7.3	(0.6)
Q1 Income	0.6	(2.9)	57.9	(2.3)
Q2 Income	0.3	(2.1)	31.3	(1.6)
Q3 Income	-1.1	(1.2)	8.7	(0.9)
Very Poor	0.6	(1.8)	14.9	(1.4)
Poor	0.1	(2.2)	40.6	(1.8)

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Balance - Enrolled

Table: Balance for Being Enrolled at Baseline

	Enrolled-Nonenrolled		Mean Control	
Household size	-0.04	(0.12)	4.92	(0.08)
Durable goods	*0.38**	*(0.12)*	*4.46*	*(0.08)*
Owns Dwelling	0.05	(0.03)	0.34	(0.02)
Mother head of hh	0.001	(0.03)	0.83	(0.01)
Mother NHS	-0.01	(0.02)	0.19	(0.02)
Mother HS	-0.04	(0.02)	0.39	(0.02)
Mother HE	0.007	(0.01)	0.83	(0.02)
Poor	-0.01	(0.01)	0.89	(0.01)
Another child in primary	0.01	(0.03)	0.40	(0.02)
Gestation Weeks	-0.02	(0.09)	38.7	(0.05)
Birth Weight	-0.03	(0.26)	3.34	(15.40)
Mother's Age	0.32	(0.36)	25.3	(0.21)
Father's Age	-1.6	(1.22)	36.4	(0.93)
Marital Status	-0.02	(0.02)	1.7	(0.01)
Doctor	-0.01	(0.02)	0.3	(0.02)
Hospital	*0.01**	*(0.01)*	*0.97*	*(0.01)*
Number of Children	0.10	(0.09)	1.8	(0.04)

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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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IV Moments - Instruments

The instruments include:

- Baseline voucher (time variation).
- Variation in prices induced by the SEP policy (targeted vouchers).
  - Percent of Kids Elegible for SEP within 1 km
  - Interacted with SEP policy timing
- Cross-market cost shifters: teacher wages (from IRS).
  - Teacher Wage Market FE (pct 75)
  - Teacher Wage Market FE (pct 25)
- Additional instruments
  - Number of for profit Schools within 0.5 km
  - Number of for profit Schools within 5 km
  - Percent of Kids with non poor HE mom within 1 km
  - Distance to closest school
  - Average distance to nearest 5 schools

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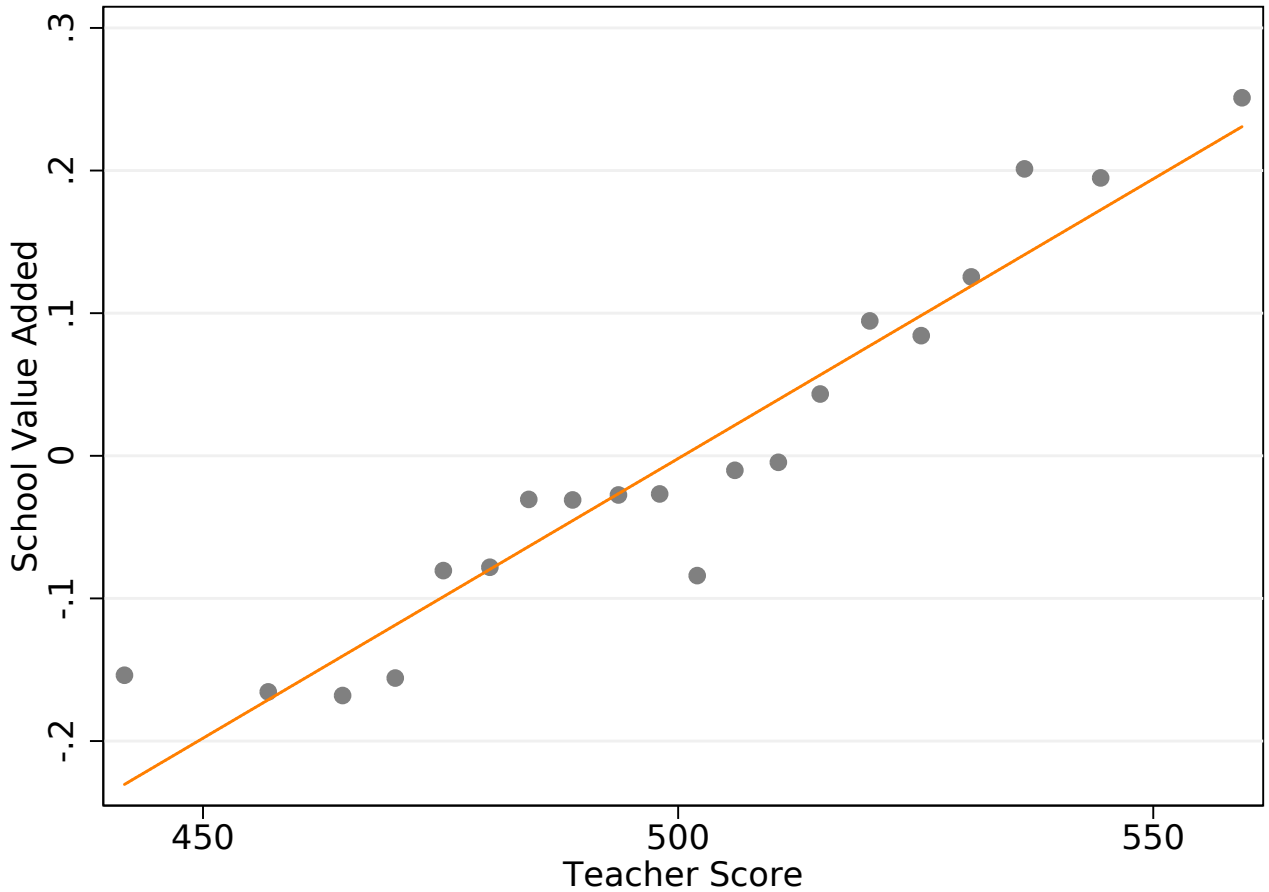
Figure: Value Added and Teacher Test Scores



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Experiment Moments

	Distance	OOP Price	Value Added
	(1)	(2)	(3)
Panel A: All Non Enrolled			
Treatment	0.248	0.002	0.092
	(0.065)	(0.001)	(0.032)
N obs.	699	796	789
Panel B: Non Enrolled - No High School Mom			
Treatment	0.278	0.002	0.121
	(0.131)	(0.002)	(0.051)
N obs.	214	241	239
Panel C: Non Enrolled - High School Mom			
Treatment	0.250	0.002	0.056
	(0.074)	(0.002)	(0.039)
N obs.			

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Bibliography