Crowding Out Community Colleges? The Enrollment Effects of Affiliated Campuses

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Abstract

Some public university systems (including the Ohio State University system and the Pennsylvania State University Commonwealth Campuses) have a "flagship campus" and a number of affiliated campuses. These affiliated campuses blend the traditional 2- and 4-year institutional missions and offer a streamlined transfer pipeline into the flagship campus. I build a general theoretical framework of college enrollment with two admissions stages (first-time and transfer) and multiple institutions (a flagship campus, community college, and potentially an affiliated campus). The model predicts that opening an affiliated campus causes community colleges to enroll less academically prepared students in first-time admissions and may cause transfer applicants from community colleges to be crowded out by less academically prepared affiliated campus applicants. Moreover, while transfer admissions strictly reduces wealth inequity in access to the flagship campus when there is no affiliated campus, opening an affiliated campus can exacerbate wealth inequity in transfer admissions. From the perspective of a social planner who considers students and institutions complements, opening an affiliated campus has ambiguous welfare effects and is never a Pareto improvement on the status quo. Finally, I show that opening an affiliated campus tends to be welfare increasing under the same circumstances that individual students prefer for an affiliated campus to be opened: when it is a closer educational substitute for the flagship campus than it is for the community college.

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Some public university systems consist of a flagship campus along with one or several affiliated campuses located in other regions of the state. I define an "affiliated campus" as an public institution of higher education that is independently to confer 5-year degrees, is connected to a flagship campus by shared name, is more affordable than its flagship campus, and that offers a priority transfer pathway into the flagship campus. This structure differs from public university systems in which members are independent peer institutions (e.g., the University of California or State University of New York systems) because affiliated campuses blend the traditional two-year and four-year institutional missions and can be thought of as "junior" to the flagship campus. Two major examples include the Ohio State University (OSU) regional campuses and the Pennsylvania State University (PS) Commonwealth campuses.

Little is currently known about how affiliated campuses affect the overarching ecosystem of higher education. As a first step, this paper builds a theoretical model with multiple campuses to explore different student pathways. This paper offers guidance on how public universities can most effectively implement affiliated campuses given their institutional goals. This guidance is directed towards policymakers and university administrators who are facing increased application competition over limited enrollment slots and are considering ways to balance between two conflicting goals: (1) increasing access to flagship campuses and (2) maintaining selectivity at flagship campuses.

It is clear that flagship campuses benefit from affiliated campuses. Affiliated campuses make the university system better off in two ways: they increase increase overall enrollment and allow the university to sort students between the flagship and affiliated campuses based on application strength. Affiliated campuses keep overall enrollment high while flagship campuses maintain selectivity, which may be important for prestige purposes like maintaining a high ranking.

However, it is unclear how affiliated campuses affect local community colleges. Community colleges could be made worse off by affiliated campuses if they compete over first-time applicants. Also, students at affiliated campuses have a streamlined transfer pipeline into the flagship. Therefore, an affiliated campus may make it more difficult for the community college to successfully transfer students into the flagship campus. This is particularly concerning because transfer from community college reduces wealth inequity in access to elite institutions of higher education.

Finally, it is also unclear how affiliated campuses affect students. On one hand, students benefit from an increase in the options for higher education. Affiliated campuses are less expensive to attend than flagship campus, especially considering the opportunity cost of college. Students who are able to attend more local affiliated campuses can save on board and have more time for part-time work. On the other hand, community college students may be made worse off in transfer admissions because they compete with students at affiliated campuses who are prioritized in transfer. So while affiliated campuses may open up more academic pathways in first-time admissions, it's possible that they narrow academic pathways through transfer admissions.

This paper presents a theoretical framework of college enrollment with multiple institutions to better understand the effects of introducing an affiliated campus. I focus on enrollment changes because all higher education outcomes are ultimately downstream of enrollment; understanding who starts at what institution is therefore key to contextualizing all other higher education outcomes. Under general assumptions, the model predicts that introducing an affiliated campus makes community colleges worse off in two ways: (1) they enroll less academically prepared first-time student bodies because affiliated campuses attract some well-prepared students away, and (2) affiliated campus students can "crowd out" better prepared community college students in transfer admissions. Also, while transfer admissions in the absence of an affiliated campus strictly reduces wealth inequity in access to the flagship campus, adding an affiliated campus can cause transfer admissions to exacerbate existing wealth inequity. So while affiliated campuses benefit the flagship campus, they may make it harder for community colleges to execute their traditional institutional missions: graduating students with two-year degrees (because they enroll less prepared students) and facilitating transfer into flagship campuses (because their students are not prioritized in transfer).

I then consider a social welfare exercise: Should a social planner who considers students and colleges complements subsidize tuition to modestly grow its flagship campus or instead open a larger affiliated campus? Tuition subsidization at the flagship is always a Pareto improvement because tuition subsidization expands overall enrollment in a way that preserves positive sorting of well-prepared students to higher ranked institutions. Decreased tuition induces some low wealth, highly academically prepared students to enroll at the flagship campus instead of the community college. This opens up capacity at the community college for students who were marginally inadmissible. Because these low wealth, highly academically prepared students are among those who would've originally started at a community college and successfully transferred, it also frees capacity for transfer admissions.

In contrast, the welfare effects of opening an affiliated campus are ambiguous; while opening an affiliated campus can potentially increase welfare more than tuition subsidization, it is never a Pareto improvement because opening an affiliated campus does not maintain positive sorting between students and institutions. These mixed welfare effects are generated through both first-time and transfer admissions. In first-time admissions, it is welfare decreasing to draw academically well-prepared students away from the flagship to the affiliated campus, but it is welfare increasing to draw them away from the community college to the affiliated campus. As for transfer admissions, the affiliated campus increases welfare because it opens a new academic pathway for some students who are well-matched to the flagship campus but don't apply to the flagship in first-time admissions, but it decreases welfare because some well-prepared community college transfer applicants are crowded out by less prepared but prioritized affiliated campus transfers.

I conclude the social welfare exercise by showing that the social planner prefers opening an affiliated campus over tuition subsidization when the affiliated campus is closer to being a substitute for the flagship than it is a substitute for community college. This is also when students tend to benefit the most from an affiliated

campus at an individual level too, so there is synergy between what is individually optimal for students as well as what is socially preferable.

I now provide an overview of the rest of the paper. After a literature review in Section 1, I give background on existing affiliated campus systems in Section 2. In Section 3, I construct a theoretical framework of first-time and transfer admissions with multiple institutions. I then present a social welfare analysis comparing the predicted welfare effects of tuition subsidization vs. opening an affiliated campus in Section 4, and conclude in Section 5.

1 Literature Review

This paper rests within the literature on student pathways over higher education. For a comprehensive review, see Lovenheim and Smith (2023). Many students enroll at more than one post-secondary institution, motivating the need to understand different student pathways. Andrews, Li, and Lovenheim (2014) study students who enrolled for the first time at public Texas institutions between 1992-2002 and find that 31.4% of students transferred at least once, most often from a community college. Moreover, they find that transfer among students who eventually received a bachelor's degree is high: around half of eventual degree recipients transfer at least once. Similarly, the National Student Clearinghouse Research Center reports in *Two-Year Contributions to Four-Year Completions* (2017) that 49% of students who completed a bachelor's degree in the 2015-16 academic year had enrolled at a two-year public institution in the last ten years.

These facts point to the important role community colleges have as a starting institution. Kane and Rouse (1999) provide an overview of community college's role in the U.S. ecosystem of higher education. Community colleges are associated with upwards mobility: they are more affordable than four-year institutions and often serve non-traditional and part-time students (*An Introduction to Community Colleges and Their Students* 2021). Attending community college is also common; more students were enrolled at community colleges than at public four-year institutions in 2019 (9.6 million vs. 7.3 million), and more first-time students started at community colleges than at four-year universities in pre-COVID years (Fink 2024).

Although many students start at a community college, the majority of these students report their eventual goal is a bachelor's degree (*What We Know About Transfer* 2015). However, there are systematic differences in bachelor's degree completion based on starting institution. Only 31% of community college students in the Fall 2010 cohort eventually transferred to a four-year institution, and less than half of those transfers (14% of the cohort) went on to complete a bachelor's degree (Shapiro et al. 2017). In comparison, the 6-year graduation rate for the Fall 2010 cohort of full-time, first-time students who started at four-year institutions was over 4 times higher at 60% (de Brey et al. 2019).

Some of this attrition is expected because students may change their preferences. In Rouse (1995)'s frame-

work, this is called the "diversion" effect: some students who would have completed a bachelor's degree if they had started at a four-year university may choose not to transfer because they change their preferences after exposure to the community college as a first-time student. However, Rouse (1995) also points to a countervailing force, the "democratization" effect. Some students who start at a community college may decide to pursue a four-year degree only after becoming exposed to higher education. I partially build off of Rouse (1995) when considering transfer admissions in this paper. Empirical work by Mountjoy (2022) finds evidence of both the democratization and diversion effects. Mountjoy (2022) studies tenth grade students who enrolled at a Texas public high school between 1998-2002 and finds that increased access to two-year institutions increases educational attainment and later earnings overall, but as theoretically predicted, there are two opposing effects. Around 1/3 of community college students were diverted from a four-year institution, while the other 2/3 of students were democratized. See also research papers on the effects of "Promise" programs that make community college free (or highly cost subsidized) to local high school graduates, including Nguyen (2020), Bell (2021), Acton (2021), and Billings, Gándara, and Li (2021).

Students may also change their preferences before even entering higher education if they strategically apply to colleges. See Bound, Hershbein, and Long (2009) for a review on how students change their admissions behavior in response to increased competition, which is especially relevant to the environment I study: as I discuss in the next section, one reason OSU expanded its regional campuses is in response to increasing competitiveness in applications. See also Chade, Lewis, and Smith (2014), Pallais (2015), and Knight and Schiff (2022) for research on how changes in student application behavior affect enrollment. The increased competition for limited enrollment also motivates the exploration of how OSU has utilized its regional campuses: other large public universities may consider using similar campuses to alleviate enrollment demand.

Finally, I add to research that build theoretical frameworks of college enrollment. I follow the matching framework from Azevedo and Leshno (2016), who show that for a large, decentralized two-sided matching environment with a continuum of agents, a stable matching can be equivalently characterized in a supply and demand framework. In the context of college admissions, prices are analogous to level of institutional selectivity; in equilibrium, a university picks a cut-off level of selectivity. Blair and Smetters (2021) uses the same framework and imposes assumptions on positive sorting that are similar to those I use to characterize the social planer's problem in Section 4. See also Che and Koh (2016), as well as Epple, Romano, and Sieg (2006) and Fu (2014) for equilibrium models of college admissions.

2 Affiliated Campuses

I define an affiliated campus as a public post-secondary educational institution that:

1. Is independently accredited to confer four-year degrees.[1]
2. Is affiliated with a higher ranked "flagship campus" via shared name. This signals to students that the campuses are connected. Rank is determined by the US News Best Colleges list.
3. Is more affordable than its associated flagship campus.
4. Has a streamlined transfer process into the flagship that doesn't require an additional application, only for students who start at the affiliated campus to meet certain minimum requirements.

Table 1: Universities with Affiliated Campuses

Institution Name	State	Information
Ohio State University system	Ohio	Students who start at the 4 regional campuses may transfer to the flagship campus if the student has completed a minimum of 30 credit hours with a 2.0 GPA. Information.
Kent State University system	Ohio	Students who start at the 8 regional campuses may transfer to the flagship campus if the student has completed a minimum of 12 semester hours with a 2.0 GPA. Information.
Miami University system	Ohio	Students who start at the 3 regional campuses may transfer to the flagship campus if the student has completed a minimum of 16 credit hours with a 2.0 GPA. Information.
Ohio University system	Ohio	Students who start at the 5 regional campuses may transfer to the flagship campus if the student has completed a minimum of 30 credit hours with a 2.0 GPA. Information.
Pennsylvania State University Commonwealth Campuses	Pennsylvania	The 2+2 program allows students to start at any of the 24 Pennsylvania State University Commonwealth campuses and complete their major at a different campus. Requirements are major dependent. Information.

I searched all institutions that could potentially fit these criteria on the National Center for Education Statistic's College Navigator and started with a full list of candidates. That list can be found in Appendix A. I then looked at the admissions criteria for all candidate institutions and narrowed down the list to the 5 university systems that appear in Table 1. Many candidate public university systems are ultimately eliminated because there is no specialized transfer program between campuses—students who start at one campus and want to graduate at a different campus must go through the same or a comparable transfer application process as a student who started at an institution outside of the system.[2] In this paper, I concentrate mostly on the Ohio State University (OSU) and Pennsylvania State University (PSU) systems, as these are relatively large and well-established public university systems.

[1] Many affiliated campuses are additionally accredited to confer two-year degrees.

[2] It may also be worth noting that I eliminate 4 more systems (University of Connecticut, University of Tennessee, Texas A&M, University of Virginia) that require an invitation to internally transfer. Either the invitation is given upon first-time enrollment—in which case the student was admissible and the invitation acts more like a deferred acceptance—or the invitation must be actively solicited by the student, which means the transfer process is not streamlined.

There remain frictions in transferring from an affiliated campus. First, the transfer has to be proactively initiated by the student. A student defaults to remaining at the affiliated campus she starts at. Second, there may be more selective major/program-specific requirements. For example, the PSU 2+2 Program has major-based requirements to transfer into specific programs. Similarly, the OSU Fisher College of Business requires a "[m]inimum Ohio State GPA of 3.10 or better" (*Admission to Major Program and Specialization Criteria* 2024). Business Management is offered as a bachelor's degree at all of OSU's affiliated campuses, so a student who marginally qualifies to transfer to the flagship campus in general but has a strong preference to pursue Business Management may choose to remain at the affiliated campus.

Nevertheless, affiliated campuses offer a more streamlined academic pathway to a flagship campus than starting at an unaffiliated institution. Affiliated campuses also *advertise* themselves as such and the ability to transfer into a highly ranked flagship is likely a huge motivating factor for why students choose affiliated campuses. For example, 51% of students who started at an OSU regional campus in 2021 reported that their first choice was the OSU flagship campus (*New First Year Students by Campus Choice* 2022). Also, in comparison, external transfers face all the frictions that affiliated campus transfers do, in addition to having a more onerous transfer application process.

3 Theoretical Model

I develop a generalized theoretical model of university admissions with up to three options: a flagship campus, an affiliated campus, and a community college. As a benchmark, I start with what I call the "unaffiliated environment" with a flagship campus and a community college. Then I show how admissions selectivity changes in the affiliated environment, after an affiliated campus is added as a third option. Throughout this section, I present the major results and provide the proofs in Appendix B.

3.1 Unaffiliated Environment

First suppose there are only two institutions available to local students, a flagship campus F and a community college C. University enrollment happens over two time periods: first-time admissions and transfer admissions.[3] Denote an arbitrary institution as $j \in \{C, F\}$. Each institution has capacity for first-time, full-time students denoted $\kappa_j \in (0, 1)$. Furthermore, let $\kappa_F + \kappa_C < 1$. The flagship also has capacity for transfer students in the second round of admissions, $\kappa_T \in (0, \kappa_C)$.

There is a unit mass of local students who demand higher education. Since total capacity $\kappa_F + \kappa_C < 1$, higher education is selective in the sense that there are always some students unable to enroll anywhere. Students differ in academic preparedness $a \in [0, 1]$ and wealth $w \in [0, 1]$, so that an arbitrary student i is

[3] I focus on enrollment effects, so I do not include a third period during which final academic outcomes are realized.

described by her type $(a_i, w_i) \in [0,1] \times [0,1]$. Both a and w are independently drawn from the distribution Uniform$[0,1]$.[4] Distribution over type is common knowledge. If student i applies to an institution (first-time or transfer), then she directly reveals her academic preparedness a_i to that institution.

In the unaffiliated environment, there are three academic pathways for students who successfully enroll somewhere as a first-time student: (1) start at and only attend the flagship, (2) start at and only attend the community college, or (3) start at the community college and transfer to the flagship campus.[5]

3.1.1 First-time Enrollment

Institutions differ in price and value, which together determine a student's *initial* preferences over institutions. I assume that students don't know their individual value of attending a given institution before actually attending, so all students assign each institution the same expected value based on the perceived prestige of attending that institution. The shared prestige value could be based on its ranking or the average outcome of its graduates.[6] They also face the same expected cost at each institution.[7] Fix the price and value of attending the community college C to 0 and denote the price and value of attending the university's flagship campus F as $p_F \in (0,1]$ and $v_F \in (0,1]$ respectively.

Students have log-linear utility in wealth and the value of the institution attended; the outside option of no higher education is strictly negative. Therefore, the utility that student i yields from attending C is

$$u(w_i, C) = ln(1 + w_i), \tag{1}$$

and the utility from attending F is

$$u(w_i, F) = ln(1 + w_i - p_F) + v_F. \tag{2}$$

Students always prefer education to no education, but different types of students prefer different institutions based on what the student perceives she can afford. First, I impose the following regularity condition:

[4] Assuming a uniform distribution simplifies notation and analysis, but I can let academic preparedness follow any arbitrary probability distribution over $[0,1]$. For example, it may be more reasonable to assume that when admissions office consider applications, they transform the score associated with each application so that the distribution is roughly normal. Assuming other distributions over $[0,1]$ wouldn't qualitatively change theoretical results but adds modeling complexity, hence why I use the uniform distribution for convenience. The same is roughly true for allowing academic preparedness and wealth to correlate: I could define a parameter that describes the degree of correlation, but this would add modeling complexity without affecting the broad strokes of the results.

[5] There are, of course, more academic *outcomes*. But this paper concentrates on academic pathways, not outcomes.

[6] The intuition here is that applicants may know University A is ranked higher than University B, but doesn't know how much better attending University A would be for her specifically until she attends and learns more about how University A benefits her. Later, when considering the social planner's problem, I will assume that the social planner prefers to match highly academically prepared students to the flagship campus because the social planner has positive assortative preferences.

[7] In practice, lower income students generally receive more financial aid at universities than at community colleges. However, students likely face informational frictions that may cause them to reference average price rather than the net price they would face conditional on enrollment. So it is not unrealistic to assume that low wealth students fail to internalize the fact that net price may actually be lower at the flagship campus. Also, opportunity cost of attending the flagship might also be substantial for students who would work if attending a community college.

Condition 1 (Unaffiliated preferences condition)**.** (p_F, v_F) *together satisfy:*

1. *A student with* $w_i = 1$ *prefers the flagship campus over the community college:*

$$ln(2 - p_F) + v_F > ln(2).$$

2. *A student with* $w_i = 0$ *prefers the community college over the flagship campus:*

$$ln(1 - p_F) + v_F < 0.$$

This condition guarantees that Equation 2 crosses Equation 1 exactly once from below. It also guarantees that there is variance over initial preferences. Student preferences can be described as a threshold on wealth. That is, students care about how affordable higher education is and will try to go to the best possible institution given their budgets.

Lemma 1. *Let Condition 1 on unaffiliated preferences hold. There exists a wealth cut-off* $\hat{w}^{UN}$ *such that* i *initially prefers the flagship if and only if* $w_i \geq \hat{w}^{UN}$*; furthermore,*

$$\hat{w}^{UN} = \frac{1 - e^{v_F}(1 - p_F)}{e^{v_F} - 1} \in (0, 1). \tag{3}$$

First-time admissions happens over two steps:

1. Students who prefer the flagship apply there.
2. Students who prefer the community college or were previously rejected at the flagship apply to the community college.

Now let's consider the flagship's first-time enrollment problem. I assume that the flagship gets value from both enrolling more students as well as maintaining high selectivity; these incentives compete with each other. The flagship's first-time enrollment decision can be characterized as an academic preparedness cut-off $a_F \in [0, 1]$ such that the flagship enrolls applicant i if and only if $a_i \geq a_F$.

Denote the quantity of students above the flagship's cut-off $q_F = 1 - a_F$.[8] Let $\pi_F \in \mathbb{R}_{++}$ be the expected and constant "profit" of enrolling a student. Let $\rho_F(q_F) : [0, 1] \to \mathbb{R}_+$ be a continuous and differentiable function that captures the flagship's prestige concern, which satisfies the regularity conditions $\rho_F(0) = 0, \rho_F(1) > \pi$, $\frac{\partial}{\partial q_F}\rho_F(q_F) > 0$, and $\frac{\partial^2}{\partial q_F^2}\rho_F(q_F) > 0$. This function can be interpreted as the "prestige cost" of increasing enrollment, and the regularity assumptions imposed translate to two important characteristics. First, there is no prestige cost at the highest level of selectivity ($\rho_F(0) = 0$), so the flagship always enrolls some students.

[8] Note that q_F isn't the quantity of students that flagship ultimately enrolls, since not all students will apply to the flagship.

Second, the marginal prestige cost of decreasing selectivity is increasing. That is, lowering the cut-off from 0.5 to 0.45 incurs a larger prestige cost than dropping it from 0.9 to 0.85.

Given the fraction of students who apply at the flagship $(1 - \hat{w}^{UN})$, the flagship's enrollment problem is:

$$\max_{q_F} \quad (1 - \hat{w}^{UN}) \int_0^{q_F} (\pi_F - \rho_F(q_F)) q_F dq_F \tag{4}$$

subject to the capacity constraint $(1-\hat{w}^{UN})q_F \leq \kappa_F$. Denote a_F^{UN} the optimal first-time cut-off on academic preparedness for the flagship F in the unaffiliated environment.

If the flagship's capacity constraint doesn't bind, then there is a straightforward marginal benefit-marginal cost interpretation of the optimal level of enrollment: enroll until $\pi_F = \rho_F(q_F^{UN})$ (marginal benefit of enrollment = marginal prestige cost of enrollment).[9] If the capacity constraint binds, then the flagship would enroll more students, but cannot. The flagship therefore enrolls the best applicants up to capacity.

Both the capacity constrained and unconstrained cases are interesting and policy relevant. Affiliated campuses are intrinsically linked to flagship campuses being capacity constrained and needing outlets for qualified students to enroll. But in the future, due to the "demographic cliff" in college enrollment, it may become more realistic to assume that capacity constraints even at flagship institutions are less likely to bind. I prioritize discussing the capacity unconstrained case in the main body because this means the flagship's prestige concern is equally as strong in both environments. This means I can isolate the effects of adding an affiliated campus that are purely driven by changes in the academic pathways students choose to take (as opposed to changes driven by institutional priorities shifting).

I assume the community college enrolls the best applicants up to capacity. Denote a_C^{UN} the optimal first-time cut-off on academic preparedness for the community college in the unaffiliated environment. The first-time admissions cut-offs at each institution follow.

Proposition 1. *Let Condition 1 on unaffiliated preferences hold. The first-time admissions cut-offs at the flagship F and community college C are:*

$$\begin{aligned} a_F^{UN} &= 1 - \rho_F^{-1}(\pi_F), \\ a_C^{UN} &= \hat{w}^{UN} + (1 - \hat{w}^{UN}) a_F^{UN} - \kappa_C. \end{aligned}$$

It is sensible to impose a regularity condition on capacity. If capacity at the community college is too small,

[9] I note here that there may be a question as to why the expected "profit" of enrolling a student is constant. I could have instead let the expected "profit" of enrolling a student depend on academic well-preparedness, as it would be sensible to assume that better-prepared students contribute more to activities that increase an institution's prestige. To simplify notation and make the objective function neater, I instead allow all variance in student quality to be captured within the prestige concern function $\rho_F()$. Analysis would not substantively change if I let π_F vary in student quality and we would still arrive at a result that captures the trade-off between "marginal benefit of increasing enrollment" vs. "marginal cost of decreasing prestige". So I make this convenient simplifying assumption that π_F is constant, given that underlying analysis and interpretation doesn't change.

then the model can generate the unintuitive result that the flagship is less selective than the community college. I therefore exclusively concentrate on the case where capacity at the community college is large enough that the flagship is the most selective institution.

Corollary 1. *Let* $\kappa_C > \hat{w}^{UN} \cdot \rho_F^{-1}(\pi_F)$. *Then* $a_F^{UN} > a_C^{UN}$.

Following Azevedo and Leshno (2016), the first-time enrollment cut-offs are *stable*. Stability implies that neither universities nor students have "justifiable regret": students can do no better, because her more preferred institution would not accept her, and institutions can do no better, because any students they want to enroll have been admitted to an institution that the student prefers more. All following results on optimal cut-offs will also be stable by Azevedo and Leshno (2016) as well.

This model predicts fundamental wealth-based inequity in first-time college admissions. Students with higher wealth endowments are more likely to apply to the flagship institution. However, we will see in the next part of the model that allowing for transfer admissions alleviates some wealth-based inequity.

3.1.2 Transfer Enrollment

The community college only has first-time enrollment. However, the flagship campus accepts transfer applications from students who start at a different institution.

Who wants to transfer? I follow the transfer framework from Rouse (1995) with simplifications.[10] I assume that students who start at a community college may have their preferences "democratized" by exposure to the higher education system and become interested in attaining a four-year degree. In this paper, democratized students initially preferred the community college and didn't apply to the flagship in first-time admissions, but they apply to the flagship in transfer admissions. Denote $\delta \in [0, 1]$ the fraction of democratized community college students.

I assume that the flagship doesn't have a prestige concern over transfer admissions. External measures of prestige such as the U.S. News Best Colleges ranking only take into account the outcomes of students who *started* at a given institution. Similarly, institutions are not required to submit detailed data on transfer-in students to the Integrated Postsecondary Education Data System.[11] As such, the incentive to admit transfer students shifts towards enrollment. To capture this, I assume that the flagship admits the best transfer students based off of academic preparedness up to transfer capacity $\kappa_T \in (0, \kappa_C)$.

[10] There are two major simplifications. First, democratization is independent of student type. It is more realistic to assume that democratization is positively correlated with academic preparedness. The best community college students probably receive more positive feedback from their instructors about transferring. Second, in the transfer framework from Rouse (1995), students who initially preferred and applied to the flagship but were not admitted and therefore were admitted to the community college in first-time admissions may have their preferences "diverted" by exposure to the community college and no longer want to transfer to the flagship. Diversion is likely negatively correlated with academic preparedness.

[11] Institutions are only required to submit information on graduation rates of students who were first-time, full-time students at that institution. Transfer students who complete a degree are included in data on the number of degrees conferred, and these data do not distinguish between degrees completed by a student who started at that institution or elsewhere.

Denote a_T^{UN} as the cut-off for transfer applicants in the unaffiliated environment: a community college student i who applies to transfer is admitted if and only if $a_i \geq a_T^{UN}$. I now solve for the transfer cut-off.

Proposition 2. *Let Condition 1 on unaffiliated preferences hold. Let transfer capacity be large enough to admit previously rejected first-time applicants. The unaffiliated transfer cut-off is*

$$a_T^{UN} = \frac{\hat{w}^{UN} \cdot \delta + (1 - \hat{w}^{UN}) a_F^{UN} - \kappa_T}{\hat{w}^{UN} \cdot \delta + (1 - \hat{w}^{UN})}.$$

Similar to the first-time admissions problem, it is possible that the flagship is *more* selective over transfer admissions than first-time admissions if transfer capacity is too small. In this case, only democratized, highly academically prepared students can transfer. I show the complete result in Lemma **??** in Appendix B, but this is unlikely to hold in reality. Institutions would have an incentive to voluntarily disclose information on transfer-in students if they were higher-performing than their first-time cohorts. I therefore concentrate on the case where transfer capacity opens up a new academic pathway for students who wanted to attend the flagship but weren't admitted in first-time admissions.

Corollary 2. *Let $\kappa_T > \hat{w}^{UN} \cdot \delta(1 - a_F^{UN})$. Then $a_T^{UN} < a_F^{UN}$.*

That is, the flagship is less selective over transfer admissions than first-time admissions.

I conclude by summarizing academic pathways in the unaffiliated environment and a key takeaway on the role of transfer admissions in affecting wealth inequity. A student could (1) start at and only attend the flagship, (2) start at and only attend the community college, or (3) start at the community college and transfer to the flagship campus.

Takeaway 1. *In the affiliated environment, there is wealth inequity in first-time college admissions because lower income students never apply to the flagship campus in first-time admissions. However, transfer admissions reduces wealth inequity because highly academically well-prepared students who start at the community college because they are sensitive to college affordability may be democratized and successfully transfer into the flagship campus.*

Of course, transfer admissions doesn't exclusively help low income students. There will also be some students who wanted to attend the flagship initially and only gain access through transfer admissions. However, recall that I made the simplifying assumption that the fraction δ of low income students who initially prefer the community college and are democratized is independent of other variables. If I had made the (more realistic) assumption that δ is correlated positively with academic preparedness, then transfer reduces wealth inequity even more.

Next, I show how academic pathways change when an affiliated campus is introduced.

3.2 Affiliated Environment

Student types remain the same, but now suppose there is a third institution: a non-selective affiliated campus A.[12] The affiliated campus has first-time enrollment capacity $\kappa_A \in (0,1)$. Capacity constraints at the flagship and community college are the same as before, and I continue to assume that not everybody who wants higher education can receive it: $\kappa_F + \kappa_A + \kappa_C < 1$.

Denote the relative price and value of attending the affiliated campus as $p_A \in (0, p_F)$ and $v_A \in (0, v_F)$.[13] The utility a student i gets from attending an affiliated campus is

$$u(w_i, A) = ln(1 + w_i - p_A) + v_A. \tag{5}$$

3.2.1 First-time Enrollment

I fully characterize student preferences over institutions in the affiliated campus in Appendix B.2. To give an overview of the derivation, I back out preferences in three steps. Step 1: Suppose students compare between the flagship and affiliated campuses. Assume that students with the highest wealth endowment prefer the flagship and those with the lowest wealth endowment prefer the affiliated campus. From this, I can derive an "upper" cut-off $\bar{w}^{AF}$ such that all students with $w_i \geq \bar{w}^{AF}$ prefer the flagship over the affiliated campus.

Step 2: Suppose students compare between the affiliated campus and community college. Assume that students with the highest wealth endowment prefer the affiliated campus and those with the lowest wealth endowment prefer the community college. From this, I can derive a "lower" cut-off $\underline{w}^{AF}$ such that all students with $w_i \geq \underline{w}^{AF}$ prefer the affiliated campus over the community college.

Step 3: I need to ensure that preferences are well-ordered—the proposed upper cut-off should in fact be higher than the proposed lower cut-off. To do so, I need to impose a "supermodularity-like" condition:[14]

$$(e^{v_F+v_A} - e^{v_F})p_F > (e^{v_F+v_A} - e^{v_A})p_A.$$

Given that the flagship is more expensive than the affiliated campus, the marginal benefit from attending the flagship instead of the affiliated campus must be large enough to justify the marginal cost of the flagship. For example, if the flagship and affiliated campuses are close educational substitutes but the affiliated campus is significantly cheaper, then the wealth cut-offs won't be well-behaved because students can get almost the same academic experience at the affiliated campus for cheaper, which can cause the upper and lower bounds

[12] I continue to use j to refer to an arbitrary institution, but now $j \in \{A, C, F\}$.

[13] These restrictions on the price and value of the affiliated campus come from how I defined the affiliated campus in Section 2. An affiliated campus is less prestigious than the flagship campus it is connected to, but it is also cheaper.

[14] Supermodularity implies "increasing differences", which is analogous to the intuition I explain: the three institutions must be sufficiently differentiated. Supermodularity is often sufficient in matching problems for positive assortative matching to occur, so it is not too surprising to need a "supermodular-like" condition to guarantee intuitively well-ordered preferences based on wealth.

to flip.

This results in five assumptions:

Condition 2 (Affiliated preferences conditions)**.** *(p_A, v_A) and (p_F, v_F) together satisfy:*

1. *A student with $w_i = 1$ prefers the flagship campus over the affiliated campus:*

$$ln(2 - p_F) + v_F > ln(2 - p_A) + v_A.$$

2. *A student with $w_i = 0$ prefers the affiliated campus over the flagship campus:*

$$ln(1 - p_F) + v_F < ln(1 - p_A) + v_A.$$

3. *A student with $w_i = 1$ prefers the affiliated campus over the community college:*

$$ln(2 - p_A) + v_A > ln(2).$$

4. *A student with $w_i = 0$ prefers the community college over the affiliated campus:*

$$ln(1 - p_A) + v_A < 0.$$

5. *There is a supermodularity-like condition to ensure well-ordered cut-offs:*

$$(e^{v_F + v_A} - e^{v_F})p_F > (e^{v_F + v_A} - e^{v_A})p_A.$$

Under these preference assumptions, student preferences over first-time admissions can be fully characterized.

Proposition 3. *Let Condition 2 on preferences hold. Then*

$$\begin{aligned}
\bar{w}^{AF} &= \frac{e^{v_A}(1 - p_A) - e^{v_F}(1 - p_F)}{e^{v_F} - e^{v_A}} \in (0, 1), \\
\underline{w}^{AF} &= \frac{1 - e^{v_A}(1 - p_A)}{e^{v_A} - 1} \in (0, 1), \\
\bar{w}^{AF} &> \underline{w}^{AF}.
\end{aligned}$$

The presence of the affiliated campus naturally changes student preferences.

Proposition 4. *Let Conditions 1 and 2 on preferences hold. $\bar{w}^{AF} > \hat{w}^{UN} > \underline{w}^{AF}$.*

That is, the affiliated campus draws some students away from both the community college *and* the flagship campus in first-time admissions.

Given student preferences, first-time admissions continues to happen over two steps, but the first step is different from the unaffiliated environment:

1. Students who most the flagship or affiliated campus apply to the university system. The university system selects which (if any) campus to admit the students to.[15]
2. Students who most prefer the community college or who were previously rejected at the university system apply to the community college and the best applicants are accepted up to capacity.

The flagship campus and the community college have the same enrollment priorities as before. The affiliated campus is non-selective and enrolls students up to capacity.[16]

Denote the flagship's first-time enrollment cut-off in the affiliated environment as a_F^{AF}.

Corollary 3. *Let the conditions from Proposition 4 hold. After an affiliated campus opens, the flagship campus's first-time admissions cut-off changes depending on whether the flagship campus was capacity constrained before the affiliated campus is introduced.*

1. *If the flagship was initially capacity constrained, then the flagship enrolls weakly fewer students and becomes strictly less selective.*
2. *If not, then the flagship is equally as selective but enrolls strictly fewer students.*

If the flagship was capacity constrained, then the flagship *wanted* to enroll more students (lowering selectivity), but couldn't because all seats were already occupied. When the affiliated campus opens, some highly academically well-prepared students are drawn away from the flagship to the affiliated campus, opening seats for less academically well-prepared but still admissible students. However, if the flagship was not capacity constrained, then the stronger constraint is the flagship's prestige concern. The prestige concern remains equally as restrictive, but again, the affiliated campus draws some highly academically well-prepared students away from the flagship to the affiliated campus. Therefore, the flagship enrolls fewer students without changing its level of selectivity. I focus on the second case so that any changes in academic pathways are purely driven by changes in where students apply and not changes in institutional selectivity.

[15]This is how most public university systems with affiliated campuses work in reality. For example, students interested in any OSU campus apply to the "OSU system". In the application, students can indicate a preference for a specific campus, but the university may offer admission to a less preferred option (e.g., an affiliated campus even though the student most prefers the flagship).

[16]Non-selectivity is consistent with consistent with at least one major affiliated campus system: *Accelerating Excellence, Access and Service: Strategic Enrollment Plan for The Ohio State University, 2022-2024* (2021) states that the primary enrollment goal at the Ohio State University affiliated campuses is expansion. Moreover, in the OSU system, any first-time student with a high school degree or equivalent are admissible at an affiliated campus (*Undergraduate Admissions: Regional Campuses* 2023).

Denote the first-time admissions cut-offs at each institution in the affiliated environment as a_F^{AF}, a_A^{AF}, and a_C^{AF} for the flagship campus F, affiliated campus A, and community college C respectively.

Proposition 5. *Let Conditions 1 and 2 on preferences hold. The first-time cut-offs in the affiliated environment are:*

$$\begin{aligned} a_F^{AF} &= a_F^{UN} = 1 - \rho_F^{-1}(\pi_F) \\ a_A^{AF} &= \frac{(\bar{w}^{AF} - \underline{w}^{AF}) + (1 - \bar{w}^{AF})a_F^{AF} - \kappa_A}{1 - \underline{w}^{AF}} \\ a_C^{AF} &= \bar{w}^{AF} + (1 - \bar{w}^{AF})a_F^{AF} - \kappa_A - \kappa_C \end{aligned}$$

I again need to impose some regularity conditions on capacity. If capacities at the affiliated campus and community college are too small, then the model can generate unintuitive results like the flagship being the least selective institution, which makes characterizing transfer enrollment trivial because nobody would want to transfer to the flagship. I therefore exclusively concentrate on cases where capacities at the affiliated campus and community college are large enough to ensure sensible first-time admissions behaviors.

Corollary 4. *Let $\kappa_A > (\bar{w}^{AF} - \underline{w}^{AF})(1 - a_F^{AF})$ and $\kappa_C > \underline{w}^{AF}(1 - a_A^{AF})$. Then $a_F^{AF} > a_A^{AF} > a_C^{AF}$. That is, the flagship campus is most selective and the community college is least selective in first-time admissions.*

It immediately follows that under the capacity constraint conditions, the community college becomes less selective in first-time admissions after the affiliated campus opens.

Proposition 6. *Let the conditions from Proposition 5 and Corollary 4 hold. The community college is less selective after the affiliated campus opens: $a_C^{UN} - a_C^{AF} > 0$.*

It is also of interest to understand *how much* less selective the community college is after the affiliated campus opens.

Corollary 5. *Let the conditions from Proposition 6 hold. The gap between cut-offs at the community college in the two environments,*

$$a_C^{UN} - a_C^{AF} = \kappa_A - (\bar{w}^{AF} - \hat{w}^{UN})(1 - a_F^{AF}) > 0,$$

is decreasing in $(\bar{w}^{AF} - \hat{w}^{UN})$, and increasing in both a_F^{AF} and κ_A.

The comparative statics result has three parts. First, if $(\bar{w}^{AF} - \hat{w}^{UN})$ increases, then there are more students who would've applied to the flagship in first-time admissions who are drawn away to the affiliated campus. This increases competition for limited first-time enrollment seats at the affiliated campus and causes some students who were marginally admissible before the preference shock to "trickle down" to the community

college. This increases selectivity at the community college and closes the gap in community college selectivity between the unaffiliated and affiliated campuses.

Second, if the flagship campus becomes more selective, then a_F^{AF} increases. The community college benefits in both the affiliated and unaffiliated environments because some academically well-prepared students are no longer accepted at the flagship. However, increased selectivity at the flagship benefits the community college *more* in the unaffiliated setting because the community college directly admits the students who "trickle down" from the flagship. In the affiliated environment, those students first "trickle down" to the affiliated campus, and it's the marginally admissible students at the affiliated campus who then "trickle down" to the community college. This dilutes the benefit to the community college of increased selectivity at the flagship in the affiliated environment.

Finally, as seats at the affiliated campus increase, κ_A increases. The most academically well-prepared students who wanted to attend the affiliated campus but were previously not accepted due to capacity constraints and therefore had to attend the community college gain access to their preferred option, the affiliated campus. As such, the community college becomes more selective.

To summarize the effects of opening an affiliated campus on first-time admissions pathway, the affiliated campus draws some students away from both the community college and the flagship. This definitely makes the community college less selective. I conclude with a note on wealth inequity in first-time admissions in the affiliated environment compared to the unaffiliated environment.

Takeaway 2. *Compared to first-time admissions in the unaffiliated environment, adding an affiliated campus exacerbates wealth inequity in some ways but alleviates it in others. This is because students with wealth levels* $a \in [\hat{w}^{UN}, \bar{w}^{AF}]$ *are drawn away from the flagship to the affiliated campus (increases wealth inequity), but students with wealth levels* $a \in [\underline{w}^{AF}, \hat{w}^{UN}]$ *are drawn to the affiliated campus away from the community college (decreases wealth inequity).*

3.2.2 Transfer Enrollment

Now to consider transfer admissions. I concentrate exclusively on transfer from other institutions to the flagship campus.[17] I assume that students at an affiliated campus who initially preferred the flagship campus don't change their preferences. While this is a strong assumption at the individual level, it may be plausible at the group level. Using the Ohio State University system as an example, 51% of students who started at an OSU regional campus reported that the OSU flagship campus was their first choice in 2021 (*New First Year Students by Campus Choice* 2022), while the transfer-out rates at the OSU regional campuses are between 45%-67% according to the NCES College Navigator.

[17] It is possible that students who start at the community college may want to transfer to an affiliated campus, but incorporating this adds modeling complexity that is tangential to the main focus of this paper, student pathways to the flagship campus.

Transferring from the affiliated campus to the flagship campus ("internal transfer") is streamlined in 2 ways compared to transferring from the community college to the flagship campus ("external transfer"). First, applicants from the affiliated campus receive priority in transfer. That is, the flagship campus first fills transfer seats with qualified students from the affiliated campus before making a decision on which community college applicants to admit. Second, the flagship campus chooses an internal transfer cut-off $a_{Min} \in (a_A^{AF}, a_F^{AF})$ and admits any applicants from the affiliated campus with academic preparedness at least as high as this minimum cut-off. I assume that a_{Min} is *not* endogenously determined because this seems to reflect how actual university systems behave. For example, OSU's campus change threshold (2.0 GPA, 30 credit hours) was likely not chosen strategically. I was able to verify using the Internet Archive that these requirements haven't changed since at least May 2014, strongly suggesting that the cut-off is not endogenously determined. The bounds on a_{Min} reflect that while transfer admissions is not as selective as first-time admissions, not all affiliated campus students can transfer to the flagship campus.

Denote a_T^{AF} as the flagship campus's optimal cut-off for external transfers in the affiliated campus.

Proposition 7. *Let Conditions 1 and 2 on preferences hold. The external transfer cut-off in the affiliated environment is*

$$a_T^{AF} = \frac{\underline{w}^{AF} \cdot \delta + (1 - \bar{w}^{AF})(a_F^{AF} - a_{Min}) - \kappa_T}{\underline{w}^{AF} \cdot \delta}.$$

I again need to impose a regularity condition on capacity. If transfer capacity is too low, then no community college students can transfer. But in practice, public universities with affiliated campus systems admit both internal and external transfer students every year. I therefore concentrate on the case where a transfer pathway between the community college and flagship campus remains open.

Corollary 6. *Let $\kappa_T > (1 - \bar{w}^{AF})(a_A^{AF} - a_{Min})$. Then the flagship campus admits both students from the affiliated campus and community college in transfer admissions.*

Next, I address the following question: How does the transfer cut-off compare in the unaffiliated vs. affiliated environments? Does the affiliated campus make it more difficult for community college students to transfer?

Theorem 1. *Let Conditions 1 and 2 on preferences hold. Suppose all capacity constraint conditions hold. The transfer cut-off for community college students is strictly higher after an affiliated campus is added (that is, $a_T^{AF} > a_T^{UN}$) if and only if*

$$a_{Min} < \frac{1 - \hat{w}^{UN}}{1 - \bar{w}^{AF}} - \frac{\bar{w}^{AF} - \hat{w}^{UN}}{1 - \bar{w}^{AF}} \cdot a_F^{AF} \qquad \text{(Crowd-Out Condition)}$$

Theorem 1 implies that if the exogenously selected internal transfer cut-off a_{Min} is too low, then students at the affiliated campus who use their prioritized transfer status crowd out community college students in the

transfer process. This is because the marginally acceptable internal transfer applicant who has $a_i = a_{Min}$ is admitted before the most academically well-prepared external transfer applicants. However, if the internal transfer cut-off a_{Min} is set high enough, then there is no crowd-out effect because the affiliated campus transfer applicants would have been able to transfer even without priority—that is, the affiliated campus priority is functionally irrelevant.

To better understand Theorem 1, it is useful to consider the comparative statics on the Crowd-Out Condition,

$$a_{Min} < \underbrace{\frac{1-\hat{w}^{UN}}{1-\bar{w}^{AF}}}_{\text{Component 1}} - \underbrace{\frac{\bar{w}^{AF}-\hat{w}^{UN}}{1-\bar{w}^{AF}}}_{\text{Component 2}} \cdot a_F^{AF}.$$

First, recall from Proposition 4 that opening an affiliated campus draws some students to the affiliated campus and away from applying to the flagship campus in first-time admissions. These are exactly the students with wealth $w \in [\hat{w}^{UN}, \bar{w}^{AF}]$. Call these students "flagship to affiliated" (FA) switchers.

If there are relatively few FA switchers, then $\bar{w}^{AF} - \hat{w}^{UN} \to 0$. That implies that the numerator of Component 1 in the Crowd-Out Condition is converging to its denominator, so that

$$\underbrace{\frac{1-\hat{w}^{UN}}{1-\bar{w}^{AF}}}_{\text{Component 1}} \to 1.$$

At the same time, the numerator of Component 2 is converging to 0, so

$$\underbrace{\frac{\bar{w}^{AF}-\hat{w}^{UN}}{1-\bar{w}^{AF}}}_{\text{Component 2}} \to 0.$$

Therefore, the entire right-hand side of the Crowd-Out condition converges to 1 as the number of FA switchers decreases. Since a_{Min} is strictly less than 1, it becomes more and more likely that the Crowd-Out Condition holds when there are very few FA switchers—that is, the affiliated campus is not an intrinsically attractive educational option. Students don't want to attend the affiliated campus for what it offers educationally, they primarily attend the affiliated campus to gain a prioritized pathway into the flagship campus. As such, there is a relatively large mass of students who enroll at the affiliated campus in first-time admissions and will definitely make use of the affiliated campus's transfer priority, leaving fewer seats for community college transfer applicants.

Recall that in the unaffiliated environment, transfer admissions strictly reduced wealth inequity in academic pathways. This insight was summarized in Takeaway 1. Once the affiliated campus is introduced, though, that is no longer the case.

Takeaway 3. *In the unaffiliated environment, transfer admissions always reduces wealth inequity in accessibility to the flagship campus. However, adding an affiliated campus weakly exacerbates wealth inequity in*

transfer admissions.[18]

In the unaffiliated environment, transfer admissions increased access to the flagship campus for relatively lower income students who start at the community college. However, in the affiliated environment, crowd-out is most distorting for low-income, highly academically prepared students who start at the community college and are democratized by exposure to higher education. To illustrate how transfer admissions can exacerbate wealth inequity after adding an affiliated campus, I give an example next.

Example 1. *Suppose there is a pair of students.*

Student 1 has $a_i > \max\{a_F^{UF}, a_F^{AF}\}$ *and* $w_i \in [0, \underline{w}^{AF}]$. *Student 1 is always admissible to the flagship campus in first-time admissions, but she always enrolls at the community college first. Suppose that Student 1 is always democratized.*

Student 2 has $a_i \in [a_{Min}, a_F^{AF})$ *and* $w_i \in [\bar{w}^{AF}, 1]$. *Student 2 always most prefers the flagship campus. In the unaffiliated environment, he starts at the community college; in the affiliated environment, he starts at the affiliated campus.*

That is, Student 1 is a "highly academically prepared, low income" student whereas Student 2 is a "moderately academically prepared, high income" student (at least, relative to each other). In the unaffiliated environment, both will apply to transfer to the flagship campus. Student 1 is accepted with certainty, while Student 2 may or may not be accepted. In the affiliated environment, both still apply to the flagship campus, but Student 2 is prioritized while Student 1 is potentially crowded out.

The internal transfer priority that causes these distortions. If transfer priority were removed—or if the internal cut-off a_{Min} is so high that it effectively evaluates internal and external applicants in the same way—then affiliated transfer admissions wouldn't increase wealth inequity.

Because transfer crowd-out is driven primarily by FA switchers, I conclude this section by showing some comparative statics on how many FA switchers are created when an affiliated campus is opened (that is, on $\bar{w}^{AF} - \hat{w}^{UN}$).

Proposition 8. *Let the same conditions as in Theorem 1 hold.* $\bar{w}^{AF} - \hat{w}^{UN}$ *is increasing in* p_F *and* v_A, *and decreasing in* p_A *and* v_F.

Proposition 8 implies there are two situations likely to cause crowd-out. The first crowd-out causing situation is when the flagship campus costs only a little more than the affiliated campus. If it's too expensive to attend the affiliated campus, then most students will not be drawn towards it because the affiliated campus doesn't offer a good educational bargain given its price. Students who start at the affiliated campus primarily attend

[18] Recall that in the unaffiliated environment, if we loosened the assumption that the fraction of democratized community college student δ is independent of academic preparedness, then transfer admissions becomes even more equalizing. The opposite is true here.

because they see it as a way to eventually get to the flagship campus—which creates crowd-out. The second crowd-out causing situation is when the marginal value of attending the flagship campus vs. the affiliated campus is large. In that case, the affiliated campus is a weak educational substitute for the flagship campus—and again, this means fewer students will want to attend the affiliated campus for what the affiliated campus itself offers, and primarily attend to make use of prioritized transfer. On the flipside, crowd-out in transfer is less likely when the affiliated campus delivers a well-differentiated and intrinsically desirable educational experience.

3.3 Applying the Model Predictions

Do actual affiliated campus systems seem to create crowd-out? I show some descriptive statistics for the Ohio State University and Pennsylvania State University systems next. In Tables 2 and 3, I summarize student outcomes across the two campus systems.[19] To fix standards, note that the nationwide 8-year completion rate for the Fall 2016 cohort was 64.7% (National Student Clearinghouse Research Center 2025) and that the average transfer-out rate for the Fall 2020 cohort that started at a U.S. community college was 31.5% (Shapiro et al. 2017).

Table 2: Student Outcomes—Ohio State University System

Campus	Graduation Rate	Transfer-Out Rate
Columbus (Flagship)	88%	7%
Lima	23%	51%
Mansfield	15%	59%
Marion	27%	54%
Newark	29%	47%

Data from the NCES College Navigator. Graduation rate includes students who complete a degree/certificate within 150% of "normal time" for completing the program in which a student is enrolled. It includes only first-time, full time students. Fall 2018 cohort.

As expected, the graduation rate is high and transfer-out rate is low at the OSU flagship campus. Transfer-out rates are high at the 4 OSU regional campuses (between 47%-59%) while completion rates are low (between 15%-29%). Note that the degree completion rate only tracks students who started and finished a degree at the same institution, which accounts for why completion rates appear to be so low at the OSU regional campuses—many transfer to the flagship campus to complete their degrees. Given our points of comparison, the OSU regional campuses have noticeably high transfer-out rates—1.5 to almost 2 times the average transfer-out rate at community colleges.

In comparison, there are more PSU Commonwealth campuses and perhaps unsurprisingly, more variance in outcomes. Transfer-out rates vary between 15% (about half the average) to 46% (about 1.5 times the average). While there doesn't appear to be a systematic correlation between graduation rates and transfer-

[19] I don't include the OSU Wooster campus due to being a specialized school in agricultural technology. I don't include the PSU Great Valley campus, as it only confers post-graduate degrees.

Table 3: Student Outcomes—Pennsylvania State University System

Campus	Graduation Rate	Transfer-Out Rate
University Park (Flagship)	86%	2%
Abington	20%	39%
Altoona	17%	45%
Beaver	22%	35%
Berks	32%	34%
Brandywine	26%	28%
DuBois	34%	37%
Erie-Behrend	44%	24%
Fayette-Eberly	39%	16%
Greater Allegheny	19%	33%
Harrisburg	26%	46%
Hazleton	26%	33%
Lehigh Valley	18%	43%
Mont Alto	34%	28%
New Kensington	28%	27%
Schuylkill	32%	22%
Scranton	39%	24%
Shenango	42%	15%
Wilkes-Barre	23%	48%
York	16%	49%

Data from the NCES College Navigator. Graduation rate includes students who complete a degree/certificate within 150% of "normal time" for completing the program in which a student is enrolled. It includes only first-time, full time students. Fall 2018 cohort.

out rates, it does bear noting that the campuses with the highest transfer-out rates (Altoona, Harrisburg, Lehigh Valley, York) also have relatively lower graduation rates.

Crowd-out, of course, would affect local community colleges. I next show similar information for public community colleges located near affiliated campuses in Tables 4 and 5. Transfer-out rates at the comparison Ohio community colleges are low—about half of the national average—while 2 out of 3 of the comparison Pennsylvania community colleges do not seem to be affected by the presence of a PSU Commonwealth campus.

However, variance between crowd-out in Ohio vs. Pennsylvania is expected for 2 reasons. First, Pennsylvania has more options for relatively prestigious in-state transfer targets.[20] The transfer-out rate likely partially reflects the fact that students at the Pennsylvania comparison colleges could transfer to more institutions to begin with. Second, more relevant to the theoretical framework, the OSU internal transfer requirements are lower than the PSU internal transfer requirements. According to Theorem 1, that means the theoretical model predicts crowd-out is more likely in Ohio than in Pennsylvania. Therefore, these descriptive statistics are consistent with what the model shows.

[20]Searching for four-year institutions that confer a bachelor's degree on College Navigator returns 118 results for Ohio and 125 for Pennsylvania. Ohio has 2 universities ranked in the top 100 national universities and 4 ranked in the top 100 liberal arts colleges on the US News Best Colleges list. Pennsylvania has 7 universities and 15 colleges in the top 100 of each list.

Table 4: Ohio Comparison Community Colleges

Campus	Location	Graduation Rate	Transfer-Out Rate
Central Ohio Technical University	Newark	30%	14%
North Central State College	Mansfield	36%	19%
Rhodes State College	Lima	47%	14%

Data from the NCES College Navigator. Graduation rate includes students who complete a degree/certificate within 150% of "normal time" for completing the program in which a student is enrolled. It includes only first-time, full time students. Fall 2018 cohort.

Table 5: Pennsylvania Comparison Community Colleges—2016-2017 Cohort

Campus	Location	8-Year Graduation Rate	Transfer-Out Rate
Community College of Beaver County	Beaver	12%	28%
Harrisburg Area Community College	Harrisburg	21%	23%
Reading Area Community College	Berks	34%	13%

Data from the NCES College Navigator. Graduation rate includes students who complete a degree/certificate within 150% of "normal time" for completing the program in which a student is enrolled. It includes only first-time, full time students. Fall 2018 cohort.

4 A Social Planner's Problem

Now suppose that a welfare-maximizing state policymaker (social planner) has funds to invest in higher education. The state initially is in the unaffiliated environment. The social planner must choose between expanding enrollment the flagship campus modestly or opening a new affiliated campus. The social planner has *positive assortative* preferences in matching students to institutions, but cannot directly make matches.[21]

I assume that all the conditions in Theorem 1 hold and I assume that the Crowd-Out Condition also holds.[22] An intuitive way to think about what these conditions mean is that if an affiliated campus opens, its price and value is well-differentiated from both the community college and flagship campus but nevertheless generates some crowd-out. If the affiliated campus behaves too much like a close substitute for either, but especially the flagship campus, this can result in an unintuitive result like students always preferring an affiliated campus over the flagship campus.

Denote the social benefit of attending the flagship campus as $b_F \in \mathbb{R}_{++} \setminus (0,1]$, of attending the affiliated campus $b_A \in (1, b_F]$, and of attending the community college as $b_C = 1$. The social benefit generated when student i with academic preparedness a_i who finishes her education at institution j is $a_i \cdot b_j$.[23]

[21] That is, the social planner treats institutions and students as complements. If admissions were centralized, then the social planner would first enroll the best students based on academic preparedness to the flagship campus until its capacity is full, then to the affiliated campus (if it is available) until its capacity is full, and finally to the community college until its capacity is full.

[22] This means that $a_F^{AF} = a_F^{UN} > a_T^{AF} > a_T^{UN} > a_{Min} > a_A^{AF} > a_C^{UN} > a_C^{AF}$.

[23] This means that a student i who enrolls at the flagship campus via first-time admissions and ultimately graduates creates a social benefit of $a_i \cdot b_F$. A student i' who starts at the community college but successfully transfers to and graduates from the flagship campus creates a social benefit of $a_{i'} \cdot b_F$.

4.1 Expanding Flagship Campus Enrollment Is a Pareto Improvement

If the social planner expands enrollment the flagship campus, then we remain in the unaffiliated environment. Flagship expansion is different depending on whether the flagship is initially capacity constrained or not, but the analysis doesn't substantially differ in either case. If the flagship campus was capacity constrained, then the social planner must incur a cost per additional student enrolled. If the flagship campus was not capacity constrained, then directly expanding capacity doesn't affect enrollment—instead, the social planner has to partially subsidize tuition to induce more highly academically-prepared, lower-income students to apply for the flagship in first-time admissions. This is a realistic investment to make, since state governments appropriate funds to their public universities in part to subsidize tuition for in-state students and encourage college-going. To fix ideas, I work with the latter case.

Under tuition subsidization, students at the flagship campus now pay $p_F^{TS} = p_F - \psi$ for some $\psi \in \mathbb{R}_{++}$ small. This lowers the wealth cut-off to

$$\hat{w}^{TS} = \frac{1 - e^{v_F}(1 - p_F^{TS})}{e^{v_F} - 1}, \text{ and}$$
$$\hat{w}^{UN} - \hat{w}^{TS} = \frac{e^{v_F} \cdot \psi}{e^{v_F} - 1}.$$

All students at the flagship benefit from subsidization, including those who would enroll even without the tuition subsidy, so the social cost of tuition subsidization is

$$\text{Social Cost} = (1 - \hat{w}^{TS})(1 - a_F^{UN})\psi.$$

Tuition subsidization increases social welfare in 3 ways. First, students with academic preparedness $a \in [a_F^{UN}, 1]$ and wealth $w \in [\hat{w}^{TS}, \hat{w}^{UN})$ now enroll as first-time students at the flagship campus, whereas they would have previously preferred and enrolled at the community college and only a fraction δ of them would become democratized and successfully transferred. Because the social planner has positive assortative preferences, the welfare gain is

$$B_F^{TS} = \frac{1}{2}(\hat{w}^{UN} - \hat{w}^{TS})(1 - \delta)(1 - (a_F^{UN})^2)(b_F - 1) > 0.$$

Second, the community college becomes less selective. The flagship enrolls some students who would've otherwise started at the community college, which opens up seats at the community college to admit students who were previously marginally inadmissible. Denote the new cut-off $a_C^{TS} < a_C^{UN}$. The welfare gain is

$$B_C^{TS} = \frac{1}{2}((a_C^{UN})^2 - (a_C^{TS})^2) > 0.$$

Finally, the transfer cut-off is lower. Previously, democratized community college students with academic preparedness $a \in [a_F^{UN}, 1]$ and wealth $w \in [\hat{w}^{TS}, \hat{w}^{UN})$ would have started at the community college and and transferred to the flagship campus. After tuition subsidization, these students now start at the flagship. That frees up some transfer seats for applicants who were previously marginally inadmissible. Denote the new cut-off $a_T^{TS} < a_T^{UN}$. The welfare gain is

$$B_T^{TS} = \frac{1}{2}(\hat{w}^{TS} \cdot \delta + (1 - \hat{w}^{TS}))((a_T^{UN})^2 - (a_T^{UN})^2)(b_F - 1) > 0.$$

Tuition subsidization unambiguously increases welfare. More students are enrolled and in a way that preserves positive sorting. Moreover, tuition subsidization ensures that more highly academically prepared, low-income students graduate from the flagship because tuition subsidization attracts this group of students to apply to the flagship in first-time admissions. Before tuition subsidization, this group of students would start at the community college and only some would be democratized.

4.2 Opening an Affiliated Campus Has Ambiguous Welfare Effects

Now suppose that the social planner instead opens an affiliated campus. The affiliated campus must expand overall expansion strictly more than tuition subsidization, or else the social planner's problem is straightforward: always subsidize tuition. Therefore, capacity at the affiliated campus must satisfy $\kappa_A \in ((\hat{w}^{UN} - \hat{w}^{TS})(1 - a_F^{UN}), 1)$ in addition to the capacity conditions from the main theoretical framework.

I fully back out the welfare changes in Appendix C and summarize the results here. Unlike tuition subsidization, there are both welfare gains *and* welfare losses to opening an affiliated campus, so that the overall effect is ambiguous without imposing additional assumptions.

The certain welfare gains from opening the affiliated campus are

$$\begin{aligned} B_{Gain}^{AF} = \frac{1}{2}[&(1 - \bar{w}^{AF})((a_T^{UN})^2 - (a_{Min})^2)(b_F - 1) + (\bar{w}^{AF} - \underline{w}^{AF})((a_T^{UN})^2 - (a_{Min})^2)(b_A - 1) \\ &+ (1 - \underline{w}^{AF})((a_{Min})^2 - (a_A^{AF})^2)(b_A - 1) + ((a_C^{UN})^2 - (a_C^{AF})^2)]. \end{aligned}$$

The welfare gains can be broken into 2 categories. First, gains come from students who would have enrolled at the community college and certainly fail to transfer to the flagship in the unaffiliated environment, but enroll at the affiliated campus in the affiliated environment. These are the students from the first 3 components,

$$\underbrace{(1 - \bar{w}^{AF})((a_T^{UN})^2 - (a_{Min})^2)(b_F - 1)}_{\text{Group 1}} + (\bar{w}^{AF} - \underline{w}^{AF})((a_T^{UN})^2 - (a_{Min})^2)(b_A - 1) + (1 - \underline{w}^{AF})((a_{Min})^2 - (a_A^{AF})^2)(b_A - 1).$$

Students from Group 1 particularly benefit from the affiliated campus. These are students who most prefer

the flagship campus, and are only able to gain access to the flagship campus by starting at the affiliated campus. However, these are also precisely the students who crowd out highly academically prepared community college students in transfer admissions.

Second, gains come from students who are not enrolled anywhere in the affiliated environment, but gain access to the community college after the affiliated campus,

$$((a_C^{UN})^2 - (a_C^{AF})^2).$$

The certain welfare losses are

$$B_{Loss}^{AF} = \frac{1}{2}[(\bar{w}^{AF} - \hat{w}^{UN})(1 - (a_T^{UN})^2)(b_A - b_F) + \underline{w}^{AF}((a_T^{AF})^2 - (a_T^{UN})^2)(1 - b_F)\delta].$$

The welfare losses can be broken down into 2 categories. First, losses come from students who enroll at the flagship campus in either first-time or transfer admissions in the unaffiliated environment, but choose to enroll and stay at the affiliated campus. in the affiliated environment.[24] These are the students from the first component,

$$(\bar{w}^{AF} - \hat{w}^{UN})(1 - (a_T^{UN})^2)(b_A - b_F).$$

Second, losses come from students who always start at the community college and can transfer into the flagship in the unaffiliated campus, but are crowded out of transfer in the affiliated environment,

$$\underline{w}^{AF}((a_T^{AF})^2 - (a_T^{UN})^2)(1 - b_F)\delta.$$

Finally, ambiguous welfare effects are

$$B_{Ambig}^{AF} = \frac{1}{2}(\hat{w}^{UN} - \underline{w}^{AF})(1 - (a_T^{UN})^2)(\delta \cdot b_F + (1 - \delta) - b_A)).$$

These ambiguous welfare changes are created by highly academically prepared students who most prefer the community college in the unaffiliated environment, but most prefer the affiliated campus if it opens. In the unaffiliated environment, a fraction δ of these students would become democratized and successfully transfer to the flagship. But in the affiliated environment, *all* of these students most prefer and start at the affiliated campus and will not transfer. If the marginal social benefit of enrolling at flagship is high (b_F is very large relative to b_A, or b_A is not that much larger than 1, or both) and/or the democratization effect is high (δ is large), then this is more likely to be a welfare loss.

[24] These students are similar to "diverted" students in the framework of community college student pathways from Rouse (1995): exposure to the affiliated campus permanently changes their academic pathway away from flagship campus, even though they would've been admitted at flagship campus.

4.3 Comparing the Options

Takeaway 4. *Expanding access to the flagship campus is always a Pareto improvement. While opening an affiliated campus can be welfare-increasing, it is never a Pareto improvement.*

The reason that an affiliated campus isn't Pareto improving is because of mismatch in sorting. Opening the affiliated campus draws some highly academically prepared students away from the flagship campus in first-time admissions. Also, some highly academically prepared community college students are crowded out by less prepared affiliated campus students in transfer admissions. Mismatch in both first-time and transfer enrollment is welfare-reducing because of the social planner's positive assortative preferences.

When does an affiliated campus increase or decrease overall welfare?[25] First, as the marginal social benefit of attending the affiliated campus decreases ($b_A \to 1$), welfare gains decrease, welfare losses increase, and ambiguous welfare changes are more likely to be negative. That is, if the affiliated campus isn't delivering a substantially better educational experience than the community college, then the main value of the affiliated campus to students is its internal transfer priority. Since crowd-out of highly academically prepared community college transfer applicants is welfare-reducing, the marginal social benefit of the affiliated campus is small relative to the marginal social cost of crowd-out.

Second, as the social benefit of enrolling at the affiliated campus increases and approaches the social benefit of enrolling at the flagship campus ($b_A \to b_F$), welfare gains increase, welfare losses decrease, and ambiguous welfare effects are more likely to be welfare increasing. Therefore, the closer that the affiliated campus is to substituting for the flagship campus, the more likely it is for adding an affiliated campus is to be welfare improving. This is a similar result as Theorem 1 and Proposition 8, which together implied that less transfer crowd-out occurs when an affiliated campus delivers educational comparable value to the flagship campus.

Takeaway 5. *If the social benefit of each institution positively correlates with the expected individual benefit, then the social planner will prefer opening an affiliated campus under the same circumstances that students particularly benefit from an affiliated campus.*

That is, student preferences will tend to align with the social planner's preferences. The social planner most wants to open an affiliated campus when opening the affiliated campus tends to benefit students more.

[25] It's not helpful to look at student preferences to answer the question. In Appendix C, I show that students who share the same preferences over institutions can generate different welfare effects depending on their level of academic preparedness.

5 Conclusion

This paper constructs a general theoretical framework that describes first-time and transfer admissions with multiple institutions. While the framework can be adapted for other applications, this paper concentrates on how adding a campus affiliated with a flagship affects student pathways. I conclude with some additional remarks on how this work may additionally be useful for policymakers. Enrollment at selective institutions of higher education has not kept pace with increased student demand for it (Bound, Hershbein, and Long 2009). While state policymakers might want to increase capacity at their public flagships, this may be physically infeasible. In that case, opening an affiliated campus may be a more realistic alternative. However, policymakers should be aware that this may have spillover effects onto community colleges. The model in this paper predicts that opening an affiliated campus can adversely affect local community colleges in both first-time and transfer admissions

Moreover, opening an affiliated campus might also increase wealth inequity in access to the flagship campus. Without an affiliated campus, transfer admissions unambiguously increases accessibility to the flagship campus—especially for lower income students, which strictly decreases wealth inequity at the flagship. However, after an affiliated campus is opened, transfer applicants from the affiliated campus may crowd out highly academically prepared, low income students who start at a community college in transfer admissions. Transfer admissions therefore can exacerbate existing wealth inequities in higher education.

Another contribution of this work is that it provides policy guidelines on how to expand higher education enrollment. I characterize the welfare gains and losses to subsidizing tuition at a public flagship vs. opening an affiliated campus affiliated with the public flagship. I find that tuition subsidization is always a Pareto improvement because it maintains positive sorting of students to institutions. While the welfare effects of opening an affiliated campus are ambiguous, it is socially preferred if the new affiliated campus offers strong educational value given its price relative to the flagship campus. I also find that a social planner generally prefers opening an affiliated under similar conditions to when students would also prefer for an affiliated campus to open. This is desirable, since policymaker incentives align with their constituents' preferences.

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A Affiliated Campuses

Table 6: Affiliated Campus Determination

Institution	State	Qualifies?	Information	Rationale
Auburn University at Montgomery	AL	No	Link	No specialized transfer program between campuses.
Arizona State University system	AZ	No	Link	Campuses are considered one institution.
University of Arkansas system	AK	No	Link	Although unified by name, institutions are independent. There is no unified internal transfer program, although there are major-specific transfer pathways.
University of California system	CA	No	Link	This system only prioritizes transfers from California community colleges, not between institutions
California State University system	CA	No	Link	This system only prioritizes transfers from California community colleges, not between institutions
Colorado State University Pueblo	CO	No	Link	This institution is independent from Colorado State University.
University of Connecticut system	CT	No	Link	Requires an invitation.
Southern Illinois University system	IL	No	Link	Its two main institutions are separate.
University of Illinois system	IL	No	Link	No specialized transfer program between campuses.
University of Indiana system	IN	No	Link	No specialized transfer program between campuses.
Purdue University system	IN	No	Link	Campuses are considered one institution.
Louisiana State University system	LA	No	Link	No specialized transfer program between campuses.
Southern University system	LA	No	Link	No specialized transfer program between campuses.
University of Louisiana at Monroe	LA	No	Link	No specialized transfer program between campuses. University of Louisiana institutions are separate.
University of Maine system	ME	No	Link	No specialized transfer program between campuses.
University of Maryland system	MD	No	Link	Although unified by name, institutions are independent. There is no unified internal transfer program.
University of Massachusetts system	MA	No	Link	No specialized transfer program between campuses. However, regional campus students receive an application waiver.
University of Michigan system	MI	No	Link	No specialized transfer program between campuses.
University of Minnesota system	MN	No	Link	No specialized transfer program between campuses.
University of Missouri system	MO	No	Link	Although unified by name, institutions are independent. There is no unified internal transfer program.
Montana State University system	MT	No	Link	Although unified by name, institutions are independent. There is no unified internal transfer program.
The University of Montana-Western	MT	No	Link	No specialized transfer program between campuses.
University of Nebraska system	NE	No	Link	No specialized transfer program between campuses, only a guarantee that credits transfer.
University of Nevada-Las Vegas	NV	No	Link	Although unified by name, institutions are independent. There is no unified internal transfer program.
University of New Hampshire at Manchester	NH	No	Link	No specialized transfer program between campuses.
Bloomfield College of Montclair State University	NJ	No	Link	No specialized transfer program between campuses.
Rutgers University system	NJ	No	Link	No specialized transfer program between campuses.
Eastern New Mexico University system	NM	No	Link	Non-main campuses are exclusively two-year institutions. No specialized transfer program between campuses.
New Mexico State University system	NM	No	Link	Non-main campuses are exclusively two-year institutions. No specialized transfer program between campuses.
University of New Mexico system	NM	No	Link	Non-main campuses are exclusively two-year institutions. No specialized transfer program between campuses.
State University of New York system	NY	No	Link 1, Link 2	This system only prioritizes transfers from 2 year institutions, not between institutions
City University of New York system	NY	No	Link	This system only prioritizes transfers from 2 year institutions, not between institutions
University of North Carolina System	NC	No	Link	No specialized transfer program between campuses.
The Ohio State University system	OH	Yes	Link	See main text.
Bowling Green State University-Firelands	OH	No	Link	No specialized transfer program between campuses.
Kent State University system	OH	Yes	Link	See main text.
Miami University system	OH	Yes	Link	See main text.
Ohio University system	OH	Yes	Link	See main text.
University of Akron Wayne College	OH	No	Link	No specialized transfer program between campuses.
University of Cincinnati system	OH	No	Link	No specialized transfer program between campuses.

Institution	State	Qualifies?	Information	Rationale
Oklahoma State University-Oklahoma City	OK	No	Link	No specialized transfer program between campuses.
Pennsylvania State University Commonwealth Campuses	PA	Yes	Link	See main text.
University of Pittsburgh system	PA	No	Link	No specialized transfer program between campuses.
Temple University Ambler	PA	No	Link	No specialized transfer program between campuses.
University of South Carolina system	SC	No	Link	No specialized transfer program between campuses.
University of Tennessee system	TN	No	Link	Requires an invitation.
Texas A&M University system	TX	No	Link	Requires an invitation.
University of Houston system	TX	No	Link	Although unified by name, institutions are independent. There is no unified internal transfer program.
University of North Texas at Dallas	TX	No	Link	Although unified by name, institutions are independent. There is no unified internal transfer program.
University of Texas system	TX	Yes	Link	See main text.
University of Virginia's College at Wise	VA	No	Link	Requires an invitation.
University of Washington system	WA	No	Link	No specialized transfer program between campuses.
Washington State University system	WA	No	Link	No specialized transfer program between campuses.
University of Wisconsin system	WI	No	Link	No specialized transfer program between campuses.
West Virginia University system	WV	No	Link	No specialized transfer program between campuses.

B Proofs and Comparative Statics

In this appendix, I present the proofs for results that appear in the main text as well as additional comparative statics. As in the main text, I separate analysis between the unaffiliated and affiliated environments.

B.1 Unaffiliated Environment

The first main result in the unaffiliated environment was to describe student preferences over institutions.

Lemma 1. *Let Condition 1 on unaffiliated preferences hold. There exists a wealth cut-off $\hat{w}^{UN}$ such that i initially prefers the flagship if and only if $w_i \geq \hat{w}^{UN}$; furthermore,*

$$\hat{w}^{UN} = \frac{1 - e^{v_F}(1 - p_F)}{e^{v_F} - 1} \in (0, 1). \tag{3}$$

Proof. Because Condition 1 is a single-crossing condition, $\hat{w}^{UN}$ is determined by setting $u(\hat{w}^{UN}, C) = u(\hat{w}^{UN}, F)$ from Equations 1 and 2 and solving for $\hat{w}^{UN}$:

$$\begin{aligned} ln(1 + \hat{w}^{UN}) &= ln(1 + \hat{w}^{UN} - p_F) + v_F \\ \Rightarrow \hat{w}^{UN} &= \frac{1 - e^{v_F}(1 - p_F)}{e^{v_F} - 1}. \end{aligned}$$

Now to check that $\hat{w}^{UN}$ is well-defined. To see that $\hat{w}^{UN} \in (0, 1)$, first suppose not and that $\hat{w}^{UN} \leq 0$. Since

$e^{v_F} - 1 > 0$ for $v_F \in (0, 1]$, it must be the case that

$$\begin{aligned} 1 - e^{v_F}(1 - p_F) &\leq 0 \\ \Rightarrow ln(\frac{1}{1 - p_F}) &\leq v_F \\ \Rightarrow 0 &\leq ln(1 - p_F) + v_F, \end{aligned}$$

contradicting that $ln(1 - p_F) + v_F < 0$ from Condition 1. Now suppose that $\hat{w}^{UN} \geq 1$. Then,

$$\begin{aligned} 1 - e^{v_F}(1 - p_F) &\geq e^{v_F} - 1 \\ \Rightarrow 2 &\geq e^{v_F}(2 - p_F) \\ \Rightarrow ln(2) &\geq ln(2 - p_F) + v_F, \end{aligned}$$

contradicting that $ln(2 - p_F) + v_F > ln(2)$ from Condition 1. So $\hat{w}^{UN} \in (0, 1)$. □

I now show comparative statics on the unaffiliated wealth cut-off, $\hat{w}^{UN}$.

Corollary 7. *Let the same conditions as in Lemma 1 hold. $\hat{w}^{UN}$ is increasing in p_F and decreasing in v_F.*

Proof.

$$\begin{aligned} \frac{\partial}{\partial p_F}\hat{w}^{UN} &= \frac{e^{v_F}}{e^{v_F} - 1} > 0, \\ \frac{\partial}{\partial v_F}\hat{w}^{UN} &= \frac{-e^{v_F}p_F}{(e^{v_F} - 1)^2} < 0, \end{aligned}$$

since for $v_F \in (0, 1)$, $e^{v_F} > 1$. □

The next result in the main text derives the unaffiliated first-time admissions cut-offs.

Proposition 1. *Let Condition 1 on unaffiliated preferences hold. The first-time admissions cut-offs at the flagship F and community college C are:*

$$\begin{aligned} a_F^{UN} &= 1 - \rho_F^{-1}(\pi_F), \\ a_C^{UN} &= \hat{w}^{UN} + (1 - \hat{w}^{UN})a_F^{UN} - \kappa_C. \end{aligned}$$

Proof. If capacity does not bind, then the optimal cut-off at the flagship campus is determined by the optimization problem defined in Equation 4, which by the Fundamental Theorem of Calculus and the assumption that $\rho_F(0) = 0$, implies that

$$\pi_F - \rho_F(q_F^{UN}) = 0 \iff q_F^{UN} = \rho_F^{-1}(\pi_F) \iff a_F^{UN} = 1 - \rho_F^{-1}(\pi_F).$$

Since the community college fills up enrollment to capacity from the strongest applicants,

$$\begin{aligned}\kappa_C &= \hat{w}^{UN}(1 - a_F^{UN}) + (a_F^{UN} - a_C^{UN}) \iff a_C^{UN} \\ &= \hat{w}^{UN} + (1 - \hat{w}^{UN})a_F^{UN} - \kappa_C.\end{aligned}$$

□

Comparative statics on the unaffiliated first-time admissions cut-offs follow.

Corollary 8. *Let the same conditions as in Proposition 1 hold. a_F^{UN} is decreasing in π_F. a_C^{UN} is increasing in $\hat{w}^{UN}$ and a_F^{UN}, and decreasing in κ_C.*

The comparative statics are straightforward to derive, so the full derivations are redacted for brevity. I move to interpreting the results. As the flagship campus's enrollment benefit increases, the flagship enrolls more students (selectivity decreases). As the wealth cut-off $\hat{w}^{UN}$ increases, more students initially prefer the community college, including highly academically prepared students. This increases selectivity at the community college. As the flagship increases its first-time cut-off, a_F^{UN}, students who were marginally acceptable at the flagship before lose access to the flagship and instead enroll at the community college, which causes the students marginally acceptable at the community college to lose access. Therefore, the community college becomes more selective. Finally, as κ_C increases, the community college can accept students that were previously marginally unacceptable, so the community college becomes less selective.

The next result in the main text derives the unaffiliated transfer cut-off.

Proposition 2. *Let Condition 1 on unaffiliated preferences hold. Let transfer capacity be large enough to admit previously rejected first-time applicants. The unaffiliated transfer cut-off is*

$$a_T^{UN} = \frac{\hat{w}^{UN} \cdot \delta + (1 - \hat{w}^{UN})a_F^{UN} - \kappa_T}{\hat{w}^{UN} \cdot \delta + (1 - \hat{w}^{UN})}.$$

Proof. The flagship admits up to transfer capacity, so

$$\kappa_T = (1 - \hat{w}^{UN})(a_F^{UN} - a_T^{UN}) + \hat{w}^{UN} \cdot \delta(1 - a_T^{UN}),$$

and rearranging to solve for a_T^{UN} gives the result. □

Comparative statics on the unaffiliated transfer cut-off follow.

Corollary 9. *Let the same conditions as in Proposition 2 hold. a_T^{UN} is decreasing in transfer capacity κ_T and increasing in the democratization fraction δ. Also, a_T^{UN} is increasing in wealth cut-off $\hat{w}^{UN}$ if and only if $a_F^{UN} < (1 - \delta)a_T^{UN} + \delta$.*

Proof. First,

$$\frac{\partial}{\partial k_T} a_T^{UN} = -\frac{1}{\hat{w}^{UN} \cdot \delta + (1 - \hat{w}^{UN})} < 0,$$
$$\frac{\partial}{\partial \delta} a_T^{UN} = \frac{\hat{w}^{UN}[(1 - \hat{w}^{UN})(1 - a_F^{UN}) + \kappa_T]}{(\hat{w}^{UN} \cdot \delta + (1 - \hat{w}^{UN}))^2} > 0,$$

since $\hat{w}^{UN}, a_F^{UN}, \delta \in (0, 1)$. Next,

$$\frac{\partial}{\partial \hat{w}^{UN}} a_T^{UN} = \frac{\delta(1 - a_F^{UN}) - (1 - \delta)\kappa_T}{(\hat{w}^{UN} \cdot \delta + (1 - \hat{w}^{UN}))^2},$$

so $\frac{\partial}{\partial \hat{w}^{UN}} a_T^{UN} > 0$ if and only if $\delta(1 - a_F^{UN}) > (1 - \delta)\kappa_T$. Substitute in $\kappa_T = (1 - \hat{w}^{UN})(a_F^{UN} - a_T^{UN}) + \hat{w}^{UN} \cdot \delta(1 - a_T^{UN})$ and suppose not:

$$\begin{aligned} &\delta(1 - a_F^{UN}) \leq (1 - \delta)((1 - \hat{w}^{UN})(a_F^{UN} - a_T^{UN}) + \hat{w}^{UN} \cdot \delta(1 - a_T^{UN})) \\ &\quad \Rightarrow a_F^{UN} \geq (1 - \delta) a_T^{UN} + \delta, \end{aligned}$$

contradicting that $a_F^{UN} < (1 - \delta) a_T^{UN} + \delta$ by assumption. □

First, increasing transfer capacity κ_T decreases competition for limited transfer seats and therefore also decreases transfer selectivity. Second, increasing the fraction of democratized community college students δ increases transfer competition and selectivity.

For the final part of Corollary 9, an increasing in the unaffiliated wealth cut-off $\hat{w}^{UN}$ increases the measure of students who initially prefer the community college. This creates two effects that work in opposite directions. On one hand, more students prefer the community college over the flagship campus. This increases academic preparedness at C. On the other hand, having more academically well-prepared first-time students increases competition for limited transfer seats among democratized students. The expression $a_F^{UN} < (1 - \delta) a_T^{UN} + \delta$ could be interpreted as a check on which of those effects is stronger.

B.2 Affiliated Environment

The next result in the main text derives student preferences over institutions in the affiliated environment.

Proposition 5. *Let Conditions 1 and 2 on preferences hold. The first-time cut-offs in the affiliated envi-*

ronment are:

$$
\begin{aligned}
a_F^{AF} &= a_F^{UN} = 1 - \rho_F^{-1}(\pi_F) \\
a_A^{AF} &= \frac{(\bar{w}^{AF} - \underline{w}^{AF}) + (1 - \bar{w}^{AF})a_F^{AF} - \kappa_A}{1 - \underline{w}^{AF}} \\
a_C^{AF} &= \bar{w}^{AF} + (1 - \bar{w}^{AF})a_F^{AF} - \kappa_A - \kappa_C
\end{aligned}
$$

Proof. The upper affiliated wealth cut-off $\bar{w}^{AF}$ is determined by setting $u(\bar{w}^{AF}, A) = u(\bar{w}^{AF}, F)$ and solving for $\bar{w}^{AF}$,

$$
\begin{aligned}
ln(1 + \bar{w}^{AF} - p_A) + v_A &= ln(1 + \bar{w}^{AF} - p_F) + v_F \\
\Rightarrow \bar{w}^{AF} &= \frac{e^{v_A}(1 - p_A) - e^{v_F}(1 - p_F)}{e^{v_F} - e^{v_A}}.
\end{aligned}
$$

To see that $\bar{w}^{AF} \in (0, 1)$, first suppose not and that $\bar{w}^{AF} \leq 0$. Then there will be a contradiction on $ln(1 - p_F) + v_F < ln(1 - p_A) + v_A$. Next, suppose not and $\bar{w}^{AF} \geq 1$, then there will be a contradiction on $ln(2 - p_F) + v_F > ln(2 - p_A) + v_A$.

Structurally, it is very similar to back out $\underline{w}^{AF}$. Set $u(\underline{w}^{AF}, A) = u(\underline{w}^{AF} < C)$ and solve for $\underline{w}^{AF}$. Since the derivation is identical, I omit the details.

The more important derivation is to close the loop and show that the upper cut-off is indeed higher than the lower cut-off. Suppose for a contradiction that $\bar{w}^{AF} \leq \underline{w}^{AF}$. Then

$$
\begin{aligned}
\frac{e^{v_A}(1 - p_A) - e^{v_F}(1 - p_F)}{e^{v_F} - e^{v_A}} &\leq \frac{1 - e^{v_A}(1 - p_A)}{e^{v_A} - 1} \\
\Rightarrow e^{v_F + v_A}(p_F - p_A) &\leq e^{v_F} p_F - e^{v_A} p_A,
\end{aligned}
$$

once again contradicting that $(e^{v_F + v_A} - e^{v_F})p_F > (e^{v_F + v_A} - e^{v_A})p_A$. □

I now show comparative statics on the affiliated wealth cut-offs. First, comparative statics on $\bar{w}^{AF}$.

Corollary 10. *Let the same conditions as in Proposition 5 hold. $\bar{w}^{AF}$ is increasing in p_F and v_A and decreasing in p_A and v_F.*

Proof. First,

$$
\begin{aligned}
\frac{\partial}{\partial p_F}\bar{w}^{AF} &= \frac{e^{v_F}}{e^{v_F} - e^{v_A}} > 0, \\
\frac{\partial}{\partial p_A}\bar{w}^{AF} &= -\frac{e^{v_A}}{e^{v_F} - e^{v_A}} < 0,
\end{aligned}
$$

since $v_F, v_A \in (0,1)$ and $v_F > v_A$. That is, e^{v_F}, e^{v_A}, and $e^{v_F} - e^{v_A}$ are strictly positive. Next,

$$\frac{\partial}{\partial v_F}\bar{w}^{AF} = -\frac{e^{v_F}(1-p_F)}{e^{v_F}-e^{v_A}} - \frac{e^{v_F}[e^{v_A}(1-p_A) - e^{v_F}(1-p_F)]}{(e^{v_F}-e^{v_A})^2} < 0.$$

The first component is strictly negative, since $v_F, p_F \in (0,1)$ and $v_F > v_A$. The second component is strictly positive, since e^{v_F} is strictly positive and from Proposition 5, the numerator is also strictly positive. So $\frac{\partial}{\partial v_F}\bar{w}^{AF} < 0$. Finally for similar reasoning,

$$\frac{\partial}{\partial v_A}\bar{w}^{AF} = \frac{e^{v_A}(1-p_A)}{e^{v_F}-e^{v_A}} + \frac{e^{v_A}[e^{v_A}(1-p_A) - e^{v_F}(1-p_F)]}{(e^{v_F}-e^{v_A})^2} > 0.$$

□

As the price of the flagship campus or the value of the affiliated campus increases, the marginal utility of attending the flagship instead of the affiliated campus decreases, so more students prefer the affiliated campus. Conversely, as the value of attending the flagship or the price of the affiliated campus increases, the opposite occurs.

Next, comparative statics on $\underline{w}^{AF}$ follow. The derivation and intuition is similar to Corollary 10, so are redacted for brevity.

Corollary 11. *Let the same conditions as in Proposition 5 hold. $\underline{w}^{AF}$ is increasing in p_A and decreasing in v_A.*

The next result in the main text shows that when the affiliated campus opens, some students are diverted from both the community college and the flagship campus to the affiliated campus.

Proposition 4. *Let Conditions 1 and 2 on preferences hold. $\bar{w}^{AF} > \hat{w}^{UN} > \underline{w}^{AF}$.*

Proof. First, for a contradiction, suppose that $\bar{w}^{AF} \leq \hat{w}^{UN}$. Then

$$\begin{aligned} \frac{e^{v_A}(1-p_A) - e^{v_F}(1-p_F)}{e^{v_F}-e^{v_A}} &\leq \frac{1-e^{v_F}(1-p_F)}{e^{v_F}-1} \\ \Rightarrow e^{v_F+v_A}(1-p_A) + e^{v_A}p_A - e^{v_F}p_F &\leq e^{v_A+v_F}(1-p_F) \\ \Rightarrow e^{v_F+v_A}(p_F F - p_A) &\leq e^{v_F}p_F - e^{v_A}p_A \end{aligned}$$

contradicting that $(e^{v_F+v_A} - e^{v_F})p_F > (e^{v_F+v_A} - e^{v_A})p_A$.

Then for another contradiction, suppose that $\hat{w}^{UN} \leq \underline{w}^{AF}$. Then

$$\begin{aligned}
\frac{1-e^{v_F}(1-p_F)}{e^{v_F}-1} &\leq \frac{1-e^{v_A}(1-p_A)}{e^{v_A}-1} \\
\Rightarrow -e^{v_F+v_A}(1-p_F)-e^{v_F}p_F &\leq -e^{v_F+v_A}(1-p_A)-e^{v_A}p_A \\
\Rightarrow e^{v_F+v_A}(p_F-p_A) &\leq e^{v_F}p_F-e^{v_A}p_A
\end{aligned}$$

again contradicting that $(e^{v_F+v_A}-e^{v_F})p_F > (e^{v_F+v_A}-e^{v_A})p_A$. □

The next result in the main text derives the affiliated first-time admissions cut-offs.

Proposition 5. *Let Conditions 1 and 2 on preferences hold. The first-time cut-offs in the affiliated environment are:*

$$\begin{aligned}
a_F^{AF} &= a_F^{UN} = 1-\rho_F^{-1}(\pi_F) \\
a_A^{AF} &= \frac{(\bar{w}^{AF}-\underline{w}^{AF})+(1-\bar{w}^{AF})a_F^{AF}-\kappa_A}{1-\underline{w}^{AF}} \\
a_C^{AF} &= \bar{w}^{AF}+(1-\bar{w}^{AF})a_F^{AF}-\kappa_A-\kappa_C
\end{aligned}$$

Proof. a_F^{AF} follows from Corollary 3. Capacity constraints determine cut-offs at the other institutions, so

$$\begin{aligned}
\kappa_A &= (\bar{w}^{AF}-\underline{w}^{AF})(1-a_A^{AF})+(1-\bar{w}^{AF})(a_F^{AF}-a_A^{AF}), \\
\kappa_C &= \underline{w}^{AF}(1-a_C^{AF})+(1-\underline{w}^{AF})(a_A^{AF}-a_C^{AF}),
\end{aligned}$$

and rearranging to solve for a_A^{AF}, a_C^{AF} gives the result. □

Since the comparative static on the first-time cut-off at the flagship campus a_F^{AF} is identical to Corollary 8, I redact this analysis for brevity and immediately discuss comparative statics on the first-time cut-off at the affiliated campus a_A^{AF}.

Corollary 12. *Let the same conditions as in Proposition 5 hold. a_A^{AF} is increasing in $\bar{w}^{AF}$ and a_F^{AF}, and decreasing in $\underline{w}^{AF}$ and κ_A.*

Proof.

$$\begin{aligned}
\frac{\partial}{\partial \bar{w}^{AF}} a_A^{AF} &= \frac{1 - a_F^{AF}}{1 - \underline{w}^{AF}} > 0, \\
\frac{\partial}{\partial \underline{w}^{AF}} a_A^{AF} &= \frac{(a_F^{AF} - 1)(1 - \bar{w}^{AF}) - \kappa_A}{(1 - \underline{w}^{AF})^2} < 0 \\
\frac{\partial}{\partial a_F^{AF}} a_A^{AF} &= \frac{1 - \bar{w}^{AF}}{1 - \underline{w}^{AF}} > 0, \\
\frac{\partial}{\partial \kappa_A} a_A^{AF} &= -\frac{1}{1 - \underline{w}^{AF}} < 0.
\end{aligned}$$

since $\bar{w}^{AF}, \underline{w}^{AF}, a_F^{AF}, \kappa_A \in (0, 1)$. □

As the upper affiliated wealth cut-off $\bar{w}^{AF}$ increases, more students prefer the affiliated campus over the flagship campus; this increases selectivity at the affiliated campus due to increased competition for enrollment seats. An increase in selectivity at the flagship campus has the same effect. Conversely, as the lower affiliated wealth cut-off $\underline{w}^{AF}$ increases, more students prefer the community college over the affiliated campus; this decreases selectivity at affiliated campus. An increase in capacity at the affiliated campus κ_A has the same effect.

Now for the comparative statics on the first-time cut-off at the community college a_C^{AF} in the affiliated environment.

Corollary 13. *Let the same conditions as Proposition 5 hold. a_C^{AF} is increasing in $\bar{w}^{AF}$ and a_F^{AF}, and decreasing in κ_A and κ_C.*

The math is straightforward so is omitted. The first-time affiliated cut-off at the community college a_C^{AF} is increasing in the upper wealth cut-off $\bar{w}^{AF}$. As $\bar{w}^{AF}$ increases, more students initially prefer the affiliated campus over the flagship campus, which has an indirect enrollment effect on the community college. The affiliated campus is able to enroll a more academically prepared student body, so students who were previously marginally acceptable at the affiliated campus must instead enroll at the community college, which causes academic preparedness to also increase at the community college. An increase in the first-time cut-off at the flagship a_F^{AF} has the same effect. Finally, a_C^{AF} is decreasing in capacities at the affiliated campus and community college, κ_A and κ_C. As the affiliated campus increases capacity, the affiliated campus will enroll some students who previously had to enroll at the community college. This indirectly causes community college to also become less selective. If capacity at the community college κ_C increases, then the community college enrolls students who were previously marginally inadmissible and lowers selectivity.

The next result in the main text shows that the community college becomes less selective after the affiliated campus opens.

Proposition 6. *Let the conditions from Proposition 5 and Corollary 4 hold. The community college is less*

selective after the affiliated campus opens: $a_C^{UN} - a_C^{AF} > 0$.

Proof. Suppose not, and $a_C^{AF} \geq a_C^{UN}$. Then

$$\begin{aligned} \bar{w}^{AF} + (1 - \bar{w}^{AF})a_F^{AF} - \kappa_A - \kappa_C &\geq \hat{w}^{UN} + (1 - \hat{w}^{UN})a_F^{UN} - \kappa_C \\ \Rightarrow (\bar{w}^{AF} - \hat{w}^{UN})(1 - a_F^{UN}) &\geq \kappa_A \\ \Rightarrow (\bar{w}^{AF} - \underline{w}^{AF})(1 - a_F^{AF}) > (\bar{w}^{AF} - \hat{w}^{UN})(1 - a_F^{UN}) &\geq \kappa_A, \end{aligned}$$

but $\kappa_A > (\bar{w}^{AF} - \underline{w}^{AF})(1 - a_F^{AF})$, hence the contradiction. □

The next result in the main text derives the affiliated transfer cut-off.

Proposition 7. *Let Conditions 1 and 2 on preferences hold. The external transfer cut-off in the affiliated environment is*

$$a_T^{AF} = \frac{\underline{w}^{AF} \cdot \delta + (1 - \bar{w}^{AF})(a_F^{AF} - a_{Min}) - \kappa_T}{\underline{w}^{AF} \cdot \delta}.$$

Proof. Since $a_T^{AF} > a_{Min}$, there are two kinds of students who transfer. First, students from the affiliated campus, who receive priority. Second, democratized community college students. Hence,

$$\kappa_T = (1 - \bar{w}^{AF})(a_F^{AF} - a_{Min}) + \underline{w}^{AF} \cdot \delta(1 - a_T^{AF}),$$

and solving for a_T^{AF} gives the result. □

Comparative statics on the affiliated transfer cut-off a_T^{AF} follow:

Corollary 14. *Let the conditions from Proposition 7 hold. The external transfer cut-off for community college students* a_T^{AF} *is increasing in* $\underline{w}^{AF}$ *and* a_M^{AF}*, and decreasing in* $\bar{w}^{AF}$ *and* a_{Min}*.*

Proof.

$$\begin{aligned} \frac{\partial}{\partial \bar{w}^{AF}} a_T^{AF} &= -\frac{a_F^{AF} - a_{Min}}{\underline{w}^{AF} \cdot \delta} < 0, \\ \frac{\partial}{\partial \underline{w}^{AF}} a_T^{AF} &= \frac{\kappa_T - (1 - \bar{w}^{AF})(a_F^{AF} - a_{Min})}{()\underline{w}^{AF})^2 \cdot \delta} > 0, \\ \frac{\partial}{\partial a_F^{AF}} a_T^{AF} &= \frac{1 - \bar{w}^{AF}}{\underline{w}^{AF} \cdot \delta} > 0, \\ \frac{\partial}{\partial a_{Min}} a_T^{AF} &= -\frac{1 - \bar{w}^{AF}}{\underline{w}^{AF} \cdot \delta} < 0. \end{aligned}$$

The first inequality follows from assuming that $\kappa_T >= (1 - \bar{w}^{AF})(a_F^{AF} - a_{Min})$. The second inequality follows from assuming that $a_{Min} \in (a_A^{AF}, a_F^{AF})$. □

To give some intuition about comparative statics, first note that as the lower affiliated wealth cut-off $\underline{w}^{AF}$ increases, more people prefer the community college over the affiliated campus. Since more highly prepared students will start at the community college, competition *within* the external transfer applicants increases and makes external transfer more selective. Next, as the first-time cut-off at the flagship campus a_F^{AF} increases, some students lose access to the flagship campus as a first-time student. As such, both the affiliated campus and community college are able to enroll a more academically prepared first-time student body. This increases competition both *within* external transfer applicants as well as *between* external and internal transfers. Both forms of competition increase selectivity over external transfers. Finally, as the upper affiliated wealth cut-off $\bar{w}^{AF}$ increases, more people most prefer the affiliated campus and will not transfer. Similarly, as the internal transfer cut-off a_{Min} increases, fewer students from the affiliated campus are able to transfer. Both of these effects decreases competition for transfer applicants and decreases selectivity in external transfers.

The next result in the main text determines when the affiliated campus causes crowd-out in transfer admissions.

Theorem 1. *Let Conditions 1 and 2 on preferences hold. Suppose all capacity constraint conditions hold. The transfer cut-off for community college students is strictly higher after an affiliated campus is added (that is, $a_T^{AF} > a_T^{UN}$) if and only if*

$$a_{Min} < \frac{1-\hat{w}^{UN}}{1-\bar{w}^{AF}} - \frac{\bar{w}^{AF}-\hat{w}^{UN}}{1-\bar{w}^{AF}} \cdot a_F^{AF} \qquad \text{(Crowd-Out Condition)}$$

Proof. $a_T^{AF} > a_T^{UN}$ if and only if

$$\frac{\underline{w}^{AF}\cdot\delta + (1-\bar{w}^{AF})(a_F^{AF}-a_{Min}) - \kappa_T}{\underline{w}^{AF}\cdot\delta} > \frac{\hat{w}^{UN}\cdot\delta + (1-\hat{w}^{UN})a_F^{UN} - \kappa_T}{\hat{w}^{UN}\cdot\delta + (1-\hat{w}^{UN})}.$$

First, rearrange to get the following expression for transfer capacity κ_T:

$$\kappa_T < \frac{\underline{w}^{AF}\cdot\delta(1-\hat{w}^{UN})(1-a_F^{AF})}{\hat{w}^{UN}\cdot\delta + (1-\hat{w}^{UN}) - \underline{w}^{AF}\cdot\delta} + \frac{(\hat{w}^{UN}\cdot\delta + (1-\hat{w}^{UN}))(1-\bar{w}^{AF})(a_F^{AF}-a_{Min})}{\hat{w}^{UN}\cdot\delta + (1-\hat{w}^{UN}) - \underline{w}^{AF}\cdot\delta}.$$

I assume that $\kappa_T > (1-\bar{w}^{AF})(a_F^{AF}-a_{Min})$. Therefore,

$$(1-\bar{w}^{AF})(a_F^{AF}-a_{Min}) < \kappa_T < \frac{\underline{w}^{AF}\cdot\delta(1-\hat{w}^{UN})(1-a_F^{AF})}{\hat{w}^{UN}\cdot\delta + (1-\hat{w}^{UN}) - \underline{w}^{AF}\cdot\delta} + \frac{(\hat{w}^{UN}\cdot\delta + (1-\hat{w}^{UN}))(1-\bar{w}^{AF})(a_F^{AF}-a_{Min})}{\hat{w}^{UN}\cdot\delta + (1-\hat{w}^{UN}) - \underline{w}^{AF}\cdot\delta},$$

and rearranging to express a_{Min} as an inequality related to other components gives the result. □

The next result in the main text is a comparative statics result to determine when crowd-out is more or less likely.

Proposition 8. *Let the same conditions as in Theorem 1 hold.* $\bar{w}^{AF} - \hat{w}^{UN}$ *is increasing in* p_F *and* v_A*, and decreasing in* p_A *and* v_F*.*

Proof. I derived expressions for $\hat{w}^{UN}$ and $\bar{w}^{AF}$ in Propositions 1 and 5. So,

$$\begin{aligned}\bar{w}^{AF} - \hat{w}^{UN} &= \frac{1 - e^{v_F}(1 - p_F)}{e^{v_F} - 1} - \frac{e^{v_A}(1 - p_A) - e^{v_F}(1 - p_F)}{e^{v_F} - e^{v_A}} \\ &= \frac{e^{v_F + v_A}(p_F - p_A) - e^{v_F} \cdot p_F + e^{v_A} \cdot p_A}{(e^{v_F} - e^{v_A})(e^{v_F} - 1)}.\end{aligned}$$

By Proposition 4, $\bar{w}^{AF} - \hat{w}^{UN} > 0$. Since the denominator of the expression above is strictly positive, it must be the case that the numerator is also strictly positive. For convenience, denote

$$e^{v_F + v_A}(p_F - p_A) - e^{v_F} \cdot p_F + e^{v_A} \cdot p_A = Num.$$

Now,

$$\begin{aligned}\frac{\partial}{\partial p_F}\bar{w}^{AF} - \hat{w}^{UN} &= \frac{e^{v_F + v_A} - e^{v_F}}{(e^{v_F} - e^{v_A})(e^{v_F} - 1)} > 0 \\ \frac{\partial}{\partial v_F}\bar{w}^{AF} - \hat{w}^{UN} &= -\frac{e^{v_F} \cdot Num}{(e^{v_F} - e^{v_A})^2(e^{v_F} - 1)} - \frac{e^{v_F} \cdot Num}{(e^{v_F} - e^{v_A})(e^{v_F} - 1)^2} - \frac{Num - e^{v_A} \cdot p_A}{(e^{v_F} - e^{v_A})(e^{v_F} - 1)} < 0 \\ \frac{\partial}{\partial p_A}\bar{w}^{AF} - \hat{w}^{UN} &= \frac{e^{v_A} - e^{v_F + v_A}}{(e^{v_F} - e^{v_A})(e^{v_F} - 1)} < 0 \\ \frac{\partial}{\partial v_A}\bar{w}^{AF} - \hat{w}^{UN} &= \frac{e^{v_A} \cdot Num}{(e^{v_F} - e^{v_A})^2(1 - e^{v_F})} + \frac{Num + e^{v_F} \cdot p_F}{(e^{v_F} - e^{v_A})(e^{v_F} - 1)} > 0\end{aligned}$$

□

C Welfare Analysis: Opening an Affiliated Campus

To briefly recap, I consider in Section 4 whether a state policymaker with assortative preferences would rather modestly expand a flagship campus or open a larger affiliated campus. I do the welfare analysis in groups based on level of academic preparedness (which determines where students can potentially enroll), and then subgroups based on wealth endowment (which determines students' preferences). Recall that Proposition 4 implies students with wealth $w \in [\bar{w}^{AF}, 1]$ always most prefer the flagship campus, students with wealth $w \in [\hat{w}^{UN}, \bar{w}^{AF})$ most prefer the flagship in the unaffiliated environment but most prefer the affiliated campus in the affiliated environment, students with $w \in [\underline{w}^{AF}, \hat{w}^{UN})$ most prefer the community college in the unaffiliated environment but most prefer the affiliated campus in the affiliated environment, and students with $w \in [0, \underline{w}^{AF})$ always most prefer the community college

Group 1. Students with $a \in [a_F^{AF}, 1]$. These students are accepted at all institutions as both a first-time and

transfer applicant.

1. $w \in [\bar{w}^{AF}, 1]$: These students always most prefer and enroll at the flagship as a first-time student. There is no change in welfare if the affiliated campus opens.

2. $w \in [\hat{w}^{UN}, \bar{w}^{AF})$: In the unaffiliated environment, these students most prefer and enroll at the flagship during first-time admissions. In the affiliated environment, they most prefer and enroll at the affiliated campus during first-time admissions and will not transfer. The resulting loss in welfare is:

$$B_1^R = \frac{1}{2}(\bar{w}^{AF} - \hat{w}^{UN})(1 - (a_F^{UN})^2)(b_A - b_F) < 0.$$

3. $w \in [\underline{w}^{AF}, \hat{w}^{UN})$: In the unaffiliated environment, these students most prefer and enroll at the community college as a first-time student, and a fraction δ transfer to the flagship. In the affiliated environment, they most prefer and enroll at the affiliated campus as a first-time student and will not apply to transfer. The resulting change in welfare is:

$$B_2^R = \frac{1}{2}(\hat{w}^{UN} - \underline{w}^{AF})(1 - (a_F^{UN})^2) \underbrace{(b_F \cdot \delta + (1-\delta) - b_A)}_{\text{Ambiguous sign}}.$$

4. $w \in [0, \underline{w}^{AF})$: These students always enroll at the community college as a first-time student, and a fraction δ always transfer to the flagship campus. There is no change in welfare when the affiliated campus opens.

Group 2. Students with $a \in [a_T^{AF}, a_F^{UN})$. These students are accepted at the affiliated campus and community college first-time applicants, and are always accepted at the flagship as a transfer applicant.

1. $w \in [\bar{w}^{AF}, 1]$: These students always most prefer the flagship, but cannot enroll there as a first-time student. They always successfully transfer to flagship. There is no change in welfare if the affiliated campus opens.

2. $w \in [\hat{w}^{UN}, \bar{w}^{AF})$: In the unaffiliated environment, these students most prefer the flagship but must enroll at the community college as a first-time student, and always successfully transfer. In the affiliated environment, they most prefer and enroll at the affiliated campus as a first-time student and will not apply to transfer. The resulting loss in welfare is:

$$B_3^R = \frac{1}{2}(\bar{w}^{AF} - \hat{w}^{UN})((a_F^{UN})^2 - (a_T^{AF})^2)(b_A - b_F) < 0.$$

3. $w \in [\underline{w}^{AF}, \hat{w}^{UN})$: In the unaffiliated environment, these students most prefer and enroll at the community college as a first-time student, and a fraction δ transfer to the flagship. In the affiliated

environment, they most prefer and enroll at the affiliated campus as a first-time student and will not apply to transfer. The resulting change in welfare is:

$$B_4^R = \frac{1}{2}(\hat{w}^{UN} - \underline{w}^{AF})((a_F^{UN})^2 - (a_T^{AF})^2)\underbrace{(b_F \cdot \delta + (1-\delta) - b_A)}_{\text{Ambiguous sign}}.$$

4. $w \in [0, \underline{w}^{AF})$: These students always enroll at the community college as a first-time student, and a fraction δ always transfer to the flagship. There is no change in welfare if the affiliated campus opens.

Group 3. Students with $a \in [a_T^{UN}, a_T^{AF})$. These students are accepted at the affiliated campus and community college as first-time applicants. In the unaffiliated environment, students at the community college can transfer into the flagship. In the affiliated environment, students who start at the affiliated campus can transfer, but students who start at the community college cannot.

1. $w \in [\bar{w}^{AF}, 1]$: These students always most prefer the flagship, but cannot enroll there as a first-time student. Regardless of environment, they always successfully transfer to the flagship. There is no change in welfare if an affiliated campus opens.

2. $w \in [\hat{w}^{UN}, \bar{w}^{AF})$: In the unaffiliated environment, these students most prefer the flagship but must enroll at the community college as a first-time student, and always successfully transfer. In the affiliated environment, they most prefer and enroll at the affiliated campus as a first-time student and will not apply to transfer. The resulting loss in welfare is:

$$B_5^R = \frac{1}{2}(\bar{w}^{AF} - \hat{w}^{UN})((a_T^{AF})^2 - (a_T^{UN})^2)(b_A - b_F) < 0.$$

3. $w \in [\underline{w}^{AF}, \hat{w}^{UN})$: In the unaffiliated environment, these students most prefer and enroll at the community college as a first-time student, and a fraction δ transfer to the flagship. In the affiliated environment, they most prefer and enroll at the affiliated campus as a first-time student and will not apply to transfer. The resulting change in welfare is:

$$B_6^R = \frac{1}{2}(\hat{w}^{UN} - \underline{w}^{AF})((a_T^{AF})^2 - (a_T^{UN})^2)\underbrace{(b_F \cdot \delta + (1-\delta) - b_A)}_{\text{Ambiguous sign}}.$$

4. $w \in [0, \underline{w}^{AF})$: Students always enroll at the community college as a first-time student. A fraction δ transfer to the flagship in the unaffiliated environment, but cannot transfer in the affiliated environment. The resulting loss in welfare is:

$$B_7^R = \frac{1}{2}\underline{w}^{AF}((a_T^{AF})^2 - (a_T^{UN})^2)(1 - b_F)\delta < 0.$$

Group 4. Students with $a \in [a_{Min}, a_T^{UN})$. These students are accepted at the affiliated campus and community college as first-time students. In the unaffiliated environment, students start at the community college and cannot transfer into the flagship. In the affiliated environment, the students who start at the affiliated campus can transfer, but the students who start at the community college cannot.

1. $w \in [\bar{w}^{AF}, 1]$: These students always most prefer the flagship, but cannot enroll there as a first-time student. In the unaffiliated environment, they enroll at the community college and cannot transfer. In the affiliated environment, they enroll at the affiliated campus and successfully transfer to the flagship. The resulting increase in welfare is:

$$B_8^R = \frac{1}{2}(1 - \bar{w}^{AF})((a_T^{UN})^2 - (a_{Min})^2)(b_F - 1) > 0.$$

2. $w \in [\hat{w}^{UN}, \bar{w}^{AF})$: In the unaffiliated environment, these students most prefer the flagship but must enroll at the community college as a first-time student and cannot transfer. In the affiliated environment, they most prefer and enroll at the affiliated campus as a first-time student and will not apply to transfer. The resulting increase in welfare is:

$$B_9^R = \frac{1}{2}(\bar{w}^{AF} - \hat{w}^{UN})((a_T^{AF})^2 - (a_{Min})^2)(b_A - 1) > 0.$$

3. $w \in [\underline{w}^{AF}, \hat{w}^{UN})$: In the unaffiliated environment, these students most prefer and enroll at the community college as a first-time student, and cannot transfer. In the affiliated environment, they most prefer and enroll at the affiliated campus as a first-time student and will not apply to transfer. The resulting increase in welfare is:

$$B_{10}^R = \frac{1}{2}(\hat{w}^{UN} - \underline{w}^{AF})((a_T^{UN})^2 - (a_{Min})^2)(b_A - 1) > 0.$$

4. $w \in [0, \underline{w})^{AF}$: Students always enroll at the community college as a first-time student and cannot transfer. There is no change in welfare if the affiliated campus opens.

Group 5. Students with $a \in [a_A^{AF}, a_{Min})$. These students are accepted at the affiliated campus and community college as first-time students, but cannot transfer in either environment.

1. $w \in [\bar{w}^{AF}, 1]$: These students always most prefer the flagship, but cannot enroll there as a first-time student. In the unaffiliated environment, they enroll at the community college and cannot transfer. In the affiliated environment, they enroll at the affiliated campus and cannot transfer. The resulting increase in welfare is:

$$B_{11}^R = \frac{1}{2}(1 - \bar{w}^{AF})((a_{Min})^2 - (a_A^{AF})^2)(b_A - 1) > 0.$$

2. $w \in [\hat{w}^{UN}, \bar{w}^{AF})$: In the unaffiliated environment, these students most prefer the flagship but must enroll in the community college as a first-time student and cannot transfer. In the affiliated environment, they most prefer and enroll at the affiliated campus as a first-time student and will not apply to transfer. The resulting increase in welfare is:

$$B_{12}^R = \frac{1}{2}(\bar{w}^{AF} - \hat{w}^{UN})((a_{Min})^2 - (a_A^{AF})^2)(b_A - 1) > 0.$$

3. $w \in [\underline{w}^{AF}, \hat{w}^{UN})$: In the unaffiliated environment, these students most prefer and enroll at the community college as a first-time student and cannot transfer. In the affiliated environment, they most prefer and enroll at the affiliated campus as a first-time student and will not apply to transfer. The resulting increase in welfare is:

$$B_{13}^R = \frac{1}{2}(\hat{w}^{UN} - \underline{w}^{AF})((a_{Min})^2 - (a_A^{AF})^2)(b_A - 1) > 0.$$

4. $w \in [0, \underline{w}^{AF})$: These students always enroll at the community college as a first-time student and cannot transfer. There is no change in welfare if the affiliated campus opens.

Group 6. Students with $a \in [a_C^{UN}, a_A^{AF})$. These students are only accepted at the community college as first-time students in both environments and can never transfer. There is no change in welfare if the affiliated campus opens.

Group 7. Students with $a \in [a_C^{AF}, a_C^{UN})$. These students are only accepted at the community college as first-time students in the affiliated environment and can never transfer. The resulting gain in welfare is:

$$B_{14}^R = \frac{1}{2}((a_C^{UN})^2 - (a_C^{AF})^2) > 0.$$

Group 8. Students with $a \in [0, a_C^{AF})$. These students are never enrolled. There are no changes in welfare if the affiliated campus opens.

Putting it altogether, the certain welfare gains from opening an affiliated campus are

$$\begin{aligned} B_{Gain}^R = \frac{1}{2}[&(1 - \bar{w}^{AF})((a_T^{UN})^2 - (a_{Min})^2)(b_F - 1) + \\ &(\bar{w}^{AF} - \underline{w}^{AF})((a_T^{UN})^2 - (a_{Min})^2)(b_A - 1) + \\ &(1 - \underline{w}^{AF})((a_{Min})^2 - (a_A^{AF})^2)(b_A - 1) + ((a_C^{UN})^2 - (a_C^{AF})^2)], \end{aligned}$$

the certain welfare losses are

$$B_{Loss}^R = \frac{1}{2}[(\bar{w}^{AF} - \hat{w}^{UN})(1 - (a_T^{UN})^2)(b_A - b_F) + \underline{w}^{AF}((a_T^{AF})^2 - (a_T^{UN})^2)(1 - b_F)\delta],$$

and ambiguous welfare effects are

$$B^R_{Ambig} = \frac{1}{2}(\hat{w}^{UN} - \underline{w}^{AF})(1 - (a_T^{UN})^2)(b_F \cdot delta + (1-\delta) - b_A).$$

I discuss how to interpret these results in Section 4.2.

Another way to look at welfare changes is to consider *how many* students accrue the gains/losses from opening an affiliated campus. To see this, I rewrite the welfare effects now grouped by student preferences. First, students who always most prefer the flagship have wealth $w \in [\bar{w}^{AF}, 1]$, and these students only increase welfare after the affiliated campus is opened.

$$B_{FF} = \frac{1}{2}(1 - \bar{w}^{AF})[(a_T^{UN})^2 - (a_{Min})^2)(b_F - 1) + ((a_{Min})^2 - (a_A^{AF})^2)(b_A - 1) + ((a_C^{UN})^2 - (a_C^{AF})^2)]$$

Second, consider students who most prefer the flagship in the unaffiliated environment, but switch to most preferring the affiliated campus in the affiliated environment. These students have wealth $w \in [\hat{w}^{UN}, \bar{w}^{AF}]$.

$$B_{FA} = \frac{1}{2}(\bar{w}^{AF} - \hat{w}^{UN})[\underbrace{((a_T^{UN})^2 - (a_A^{AF})^2)(b_A - 1) + ((a_C^{UN})^2 - (a_C^{AF})^2)}_{\text{Gain}} + \underbrace{(1 - (a_T^{UN})^2(b_A - b_F))}_{\text{Loss}}]$$

Next, consider students who most prefer the community college in the unaffiliated environment, but switch to most preferring the affiliated campus in the affiliated environment. These students have wealth $w \in [\underline{w}^{AF}, \hat{w}^{UN}]$.

$$B_{CA} = \frac{1}{2}(\hat{w}^{UN} - \underline{w}^{AF})[\underbrace{(a_T^{UN})^2 - (a_A^{AF})^2(b_A - 1) + ((a_C^{UN}) - (a_C^{AF})^2)}_{\text{Gain}} + \underbrace{(1 - (a_T^{UN})^2)(b_F \cdot \delta + (1-\delta) - b_A)}_{\text{Ambig}}]$$

Finally, consider students who always most prefer the community college. These students have wealth $w \in [0, \underline{w}^{AF}]$.

$$B_{CC} = \frac{1}{2}\underline{w}^{AF}[\underbrace{((a_C^{UN}) - (a_C^{AF})^2)}_{\text{Gain}} + \underbrace{((a_T^{AF})^2 - (a_T^{UN})^2(1 - b_F))\delta}_{\text{Loss}}]$$