

Research statement

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My research focuses on the Economics of Education, drawing on Development and Public Economics to study school markets and educational policies. Specifically, my papers consider three ways in which policymakers have sought to improve school performance: i) by introducing school choice and competition, ii) by increasing inputs or funding, and iii) by relying on information to hold schools accountable. In each of these areas, my work makes two contributions: i) it uses novel research designs that attempt to credibly isolate effects that have been difficult to quantify, and ii) it analyzes how sorting or stratification (the tendency for individuals to attend school with others similar to themselves) affects the way in which interventions should be evaluated and designed.

To elaborate, this statement describes past and future work in five areas:

- 1) The impact of school choice on stratification and educational outcomes,
- 2) The effect of school system structure on educational performance,
- 3) Class size determination and its effects on academic achievement,
- 4) The effects of statistical noise and stratification on accountability measures, and
- 5) The consequences of attending a better school.

Two final entries briefly discuss future work and research outside these four topics.

1) School choice, stratification, and educational outcomes

A sense that educational outcomes need improvement is essentially universal, the more so when it comes to developing countries. Yet such improvements have been surprisingly hard to elicit from school systems, which sometimes display characteristics consistent with inefficiency (e.g. Hanushek and Woessman, 2008). These facts have led economists to propose a greater role for school choice and competition in school markets. A concern with this approach has been that if parents use increased choice to obtain better peer groups for their children, these measures could result in stratification that might, through peer effects or fiscal mechanisms, have adverse effects on some children. Clear evidence on the impact of choice has been hard to produce because, as argued by Hoxby (2000) and others: i) the degree to which school markets display given levels of choice (e.g. high or low private enrollment rates) is not exogenously assigned, and ii) to learn about the effects of choice, one needs situations in which there is variation in the degree of competition across markets.

I address these challenges in three completed papers. A first one (*Does school choice lead to sorting? Evidence from Tiebout variation*, **American Economic Review**, 95(4), 2005) considers whether the number of school districts in U.S. metropolitan areas (MAs) is related to how homogeneous their children's peer groups are. It exploits the fact that some MAs have different numbers of districts at the primary and the secondary level, with the motivation that in such cases one can observe the behavior of the same set of households when it faces different opportunities to sort out. The results suggest that increases in district availability indeed result in children having more homogeneous peer groups, both at the district and the school level.

A second paper (*The effects of generalized school choice on achievement and stratification: Evidence from Chile's voucher program*, with Chang-Tai Hsieh, **Journal of Public Economics**,

90, 2006), considers one of the most innovative school finance experiments. Specifically, in 1981 Chile started providing a voucher to any student wishing to attend private school. As a result, more than 1,000 (often for-profit) private schools entered the market, and the private enrollment rate increased by 20 percentage points, with greater impacts in some communities. The paper uses this differential impact to measure the effects of choice, finding that it led to substantial sorting as the “best” public school students left for the private sector. Surprisingly (in a finding I return to below), it did not seem to raise average test scores.

These papers make points that affected academic and policy discussions. For example, they imply that stratification matters when evaluating the effects of school choice; to illustrate, if peer effects exist and school choice leads to sorting, then conclusions regarding the desirability of vouchers might depend on whether one analyzes large scale experiments (which can have general equilibrium repercussions like sorting) or small scale ones (which typically, cannot). This point is addressed directly in recent work by Bettinger, Kremer, and Saavedra (2007). Additionally, these results affected discussions on how school choice might best be structured. For instance, they were referenced in the World Bank’s (2004) World Development Report on public service delivery.

The second paper also was the start of my work on Chile, which has contributed to academic and policy discussions. For instance, its findings have been part of a discussion that resulted in Chile’s voucher payments becoming differentiated (higher for lower income children), and are part of a policy-oriented review paper on this and other work I have done on Chile (*School choice, stratification, and information on school performance: Lessons from Chile*, with Patrick McEwan and Emiliana Vegas, *Economia*, 8(2), 2008). This work is also referenced in Gruber (2005), a leading text in Public Finance, and in a review by Ladd (2004) in the *Journal of Economic Perspectives*.

2) The effect of school system structure on educational performance

As stated, my research on Chile suggests that its voucher initiative led to sorting, but barely affected school productivity. Consistent with this finding, the literature has failed to produce *consistent* evidence that introducing greater competition into school markets has substantial and robust effects on learning. For example, in a recent review, Neal (2008) states that “Measured solely by effects on achievement and attainment existing evidence does not support the view that private schools are generally superior to public schools in all settings.”

This presents a puzzle because, since at least the work of Milton Friedman, economists expect that competition, combined with reputational concerns on the part of firms, should deliver efficiency. A recent working paper (*Anti-lemons: School reputation and educational quality*, with Bentley MacLeod, NBER Working Paper No. 15112) puts forth a model that provides an explanation for these mixed findings, and also generates implications for how school choice initiatives might be better designed. Specifically, it makes the case that in markets for sophisticated good like education, competition can have disappointing results because some characteristics of schools’ services (like their value added in terms of labor market outcomes) are observed with delay and only imperfectly. As a result, buyers must guide themselves by proxies for quality—notably peer composition—and schools can therefore develop good reputations by excluding weak students rather than by raising their value added.

The implication is that to the extent that they induce sorting, competition initiatives may not in fact expand choice for all students, and they may reduce student effort.¹ The intuition for

¹ While student effort has generally been understudied, there are exceptions to this, including recent empirical

this is that when schools are selective, a student's school of origin provides a clear sense of his innate ability; this reduces his incentives to influence the market's perception by studying to do well on other measures, like graduation tests. In short, this model shows that school choice can have adverse effects even abstracting from peer effect externalities, which are important in seminal models of school choice (e.g. Epple and Romano, 1998). The bottom line is that the design of competition initiatives may matter, and thus it may not be surprising to observe mixed empirical evidence. For example, the model predicts that Chile's design, which facilitates stratification, may be less desirable than an approach featuring something closer to charter schools, which generally have significantly less latitude in selecting students (this is consistent with recent findings on charter school effects by Hoxby and Murarka (2008) and Abdulkadiroglu et al. (2009)).

While the paper consists solely of applied theory, it generates testable implications regarding the way in which the structure of school systems will affect their performance. For example, it suggests learning will be higher in systems that emphasize individual-specific measures of learning, like standardized graduation and college admission exams. Additionally, it predicts that student effort and learning will not be independent of whether and how school systems are tracked (e.g. by ability, or by including vocational offerings). I expect to explore these predictions using quasi-experimental designs involving the introduction of an exit exam in Colombia (with Bentley MacLeod and Juan Saavedra) and cross-state variation in tracking configurations in Germany (with Bentley MacLeod and Johannes Schmieder). This work should take place over the next couple of years (we have requested funding from the National Science Foundation and other sources), and hopefully will ultimately contribute to knowledge and policy on school system design.

3) Class size determination and its effects

Another way in which policy has tried to improve school systems is by simply increasing their funding. The literature has warned, however, that in some cases raising spending may have little effect, and knowing the impact of individual inputs is important for cost-effectiveness calculations. In this area, my research has focused on class size, perhaps the most studied of all school inputs. Here again there is a large literature, but most of it does not provide clear information on the causal impact of this variable.

To address this, a first paper (*Identifying class size effects in developing countries: Evidence from rural Bolivia*, **Review of Economics and Statistics**, 88, 2006) follows seminal work by Angrist and Lavy (1999) in applying a regression discontinuity design to exploit a situation in which the existence of a class size cap determines that schools' enrollments and class sizes are discontinuously related, allowing one to control for confounding factors. Using data from rural Bolivia, the results suggest that increases in class size negatively affect test scores, a result consistent with Angrist and Lavy (1999). This paper was one of the first to apply a regression discontinuity technique in a developing country setting.

This approach was subsequently also used to analyze class size in Denmark, France, Holland, Norway, and the U.S. A second paper (*Class size caps, sorting, and the regression discontinuity design*, with Eric Verhoogen, **American Economic Review**, forthcoming) explores how sorting can affect such analyses, and in a well-defined subset of cases, invalidate them. Specifically, focusing on the liberalized Chilean educational market, in which for-profit schools are common, the paper

work like Angrist, Lang, and Oreopolous (forthcoming) and Kremer, Miguel, and Thornton (forthcoming). One of this project's aims is to provide a theoretical complement to this work.

models how profit-maximizing schools differentiate their products by choosing class size, and how these choices influence households' school selection.

The model predicts that some schools at the class size cap will adjust prices or enrollments to avoid adding another classroom, producing "stacking"—i.e., peaks in the density of observed enrollment—at multiples of the cap. This generates discontinuities in the relationship between enrollment and household characteristics at those points, violating assumptions underlying the regression discontinuity design. This suggests caution in applying this approach in settings in which parents can easily sort between schools, and in which schools are able to influence their enrollments.

These papers have had an impact on the class size literature and on broader methodological discussions. For instance, Imbens and Lemieux (2007) cite both in a *Journal of Econometrics* review of the regression discontinuity design. The tests suggested in the second paper have been applied to Israel by Cohen-Zada and Reuven (2008), and are discussed in a forthcoming piece in the *Journal of Economic Literature* (by Lee and Lemieux). This reflects that it is one of the first papers to provide a formalized model of how economic behavior can invalidate the regression discontinuity design, a broader point explored by McCrary (2008). The paper is also cited by Deaton (2009) in a discussion of the application of empirical methods to questions of Economic Development.

4) The effects of statistical noise and stratification on accountability measures

A third way in which policymakers have attempted to improve education is by using data on schools' performance both to provide schools with incentives, and to help parents in making school choices. This approach has grown as countries have set up *No Child Left Behind*-type initiatives. There has been interest, therefore, in evaluating interventions that assign schools penalties or rewards based on their performance. Such evaluations are difficult to implement, because aside from the usual complications, mean reversion poses a challenge. Specifically, consider a program that treats schools that perform poorly in a given test. Such schools are likely to have done badly partially due to transitory negative errors ("bad luck"), and they will therefore tend to show relative improvement even if the program has no effect, making it difficult to separate causal impacts from regression to the mean.

A first paper in this area (*The central role of noise in evaluating interventions that use test scores to rank schools*, with Kenneth Chay and Patrick McEwan, **American Economic Review**, 95(4), 2005) tackles the issue by considering a Chilean program which granted infrastructure and teacher-related improvements to schools, with participation determined by whether their mean scores fell below a cutoff value. This allows the use of a regression discontinuity design which suggests that transitory noise leads conventional evaluation approaches to overstate the program's positive impact. Subsequent work has taken note of this issue (e.g., Chakrabarti, 2008), and the findings had practical implications, as previous World Bank evaluations suggested significantly more positive effects.

These results also broadly follow work by Kane and Staiger (2002) in suggesting that generating useful information on school performance is harder than commonly thought. A second paper (*Ranking schools: The influence of noise and socioeconomic status on performance measures*, with Alejandra Mizala and Pilar Romaguera, **Journal of Development Economics**, 84(1), 2007) further points out that this is probably even more the case in school systems that exhibit stratification. Specifically, while one might want to provide policy makers and parents with measures of schools' value added, this is hard to achieve—in the extreme, it would require a large number of sustained randomized trials. Accountability schemes therefore rely on other performance measures, and one

might be concerned if these display either of two characteristics: i) being closely predicted by socioeconomic status (one would not want to penalize or reward schools simply because they enroll rich or poor children), and ii) substantial volatility.

The paper uses an unusually rich time series of individual level data from Chile (1993-2004) to suggest that in terms of these two criteria, several standard performance measures exhibit an undesirable trade-off. In order to generate rankings that do not closely track socioeconomic status, one is forced to use residuals and year to year changes in scores, and these measures are quite volatile. This reinforces that care must go into designing accountability systems if these are not to confuse practitioners and parents.

A third paper in this area (*Parental choice and school markets: The impact of information on school effectiveness*, with Alejandra Mizala) notes that the impact of competition is likely to depend on whether parents respond to information on school quality. In recent years the literature has produced evidence that parents do value school quality, at least as measured by test scores (e.g. Black, 1999). There is evidence, further, that parents react to the placement of schools in discrete categories (e.g., “A” vs. “B”), even when the information used to assign them to these is public (Figlio and Lucas, 2004). One issue, however, is that test scores conflate peer quality and school value added.

A gap in the literature therefore relates to whether parents’ choices and schools’ market outcomes would respond if parents were given signals intended to reflect effectiveness, even if these were not correlated with peer quality. This paper addresses this gap by considering how Chilean schools’ market shares and their tuition react when they are identified as performing well relative to schools that serve similar children. It analyzes a program which selects good performers from within more than one hundred “homogeneous groups” containing schools used by arguably comparable children. The paper uses a regression discontinuity design to test if, as in Figlio and Lucas (2004), parents react to the placement of schools in discrete categories. Through five rounds of the program, there is no consistent evidence that awards affect schools’ outcomes.

These findings are related to a broader discussion regarding possible routes to improving social services in developing countries. The World Bank (2004), for instance, suggests that information provision in itself can be quite effective. Other work, like Banerjee and Duflo (2006) and Duflo and Hanna (2006), is consistent with assigning a greater role to direct incentives, and these results tend to support the latter.

5) The consequences of attending a selective school

A last area of ongoing work addresses a classic question in education: whether students benefit from attending higher-achieving schools. For example, part of the rationale behind *No Child Left Behind* is that a child in a low-achievement institution would be better off transferring to a higher-scoring school. Solid evidence on this has been difficult to produce, mainly because students are not randomly allocated to schools. Nonetheless, several analyses have exploited compelling research designs to circumvent this problem (e.g., Dale and Krueger, 2002, and Cullen, Jacob, and Levitt, 2005), including two recent papers—Clark (2008) and Duflo, Dupas, and Kremer (2007)—which exploit regression discontinuity designs in the UK and Kenya, respectively. In other words, in each case the outcomes of students who just make it into a better school or class are compared to those who just miss gaining entry.

An ongoing project (*The consequences of going to a better school*, with Cristian Pop-Eleches)

applies a similar design to Romania's educational system, which is configured in a way that provides two distinct advantages for such an approach. First, our data cover the universe of Romanian high schools and provide information on about 2,000 cutoffs generated by three cohorts of students. This allows us to pool a large number of quasi-experiments, obtaining larger sample sizes than, to our knowledge, have been previously available for this type of research. Second, the large number of cutoffs allows us to explore the heterogeneity of school effects—whether being able to attend a more selective school, for example, is more valuable to a student whose initial performance is high or low. Further, a survey applied to children close to the discontinuities that determine admission will allow us to explore some of the channels behind these effects.

This project seems promising to the extent that it was selected for funding by the National Science Foundation, and a version with initial results was chosen for presentation at the National Bureau of Economic Research Summer Institute, in the Education group. Further, assembling these data has been substantial work, but it has put us in a position to address several questions. For instance, we expect to be able to use solid designs to analyze topics including teacher markets, the effects of vocational schooling on college attendance, and (using variation in legislation affecting access to abortion) the interaction of parental care and school quality in determining children's outcomes. The additional data necessary for this exercises was collected during the Summer of 2009.

Other research

I have done policy-oriented research in other areas related mainly to the Economics of Education in developing countries. Briefly:

- School fees and enrollment—While conditional cash transfers (which pay households a stipend if they enroll their children in school) have been widely evaluated, school fee reductions (which lower payments in an attempt to increase enrollments), are the object of fewer rigorous evaluations. To address this, a paper (*The effects of user fee reductions on enrollment: Evidence from a quasi-experiment*, with Felipe Barrera and Leigh Linden) applies a regression discontinuity analysis to a fee-reduction program in Colombia, suggesting it indeed increased enrollment.
- Developing country efforts to reach universal enrollment—I have analyzed progress towards universal enrollment in Bolivia, the Dominican Republic, and Honduras. Additionally, I carried out a related (Inter-American Bank-funded) study covering essentially all Latin American countries, published as *Apples and oranges: Educational enrollment and attainment across countries in Latin America and the Caribbean*, with Valentina Calderón, **International Journal of Educational Development**, 26, 2006. This research highlights the need to consider countries' performance not just in getting children into school, but also in turning their contact with the educational system into years of schooling.
- Teacher pay—Work on this topic includes projects in Bolivia and Uruguay, and a book (*Teachers in Bolivia: Incentives, Impact, and Performance*, published in Bolivia) on the subject. I also wrote a chapter (*Arbitrary variation in teacher salaries*, with Emiliana Vegas) for a book published by the World Bank (Vegas, 2005). One common focus of these papers is analyzing the way in which teacher pay is determined to study the incentives instructors face.
- School-to-Work and vocational programs in the U.S.—My work in this area focused on the relative effectiveness of different vocational education programs in the U.S., with some of the

results presented in *What difference does it make if school and work are connected? Evidence on Cooperative Education in the U.S.*, with David Stern and Neal Finkelstein, **Economics of Education Review**, 1997.

- The welfare effects of utility privatization—I have analyzed the impact of utility privatization in Latin America, with a focus on whether positive impacts of access improvements outweighed negative ones from price increases. One chapter (*Capitalization, regulation and the poor: Access to basic services*, with Gover Barja) appeared in a U.N. volume (Ugaz and Waddams Price, 2003) and another (*Bolivian Capitalization and privatization: An approximation to an evaluation*, with Gover Barja and David McKenzie) in a Center for Global Development volume (Nellis and Birdsall, 2005).

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