Can Successful Schools Replicate? Scaling Up Boston's Charter Sector

Sarah Cohodes — Columbia University & NBER
Elizabeth Setren — MIT
Christopher Walters — UC Berkeley & NBER

Federal Reserve Bank of Minneapolis
October 2018

Can effective programs scale?

- The feasibility of scaling remains a key problem for social policy
- Recent large-scale studies have failed to replicate the impressive gains of smaller-scale studies
  - Early childhood programs
  - Class size reductions
  - Success for All (whole school reform model)

Why might replications miss the mark?

- Differences in inputs (i.e. quality, type)
- Changing counterfactuals
- Differences in population characteristics
- Implementation fidelity/quality control
- Increased samples size $\rightarrow$ closer to true mean
- Publication bias

Focus of this study: "No Excuses" charter schools

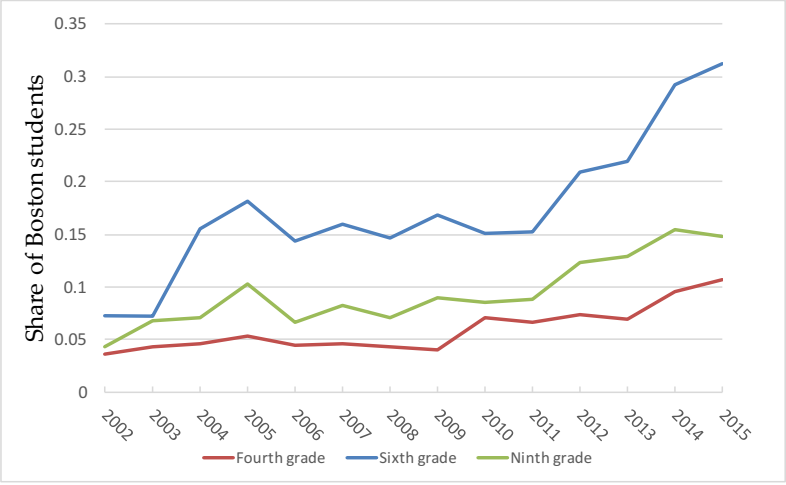
- "No Excuses" charters share a common set of practices
  - Longer school days and years
  - High academic and behavioral expectations
  - Frequent teacher feedback
  - High-intensity tutoring
  - Data-driven instruction
- Growing lottery-based evidence that "No Excuses" charter schools generate gains for low-income urban students
  - Boston, NYC, KIPP, Denver, NOLA
- No school district has adopted these "No Excuses" policies on a wide scale
- "No Excuses" charters generally serve small shares of students in the cities where they operate

Boston charter sector doubled

- In 2010, Massachusetts lifted restrictions on the number of charter schools in low-performing districts, including Boston.
- The state chose "proven providers" – schools with track records of success — and allowed them to open new campuses
- Charter sector in Boston doubled from 2010 to 2014
  - 16 $\rightarrow$ 32 charter schools
  - 15% $\rightarrow$ 31% of Boston students enrolled in charter schools

Boston charter enrollment

Figure 1: Charter School Enrollment in Boston



Notes: This figure plots the share of Boston fourth, sixth, and ninth grade students enrolled in charter schools between 2002 and 2015.

Objective

- Use randomized charter middle school admission lotteries to study:
  - whether the new replication campuses produced similar test score gains to their parent campuses
  - what explains the success of the scaling

Sample schools

- 14 charter middle schools
  - Cover 94% of Boston middle school charter enrollment in 2014
- School types
  - Four proven providers
  - Seven expansion charters
  - Three "other charters"

Growing demand, changing demographics

	Before Expansion	After Expansion
Percent of Boston students applying	15%	35%
Selection on math scores?	0.22σ	0.02σ
Selection on ELA scores?	0.30σ	0.02σ
Free/reduced price lunch	69%	80% (on par with BPS)
ELLs	12%	36% (slightly lower than BPS)
Special education	19%	20% (slightly lower than BPS)

Jointly estimate charter attendance at 5 charter types

Before Expansion	
Proven Providers	charter schools designated by the state as proven providers after the change in the law, in 2010 and prior
Other Charters	charter schools never designated proven providers after the change in the law, in 2010 and prior
After Expansion	
Proven Providers	charter schools designated by the state as proven providers after the change in the law, in 2011 and following
Expansion Charters	new charter schools, in 2011 and following
Other Charters	charter schools never designated proven providers and that are also not replication campuses after the change in the law, in 2011 and following

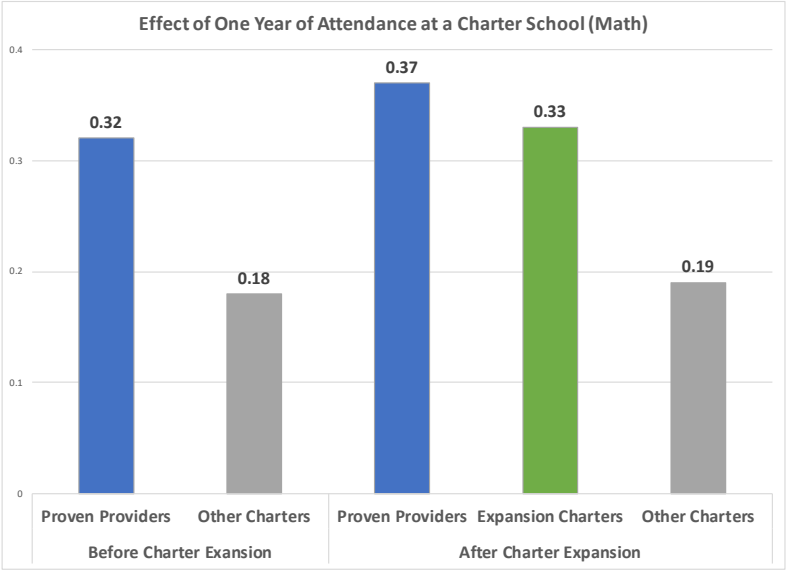
Methods

- Use charter school lotteries as *instruments* for charter school attendance
- Estimate for each charter school type (something like):

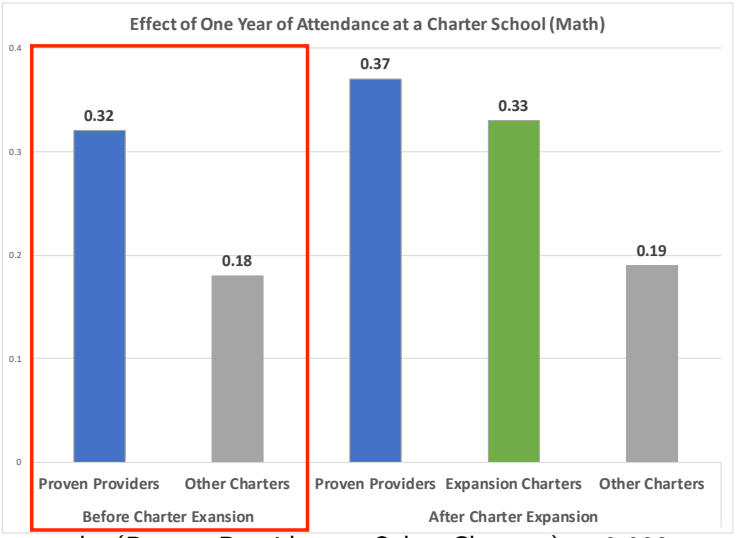
$$Effect\ of\ 1\ Year\ of\ Charter\ Attendance_{Charter\ Type\ k} = \frac{Test\ Score_{Offered\ Seat\ at\ k} - Test\ Score_{Not\ Offered\ Seat\ at\ k}}{Years\ Attended_{Offered\ Seat\ at\ k} - Years\ Attended_{Not\ Offered\ Seat\ at\ k}}$$

- Estimate 5 (k) charter types jointly so we have the right counterfactual
- Many students apply to multiple charters, especially parent and replicates, so estimate using *risk sets*

Effect of 1 Year of Attendance on Math Scores

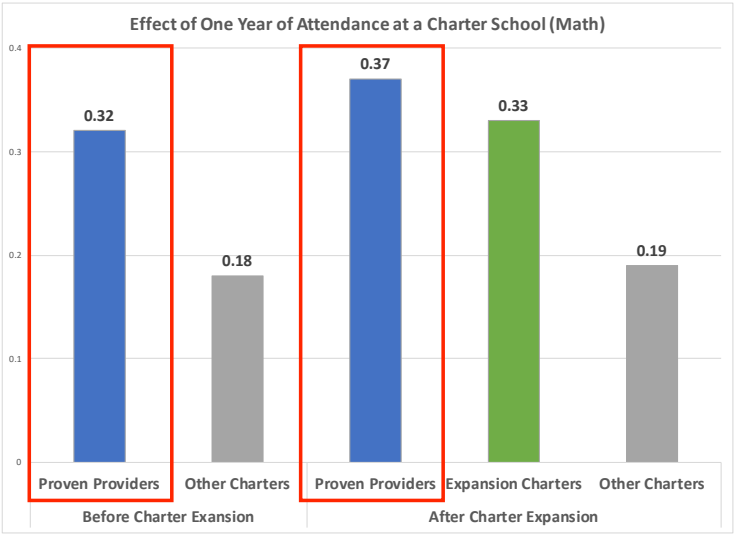


State selected more effective schools for expansion

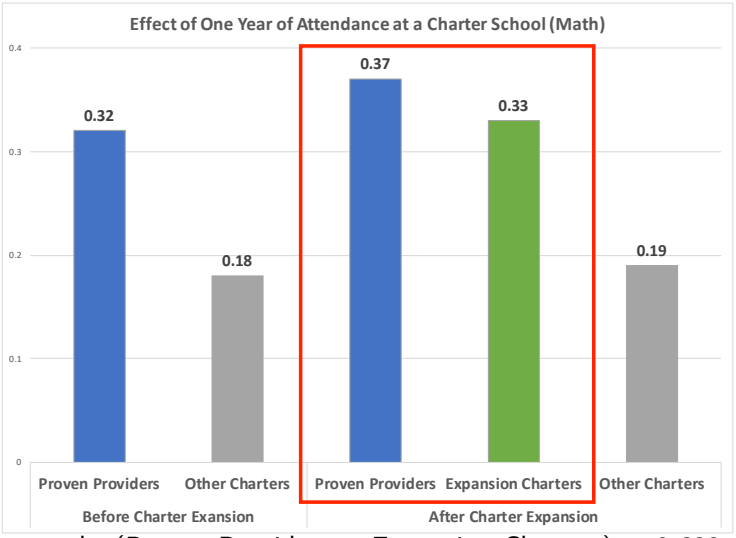


p-value(Proven Providers = Other Charters) = 0.000

Proven providers remained effective during expansion

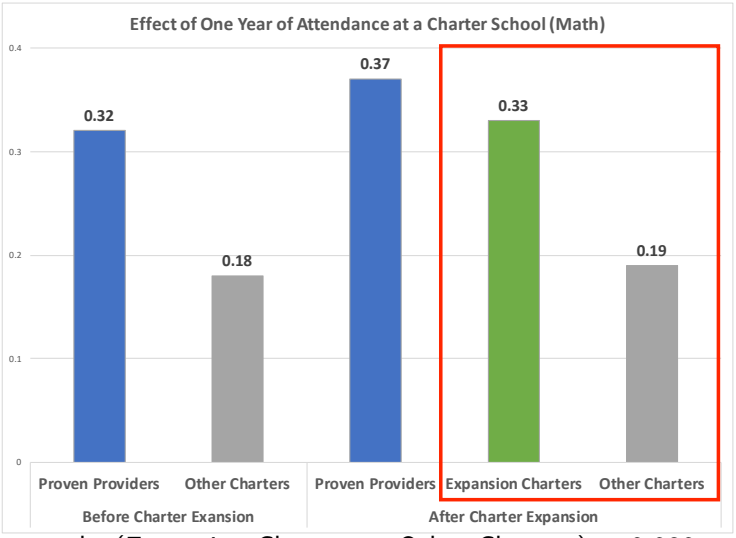


Proven providers successfully replicated their schools



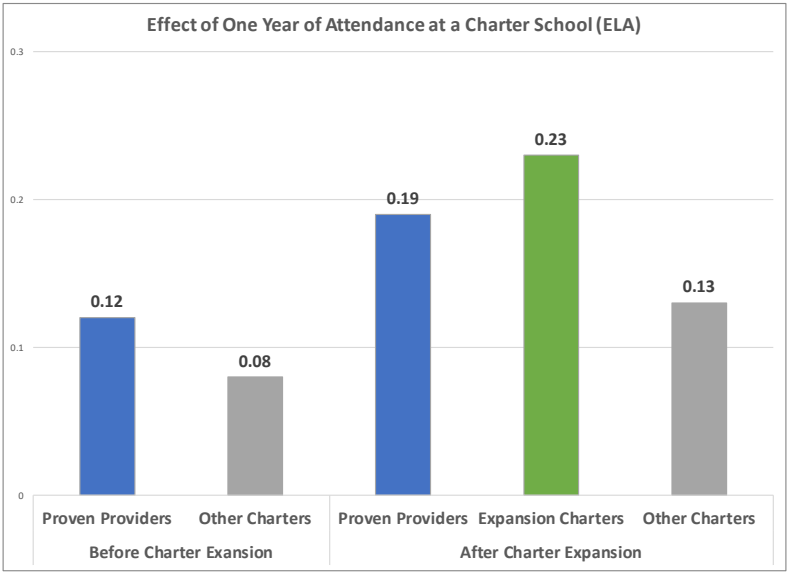
p-value(Proven Providers = Expansion Charters) = 0.632

Expansions more effective than long-running schools



p-value(Expansion Charters = Other Charters) = 0.030

Similar pattern but smaller effects in English



Potential explanations for replication's success

- Human capital management
  - Successful despite 2/3rd brand new teachers
  - School leadership trained in proven provider school
- Counterfactual schools
- Changing demographics or heterogeneous treatment effects
- School model

Teacher experience profile slightly flatter at charters

	Math		
	Charter	BPS	P-value of Charter==BPS Test
	(1)	(2)	(3)
Experience Profile			
1 - 4 Years of Experience	0.063***	0.093***	0.478
	(0.024)	(0.036)	
5 or More Years of Experience	0.031	0.078**	0.361
	(0.035)	(0.038)	

Teacher and classroom variation reduced at charters

	Math		
	Charter	BPS	P-value of Charter==BPS Test
Random Effects Parameters: SD			
School	0.133***	0.103***	0.362
	(0.028)	(0.016)	
Teacher	0.122***	0.185***	0.000
	(0.012)	(0.010)	
Class X Year	0.075***	0.151***	0.000
	(0.008)	(0.005)	

Potential explanations for replication's success

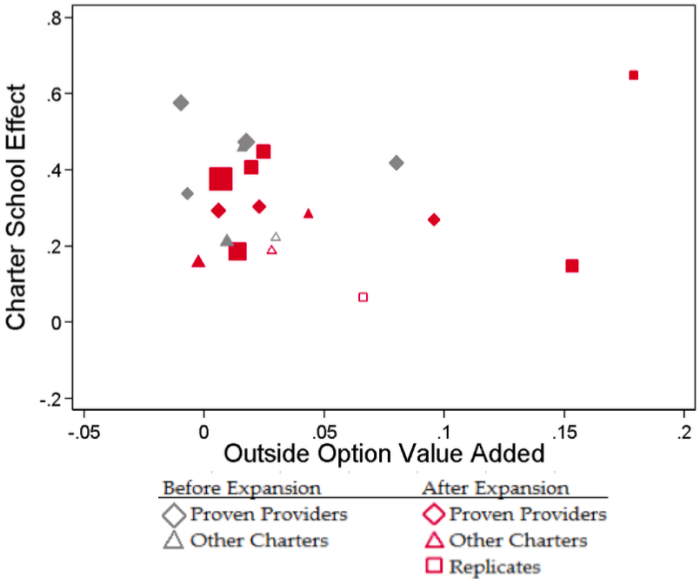
- Human capital management
  - Successful despite 2/3rd brand new teachers
  - School leadership trained in proven provider school
- Counterfactual schools
- Changing demographics or heterogeneous treatment effects
- School model

Applicants' outside options do not explain the results

	Before Charter Expansion		After Charter Expansion		
Untreated Complier Mean	Proven Providers (1)	Other Charters (2)	Proven Providers (3)	Expansion Charters (4)	Other Charters (5)
Math	0.008	0.015	0.028	0.017	0.027
	(0.010)	(0.009)	(0.015)	(0.017)	(0.013)
English	-0.015	-0.012	0.000	-0.007	-0.007
	(0.008)	(0.008)	(0.013)	(0.015)	(0.012)
N			7194		

Notes: This table displays the mean school value added for untreated compliers. School value added estimates come from OLS regressions of test scores on a set of school indicator variables, controlling for baseline test scores and student demographics. The school value added estimates

No relationship between charter effectiveness & outside option



Potential explanations for replication's success

- Human capital management
  - Successful despite 2/3rd brand new teachers
  - School leadership trained in proven provider school
- Counterfactual schools
- Changing demographics or heterogeneous treatment effects
- School model

Empirical Strategy

- Decompose charter effect into two parts for each charter type:
  - Average Treatment Effect at type k (ATE_k)
    - How effective is this charter school for the average Boston kid
  - Match at type k ($Match_k$)
    - How effective is this charter school for the mix of kids it gets (e.g. particularly effective/ineffective for low-scoring students)

Proven providers and expansions are similarly effective for the average kid

	Before Charter Expansion		After Charter Expansion		
	Proven Providers	Other Charters	Proven Providers	Expansion Charters	Other Charters
	(1)	(2)	(3)	(4)	(5)
			Panel A: IV Results		
			Math		
TOT	0.333***	0.185***	0.319***	0.359***	0.197***
	(0.029)	(0.020)	(0.050)	(0.052)	(0.037)
ATE	0.320***	0.198***	0.321***	0.345***	0.208***
	(0.030)	(0.022)	(0.051)	(0.053)	(0.038)
Match	0.013	-0.013	-0.002	0.014***	-0.011**
	(0.009)	(0.009)	(0.008)	(0.005)	(0.005)
N (scores)			15924		

Expansions enroll students that are easier for charters to produce gains for, but this advantage is relatively small

	Before Charter Expansion		After Charter Expansion		
	Proven Providers	Other Charters	Proven Providers	Expansion Charters	Other Charters
	(1)	(2)	(3)	(4)	(5)
			Panel A: IV Results		
			Math		
TOT	0.333***	0.185***	0.319***	0.359***	0.197***
	(0.029)	(0.020)	(0.050)	(0.052)	(0.037)
ATE	0.320***	0.198***	0.321***	0.345***	0.208***
	(0.030)	(0.022)	(0.051)	(0.053)	(0.038)
Match	0.013	-0.013	-0.002	0.014***	-0.011**
	(0.009)	(0.009)	(0.008)	(0.005)	(0.005)
N (scores)			15924		

Potential explanations for replication's success

- Human capital management
  - Successful despite 2/3rd brand new teachers
  - School leadership trained in proven provider school
- Counterfactual schools
- Changing demographics or heterogeneous treatment effects
- School model

Faithfulness to model

- Focus on "fit" of teachers - select heavily on commitment to school model
- Utilize scale for curriculum planning and professional development
  - Chose best lesson plans/practices
  - Quality control
- Support for new teachers and school leaders
  - Regular visits/observations/feedback
- Expand 1-2 grades at a time
- Tension between autonomy and centralization
  - Give leaders and teachers good resources and autonomy

Potential explanations for replication's success

- Human capital management
  - Successful despite 2/3rd brand new teachers
  - School leadership trained in proven provider school
- Counterfactual schools
- Changing demographics or heterogeneous treatment effects
- School model

Conclusion

- Boston's "No Excuses" charter schools reproduced their effectiveness at new campuses
- New expansion schools generate test score gains similar to those of their parent campuses, despite a doubling of charter market share
- Applicants' outside options, heterogeneous treatment effects, and changing demographics do not explain the effects
- Human capital management and faithfulness to the model might explain their success

Thank you!

Questions or comments: cohodes@tc.columbia.edu

2SLS Strategy

- Two lottery instruments per charter type k indicate if a student is admitted
  - Initial offer (Z_{ik1}) indicates admission on lottery day at that charter type k
  - Ever offer (Z_{ik2}) indicates admission on lottery day or later at that charter type k
- Risk sets: Admission is random only after conditioning on the set of schools to which a student applied
  - The charter risk set is the set of schools to which a student applied
  - For example, 3 schools generate 7 risk sets
  - We include a set of risk-set dummies (interacted with year of application) in all regressions
- Check for potential threats to validity
  - Covariate balance
  - Attrition

2SLS Specification

K First Stages:

$$C_{ig}^{k} = \mu_{g}^{k} + \sum_{\ell=1}^{K} \left(\pi_{\ell 1}^{k} Z_{i1}^{\ell} + \pi_{\ell 2}^{k} Z_{i2}^{\ell} \right) + \sum_{j=1}^{J} \lambda_{j}^{k} d_{ij} + X_{i}' \theta^{k} + \eta_{ig}^{k}; \;\; k = 1...K$$

Second Stage:

$$y_{ig} = \alpha_{g} + \sum_{k=1}^{K} \beta_{k} C_{ig}^{k} + \sum_{j=1}^{J} \delta_{j} d_{ij} + X_{i}' \gamma + \varepsilon_{ig}$$

where y_{ig} is an outcome for student i in grade g

- d_{ij} are risk sets
- C_{ig}^{k} is years of charter attendance at a k^{th} type of charter
- X_{i} is a vector of demographics
- μ_{g}^{k} and α_{g} are grade fixed effects

Empirical Strategy – Decomposing Charter School Effects

Expand 2SLS strategy to include offers as well as offers interacted with student characteristics:

$$Y_{ig} = \alpha_g + \sum_{k=1}^{K} \left(\beta_k^0 + X_i'\beta^x\right) C_{ig}^k + \sum_{j=1}^{J} \delta_j R_{ij} + X_i'\gamma + \varepsilon_{ig}$$

Then: Decompose the TOT_k into ATE_k (average effect for Boston population) and $Match_k$ (deviation due to characteristics at charter type k):

$$\begin{aligned} TOT_k &= \beta_k^0 + \bar{X}_k'\beta^x \\ &= \underbrace{\left(\beta_k^0 + \mu^{x\prime}\beta^x\right)}_{ATE_k} + \underbrace{\left(\bar{X}_k - \mu^x\right)'\beta^x}_{Match_k} \end{aligned}$$