Title: The Effects of Structured Transfer Programs in Community Colleges

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Problem / Background / Context:
Many community college students begin with the intention of transferring to a four-year school but relatively few actually do. One hypothesis for the low rates of successful two-to-four year transfers is that academic program choices in community colleges are too numerous and too complex. Community college students face an overwhelming array of available pathways and even for those students who have defined transfer as their goal a number of structural and informational barriers exist. Transfer pathways aren't always clear or well structured, there often isn't coordination between community colleges and four-year schools, and students often don't have access to formal or informal information networks (Scott-Clayton, 2011). Charting a path to a degree or transfer has been equated to "navigating a shapeless river on a dark night" (Scott-Clayton, 2011, p. 1).

Many states have reacted to low transfer rates by enacting a range of state-wide articulation agreements: incentives to transfer (such as financial aid or guaranteed acceptance); common general education requirements or common course numbering; or complete transfer degree programs (Gross and Goldhaber, 2009; Bers, 2013). As of 2011, at least 21 states had some sort of statewide articulation agreement and eight states had implemented transfer associate degrees (Roksa, 2009; Kisker et al, 2011).

There isn't much research on the success of transfer and articulation agreements. Longitudinal data, from before and after transfer policies are enacted, on outcomes such as transfer rates, number of degrees and course taking is needed to persuasively assess the effect of transfer policies. Most states don't have such data (Roksa, 2009). As a result, much of the extant research has relied on between state variation in transfer policies. These types of studies can provide suggestive evidence but they cannot provide causal estimates. Most studies of state articulation agreements haven't found economically or statistically significant effects (e.g. Anderson, Sun and Alfonso, 2006; Roksa, 2009), though there is some evidence that articulation agreements might affect certain subgroups (Gross and Goldhaber, 2009). However, it's hard to disentangle lack of effects from lack of adequate data. This will be the first study to provide quasi-experiment estimates on the effects of a state articulation agreement on degrees earned and student course taking.

Purpose / Objective / Research Question / Focus of Research:
In this paper, I will address a longer term outcome of a state articulation policy in California (number of associates degrees granted) as well as the more proximate outcome (changes in course taking patterns) implicit in these more distal goals. I will also examine whether the reform is having heterogeneous effects on different demographic groups and different degree programs.

Using data from California Community Colleges, I will answer the following research questions:
a. Do structured academic transfer programs for community college students affect student outcomes and course-taking behavior?
b. Does a more structured transfer program affect the demographics (race, age, SES, prior education) of degree programs in community colleges and does it have larger effects on particular groups of students?

Improvement Initiative / Intervention / Program / Practice:
The Student Transfer Achievement Reform Act (California SB 1440), signed into legislation in September, 2010, mandates that the CCC and CSU systems collaborate on the creation of

Associate Degrees for Transfer. The goal of the bill was to make the transfer process more efficient and reduce the number of students who transfer without an AA or AS. Prior to this legislation, each of the 112 CCCs set its own requirements for graduation and each CSU determined its own prerequisites for accepting CCC transfer students. CCC students transferring to a CSU graduated with an average of 162 semester credits when the minimum requirement is 120. Students transferred with an average of 80 semester units when only 60 are required (California Legislative Analyst's Office: http://www.lao.ca.gov/). On November 21, 2013 the California Community College Chancellor's Office announced that 1,000 AA-T/AS-T programs had been developed and each of the 112 CCCs had at least one ADT available.

Setting:
I am working closely with a community college district in Northern California. The Director of Institutional Research has provided me with 5 years of student transcript data. I have met with student advisors, the transfer dean and numerous administrators to discuss the research design and preliminary findings.

Population / Participants / Subjects:
I am using exclusively administrative data for this project. I have degree data from all CCCs and transcript data from one district. The CCC system educates more than 2.3 million students on 112 campuses. Nearly 1/3 of community college students in the country are in the CCC system. Its integral role in California human capital production is clear: CCCs educate 70% of California's nurses and 80% of the state's firefighters, law enforcement personnel and EMTs. Twenty-nine percent of UC graduates and 51% of graduates started at a CCC (Community College League of California: http://www.ccleague.org/files/public/FF2013.pdf). The district with whom I am working serves roughly 40,000 students each term. Its students are about 30% Asian, 30% White and 20% Latino/a and 65% indicate transfer as their academic goal.

Research Design:
I leverage the staggered introduction of ADTs at CCCs across the state to identify the effects of the implementation of SB 1440 on CCC student course taking and outcomes. ADTs were introduced in different departments in different CCCs over time. This set up lends itself to a difference-in-difference-in-difference (DDD) approach and will allow me to decompose observed changes into a true effect and the component due to difference between treatment and control groups.

By including controls for individual schools, individual majors, years, as well as all the double interactions, I can control for other complicating trends. This fully saturated interacted fixed effects approach is DDD model:

$$\ln(Y_{csy}) = \beta \boldsymbol{T}_{csy} + \alpha_{cs} + \delta_{cy} + \gamma_{sy} + \theta_y + \tau_c + \varphi_s + \varepsilon_{csy}$$

where Y_{csy} is the outcome of interest (here, the natural log of the number of degrees granted in college c in subject s in year y), $\boldsymbol{T}_{csy}$ is an indicator that is equal to one for treated subjects at treated colleges in treated years, α_{cs} is a set of college-by-subject fixed effects, δ_{cy} is a set of college-by-year fixed effects, γ_{sy} is a set of subject-by-year fixed effects and θ_y, τ_c, and φ_s are year, college and subject fixed effects. The main effects will drop out due to collinearity, but I include them in this model for purposes of clarity. The parameter of interest is, of course, β, which tells us the effect of being an SB 1440 active subject, holding all else constant.

The main identifying assumption here is that the observed outcomes for the control conditions provide enough information to estimate what would happen to the treated groups in the absence of treatment. In this case, we might worry the causal warrant isn't perfect because the counterfactual isn't perfect: "control" subjects might also have been affected by the treatment. If there is an increase in the number of students earning degrees in ADT subjects in treated years at treated schools, this perceived "effect" could actually be evidence of a shift in students; treated majors could be cannibalizing untreated majors. On the other hand, a perceived effect could also be due to a true effect; perhaps the introduction of SB 1440 increased the number of students who earned associates degrees in these fields by inducing students who were already planning to transfer to "pick up" a degree along the way.

Models to test the mechanisms underlying estimated effects will include subject-by-year fixed effects, subject-by-college fixed effects, college, subject and year fixed effects and, most importantly, terms that indicate the number of associates degrees for transfer available. These models control for year varying subject effects (γ_{sy}), and college specific subject effects (α_{cs}), and college-year specific terms that indicate the amount of reform based "competition."

$$\ln(Y_{csy}) = \beta * dosage_{cy} + \alpha_{cs} + \gamma_{sy} + \theta_y + \tau_c + \varphi_s + \varepsilon_{csy} \qquad (2)$$

where the outcome is the natural log of the number of degrees at a given college in a given subject in a given year, T_{cy} is an indicator that a given college in a given year has active associates degree for transfer awards and $dosage_{cy}$ is a contiuous variable that indicates how many SB1440 programs were active in a given college in a given year. In treatment years, dosage varies from 0 to 10 with a mean of 2.4 and a standard deviation of 2.1. All other terms are the same as in equation 1.

I estimate this model for three groups of majors: treated majors, all untreated majors, and "plausible losers," which I define as majors which we might expect to experience competition from ADT departments. If the presence of SB 1440 programs is affecting non-SB 1440 programs in a school, we expect that β will be negative and significant for models run on untreated majors and plausible losers.

Given that this policy affected a diverse group of disciplines across 112 different schools, it is reasonable to expect that there might be some heterogeneity of treatment effects. One way to test for this is to run our preferred specification, equation 1, in a number of different subgroups. Bahr (2013) provides a typology of California Community Colleges based on students' usage patterns (Transfer Intensive, Workforce Development Intensive…). Using these groups, I can test to see if SB 1440 had differential effects in different types of schools. Similarly, we might expect that different departments will experience different effects from the introduction of associates for transfer degrees.

To examine potential heterogeneous effects, I also estimate student-level models that include interactions between treatment and demographic characteristics. I also estimate models similar to equation 1 for other outcomes, such as the proportion of women (Asian students, older students…) enrolled in treated programs, to determine whether the policy change affected the demographic characteristics of schools and programs.

Data Collection and Analysis:
To examine if the introduction of Associates degrees for transfer affected the number of degrees granted in these fields, I will use publically available data from the California Community

College Chancellor's Office (http://datamart.cccco.edu/). The CCCCO publishes data on the number of awards granted in each department at each community college each year. For a more in depth analysis of how the introduction of associates degrees for transfer affected student behavior and which students responded the most, I will use student-level data from two community colleges. I have all transcript data (course enrollments and grades) for all students in the one Northern California district from Fall, 2008 to Winter, 2014 (just over 2 million observations). These data also include student demographic data from applications. Using the district course catalogs I can determine which degree programs were offered each year and which classes were required for each degree each year, which allows me to identify "treated" courses. The course catalogs also publish which classes are needed to fulfill general education requirements for transfer so I can also identify "transfer required general education" classes to see if the reform had any effect on enrollment in these classes.

Findings / Outcomes:
I currently have results from the system level analysis- the effect of structured transfer programs on the number of degrees granted. Table 1 shows these main results (equation 1). We see significant, positive effects in treated subjects in treated years; SB 1440 seems to have affected the behavior of students in terms of degrees earned. These results are not only statistically significant, they are also practically meaningful. I estimate an effect of 10 additional degrees granted each year in treated subjects. The mean across all subjects is 50 degrees per year, so this is a large increase.

(insert table 1 here)

Table 2 presents the results from equation 2, which estimates whether this effect was the result of the "cannibalization" of other departments or actual growth. We see no effect in untreated majors or "plausible losers;" the growth appears to be due to inducing more students to get associates degrees. Student level analyses will allow me to examine the mechanisms behind these observed effects and determine if the policy had differential effects by demographic group.

(insert table 2 here)

Conclusions:
This study provides preliminary evidence that the introduction of Associates degrees for transfer had an effect on the behavior of students. We see that departments that offered these degrees saw bigger than expected increases in the number of degrees they granted. We don't see evidence that untreated departments were affected, which could mean that the legislation induced students who were already planning to transfer to pick up a degree "on the way" as opposed to switching majors. Further analyses will allow us to look more closely at how student behavior was affected in terms of course taking patterns. Student level transcript data will also allow us to examine demographic trends in who took advantage of these programs.

As the first quasi-experimental evidence on the effects of structured transfer programs on student behavior, this study provides useful evidence on an increasingly popular policy intervention.

Appendix A. References

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Appendix B. Tables and Figures

Table 1: Estimated Effects of Offering an Associates Degree for Transfer on Number of Degrees Awarded, California Community Colleges, 2008-2012

	Balanced Panel		Unbalanced Panel	
Outcome:	# of degrees	ln(# of degrees)	# of degrees	ln(# of degrees)
ADT (treatment)	7.319	0.259 ***	10.119 **	0.33 ***
	(5.163)	(0.045)	(3.309)	(0.056)
Intercept	64.273	4.031	-84.884	1.606
	(4.799)	(0.091)	(6.255)	(0.291)
N	3445	3283	9375	8372
Adjusted R^2	0.93	0.929	0.93	0.917

 p<0.10, * p<0.05, ** p<0.01, *** p<0.001

All models include college-by-subject, college-by-year and subject-by-year fixed effects. The balanced panel includes the 13 disciplines that are present at 75% or more of schools and only those schools that have all 13 majors. The unbalanced panel includes all disciplines at all schools.

Table 2: Estimated Effects of Offering Associates Degree for Transfer Programs on Number of Degrees, California Community Colleges, 2008-2012

	Untreated Programs		"Plausible Losers"		Treated Programs	
Dosage		0.001		0.000		0.032 *
		(0.007)		(0.008)		(0.013)
N	6694	6694	4940	4940	1678	1678
Adjusted R^2	0.915	0.915	0.926	0.926	0.871	0.871

 p<0.10, * p<0.05, ** p<0.01, *** p<0.001

All models include college-by-subject and subject-by-year fixed effects and are run on an unbalanced panel: all degrees across all years. "Plausible Losers" were defined as all fields except Agriculture and Natural Resources, Architecture and Environmental Design, Foreign Language, Family and Consumer Sciences, Military Studies and Commerical Services.