

Community Colleges and Degree Attainment in Kansas

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Previous Research has shown a significant penalty for starting in a community college

- This research uses data from the 1990s and early 2000s
- Has this changed?
- The cost of college has increased faster than the rate of inflation
 - ① Community Colleges provide a way for students to save money while obtaining a degree.
 - ② Many programs are providing incentives to start in a Community College (e.g. tuition-free)
- This paper re-examines the Community College (CC) Penalty.

Overview

- Review literature on Community College Penalty
- Kansas Administrative Data
- Instrument new to the literature: Differential Distance to a 2- or 4-year institution
- Three research questions. . .

Research Questions

(1) Is there a Community College education penalty?

In Kansas, accounting for selection, there is no degree penalty for CC students.

(2) What role do remedial credits play?

The allocation of remedial credits is not as efficient as it could be and seems to prevent STEM majors.

(3) What is the role of complex pathways?

. Many students who transfer laterally to another community college or transfer down from a baccalaureate institution are less likely to graduate.

Community Colleges Remain Affordable Over Sample Period

Table: National Education Statistics for Tuition (constant 2016-2017 USD)

Year	Public Institutions	4-year	2-year	% of Cost
2012-2013	15,755	18,328	9,363	51.1%
2011-2012	15,311	17,900	9,189	51.3%
2010-2011	14,889	17,472	8,867	50.7%
2009-2010	14,353	16,834	8,630	51.3%
2008-2009	13,855	16,122	8,555	53.1%
2007-2008	13,265	15,392	7,995	51.9%

It is much more affordable to start in a Community College (assuming that starting there does not affect the likelihood of obtaining a bachelor's degree).

Gaps in the literature on CC degree attainment

Table: Overview of Community College Penalty Literature

Authors	Context	Education	Sample Years	Research Design
Long & Kurlaender (2009)	Ohio	-14.5% (9yr degree)	1998-2007	IV (Distance)
Andrews et al (2014)	Texas	-4.5 to -7.2%	1992-2002	Descriptive
Alfonso (2006)	NELS	-26 to -32%	1988 Cohort	IV (unemp./tuition)
Alba, Lavin (1981)	CUNY	Several Negative Effects	1970	Natural Experiment
Rouse (1995)	HS&B	-7 to -10.7%	1980	PSM
Melguizo, Dowd (2009)	NELS	No effect on transfers	1988 Cohort	Logit Regression
Sandy et al (2006)	NLS	Negative Student Effects	1972 Cohort	Oax. Decomp.
Bound et al (2010)	NLS & NELS	Negative CC Effects	1972 & 1992	Simulated Logit
Kurlaender et al (2016)	California	CC Quality Effects	2004-2008	Bayes Shrinkage Est.
Brand et al (2014)	Chicago	Mixed CC Effect	2001	Smoothing-Differencing
Doyle (2009)	BPS	Negative CC Effect	1996 Cohort	PSM
Denning (2017)	Texas	No effect on transfers	1994 - 2005	DiD & IV (Annex.)
Dietrich, Lichtenberger (2015)	Illinois	No effect on transfers	2003	PSM
Lee et al (1993)	HBS	No effect on transfers	1980	Logit Regression
Monaghan, Attewell (2014)	BPS	-17% (6yr degree)	2004 Cohort	PSM

Most studies show a CC penalty ranging from -7 to -32 percent.
There is limited impact once students transfer.

We use administrative data from the Kansas Board of Regents, 2007-2013

Administrative Data from Kansas

Primary data comes from the Kansas Board of Regents (KBOR)

- Administrative data for all students at public universities in Kansas
- Includes 2-year and 4-year institutions
- The years of education data run from 2007 - 2016 (High School graduation year)
 - ① We use data from 2007 - 2013 to track 6 year graduation rates.

Administrative Data from Kansas

- We have information on high school attended and high school grade point average.
- ACT test scores (college-entrance exam tests)
- Demographics including race, gender, socioeconomic status
- Information on institutions attended, courses taken, majors.
- These data are matched to employment records in Kansas and Missouri)

Constructing Analysis Sample

Population of Interest

We want to compare first-time students who began at a 2-year institution and who began at a 4-year institution with the intention to obtain a baccalaureate degree.

- If began at 4-year institution; assume baccalaureate intent.
- If began at 2-year institution; do not observe intent.
 - 1 We assume that those who transfer from a 2-year institution to a 4-year institution intended to obtain a baccalaureate degree when they started.
 - 2 We assume (consistent with the literature) that those who took the ACT but started at a 2-year institution intend to complete a baccalaureate degree.

Data: two sub-samples for analysis

Exclude the University of Kansas
& Kansas State University

- Compare Emporia State University, Pittsburg State University, Wichita State University, and Fort Hays State University with all 19 Community Colleges
- Likely something structurally different between these four and Research-intensive universities like University of Kansas and Kansas State University.

Compare Junior Transfers to 4yr
Peers with Junior Status

- Is there a penalty to starting in a Community College?
- Are there factors at Community Colleges that contribute to the Community College penalty found in the literature?

Summary Statistics

Table: Descriptive Statistics for Students' Observed Characteristics

Variable	Total	Public four-year	Public two-year	t-statistic
Credits	90	102	74	75.09
Degree	0.46	0.61	0.24	14.91
Age at FTF	18.77	18.77	18.77	1.87
Percentage female	0.51	0.52	0.50	6.12
Percentage White	0.78	0.81	0.72	29.09
Percentage Black	0.06	0.04	0.08	23.28
Percentage Hispanic	0.09	0.07	0.12	22.10
Percentage Asian	0.03	0.03	0.02	12.85
Percentage Other	0.05	0.04	0.06	9.52
ACT composite score	18.75	19.50	17.64	34.83
ACT Missing	0.15	0.17	0.11	22.79
HS GPA	2.46	2.94	1.76	120.18
HS GPA Missing	0.25	0.13	0.42	95.76
Remedial Credits	1.59	0.87	2.64	144.37
Complex Pathways (CC to CC)	0.05	0.03	0.09	98.43
Complex Pathways (BC to CC)	0.10	0.16	0.02	112.96
% below poverty	11.23	10.77	11.90	21.23

The Methods

We use Instrumental Variables to identify the causal effect of starting in a Community College on Degree completion within six years.

Identification Problem: Self-Selection of Schooling

Where to attend a higher education institution is self-selected and likely correlated with unobserved ability.

Literature has Used Distance to a Higher Education Institution as Instruments

- 1 Binary instrument: college within a certain distance
- 2 Continuous instrument: euclidean distance from HS to nearest college

Card (2001) and Imbens (2020), direct distance does not meet the exclusion restriction; notably, it may proxy for ability.

Distance instrument is no longer considered valid in the literature (despite many previous papers using this approach).

Identification: Differential Distance Instrument

Innovation in Geographic Variation: Difference in Distance

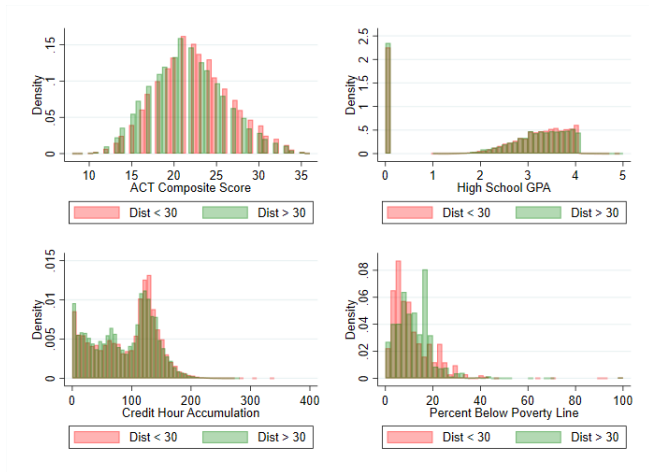
- We take the difference in distance between a 4-year and a 2-year institution
- This models the substitution choice students make between a Community College and a university (Alm and Winter, 2009)
- There is a literature on difference in distance in health economics (difference in distance to hospitals McClellan).
- First application known to us in the education literature.

Summary Statistics for Instrument

Table: Descriptive Statistics for Instrumental Variables.

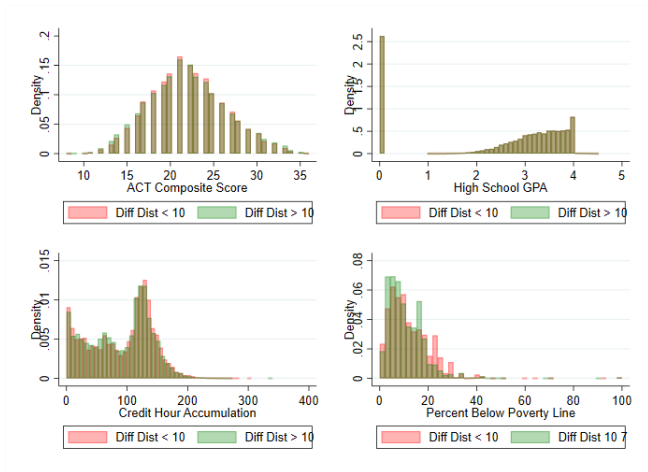
Variables	Start at Public four-year	Start at Public two-year	Total
Differential Distance	1.21	14.83	6.58
Distance from 2-yr	25.65	20.99	23.82
Distance from 4-yr	26.87	35.82	30.40

Identification: Classical Direct Distance Measure



Notice that the overlap is not as strong here. Direct distance does not meet the exclusion restriction because it transmits effects on the outcome through more than just the assignment to a CC.

Identification: New Difference in Distance Measure



Notice that the overlap is quite strong here. This is confirmed with bootstrap t-tests randomly selecting samples of 7,000 students. The mean comparisons are not statistically significantly different.

Do Covariates Differ by Median Difference in Distance?

Table: Comparing students above and below the median difference in distance

Variable	Total	Below Median Difference in Distance	Above Median Difference in Distance	t-statistic
Credits	90.35	91.54	89.34	1.05
Degree	0.46	0.46	0.46	0.05
Age at FTF	18.77	18.76	18.79	0.97
Percentage White	0.78	0.77	0.78	0.49
Percentage Black	0.06	0.06	0.06	0.12
Percentage Hispanic	0.09	0.09	0.09	0.06
Percentage Asian	0.03	0.03	0.03	0.21
Percentage Other	0.05	0.06	0.05	0.64
Percentage female	0.51	0.52	0.50	0.35
ACT composite score	18.78	18.98	18.62	1.34
HS GPA	2.45	2.44	2.46	0.57
Complex Pathways (CC to CC)	0.05	0.05	0.05	0.08
Complex Pathways (BC to CC)	0.10	0.12	0.08	1.52
% below poverty	11.20	11.88	10.62	1.33

Research Question 1

Given the literature on CC degree attainment, is there a CC penalty in the state of Kansas using a new instrument and more contemporary data?

We find no evidence of a Community College Penalty.

OLS and LPM Estimates Show Penalty

- We begin by regressing bachelor's degree receipt and total credits on starting in a community college using OLS.
- As with the previous literature we find evidence of a community college penalty.
- Even after controlling for demographics test scores, and high school GPA.

LPM Estimates of the Community College Degree Penalty

Variable	Baseline Model	Add Demographics	Add Background
Community College	-.365*** (.003)	-.349*** (.003)	-.220*** (.004)
Gender		.047*** (.003)	.010*** (.003)
Age		1.04*** (.140)	.613*** (.129)
Age Squared		-.028*** (.004)	-.016*** (.003)
Black		-.168*** (.006)	-.029*** (.006)
Hispanic		-.095*** (.006)	-.032*** (.005)
Asian		.018* (.010)	.013 (.009)
Other		-.110*** (.007)	-.068*** (.007)
Percent Below 100 Pct Poverty			-.002*** (.0002)
ACT Composite Score			.034*** (.003)
ACT Squared			-.001*** (.0001)
High School GPA			-.409*** (.027)
High School GPA Squared			.116*** (.004)
N	81,529	81,529	81,529
R2	0.13	0.15	0.26
High School Grad. Year FE	Y	Y	Y
*(p<0.10) **(p<0.05) ***(p<0.01)			

OLS Estimates of the CC Credit Accumulation Penalty

Variable	Baseline Model	Add Demographics	Add Background
Community College	-27.25*** (.348)	-25.82*** (0.353)	-12.34*** (.399)
Gender		4.88*** (.334)	.876*** (.321)
Age		58.48*** (15.77)	14.80 (14.35)
Age Squared		-1.60*** (.423)	-.394 (.385)
Black		-19.06*** (.753)	-4.60*** (.736)
Hispanic		-2.30*** (.626)	3.51*** (.591)
Asian		12.95*** (1.03)	12.74*** (.993)
Other		-15.65*** (.800)	-9.77*** (.737)
Percent Below 100 Pct Poverty			-.154*** (.013)
ACT Composite Score			5.57*** (.289)
ACT Squared			-.099*** (.006)
High School GPA			39.45*** (3.22)
High School GPA Squared			-1.42*** (.513)
N	81,529	81,529	81,529
R2	0.07	0.08	0.19
High School Grad. Year FE	Y	Y	Y
*(p<0.10) **(p<0.05) ***(p<0.01)			

First Stage Estimates

Variable	Baseline Model	Add Demographics	Add Background
Differential Distance	.0025*** (.00004)	.0024*** (.00004)	.0022*** (.00004)
N	81,529	81,529	81,529
R2	0.03	0.05	0.28
High School Grad. Year FE	Y	Y	Y
First Stage F Statistic	447.00	354.35	2074.16

- We begin by regressing differential distance on the probability of on starting in a community college using LPM.
- First-stage F-statistic is > 100

IV Estimates of the Effect of Starting in a Community College on Obtaining a Baccalaureate

- IV Estimates indicate a penalty for starting in a Community College.
- After controlling for demographics and ACT and High School GPA, there is no Community College Penalty.
- There is a small penalty on the total number of credits.

IV Estimates of the Community College Degree Penalty

Variable	Baseline Model	Add Demographics	Add Background
Community College	-.112*** (.018)	-.095*** (.019)	-.026 (.020)
Gender		.051*** (.003)	.012*** (.003)
Age		1.838*** (.162)	.896*** (.141)
Age Squared		-.049*** (.004)	-.024*** (.004)
Black		-.217*** (.007)	-.030*** (.007)
Hispanic		-.139*** (.006)	-.041*** (.006)
Asian		.042*** (.010)	.029*** (.010)
Other		-.145*** (.008)	-.076*** (.007)
Percent Below 100 Pct Poverty			-.001*** (.0002)
ACT Composite Score			.050*** (.003)
ACT Squared			-.001*** (.0001)
High School GPA			-.297*** (.030)
High School GPA Squared			.103*** (.005)
N	81,529	81,529	81,529
R2	0.07	0.08	0.23
High School Grad. Year FE	Y	Y	Y
First Stage F Statistic	494.66	374.52	2075.09
*(p<0.10) **(p<0.05) ***(p<0.01)			

IV Estimates of the CC Credit Hour Accumulation Penalty

Variable	Baseline Model	Add Demographics	Add Background
Community College	-7.86*** (1.98)	-8.16*** (2.03)	-4.13* (2.14)
Gender		4.98*** (.352)	.80** (.336)
Age		101.08*** (17.69)	19.57 (15.57)
Age Squared		-2.74*** (.475)	-.516 (.420)
Black		-20.00*** (.876)	-3.65*** (.801)
Hispanic		-4.68*** (.711)	3.16*** (.617)
Asian		14.39*** (1.08)	13.18*** (1.02)
Other		-14.12*** (.901)	-7.69*** (.805)
Percent Below 100 Pct Poverty			-.102*** (.026)
ACT Composite Score			6.09*** (.345)
ACT Squared			-.106*** (.007)
High School GPA			46.21*** (3.52)
High School GPA Squared			-2.32*** (.564)
N	81,529	81,529	81,529
R2	0.03	0.05	0.18
High School Graduation Year FE	Y	Y	Y
First Stage F Statistic	494.66	374.52	2075.12

Robustness Checks

- Robustness Checks indicate:
 - ➊ Transfer students are more likely to obtain a BA than those who start at a 4-year institution.
 - ➋ Those who transfer or start at research institutions are equally likely to complete a BA.
 - ➌ Those who transfer to a non-research university are less likely to complete a BA.
 - ➍ Those who start in a Community College and transfer to KU/K-State accumulate fewer credits.

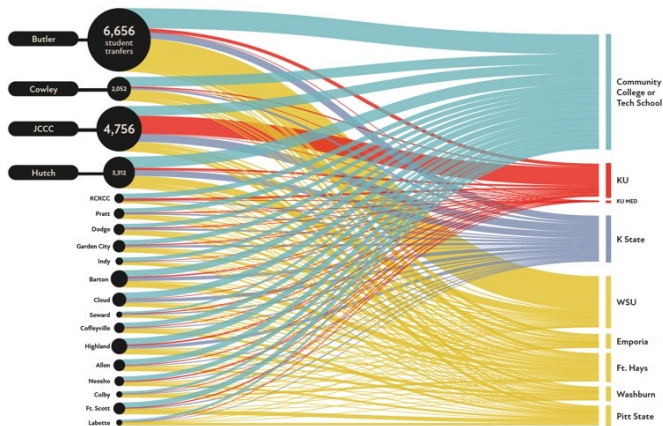
IV Estimates in Sub-samples of the dataset (Degree Attainment)

Variable	Baseline	Add Demographics	Add Background
Full Sample Community College	-.112*** (.018)	-.095*** (.019)	-.026 (.020)
N	81,529	81,529	81,529
R2	0.05	0.07	0.22
High School Grad. Year FE	Y	Y	Y
First Stage F Statistic	494.66	374.52	2075.09
Transfer Sample	.082*** (.029)	.103*** (.030)	.132*** (.032)
Community College Effect			
N	49,631	49,631	49,631
R2	0.03	0.05	0.22
High School Grad. Year FE	Y	Y	Y
First Stage F Statistic	210.81	157.53	615.66
No KU/KSU Sample	-.097*** (.030)	-.020*** (.006)	-.025*** (.005)
Community College Effect			
N	20,982	20,982	20,982
R2	0.06	0.07	0.27
High School Grad. Year FE	Y	Y	Y
First Stage F Statistic	177.36	116.37	405.72
KU/KSU Sample	.012 (.049)	.047 (.051)	.094* (.056)
Community College Effect			
N	30,186	30,186	30,186
R2	0.02	0.04	0.17
High School Grad. Year FE	Y	Y	Y
First Stage F Statistic	72.17	72.88	220.30

IV Estimates in Sub-samples of the dataset (Credit Hour Accumulation)

Variable	Baseline	Add Demographics	Add Background
Full Sample	-7.86***	-8.16***	-4.13*
Community College Effect	(1.91)	(2.03)	(2.14)
N	81,529	81,529	81,529
R2	0.03	0.05	0.18
High School Grad. Year FE	Y	Y	Y
First Stage F Statistic	494.66	374.52	2075.12
Transfer Sample	2.55	2.60	1.67
Community College Effect	(1.79)	(1.86)	(2.08)
N	49,631	49,631	49,631
R2	0.01	0.01	0.02
High School Grad. Year FE	Y	Y	Y
First Stage F Statistic	210.81	157.53	615.66
No KU/KSU Sample	-.776	.040	1.50
Community College Effect	(2.23)	(2.30)	(2.64)
N	20,982	20,982	20,982
R2	0.06	0.07	0.27
High School Grad. Year FE	Y	Y	Y
First Stage F Statistic	177.36	116.37	405.74
KU/KSU Sample	-8.11**	-9.08**	-9.37**
Community College Effect	(3.40)	(3.56)	(4.06)
N	30,186	30,186	30,186
R2	0.02	0.04	0.17
High School Grad. Year FE	Y	Y	Y
First Stage F Statistic	72.17	72.88	220.30

Complex Pathways



Many Community College starters transfer to another community college. We label these people as having a "Complex Pathway."

Explanations for Community College Disadvantage

- We Conducted Two Thought Experiments:
 - ① Remedial Credits taken at 2-Year vs. 4-Year Institutions.
 - ② Complex Pathways–
 - ③ Those who transfer to another Community College or
 - ④ From a 4-Year to a 2-Year institution,.

IV Estimates with Remedial Credits and Complex Pathways (Degree Attainment)

Variable	Remedial Credits	Complex Pathways	Both
Community College	.066** (.028)	-.026 (.022)	.065** (.030)
2 Year Remedial Credits	-.20*** (.013)		-.20*** (.013)
4 Year Remedial Credits	.027** (.011)		.025** (.011)
BC Transfer CC		-.033*** (.009)	-.023* (.009)
CC Transfer CC		-.136*** (.009)	-.131*** (.009)
N	81,529	81,529	81,529
R2	0.2096	0.2287	0.2126
High School Grad. Year FE	Y	Y	Y
First Stage F Statistic	5947.26	2630.52	6393.68

IV Estimates with Remedial Credits and Complex Pathways (Credit Hour Accumulation)

Variable	Remedial Credits	Complex Pathways	Both
Community College	-.280 (2.97)	-2.70 (2.30)	1.50 (3.14)
2 Year Remedial Credits	-5.82*** (1.37)		-6.54*** (1.39)
4 Year Remedial Credits	4.88*** (1.18)		4.89*** (1.17)
BC Transfer CC		8.98*** (.888)	9.25*** (.930)
CC Transfer CC		6.94*** (.938)	7.13*** (.917)
N	81,529	81,529	81,529
R2	0.17	0.18	0.17
Demographic Variables	Y	Y	Y
Preparation Variables	Y	Y	Y
High School Grad. Year FE	Y	Y	Y
First Stage F Statistic	6431.87	2820.66	6878.14

Research Question 2

Context for remedial credits

- Coefficient on remedial credits in degree attainment regressions is consistently negative.
- Remedial credits seems to be a barrier to choosing a STEM major.

(3) What role do remedial credits play in the path to degree attainment?

Are students at remedial-credit-intensive institutions less likely to attain a bachelors degree?

Prevalence of remedial credits

Variable	Obs	Mean	Std. Dev.	Min	Max
Likelihood of taking a remedial course					
Took Math	88,201	.247072	.4313114	0	1
Took English	88,201	.0990352	.2987109	0	1
Took Reading	88,201	.0590923	.2357987	0	1
Number of semesters of remedial courses					
Math	88,201	.265768	.4837628	0	4
English	88,201	.1023685	.3140821	0	3
Reading	88,201	.0610084	.2473605	0	3

We will focus on the impact of remedial math courses. Additional work could examine remedial English and Reading, and also look at the total impact of all remedial courses holistically.

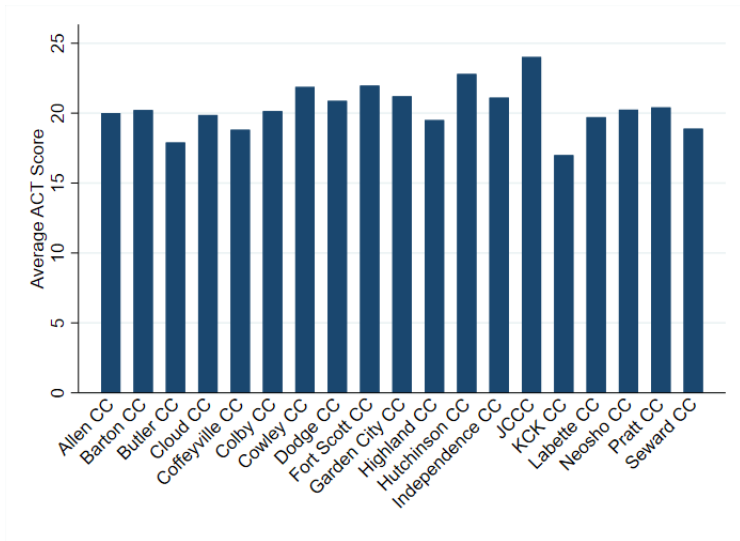
Data on placement exams

name of math test	Freq.	Percent	Cum.
ACT Mathematics Test	18,502	66.14	66.14
ASSET College Algebra	12	0.04	66.18
ASSET Elementary Algebra	79	0.28	66.46
ASSET Intermediate Algebra	72	0.26	66.72
ASSET Numerical Skills	4	0.01	66.73
Accuplacer Arithmetic	6	0.02	66.75
Accuplacer College Math	741	2.65	69.40
Accuplacer Elementary Algebra	266	0.95	70.35
COMPASS Algebra	1,919	6.86	77.21
COMPASS College Algebra Placement	2,804	10.02	87.24
COMPASS Numerical Skills/Prealgebra	721	2.58	89.81
COMPASS Plane Geometry Placement	33	0.12	89.93
COMPASS Trig. Placement	131	0.47	90.40
Mathematical Association of America	10	0.04	90.43
SAT Mathematics Test	2,364	8.45	98.88
Wichita State Internal Math Placement..	312	1.12	100.00
Total	27,976		

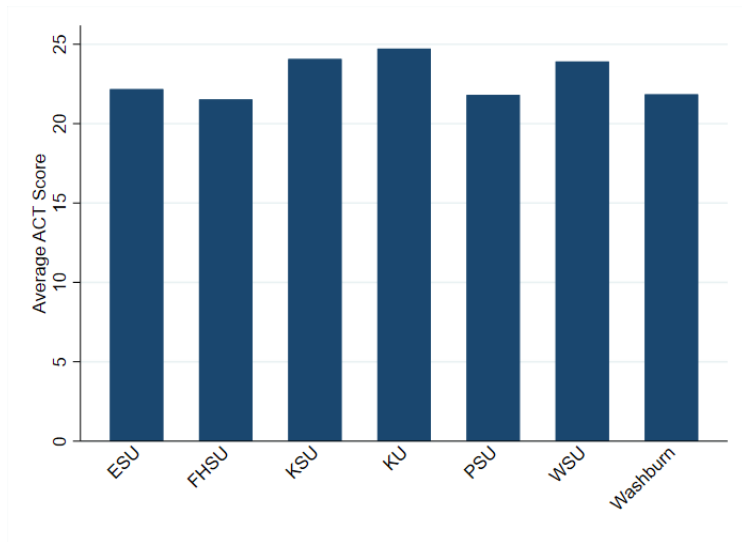
We will focus in on those taking the ACT Mathematics Test.

NOTE: ACT defines math readiness as a math test score above 21.

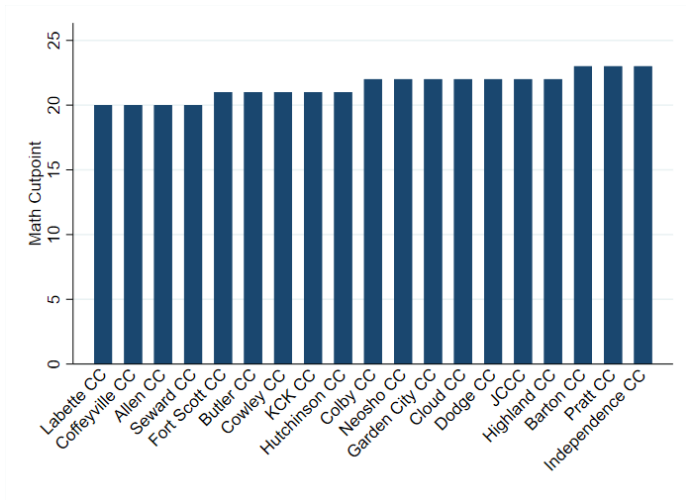
ACT Scores across community colleges



ACT Scores across baccalaureate universities



Variation in cutpoints determining math remedial credits



» Average CC Math ACT

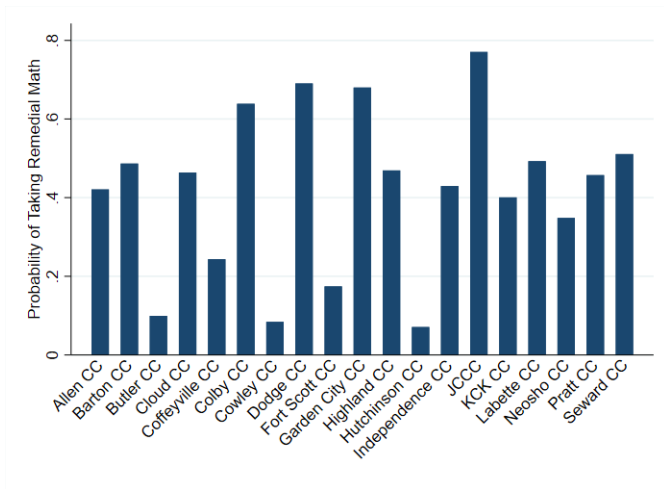
» Average BC Math ACT

» Likelihood of CC Remediation

» Likelihood of BC Remediation

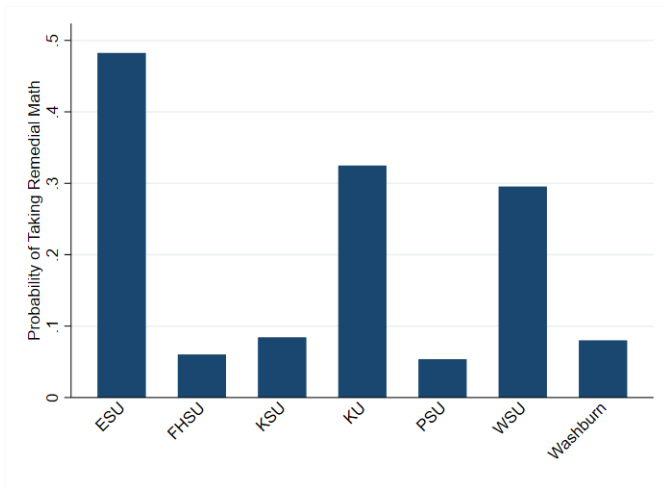
Patterns in remedial credits

Figure: Which colleges are remedial-credit intensive?



Patterns in remedial credits

Figure: Which colleges are remedial-credit intensive?



The Effect of Remedial Credits for Academically Unprepared

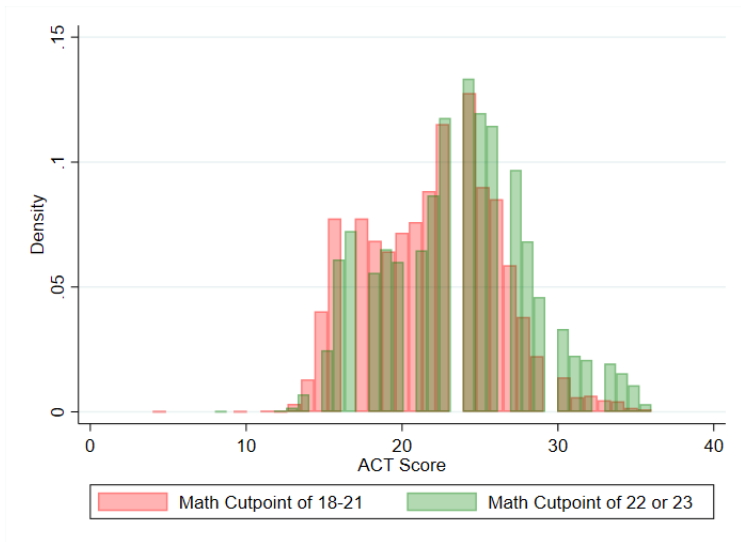
Takes Math Remedial Credits	Needs Math Remedial Credits		Total
	0	1	
0	10,338	3,982	14,320
1	1,455	2,727	4,182
Total	11,793	6,709	18,502

Of particular interest: the impact of being placed in a remedial math class and not needing it as well as the impact of not being placed in a remedial math class but needing it.

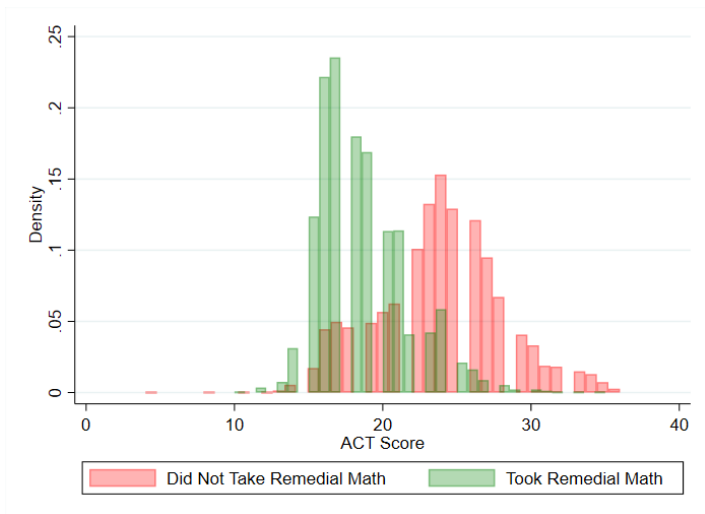
» Overlap by Cutpoint

» Overlap by Remediation

Math ACT Scores by Cutpoint Thresholds



Math ACT Scores by Whether Student Took Remedial Math Class



Identification: Propensity Score Matching

Main Variables of Interest

- 1 Binary treatment: needed remedial credits or not/took remedial credits or not
- 2 Binary outcome: attained a degree or not

How the algorithm works: matching on observed characteristics

- Use observed characteristics: where the student began, their demographics (race, gender, and economic status), and their academic preparation (composite ACT and high school GPA)
- Match a student in treatment with a student not in treatment: e.g. match a student at an institution with a high ACT threshold (treated) with a student at an institution with a low ACT threshold (control)
- Take the difference in outcomes
- Average the difference in outcomes to obtain the average treatment effect

The Effect of Remedial Credits for Academically Unprepared

Takes Math Remedial Credits	Needs Math Remedial Credits		Total
	0	1	
0	10,338	3,982	14,320
1	1,455	2,727	4,182
Total	11,793	6,709	18,502

Our first set of PSM results examines the impact of remedial credits when the ACT predicts they will need a remedial math class and some students are placed in a remedial math class and some students are not.

Propensity Score Algorithm Results

	Needs Math		Takes Math due to		Interaction
	Remedial Credits	Credits	Math Cutpoint	Math Cutpoint	
	OLS	PSM	OLS	PSM	PSM
	-0.103*** (0.0137)	-.0524*** (.0143)	.1171*** (.0147)	.1203*** (.0176)	-.0396 (.0315)
Inst.	X	X	X	X	X
Dem.	X	X	X	X	X
Acad.	X	X	X	X	X

Table: Math remediation works for population that needs it

Propensity Score Algorithm

Takes Math Remedial Credits	Needs Math Remedial Credits		Total
	0	1	
0	10,338	3,982	14,320
1	1,455	2,727	4,182
Total	11,793	6,709	18,502

We want to focus now on the first column: students who do not seem to need remedial math credits per the ACT's definition, but were placed in remedial math credits.

Propensity Score Algorithm

	Needs Math		Takes Math due to		Interaction
	Remedial Credits		Math Cutpoint		
	OLS	PSM	OLS	PSM	PSM
	-.136*** (.0040)	-.163*** (.0061	-.035*** (.0120)	-.031** (.0149)	-.099*** (.0206)
Inst.	X	X	X	X	X
Dem.	X	X	X	X	X
Acad.	X	X	X	X	X

Table: Over-placing students in remedial credits has a detrimental effect

Recap & Research Question 3

Using this approach we see results for our initial question:

- There is evidence of a CC education premium in the full sample
- CC students who transfer do slightly better than their four-year peers who reach junior status.
- There appears to be a quality difference between the R1 and non-R1 institutions in Kansas.

(3) How Do Remedial Credits and Complex Pathways Interact?

Is there a relationship between remediation and complex pathways?

Major implications

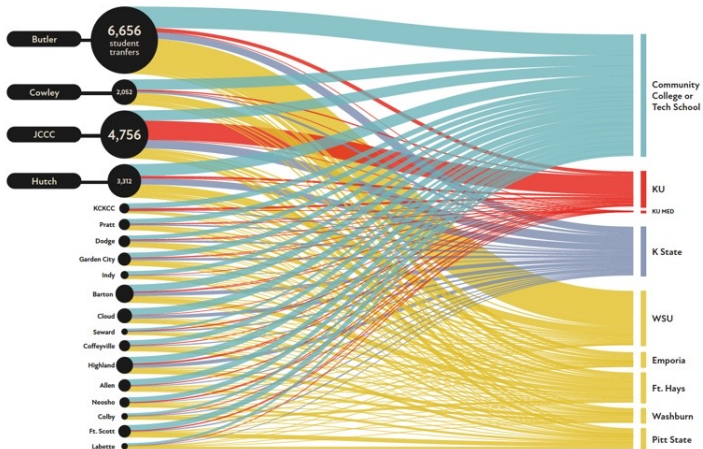
(1) CC students do well at Kansas R1 institutions

We see a small degree premium in our main sample and our transfer sample, but a degree penalty at regional publics.

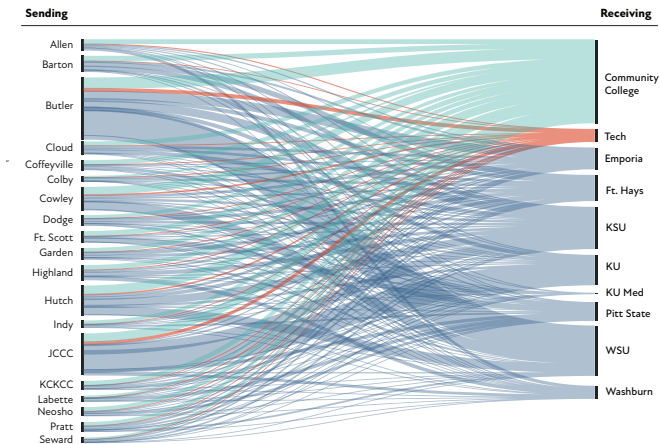
(2) Appropriate placement into remedial credits appears to be important for success

There seem to be students for whom remedial credits are needed but who do not take them and students for whom remedial credits are not necessary but who do take them: poor outcomes for both groups.

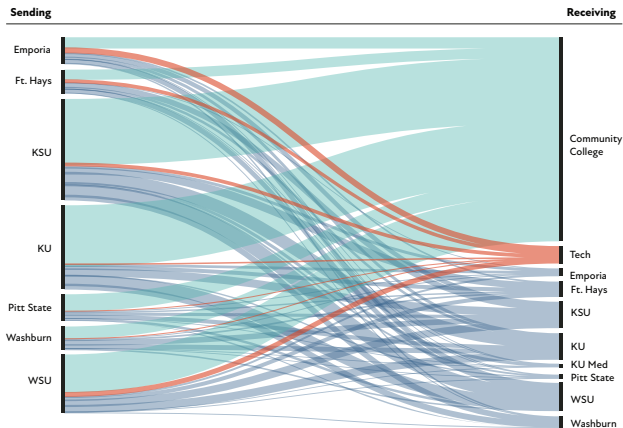
Complex Pathways!



Transfers from Community Colleges to 4-Year Institutions



Transfers from 4-Year Institutions



Research Question 3

Context for complex pathways

- Coefficient on remedial credits in degree attainment regressions are consistently negative.
- Non-remedial students and remedial students seem to have very different success rates depending on first-time institution start type.

(3) How do remedial credits intersect with complex pathways?

Do remedial credits encourage students to make lateral or downward transfers while trying to attain a baccalaureate degree?

Coefficients on Remedial Credits and Complex Pathways in Previous Estimations

	Remedial Math	CC-to-CC	BC-to-CC
OLS	-.022***	-.094***	-.080***
Full Sample	.030***	-.169***	-.020*
Transfer Sample	-.044***	-.249***	-.085***
Sample without KU/KSU	-.010***	-.072***	-.140***

Table: The impact of each variable in this table on degree attainment is consistently negative, except for remedial math in the full sample.

Main takeaway: complex pathways show consistent evidence when included as a covariate that they hinder degree attainment.

First Transfer is from a CC to a CC

Variable	Estimated Impact on
Took Math Remedial Credit	.071***
Community College Specific Effect	
Allen	.074***
Cowley	.138***
Butler	.069***
Cloud	.068***
Coffeyville	.171***
Colby	.026**
Dodge	.070***
Fort Scott	.108***
Garden City	.097***
Highland	.055***
Hutchinson	.124***
Independence	.171***
Kansas City Kansas	.062***
Labette	.071***
Neosho	.123***
Pratt	.126***
Barton	.072***
Seward	.055***

Table: Math remedial credits increase likelihood of a CC-to-CC transfer

First Transfer is from a BC to a CC

Variable	Estimated Impact on
Took Math Remedial Credit	.116***
Community College Specific Effect	
PSU	.072***
ESU	.026***
KSU	.064***
KU	.047***
Washburn	.039***
WSU	.111***

Table: Math remedial credits increase likelihood of a BC-to-CC transfer.

NOTE: Baseline is Fort Hays State where 9% of students take a complex pathway.

Degree attainment for CC students hampered by complex pathways

Table: Impact of beginning at a CC on degree attainment

	CC	CC-to-CC	BC-to-CC
These students do not take complex pathways			
Naive	.136***		
Naive + Remedial Credits	.027		
Some students take complex pathways			
Complex - Remedial Credits	.205***	-.222***	.010
Complex + Remedial Credits	.053**	-.136***	-.025***

Main takeaway: complex pathways hinder degree attainment.
Complex pathways in the presence of remedial credits hinder students beginning at baccalaureate institutions.

Conclusions from each research question

(1) CC students do well at Kansas R1 institutions

We see a small degree premium in our main sample and our transfer sample, but a degree penalty at regional publics.

(2) Appropriate placement into remedial credits appears to be important for success

There seem to be students for whom remedial credits are needed but who do not take them and students for whom remedial credits are not necessary but who do take them: poor outcomes for both groups.

(3) Complex pathways hinder CC students' baccalaureate attainment.

Additionally, complex pathways in the presence of remedial credits makes it relatively more difficult for students beginning at a baccalaureate institution to complete their degree.