The Impact of State Transfer Articulation Policies on Bachelor's Degree Attainment

Rachel Gentry

University of Maryland – College Park

Masters Candidate in Higher Education

Abstract

Community college transfer students are a growing population in higher education. However, many students face challenges navigating the transfer process. This study employs a quantitative approach to investigate the impact of state transfer articulation policies on bachelor's degree attainment. Results, policy implications, and research recommendations are discussed.

The Impact of State Transfer Articulation Policies on Bachelor's Degree Attainment

Over the past four decades, community college enrollment has increased, demonstrating the critical role that public 2-year institutions play in the American system of higher education (Kasper, 2003). While approximately 80% of students who enroll in community college have intentions of eventually obtaining a bachelor's degree, only 21% of students who begin at a community college successfully do so (Doyle, 2009). Despite this low transfer rate, community college students have degree completion rates equal to or higher than students who begin at a 4-year institutions (Shapiro et al., 2013). The challenges faced by community college students as they navigate the transfer and matriculation process are concerns for leaders and policymakers at the state and institutional level who are concerned with student persistence and degree completion rates. These challenges are often hypothesized to be rooted in the difficulties community college students encounter while attempting to transfer their courses to four-year institutions (Cohen & Brawer, 2008). This study aims to better inform policymakers of the tools and strategies related to transfer articulation policies that will best facilitate the transfer process for community college transfer students.

Background of Community College Transfer Student Success

Role of Community Colleges in American Higher Education

Over the course of the past century, the landscape of American higher education has been altered by the rise of 2-year community colleges. Community colleges are affordable, flexible to accommodate a variety of schedules, highly accessible via open door policies, and geographically close to most students (Jaeger et al., 2015). These are some of the characteristics that attract students to community colleges, and could also be contributing to the rise in community college enrollment observed over recent decades. Community college enrollment

makes up a significant portion of students pursuing higher education, with more than 45% of undergraduate students in the United States enrolled in community colleges (Jaeger et al., 2015). Kasper (2003) investigated the historical breakdown of students attending degree-granting public institutions of higher education. In 1965, only 26% of these students were enrolled in community colleges while 74% were enrolled in 4-year public universities. By 1992, however, the percentage of students attending community college had increased to 48%, while only 52% of students were enrolled in public universities. Between 1965 and 1999, community college enrollment increased 413%, compared with only a 104% enrollment increase at 4-year public universities (Kasper, 2003). Finally, in the 30 years prior to 2005, the growth in enrollment demonstrated by community colleges was greater than both public and private 4-year colleges (Stern, 2016).

It is also important to note the specific student populations served by community colleges. In discussing the ability of community colleges to serve traditionally underserved student populations, Jaeger et al. (2015) describe community college as "a vehicle for upward mobility and increased prosperity for millions of disadvantaged students." Stern (2016) also provides a perspective on the role of community colleges in providing access to higher education for marginalized populations, stating that community colleges enroll disproportionate numbers of disadvantaged and nontraditional students. He continues to assert that this is evidenced by observing a thirty year period in which higher education enrollment rates of low-income and minority students doubled as community college enrollment rates also drastically increased (Stern, 2016).

Community Colleges as a Vehicle for Bachelor's Degree Attainment

Many students also choose to begin their postsecondary careers at local community college with the aim of completing general education requirements before transferring to a 4-year institution to complete a bachelor's degree. Studies estimate that 46% of students who completed a bachelor's degree in the 2013-2014 school year were enrolled at a community college within the 10 years prior to completing their degree (National Student Clearinghouse, 2015). Kasper (2003) found that 41% of associate's degrees completed at community colleges in 1999-2000 were focused on general studies, typically indicating intent to continue studies and work towards a bachelor's degree. Doyle (2009) asserts that of all first-time students entering community college, 80% indicate that they plan to obtain a bachelor's degree. However, only 21% of these students will finish their bachelor's degree in 6 years (Doyle, 2009).

Despite this data indicating low transfer rates for community college students, there is promising evidence regarding the success of community college students once they transfer to 4-year institutions. Research suggests that students who successfully transfer into a 4-year school from a community college have higher rates of bachelor's degree attainment compared to students who start at the 4-year institution. The work of Shapiro et al. (2013) examined eight-year bachelor's degree attainment rates of two groups of students: first-time postsecondary students who began at 4-year institutions in 2003, and first-time postsecondary students who began at 2-year institutions in 2003 and then transferred to a 4-year institution in 2005. Sixty-five percent of the cohort who entered directly into 4-year institution completed a bachelor's degree within 8 years, compared with 71.1% of the cohort who transferred from a 2-year to that completed a bachelor's degree within 8 years (Shapiro et al., 2013). These results suggest that students who transfer from community colleges do frequently obtain bachelor's degrees successfully. This notion is further supported when examining the impact that having completed

an Associate's degree or certificate before transferring has on bachelor's degree attainment. Transfer students who completed a 2-year associate's degree had an 82.1% rate of bachelor's degree completion, compared with 65.1% of students who did not have a 2-year degree before transferring (Shapiro et al., 2013). This data indicates that while students who transfer without a degree have relatively the same rate of degree completion as students who begin at 4-year institutions, transferring with a 2-year degree or certificate results in much higher completion rates.

The Transfer Problem

There are three significant key takeaways presented thus far. First, community college enrollment has increased over the past four decades (Kasper, 2003). Second, many more students who enroll in community college have intentions of eventually obtaining a bachelor's degree (80%) than the number who successfully do so (21%) (Doyle, 2009). And finally, students who transfer from community colleges have higher rates of degree attainment than students who begin at a 4-year institution, particularly those that transfer after completing an associate's degree (Shapiro et al., 2013). Given that many community college students intend to transfer but significantly less actually obtain a bachelor's degree, and that those students who do transfer have higher bachelor's degree attainment rates than those who begin at 4-year institutions, it can be assumed that the problem lies not with the ability of transfer students to succeed at 4-year institutions but rather with the transfer process itself. There is a need for policy-relevant research that explores strategies to improve this process.

Statewide Transfer Articulation Policy as a Possible Policy Solution

Despite the frequency with which students are transferring from 2 to 4-year institutions, there are still many challenges that are not addressed by state systems of higher education. One challenge that is commonly reported by transfer students is the lack of clarity surrounding that

ability of course credits to transfer and count towards degree requirements. Long (2005) listed academic challenges as one of three major obstacles faced by community college transfer students, specifically citing concerns over ‘‘confusion over which courses transfer for credit and which do not’’ and courses that ‘‘may not count towards the requirements of a baccalaureate degree.” Cohen & Brawer (2008) cite the controversy and confusion surrounding the ability of community college courses to transfer to university settings as “the most pervasive, long-lived issue in community colleges.” Statewide transfer articulation agreements are one possible solution to this challenge.

As defined by Anderson et al. (2006), articulation agreements are “the principal instruments to facilitate the transfer process. Specifically, {they} serve to negotiate the requirements for students’ movement from institution to institution and support the transfer intent” (Anderson et al., 2006, p. 262-263). Articulation agreements can vary greatly in their scope and reach. Some policies are vague and do little to improve the transfer process, while others encompass some or all of a range of elements, including listing specific courses that will transfer between institutions, establishing dual-enrollment programs between universities and community colleges, creating statewide standardized course numbering systems, and automatically accepting associates degrees to fulfill general education requirements (de los Santos & Sutton, 2012). Many of these articulation policy elements are thought to be effective in supporting transfer students.

Statewide articulation policies have been gradually implemented since 1960, and as of 2004 at least thirty states had some variation of an articulation policy in place (Roksa & Keith, 2008). Articulation policies have also seen tremendous growth throughout the 21st century. Between 2001 and 2010 alone, six states that previously lacked any form of statewide

articulation policies developed transfer articulation policies (resulting in a total of 36 states with policies), 11 states developed general curricula that transfers from 2 to 4-year institutions (resulting in a total of 34 states with such curricula), nine states developed and distributed a statewide articulation guide (resulting in a total of 35 states with guides), and ten states developed statewide common course numbering systems (resulting in a total of 18 states with such systems) (LaSota & Zumeta, 2016). Stern (2016) discusses prior research focused on the relationship between community college transfer articulation policies and bachelor's degree attainment, highlighting that there is some controversy on this relationship and asserting that there is a lack of research exploring the specific impact of articulation agreements on bachelor's degree attainment (Stern, 2016). This research aims to begin the process of filling in the gaps of research related to articulation agreements and the specific manner in which they impact the transfer process and transfer student success.

Stakeholders

There are many stakeholders surrounding the issues of community college transfer students and state-level articulation policies, including state-level governing boards, community college leadership, 4-year institution leadership, students at both institutional levels, academic advising and admissions staff who work with students before, during, and after the transfer process, and even faculty who will be teaching transfer students who come from an educational background that might be different than non-transfer students. When discussing stakeholders, it should be mentioned that while transfer articulation policies would impact all community college transfer students, traditionally underrepresented students in particular could stand to benefit given the large proportion of underrepresented students served by community colleges.

Exploring policies that improve transfer and matriculation rates for community college students could have a strong impact on student populations that are historically underserved.

Theoretical Framework

Principal-agent theory (PAT) is the theoretical framework guiding this research**.** PAT is derived from economics, and is based upon the idea that there are two parties in a relationship, the principal and the agent. The agent, who is presumed to have knowledge and skills relevant to the task at hand, is contracted by the principal to make decisions and take actions that will benefit the principal (Lane & Kivisto, 2008). In this case, the principal would be the community colleges and four year public universities who must collaborate to comply with articulation policies, and the agent would be the state (and state-level policymakers charged with crafting transfer articulation policy). Lane & Kivisto (2008) also suggest that the self-interest of agents can lead to a misalignment between the interests/motivations of agents and the interests/motivations of principals.

Research Design

As mentioned earlier in this paper, there are gaps in the literature when it comes to understanding the impact of various articulation policy nuances. These methods and research questions were motivated by an effort to fill these gaps and explore the impact of various types of state-level articulation policies on bachelor's degree attainment in a state. This paper is an examination of the relationship between state-level transfer articulation policies (specifically those guaranteeing associate's degree transfer) and bachelor's degree attainment at 4-year public universities, controlling for other articulation policy components (state-wide common course numbering system and transferable core of lower-division courses) and state higher education context (community college and 4-year public enrollment). An interaction variable of student

socioeconomic background is introduced to examine if the presence of articulation policies that include guaranteed transfer of associate's degree impact the relationship between student income and bachelor's degree attainment. The primary research question guiding this study is as follows: Does the presence of state-level transfer articulation policies including guaranteed associate's degree transfer impact the number of bachelor's degrees completed at 4-year public universities? This study will use a state-level panel data set for all 50 states from 2008-2015. The variables included in this panel data set, which will be discussed in the following section, can be seen in Table 1 below, along with the secondary data sources.

The work of Zhang (2010) suggests that panel data provides more accurate and specific analyses by providing a picture of "variation across subjects at particular points in time and changes for each subject over time" (Zhang, 2010, p.308). As opposed to cross-sectional analyses that do not control for heterogeneity across units of analysis and consequently have a high likelihood of omitted variable bias, panel data analysis does control for the individual heterogeneity of each unit, or in this case state. Rather than using the cross-sectional approach of between-unit variation that only paints a picture of changes across units, such as comparing enrollment of one state to enrollment of another state, panel data allows researchers to conceptualize the manner in which an individual unit, or state, changes over the course of time. This type of within-unit analysis can provide valuable results for policymakers. Zhang (2010) specifically notes that the "conceptual appeal of panel data model lies in its attention to within-unit variations, i.e., changes for each unit (e.g., student, school, college, etc.) over time" (Zhang, 2010, p.309).

[Insert Table 1]

Variables

The various elements of transfer articulation policies aim to better facilitate the transfer process and ultimately increase the number of community college students who successfully transfer to and graduate from a four-year university, consequently resulting in a higher overall number of conferred degrees. Thus, for this study the dependent variable is the number of bachelor's degrees conferred collectively across 4-year public universities in a state. This data was retrieved from the Integrated Postsecondary Education Data System (IPEDS).

The primary independent variable for this study is the presence of a state articulation policy that incorporates guaranteed associate's degree transfer. According to the Education Commission of the States (2017) policy of this nature "guarantees students who have earned an associate degree to have met all lower-division requirements and attained junior standing at a public four-year institution." In prior investigations of articulation agreements, the articulation policy variable has been broadly defined as policies encompassing any of a range of elements, including common course numbering system, transferable core of lower-division courses, and guaranteed transfer of an associate's degree. The various elements of articulation policies can vary widely, and there has been little research on the specific components of transfer policies that are most effective (Gross & Goldhaber, 2009; Roksa & Keith, 2008). This study aims to isolate the relationship between guaranteed associate's degree transfer and bachelor's degree completion.

Prior research indicates that students who transfer after obtaining an associate's degree have higher rates of bachelor's degree attainment than both transfer students who transfer prior to obtaining an associate's degree and students who begin at 4-year institutions (Shapiro et al., 2013). This study hypothesizes that articulation policies that support students in obtaining an associate's degree before transferring will yield the most favorable outcomes for student success.

Thus, this study will examine the specific impact of state-level policies that include guaranteed transfer of an associate's degree on bachelor's degree attainment. This independent variable will be binary (0=no, 1=yes), with states coded based on whether they have a policy in place that includes guaranteed transfer of an associate's degree. The effect of this variable has been lagged for 4 years, allowing 2 years for implementation and 2 years for community college transfer students to graduate after transferring. Data for this variable was collected from The Education Commission on the States. In some cases, individual state websites/public records and the WICHE transfer articulation database were used in order to determine the exact year in which a state passed a specific transfer component.

The first two control variables included in this study are related to state higher education context. Using data collected from IPEDS, four-year public university enrollment and public community college enrollment were both included as control variables. Given this study's intention to isolate the impact of guaranteed associate's degree transfer in articulation policies, these methods will control for two other common elements of articulation policies by including the presence of a state-wide common course numbering system and the presence of a transferable core of lower-division courses as additional control variables. According to the Education Commission of the States (2017), a common course numbering system is a "uniform system for numbering courses across public higher education institutions." The Education Commissions of the States defines a transferrable core of lower-division course as a core of courses that "transfers in full across institutions meeting a receiving institution's lower-division requirements." Data on these two control variables was primarily retrieved from the Education Commission of the States, however the individual state websites/public records and the WICHE transfer articulation database were also used in order to determine the exact year in which specific policies were

passed. A final control variable of year fixed effects (or dummy variables) was included to control for the impact of changes that occur over time.

Finally, this study also aimed to examine the impact that articulation policies had on the relationship between student income and bachelor's degree attainment. Using data collected from the U.S. Department of Education, an interaction variable of student income was included. This variable was defined by the percentage of students at 4-year in-state public universities that were Pell-eligible in a given academic year. Given the disproportionately high number of low-income students that enroll in community colleges compared to their non-low-income counterparts, it is important to examine if articulation policies (specifically those that guarantee transfer of associate's degree) impact bachelor's degree conferment rates differently in states serving higher percentages of low-income students compared to those with lower numbers of these students. A test of skewness revealed that all variables were skewed, thus all variables were log transformed, with the exception of the primary independent variable and the two control variables related to articulation policy elements, as they are all binary. Descriptive statistics on all variables can be found in Table 2 below.

[Insert Table 2]

Methods

When considering a fixed effects model versus a random effects model, it is necessary to consider whether the independent variables, particularly the primary independent variable of presence of guaranteed transfer of an associate's degree, is time variant or time invariant. In most cases, after the point that an articulation policy is passed by a state it does not change, making the variable time invariant. For this reason, a random effects model, which takes into account time invariant variables, would be the appropriate regression model to use. Additionally, a fixed

effects model would not be appropriate because the effects of articulation policies passed before the first year considered by this study (2008) would not be reflected in the results.

Given that that random effects model uses OLS regression, it is necessary to test for violations of the assumptions of OLS regression. The first assumption that will be tested is homoskedacticity or the assumption that "the variance of the error terms is constant for all combinations of the independent variables" (Hoffman, 2016, p.11). A Breusch-Pagan test was conducted to test for homoscedasticity and revealed the presence of heteroskedasticity, indicating a violation of OLS assumptions. Next, a Woolridge test was performed to test for the assumption that serial correlation is not present, or the assumption that errors are "not correlated based on time or space" (Hoffmann, 2016, p.14). This test revealed that serial correlation was present, indicating a violation of the OLS assumption of no serial correlation. Finally, a Pasaran test was conducted and revealed cross-sectional dependence in the panel data set, indicating another violation of OLS assumptions (Hoffmann, 2016).

Finally, the command *testparm* was used to examine if there was a presence of unobserved time effects across units, or all states. This test indicated that there were unobserved time effects, thus it was appropriate to include year fixed effects in the model. Dummy variables were generated as year fixed effects to account for the effects of unobserved heterogeneity from year to year. Given that heteroskedasticity, serial correlation, and cross-correlation were all detected, and that it is appropriate to include unobserved time effects, the appropriate model for this analysis for this study is a pooled OLS regression with Driscoll-Kraay standard errors and year fixed effects.

Limitations

The limitations of this study include the use of secondary data, which eliminates the option to include other variables that might have an influence on the dependent variable and could result in missing/incomplete data. The variability in articulation policies between states presents an additional limitation. While this study specifically examines the impact of the policy component of guaranteed transfer of an associate's degree, there is still some variability in the way that states design/implement these policies. Additionally, when collecting data on the various articulation policy elements, such as guaranteed transfer of associate's degree, common course numbering, and a transferrable core of lower-division courses, it was often difficult to find public record and state legislation that revealed the exact date the policy was initially passed and implemented, which is key in understanding the impact a policy might have on a state. Another limitation is that there are several variables that were not included in this study, such as transfer rates and the number of associate's degrees conferred in a state, but could impact the relationship between articulation policies and bachelor's degree conferment. This study also did not include state fixed effects and thus did not take into account the effects of unobserved heterogeneity across states in this analysis.

An additional limitation of these methods is that they do not address the impact of various elements of transfer culture that students experience when transferring from a community college to a four-year institution. While better understanding the impact that articulation polices have on the transfer of credits and the transfer process in general is undoubtedly important, it is also important to consider the culture and other factors that surrounds transfer students as they move from the community college to four-year institutions. These factors include availability of transfer advising, faculty opinions and actions towards

transfer students, and the social integration of transfer students, amongst others. The inability to address and account for these factors in the methods is a limitation of the findings.

Results

The results of this regression can be seen in Table 3 below. The existence of guaranteed transfer of associate's degrees (β=.244, p<.001), public four-year university enrollment (β=.713, p<.001), and public community college enrollment (β=.277, p<.001) all demonstrated positive and statistically significant relationships with bachelor's degree completion. Student income level (i.e. the percentage of students attending in-state public universities that were Pell-eligible) demonstrated a statistically significant negative relationship with degree completion (β=-0.252, p<.001). The existence of a common course numbering system also demonstrated a statistically significant negative relationship with degree completion (β=-0.0296, p<.01). The presence of a common transferable core of lower-division courses demonstrated a positive relationship with degree completion, but the relationship was not statistically significant (β=.0111, p=.249). Finally, the research design included an interaction variable of percentage of Pell-eligible students to examine the interaction between the existence of guaranteed transfer of associate degrees and student income. The analysis showed a statistically significant positive relationship between these two variables (β=.254, p<.001).

[Insert Table 3]

Conclusions

These methods and results yield several findings related to the relationship between various policy transfer articulation policy elements and bachelor's degree attainment at four-year public universities. Across all states from 2008-2015, the results show that the presence of a state-level articulation policy that specifically includes the guaranteed transfer of an associate's

degree positively affects public 4-year bachelor's degree completion. This suggests that including this policy element in articulation agreements has a desirable impact on student degree completion. Additionally, the findings suggest that while the presence of a transferable core of lower-division courses does have a positive relationship with public 4-year bachelor's degree completion, the relationship is not statistically significant. This suggests that there is no quantitative statistical result from this study that demonstrates that transferable core of lower-division courses have any impact on or relationship with degree completion. Finally, the existence of a common course numbering system did have a statistically significant relationship with degree completion, however the relationship was negative. These findings suggest that the presence of a common course numbering system is a negative predictor of degree completion. In other words, common course numbering is not associated with desirable outcomes related to completion.

The findings also reveal that percentage of Pell-eligible students at public four-year universities in a state has a negative relationship with degree completion. This suggests that states that enroll high percentages of low-income students see lower numbers of degree completion. Finally, the analysis of the interaction variable reveals that guaranteed associate's degree transfer articulation policy has a statistically significant effect on the relationship between the percentage of Pell-eligible students and bachelor's degree completion. This finding suggests that while the percentage of Pell-eligible students is typically a negative predictor of degree completion, the presence of articulation policy that specifically includes the guaranteed transfer of an associate's degree helps to offset this effect. In other words, based on these results, this type of articulation policy seems to be an effective approach to reducing the negative effect that serving high percentages of low-income students typically has on degree completion. This

suggests that this articulation policy component is helping low-income students persist through bachelor's degree completion. This interaction is particularly notable when considering many community college transfer students are low-income and could benefit from such a policy.

This study contributes to the literature on the effectiveness of transfer articulation agreements by isolating the impact of specific articulation policy components, in this case the guaranteed transfer of an associate's degree. Much of the prior research around articulation policy has taken a blanket approach in analyzing the effectiveness of such policies by not investigating the impact of different types of articulation policies (Gross & Goldhaber, 2009). This type of research does not isolate the specific policy elements found within the vastly diverse articulation policies of each that that yield successful student outcomes (Roksa & Keith, 2008). This research magnifies the impact of several articulation policy features, and further examines the manner in which policies that guarantee the transfer of associate's degrees impact the relationship between student income and degree completion.

Policy Implications

These findings suggest that state-level transfer articulation policies do impact bachelor's degree completion at public four-year universities. Specifically, the presence of guaranteed transfer of associate's degree is positively and significantly related to degree completion, while the presence of a common course number and a transferable core of lower division course did not reveal positively statistically significant relationships with degree completion. These results provide support for the creation of state-level articulation policies that guarantee that associate's degrees will transfer from community colleges to public four-year universities. States without articulation policies should work to innovate policy that includes this element, and states with existing policies should examine these policies to ensure this element is included.

These results also show that the presence of a state-level articulation policy that specifically includes the guaranteed transfer of an associate's degree is able to decrease the extent to which student income level impacts degree completion. That is, the typically lower levels of degree completion frequently associated with states serving higher percentage of low-income students would be impacted by the presence of articulation policies including automatic transfer of associate's degree. These results suggest that guaranteeing associate's degree transfer is a policy tool that effectively supports low-income students. States should work to develop articulation policies that include this element. While this action is important for all states, it is particularly important for states serving the high levels of low-income students.

Recommendations for Future Research

This research provides a valuable addition to the literature on transfer articulation policies by disaggregating the effectiveness of particular articulation policy components. While the vast majority of prior research on this topic has viewed all types and degrees of articulation policies as equal when analyzing the effectiveness of such policies (i.e. a state with just one articulation policy element would be analyzed as equal to a state with several articulation policy elements), this study disaggregates the impact of specific policy elements (Roksa & Keith, 2008). Specifically, the results of this study demonstrate that guaranteed transfer of an associate's degree impacts bachelor's degree completion in a positive and statistically significant way, while a common course numbering system has a negative statistically significant impact on bachelor's degree completion and a transferrable core of lower division courses has a positive not statistically significant relationship with bachelor's degree completion. Future research should continue examining the nuances of articulation policies in an effort to identify policy elements

that positively impact bachelor's degree attainment and the success of community college students.

This paper did not use a technique to match similar states in order to compare the effects of articulation policies. Rather, these methods examined all states and thus the findings reveal the average effect of the treatment (or presence of an articulation policy) on the outcome (bachelor's degree attainment). This means that the impact of articulation policies was investigated across states with different state policy, higher education, and economic contexts, rather than across states with similar environments. Given the differences between the 50 states, it is important to specifically examine states with similar political and structural environments in order to isolate the impact of articulation policy components. This paper should be used to guide future research that identifies states that should be more closely examined and the states they should be compared to. Future researchers should consider the possibility of using a technique such as propensity score matching to identify comparison states.

Future research should also examine the degree to which articulation policies are enforced and implemented at both the community college and four-year university level. It is possible that while some states may have articulation policies in place, the impact of these policies on the experiences of community college transfer students is minimal because the policies are not being implemented and followed by institutions. In order for articulation policies to successfully support transfer students, there must be a commitment and collaboration between all institutions. Research examining the effectiveness of current articulation policy implementation strategies, followed by research identifying effective practices and policy solutions related to implementation, are also necessary in ensuring articulation policies are not

only created but also enforced so that institutions are compliant and students are benefitting from them.

Finally, research examining the manner in which students use and interact with articulation policies would be useful in guiding policymakers and higher education leaders as they communicate policies and procedures to prospective transfer students. This would provide insight on the strategies that are most effective in communicating transfer policies and requirements to students, such as a transfer handbook or transfer advisers that work in conjunction with both community college and four-year universities, so they actually take advantage of the pathways set up by articulation policies.

References

Anderson, G. M., Sun, J. C., & Alfonso, M. (2006). Effectiveness of statewide articulation agreements on the probability of transfer: A preliminary policy analysis. *The Review of Higher Education, 29*(3), 261–291.

Cohen, A. M., & Brawer, F. M. (2008). *The American community college (5th ed.).* San Francisco, CA: Jossey-Bass.

de los Santos, A.G & Sutton, F. (2012) Swirling students: Articulation between a major community college district and a state-supported research university. *Community College Journal of Research and Practice, 36* (12), 967-981.

Doyle, W. R. (2009). The effect of community college enrollment on bachelor's degree completion. *Economics of Education Review, 28*(2), 199–206.

Gross, B. & Goldhaber, D. (2009). Community college transfer and articulation policies: Looking beneath the surface. *Center on Reinventing Public Education.*

Hoffmann, J.P. (2016). *Regression models for categorical, count, and related variables: An applied approach.* Oakland, California: University of California Press.

Jaeger, A.J., Dunstan, S.B., & Dixon, K.G. (2015). College student access: How articulation agreements support rural students. *Peabody Journal of Education, 90*(5), 615-635.

Kasper, H.T. (2003). The changing role of community college. *Occupational Outlook Quarterly, 46* (4), 14-21. Retrieved from https://www.bls.gov/careeroutlook/2002/winter/art02.pdf

Lane, J. & Kivisto, J. (2008). Interests, information, and incentives in higher education: Principal-Agent Theory and its potential applications to the study of higher education governance. In J.C. Smart (Ed.), *Higher education: Handbook of theory and research, Volume XII,* (pp. 43-106). Dordrecht, The Netherlands: Springer.

LaSota, R.R. & Zumeta, W. (2016). What matters in increasing community college students' upward transfer to the baccalaureate degree: Findings from the beginning postsecondary study 2003-2009. *Research in Higher Education*, *57* (2), 152-189.

Long, B. T. (2005). State financial aid: Policies to enhance articulation and transfer. Boulder, CO: Western Interstate Commission for Higher Education.

National Student Clearinghouse Research Center. (2015). *Snapshot report: Contribution of two-year institutions to four-year completions*. Retrieved at http://nscresearchcenter.org/snapshotreport-twoyearcontributionfouryearcompletions17/

Roksa J. & Keith, B. (2008) Credits, time, and attainment: Articulation policies and success after transfer. *Educational Evaluation and Policy Analysis, 30(3),* 236-254.

Shapiro, D., Dundar, A., Ziskin, M., Chiang, Y. Chen, J., Torres, V., & Harrell, A. (2013). Baccalaureate attainment: A national view of the postsecondary outcomes of students who transfer from two-year to four-year institutions (Signature Report No. 5). Herndon, VA: National Student Clearinghouse Research Center.

Stern, J.M. (2016). The effect of articulation agreements on community college transfers and bachelor's degree attainment. *Community College Journal of Research and Practice, 40* (5), 355-369.

Zhang, L. (2010). The use of panel data models in higher education policy studies. In J.C. Smart (Ed.), *Higher Education: Handbook of Theory and Research* Volume 25 (pp. 307-349). Dordrecht, The Netherlands: Springer.

Table 1

Dependent, Independent, Control and Interaction Variables, Data Years 2008-2015

Variables	Observations
Dependent Variable	IPEDS
Bachelor's degrees conferred by public four-year institutions	
Independent Variable	
Guaranteed Transfer of Associate's Degree in State Articulation Policy	Education Commission of the States, WICHE, State websites and legislative histories
Control Variables – State Higher Education Context	
Four-year public institution fall enrollment	IPEDS
two-year public institution fall enrollment	IPEDS
Control Variables – Other Articulation Policy Components	
Transferable Core of Lower-Division Courses in State Articulation Policy	Education Commission of the States, WICHE, State websites and legislative histories
Common Course Numbering in State Articulation Policy	Education Commission of the States, WICHE, State websites and legislative histories
Interaction Variable	
Pell Percentage at Public Four-Year Institutions	U.S. Department of Education

Table 2

Descriptive Statistics for All Data in Study, Data Years 2008-2015

Variables	Observations	Mean	SD	Range
Dependent Variable				
Bachelor's degrees conferred by public four-year institutions	350	22,347.36	22,883.44	1,498 – 136,033
Independent Variable				
Guaranteed Transfer of Associate's Degree in State Articulation Policy	350	-	-	-
Control Variables – State Higher Education Context				
Four-year public institution fall enrollment	350	129,891.2	128,597.6	9,544 - 687,648
two-year public institution fall enrollment	350	136,664.9	230,338.1	758 – 1,629,566
Control Variables – Other Articulation Policy Components				
Transferable Core of Lower-Division Courses in State Articulation Policy	350	-	-	-
Common Course Numbering in State Articulation Policy	350	-	-	-
Interaction Variable				
Pell Percentage at Public Four-Year Institutions	350	.338005	.095643	.141 - .7197

Table 3

State-Level Analysis of Bachelor's Degree Attainment and Transfer Articulation Policies (2008-2015) Using Regression with Driscoll-Kraay Standard Errors

Variables	Coefficient
Interaction Between Guaranteed Transfer of Associate's Degree and Pell Percentage	0.254***
	(0.032)
Presence of Guaranteed Transfer of Associate's Degree in in State Articulation Policy	0.244***
	(0.023)
Pell Percentage In-State Public Universities	-0.252***
	(0.049)
Public Four-Year Enrollment	0.713***
	(0.009)
Public Two-Year Enrollment	0.277***
	(0.005)
Presence of Transferable Core of Lower-Division Courses in State Articulation Policy	0.0111
	(0.010)
Presence of Statewide Common Course Numbering in State Articulation Policy	-0.0296**
	(0.011)
Year Fixed Effects	Yes
Observations	350

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$