Title: Evaluating the Effects of Basic Skills Mathematics Placement on Academic Outcomes of Community College Students

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Abstract Body

Background / Context:

A large proportion of the high school graduates who attend a postsecondary institution take at least one basic skills/developmental/remedial course in either mathematics or English (Parsad & Lewis, 2003). A report from the Academic Senate for California Community Colleges (2000), which surveyed almost half of the community colleges in the state, found that, on average, 49 percent of students are directed to these basic skills courses.

There is considerable debate on the effects and benefits of remediation in community colleges. Proponents argue that it enables poorly prepared high school students to attain the necessary preparation to succeed in college (Boylan, Bliss, & Bonham, 1994; 1997; Lazarick, 1997). On the other hand critics argue that the benefits of remediation are not clear given there is no evidence that remediated students passed college-level courses or attained degrees at higher rates than non-remediated students (Calcagno, 2007; Calcagno & Long, 2008; Martorell & McFarlin, 2007). In addition, there is evidence that students who were placed in remediation but who took college credit courses passed these courses (Armstrong, 1999). Finally, a major criticism is that, relative to its potential benefits, remediation is too costly for the students and for the state (James, Morrow & Perry, 2002).

Every year more than 50 percent of the students from the LACCD are placed into basic skills mathematics. This is costly for the individuals and for the state. At the individual level, students need to take these courses before they can enroll in degree or transfer level courses, and this substantially increase the time that they remain in the system. The state in turn has to pay for courses that the students were supposed to take in high school. As described below, the effects of assignment of entering students to different levels of math on the academic preparation, persistence and educational outcomes are unclear at best. This study is an ambitious attempt to enhance the available research on this critical policy issue for the State of California and the nation. This evaluation will provide insights to the district and the state about the effect of placement on successful course sequences that have the potential to promote persistence and save millions of dollars to the state.

Purpose / Objective / Research Question / Focus of Study:

The main objective of our proposed study is to evaluate the effectiveness of math placement policies for entering community college students on these students' academic success in math, and their transfer and graduation rates. The main research question that guides the proposed study is: What are the effects of various basic skills mathematics paths on the course-taking patterns of community college students? Our study combines descriptive analyses with a regression discontinuity (RD) design to estimate the effect of developmental education. We have two closely related goals: 1) To provide a descriptive analysis of the course taking patterns (basic skills and college level) of community college students; 2) To use a regression-discontinuity design to test the effect of assignment to different levels of basic skills courses in mathematics on subsequent educational outcomes. Our outcomes of interest all relate to the students' educational attainment: (i) successfully passed to the next math level; (ii) enrolled and passed a college level course; (iii) community college grade point average; (iv) total college credit attained (total and transfer level); (v) attained a certificate or associate degree; and (vi) transferred to a four-year

college. We chose a RD approach because this is a technique that enables the researcher to make causal inferences when randomization is not feasible. The general idea is that the researcher "assigns" individuals to the treatment and control groups according to an exogenously determined cutoff score on the assignment variable (i.e. the cutoff point on the placement test that they need to take their first year) rather than the fair coin toss that is common on randomized trials. We will use a sharp regression discontinuity (SRD) to estimate the intent to treat (ITT), and a fuzzy regression discontinuity (FRD) to estimate the local average treatment effect (LATE).

The study described above is currently being funded by an Institute of Education Sciences (IES) research grant. At this stage the authors are still in the process of creating the final dataset, and of identifying the assessment and placement policies in the 9 community colleges. The authors expect that by the time of the conference next year, they would have complete information regarding the placement rules for the 9 community colleges of the district. The authors will present an overview of the study, a brief summary of the literature, and they will present the descriptive statistics, as well as the placement policies in each of the 9 colleges.

Setting:
Description of the research location.

The setting in which the study is conducted is the Los Angeles Community College District (LACCD). We use student transcript data since 2001 until 2009. For this first stage of the project we use the transcript data to evaluate the effect of taking a basic skills mathematics course on the probability of passing either the following level of basic skills math, or the next college level course.

Population / Participants / Subjects:

The sampling frame for our analysis consists of about 158,000 community college students who were placed into mathematics in one of nine Los Angeles County Community Colleges between June 2001 and September 2009 and for whom a Continuous Placement Score (CPS) is available in the management information system maintained by the Los Angeles Community College District. This includes about 50 percent of all entering students at these nine colleges. For each of these students, we will gain access to at least two years of course transcript data, including whether the student attained a certificate or an associate degree, transferred, or left college before graduation. The length of follow up of the outcomes will vary depending on the entering year. To assess the sensitivity of our analyses to censoring, we will compare estimates from early cohorts to estimates from later cohorts.

Intervention / Program / Practice:
Description of the intervention, program or practice, including details of administration and duration.

Assessment in mathematics in the Los Angeles Community College District

The results of the recent survey of the task force on assessment as well as informal conversations with placement administrators in the nine colleges of the LACCD indicate that there is a great deal of consistency in the assessment practices for placement in mathematics,

especially compared to English and ESL. Currently, the majority of colleges use one of the two commercially developed tests. Specifically, six colleges use the Accuplacer test, two use the Compass test, and one uses the MDTP. According to assessment staff, the test scores are used to place students, and these placement decisions are consistently enforced. In other words, students whose test scores indicate a need to take an elementary algebra course cannot enroll in any college-level math courses. Logistically, it is difficult for students to retake a placement exam to improve their scores. The colleges have specific dates and preparation scheduled for the placement exams and the colleges have to pay for each student who takes one of the commercially developed tests, making them unlikely to encourage or allow students to take a placement test more than once.

Research Design:

As introduced above, the study addresses these research questions using a regression discontinuity design. Such a design is the closest non-experimental research design to a random assignment experiment in which a portion of entering students would be assigned to one level of math and a portion would be assigned to the next higher level. The regression discontinuity design requires (a) a continuous predictor variable, and (b) discrete and exogenously established cut points. The latter must have a very strong relationship to the policy variable of interest. In the present study, the continuous predictor variable is the so-called "Continuous Placement Score" (CPS), which is derived from a college entry test that the vast majority of entering community college students take, as detailed in a previous section of this proposal. Each California community college chooses distinct cut scores on this CPS to place students in 4-5 different levels of math. While these referrals are not the only determinant of students' subsequent enrollment decisions, they are a critical part of these decisions.

As is the case in many true randomized experiments, the cut score in a regression discontinuity design merely identifies an "intent to treat." Some proportion of sample members will not follow the researchers' (or program) directions and the outcomes for those sample members are averaged in with outcomes for sample members who do act in accordance with the intended treatment. Thus, in the case of this particular study, a small proportion of the students will enroll in a different level of math than the placement score indicates, but their outcomes will be combined with those who do enroll in the assigned level to determine the impacts of assignment to different levels of math on the outcomes specified in the research questions above. This caveat must be considered when interpreting the results from our proposed research.[*] In addition, and as we explain in more detail below we will estimate the models using fuzzy regression discontinuity in order to estimate the local average treatment effect (LATE) (Calcagno & Long, 2008).

As discussed in more detail below, we are in the fortunate position that we have access to a very large sample of students. Across the nine institutions in the Los Angeles Community College district, we have access to transcript data for about 158,000 students across eight years. What this allows us to do is to estimate regression discontinuity functions for each of the four cut-points separating five levels of math instruction. The relatively short CPS score intervals between the cut points and the large sample of entering students cause the expected regression-

[*] A different way to conceptualize this issue is that the study will measure the impact of placement policies, not the impact of actual math instruction at different levels. To the extent that there is a great degree of overlap between the two, the results from the former can be generalized to the latter, but only with certain caveats.

discontinuity functions to be relatively "short and fat." In other words, we will likely be able to limit our sample to students whose CPS scores are relatively close to the cutoff scores on either end. This has several important analytical advantages. First, it means that the functional form of the regression function is likely to be more straightforward than a long regression line covering a wide range of potential CPS scores would be. This in turn minimizes the likelihood that misspecification bias affects the impact estimates. The latter is one of the major risks to the internal validity of impact estimates obtained from regression discontinuity designs, especially compared with true randomized experiments, whose internal validity is, by definition, unaffected by specification error. Second, estimation of the regression function close to the cutoff score increases the policy relevance (external validity) of the impact estimates.

Our study does have one additional complication, which is that the cut scores are independently determined by the individual community colleges, so they will not be consistent across all nine, even though the CPS is comparable across all the community colleges. In California there is no consistent strategy to determine who needs remedial education. Each community college determines for itself which placement examinations to use and what the proficiency cut-scores will be for each test and placement decision. The community colleges in our sample use one of the following placement tests: the Accuplacer CPTs by the College Board, the Compass test developed by ACT, and the Math Diagnostic Testing Program (MDTP), originally developed by faculty from the California State University (CSU) and University of California (UC).

Even though different tests are used to create the CPS and different cut scores are established by individual community colleges, the constructs will likely be sufficiently overlapping to allow analyses to be conducted pooled across all colleges, with appropriate interaction terms to control for variation in the relationship of each college's CPS with its students' academic outcomes. We will also conduct separate impact analyses for each of the nine community colleges (or for groups of colleges that use similar tests and cut scores).

Data Collection and Analysis:

Description of the methods for collecting and analyzing data.

We recently received access to the different databases compiled by the LACCD. We are in the process of combining these datasets to have information related to individual student characteristics, course enrollment, and assessment and placement practices in a single database. In addition, we have devoted substantial amount of time to identifying the variables used in the assessment and placement. The fact that each college has a unique set of rules with different tests and cut scores to place students, and that this information has not been consistently used, means that we had to spend time identifying the different variables used in the placement from the databases.

Findings / Results:

Description of the main findings with specific details.

We have been able to identify the assessment and placement practices in 4 of the 9 community colleges. Table 1 describes the placement rules for these 4 colleges. During the conference we will present an overview of the study, a brief literature review, and we will focus on describing how the placement rules result in the actual placement of students in the 9 community colleges.

Conclusions:

California is going through a major financial crisis that has already reduced the funding for community colleges by 10 percent for the 2009-10 fiscal year. Colleges are already firing part-time faculty, increasing the number of students in already over-crowded class rooms, and reducing the number of pre-requisite courses (i.e. elementary algebra) for degree attainment. All of this is going to have a negative effect in the quality of the courses provided by colleges. After three years of a California Basic Skills Initiative that focused on professional development and that did not include any accountability measure it is imperative to fund a study that will illustrate the condition of math basic skills and its impact on short- and long-term educational outcomes. This study is an ambitious attempt to enhance the available research on this critical policy issue for the State of California and the nation. This evaluation will provide insights to the district and the state about the effect of placement on successful course sequences that have the potential to promote persistence and save millions of dollars to the state.

Appendix A. References

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Appendix B. Tables and Figures

Table 1.A. Placement Rules for City College					
Multiple Measures Score (MMP). Students can get up to 5 points based on their responses on the Educational Planning Questionnaire.					
Arithmetic (AR)		**Elementary Algebra (EA)**		**College Level Math (CM)**	
		109 <= EA	CM Referral*		
		90 <= EA < 109	Math 125 (Inter Alg)	103 ≤ CM	Math 261 (Calculus I)
		76 <= EA < 90	Math121-124A (Elem Alg)	87 ≤ CM < 103	Math 260 (Pre-Calculus)
		65 <= EA < 76	MATH 115, 113, 112 (Elem Alg; 1 Sem)	75 ≤ CM < 87	Math 230-240 (Math LA to Trig)
65 <= AR	EA REF	50 < EA <65	Math 113 (Elem Alg;2 SEM)	63 <= CM < 75	Math 215-245 (College Algebra)
45<=AR<65	Math 112	38<=EA<50 OR 17<EA<38 & AR>65	Math 112 (Pre-Alg)	43 <= CM < 63 OR (17<CM<43 & EA>109)	Math 125 (Inter Alg)
17<=AR<45	Math 105	17<=EA<38	AR Ref	17 <= CM < 43	EA Ref
0<AR<17	No AR Pl	0<EA<17	No EA Pl	0 < CM < 17	No CL Pl

Table 1.B. Placement Rules for Southwest College					
Multiple Measures Score (MMP). Students can get up to 11 points and loose up to 3 points based on their responses on the Educational Planning Questionnaire.					
Arithmetic (AR)		**Elementary Algebra (EA)**		**College Level Math (CM)**	
		74>= EA	CLM Ref	104 ≤ CM	Above Math 240
65 <= AR	EA Ref	70 < =EA <74	Math 125	86 <= CM < 104	Math 240
39<=AR<65	Math 112	41<=EA<70	Math 115	63 <= CM < 86	M227-245
22<=AR<39	Math 105	28<=EA<34	Math 112	43 <= CM < 63	Math 125
1<=AR<22	Math 104	0<=EA<28	AR Ref	1 <= CM < 43	EA Ref

Table 1.C. Placement Rules for Tradetech College					
Multiple Measures Score (MMP). No multiple measures used.					
Arithmetic (AR)		**Elementary Algebra (EA)**		**College Level Math (CM)**	
1113 <= AR<120	Math 115			100 ≤ CM	Math 265
100 <= AR<113	Math 113	77 <= EA 120	Math 125	86 <= CM < 10	Math 260
60<=AR<100	Math 112	34<=EA<77	Math 115	60 <= CM < 86	Math 245
22<=AR<60	Math 105	20<=EA<34	Math 113	40 <= CM < 63	Math 125
0<=AR<22	Math 101	0<=EA<20	Math 112	0 <= CM < 40	Math 115

Table 1.D. Placement Rules for Tradetech College					
Multiple Measures Score (MMP). Students can get up to 4 points based on their responses on the Educational Planning Questionnaire.					
Arithmetic (AR)		**Elementary Algebra (EA**		**College Level Math (CM)**	
		74 <= EA	CM Ref	104 ≤ CM	Above Math 240
65 <= AR	EA Ref	70 <= EA <74	Math 125	86 <= CM < 104	Math 240
39<=AR<65	Math 112	41<=EA<70	Math 115	63 <= CM < 86	Math 245
22<=AR<39	Math 105	28<=EA<34	Math 112	43 <= CM < 63	Math 115
1<=AR<22	Math 104	1<=EA<28	AR Ref	1 <= CM < 43	EA Ref