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POSTSECONDARY OUTCOMES FOR ADULT LEARNER SCHOLARS

Evaluating the Kansas City Scholars College Scholarship Program

Addressed to:

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KCS ADULT IMPACTS

Each year, the Kansas City Scholars program offers annual scholarships of up to $5,000 to adults who interrupted their postsecondary educations prior to receiving an associate degree.[1] The scholarship is renewable for up to four years. Although the KC Scholars program has a target of offering up to 200 adult learner scholarships, in its first two cohorts, the program was undersubscribed: 91 scholarships were offered in 2017 and 137 were offered in 2018.

The purpose of the scholarships is to facilitate the re-enrollment of these adults and their degree attainment. The analyses reported here examine the impact of the scholarships on postsecondary enrollment and progress. The ideal way to gauge this impact would be to compare the postsecondary experiences of adults who received the scholarship to the (imaginary) situation of what those experiences would have been if the same adults had not received the scholarship. Since the latter situation does not exist, we need to construct a comparison group of individuals that are arguably similar to the scholarship recipients except that they did not receive the KCS adult learner scholarship. We accomplish this by using a statistical matching technique.

Five institutions of higher education (IHEs) in the Kansas City area, in which a large majority of the adult scholars enrolled, supplied anonymized enrollment information about other students, including their characteristics such as age, gender, race and ethnicity, and economic circumstances. The five institutions are 1) Johnson County Community College; 2) Kansas City, Kansas, Community College; 3) Metropolitan Community College–Penn Valley; 4) Park University; and 5) the University of Missouri–Kansas City. These IHEs supplied records for students who initially enrolled in fall 2017 and, separately, for students who initially enrolled in fall 2018, allowing us to estimate the postsecondary impacts for the first and second cohorts of KCS adult scholars. We first describe our analysis of the cohort 1 adult scholars; these impacts span the two-year period from fall 2017 to spring 2019. We then turn to the first-year outcomes for the cohort 2 adult scholars, spanning fall 2018 to spring 2019.[2] An appendix provides technical details of the methodology.

COHORT 1 ADULT LEARNERS: SECOND YEAR IMPACT ANALYSIS

Of the 90 adult learners from the first cohort who were awarded scholarships in the spring of 2017, 72 enrolled at the five campuses included in our analyses during the 2017–2018 school year.[3] The remaining 18 adult learners enrolled at more than a dozen other institutions, typically just one or two per school. In this section, we evaluate the impact of the KCS adult learner scholarship on postsecondary outcomes for the first cohort over the first two years of eligibility.

Our matching approach compares adult scholarship recipients with similar non-KCS scholarship students (based on characteristics such as gender, race and ethnicity, age, family structure, and financial need) who enroll at the same institutions and who started at the same time. This comparison

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[1] In 2019, Kansas City Scholars broadened the eligibility for these scholarships to include individuals who had received an associate degree but not a bachelor's degree.

[2] The Upjohn Institute conducted an impact analysis for the first year of cohort 1 (fall 2017 to spring 2018) in an earlier report.

[3] Originally, 91 scholarships were awarded, but one person became ineligible after moving outside the Kansas City area.

group of other enrolled students allows for the investigation of key retention outcomes, including second-year and continuous enrollment, credits attempted and earned over the two school years (2017–2018 and 2018–2019), and degree attainment. However, there are a few caveats. We can track outcomes only for students who stay at the original college at which they were enrolled in Fall 2017; students who left this institution without earning a credential are considered stopouts, even though some may have transferred elsewhere[4]. Second, we do not know how many credits the students in the comparison group had when they resumed their studies in Fall 2017, or how many credits they needed to complete. This means that the degree attainment outcomes should be treated with caution, as the KCS and comparison group students did not necessarily start from the same point in terms of credits needed to graduate.

The first pair of dots in Figure 1 shows the probability of fall 2018 enrollment—that is, retention to the second year—for the sample of KCS adults (red) and the matched comparison group (teal). Whereas 42.1 percent of the comparison group was enrolled, 70.5 percent of KCS adults were, a large and highly statistically significant difference of 28 percentage points. This enrollment advantage persisted through spring 2019, suggesting greater progress toward degree. Among KCS adults, 54 percent met this benchmark, exceeding the matched comparison group by a significant 23 percentage points.

Figure 1. KCS C1 Adults are Much More Likely to be Enrolled-Overall and Full-Time
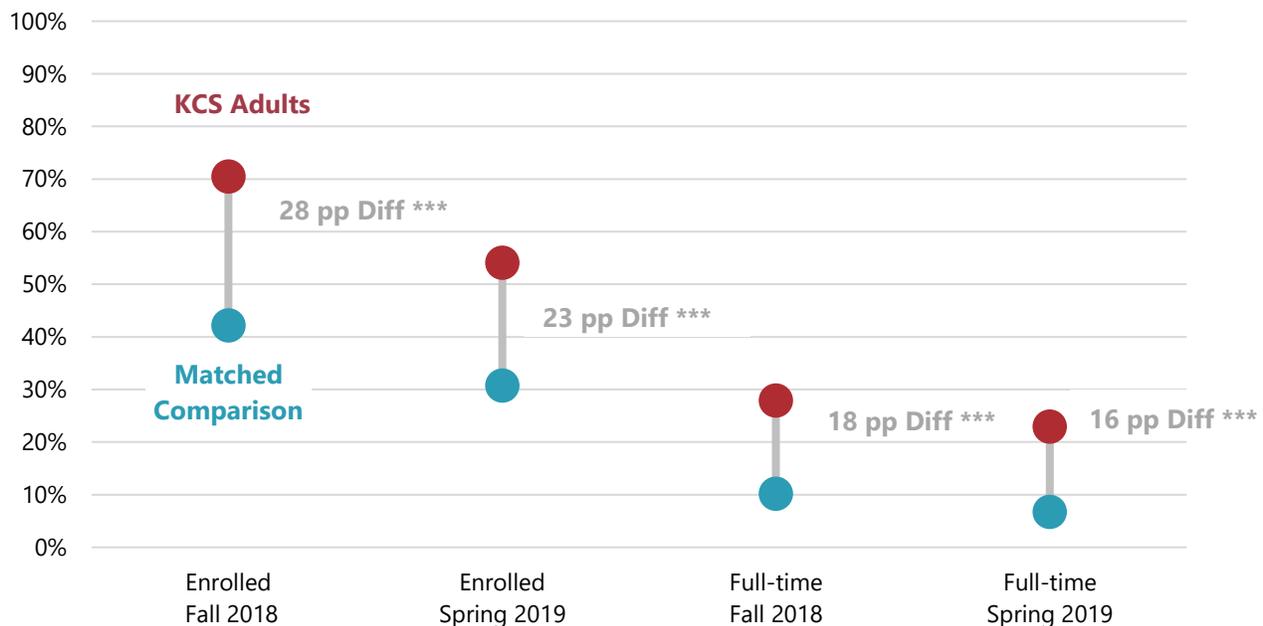
NOTE: Kernel matching estimates shown. * significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level.

The third pair of dots in the figure shows that the KCS adults were nearly 18 percentage points more likely to enroll on a full time basis (12 or more credits) in fall 2018, and the last set of dots shows that the KCS adults were about 16 percentage points more likely to be enrolled full-time in spring. For both semesters, KCS adults were more than twice as likely to be enrolled full-time as the matched

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[4] Unfortunately, our records come from specific colleges, and although we asked for them to report transfers, not all were able to do so. This is a problem for the analysis only to the extent that transfer rates differed between the KCS and control students. If transfer rates were higher for KCS than the controls, estimated impacts will be too small; if transfer rates were lower for KCS than the controls, estimated impacts will be too large.

comparison students. These effects indicate the KCS students have a very large advantage in retention relative to what would be expected in the absence of the scholarship.

Figure 2 shows estimated impacts on the number of credits attempted and earned each semester of the 2018-2019 school year, among students who enrolled. The credits-attempted outcome is a more fine-grained measure of enrollment intensity than the full-time measure in Figure 1. In both semesters of the 2018–2019 school year, KCS adults on average took and earned more credits than the matched comparison group, but the differences are not large enough to be conclusive of a definitive impact. Rather, we view these results as suggestive evidence that KCS *may* have increased credit-taking among enrolled students.

Figure 2. Among Enrolled Students, KCS C1 Adults Appear to Take and Earn More Credits

NOTE: Kernel matching estimates shown. * significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level.
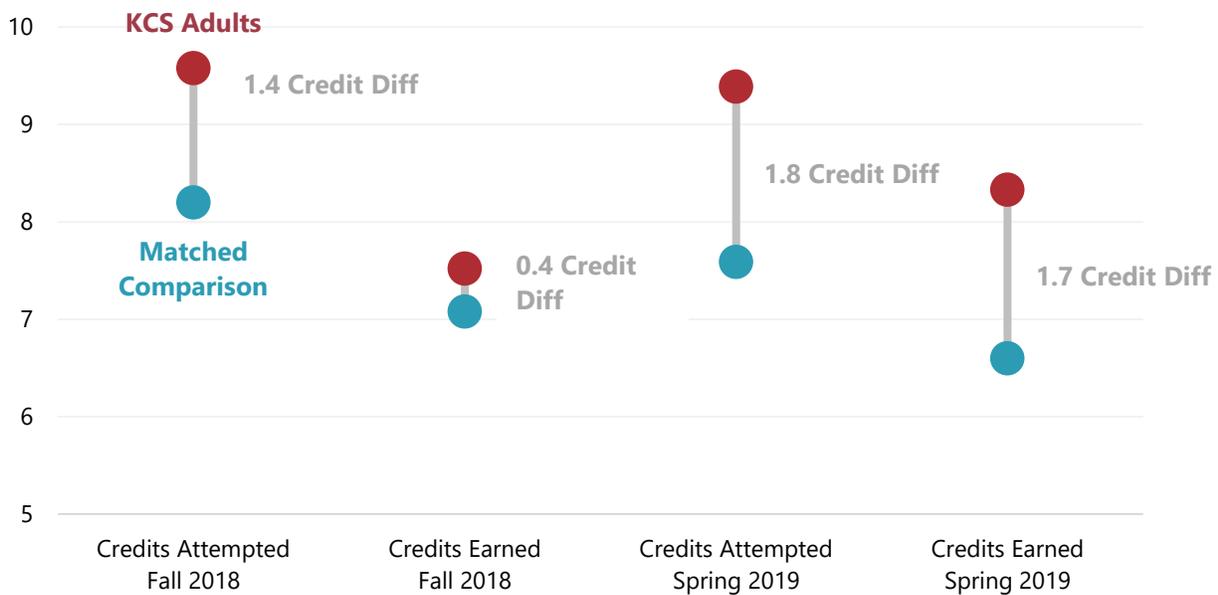
Finally, Figure 3 shows the estimated impacts on continuous enrollment and credential attainment over the two-year period from fall 2017 to spring 2019. The first set of bars shows that KCS adults are significantly more likely to be continuously enrolled over this period: 64 percent of KCS adults versus 42 percent for the matched comparison group—a 22 percentage point, statistically significant advantage. About 15 percent of the adult scholars have been continuously enrolled on a full-time basis compared to about 8 percent of the matched comparison group, although the difference is not statistically significant.

The last two sets of bars in the figure show credential attainment: the first set includes any credential, including certificates, whereas the second set is limited to associate or bachelor's degrees. About three in 10 KCS scholars earned a credential over the two-year period, and virtually all of these were associate or bachelor's degrees. This share slightly exceeds the matched comparison group, with a 1 percentage point differential among all credentials and a 4-percentage point advantage when considering only associate or bachelor's degrees; neither is statistically significant. As noted above, we did not have prior credit information for the comparison group, so the impacts for credential attainment may be underestimated to the extent that the comparison group had, on average, earned

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more credits than the KCS scholars prior to Fall 2018. (If the reverse is true, the impact may be overestimated.)

The overall results for the first cohort of KCS adult scholars suggest that the scholarship resulted in large enrollment and retention gains into the second year. These hold both for any enrollment at all and specifically for full-time enrollment. These enrollment increases translated into more credits attempted and earned. Credential attainment in the first two years, however, is more uncertain: although the first cohort of adult learners were slightly more likely to earn a degree, the result is relatively small and not statistically significant.

Figure 3. KCS C1 Adults are More Likely to be Continuously Enrolled Over the Two Years Since Receiving the Scholarship
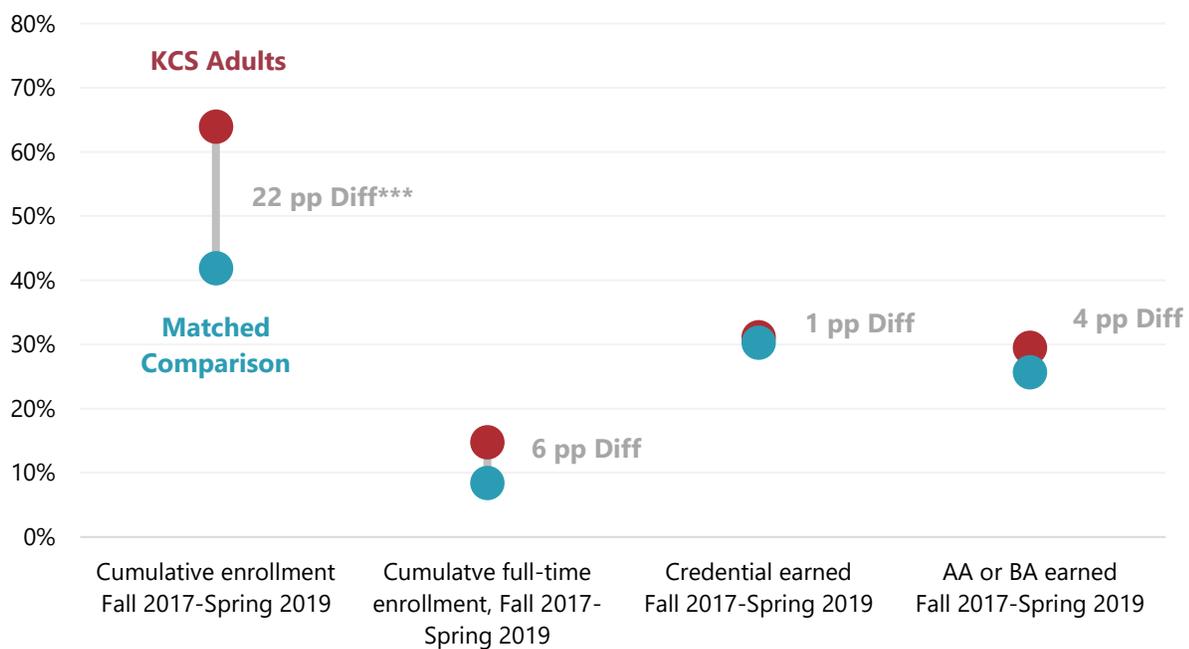
NOTE: Kernel matching estimates shown. * significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level.

COHORT 2 ADULT LEARNERS: FIRST-YEAR IMPACT ANALYSIS

Of the 137 adult learners from the second cohort who were awarded scholarships in the spring of 2018, 113 enrolled at the five campuses that comprise our analyses during the 2018–2019 school year. The remaining 24 adult learners enrolled at more than a dozen other institutions, typically just one or two per school.

To estimate the impact of the KCS adult learner scholarship on postsecondary outcomes for the 2018–2019 school year for the second cohort, we implemented a matching approach similar to that used for the first cohort, and described in detail in the appendix. For the first-year outcomes of the second cohort, we examine the likelihood of spring (2019) enrollment, credits attempted and earned in both the fall and spring semesters, and GPA in both semesters. Since we cannot examine the impact of whether the scholarship caused students to re- enroll at all in the fall of 2018—both the KCS students and the comparison group necessarily enrolled in this semester—we examine whether the scholarship affected full-time enrollment in both the fall and the spring.

The first pair of dots in Figure 4 shows the probability of full-time enrollment in the fall of 2018 for KCS adults (red) and the matched comparison group (teal). Among the latter, 28.7 percent enrolled full time, but for KCS adults, 42.1 percent did, a statistically significant gain of about 13 percentage points. This impact is in line with that of the prior analysis of the first-year impacts for the first cohort but is statistically significant here. We examine first-year retention in the second set of dots, which shows the likelihood of enrollment in the spring of 2019. Among cohort 2 KCS adults, 81 percent met this benchmark, exceeding the matched comparison group by a highly statistically significant 14 percentage points.

Figure 4. KCS C2 Adults are Significantly More Likely to be Enrolled in the Spring and Full-Time Throughout the First Year
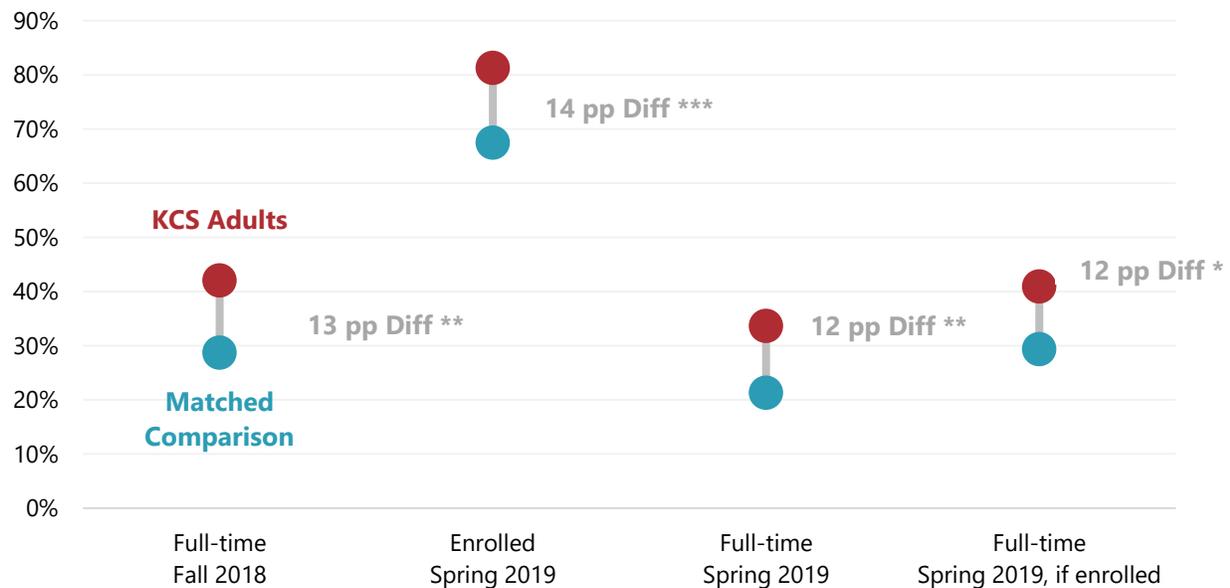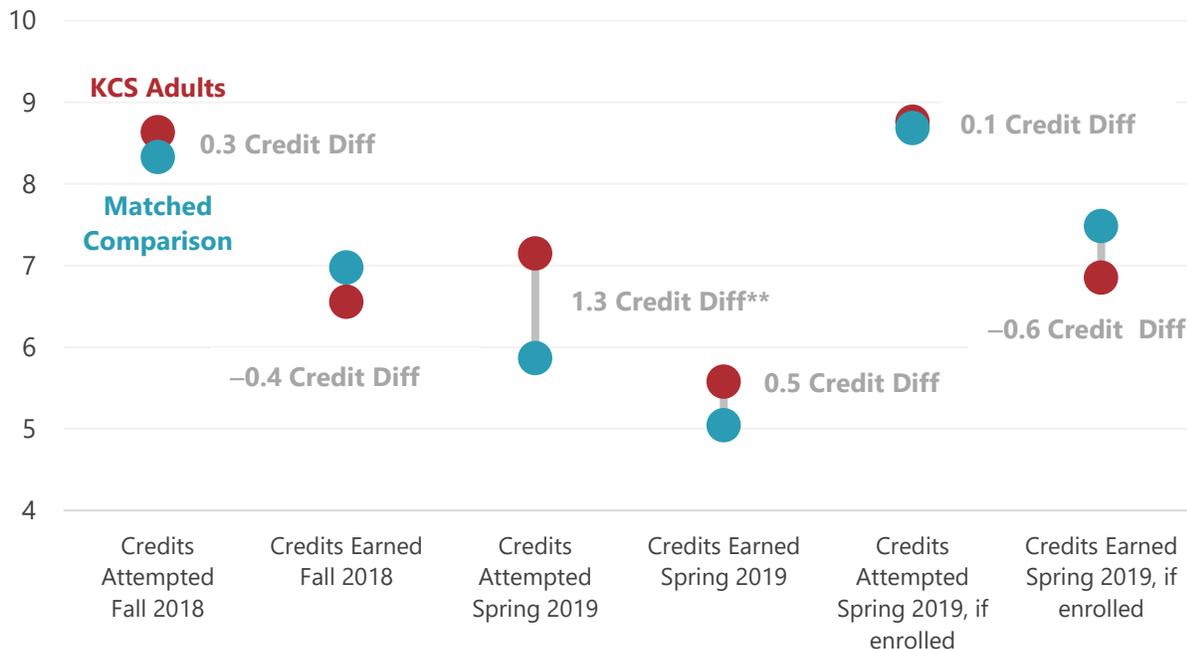

NOTE: Kernel matching estimates shown. * significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level.

The KCS adults were also over 12 percentage points more likely to enroll full time in the spring. The last pair of dots considers full-time status only among those who enrolled at all in the spring. KCS adults again show a 12-percentage-point advantage, suggesting that the overall benefit for full-time spring enrollment (third pair of dots) is likely driven by KCS adults being more likely to enroll at all in the spring (second pair of dots), rather than their shift toward full-time enrollment, per se.

Figure 5 compares the number of credits attempted and earned each semester between the two groups of students. In fall 2018, KCS adults have a slight, but statistically insignificant, 0.3 credit advantage over the matched comparison. Taken in context with the significant impact on full-time enrollment shown in Figure 4, this suggests students cluster around the 12-credit-hour mark that indicates full-time enrollment. For the spring, however, KCS adults take 1.3 credits more than the comparison group, and this impact is statistically significant. The fifth pair of dots, however, which focus on credits attempted among enrolled students, show that this gain in credits is driven by a higher likelihood of enrolling at all, not an increase in enrollment intensity of taking more classes.

Figure 5. KCS C2 Adults Attempted Slightly More Credits in the Spring but Otherwise had Few Differences with the Matched Comparison

NOTE: Kernel matching estimates shown. * significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level.

KCS adults do not appear to earn more credits than the matched comparison group. The second pair of dots shows that they earned 0.4 credits less, on average in the fall, and the fourth pair of dots shows they earned 0.5 credits more in the spring; neither difference is statistically significant. In fact, as shown in the last pair of dots, the small positive impact in the spring reverses when the comparison is only among students who enrolled that term.[5] In short, the second cohort of KCS adults did not see

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[5] It is worth noting that the matched comparison students who enroll in the spring may be positively selected (for example, in terms of motivation or drive), and this may result in the estimated difference for the last pair of dots being biased downward. For this reason, we view the results conditional on spring enrollment as more descriptive than causal.

much gain in credit-taking or earning relative to the matched comparison. Relative to the first KCS adult cohort, the impacts for the second cohort are smaller, generally half the size, at best. This seems to be driven by a combination of weaker performance among the KCS adults, relative to the earlier cohort, and a stronger performance from the comparison group.
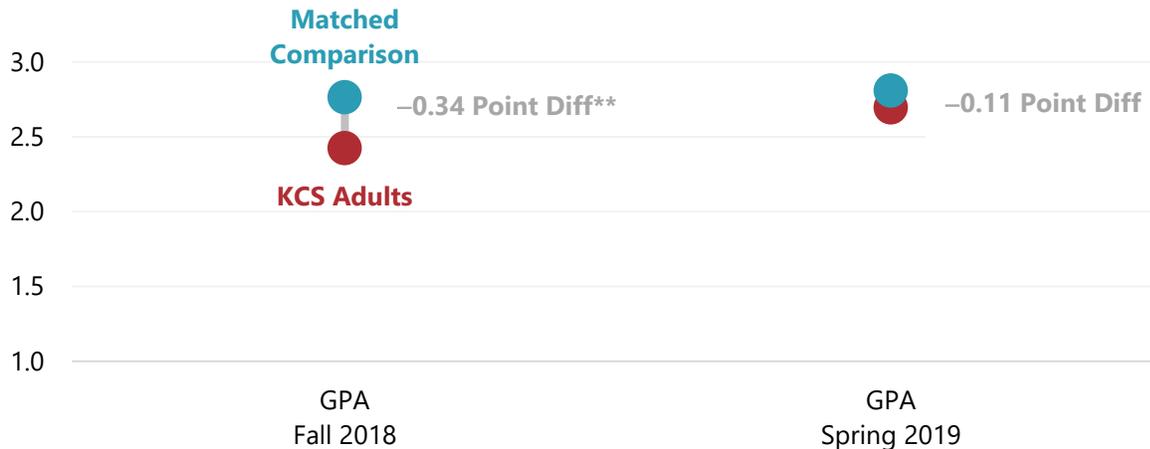
Figure 6. KCS C2 Adults have Lower GPAs in the Fall

NOTE: Kernel matching estimates shown. * significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level.

Finally, Figure 6 shows the impacts on GPA each semester (necessarily conditioning on enrollment). For the fall, the KCS adults' average GPA lags the comparison group's average GPA by one-third of a point, a large and statistically significant gap. Interestingly, the average GPA among KCS adults rises in the spring, by almost 0.3 points, while that for the comparison group barely changes; consequently, the gap between them shrinks to an insignificant 0.11 points.

The first-year outcomes for the second cohort of adult learners are roughly similar to the first-year outcomes that we reported last year for the first cohort, although there are a few differences. In both cohorts, the retention/re-enrollment rate for the KCS adults far exceeded that of the comparison group members. For spring enrollment, for example, the difference between the KCS adults and the comparison group was 95 percent to 75 percent for the first cohort, and 81 percent to 67 percent for the second cohort. There were also similar, but smaller, gains for full-time spring enrollment.

However, in the first cohort, the KCS adults attempted and earned more credits than their comparison group, while in the second cohort, there was little difference. Interestingly, the first KCS adult cohort had an average fall GPA of 2.44 that fell to 2.04 in the spring; the second cohort had essentially the same average GPA in the fall, but their GPA *rose* to 2.70 in the spring. The negative gap for fall GPA in the second cohort is thus entirely due to a higher average GPA among the comparison group. That the change in average GPA among KCS adults between fall and spring reversed from negative to positive between the first and second cohorts may reflect growing maturity in the supports provided to adult scholars.

A. METHODOLOGICAL APPENDIX AND ADDITIONAL TABLES

This paper uses a statistical matching procedure to estimate the impact of the KCS adult scholarship on academic outcomes for the first and second cohort, comparing KCS adult learners to comparison groups of enrolled students. While it would have been ideal to use a regression discontinuity design, comparing adult learners who scored just above the scholarship score cutoff with those applicants who scored just below, this design was not feasible, since all adult scholarship applicants who completed the application and met baseline eligibility requirements received the scholarship. By matching adult scholarship recipients with similar adults who did not receive the KCS award, we can still investigate several important postsecondary outcomes. A preferred matching comparison group would be other adults at least age 24, who had previously enrolled at a college, who had an expected family contribution (EFC) of no more than $12,000, and who had expressed interest in returning to college—in other words, adults who could have applied for the KCS scholarship but did not. Unfortunately, such a comparison group with records at the individual level is not available. Instead, our matching approach compares adult scholarship recipients with similar non-KCS scholarship students who enroll at the same institutions.

More specifically, our comparison samples are drawn from the five institutions mentioned at the beginning of the paper, which have the greatest number of KCS adult learners. We asked each of these postsecondary campuses to provide anonymized enrollment data (including enrollment intensity, credits attempted and earned, and GPA for each semester) for 10 randomly chosen, non-scholarship adult students for each KCS adult learner at their school for the 2017–2018 school year (first cohort) and for the 2018—2019 school year (second cohort).[6] The non-scholarship comparison students had to fit criteria analogous to the KCS awardees: at least age 24, with an EFC of no more than $12,000 (and having completed the FAFSA), and having a previous enrollment spell either at the current or another college.

Cohort 1. For the first cohort, this approach yielded 677 comparison students and 70 KCS adult awardees.[7] Among KCS adult awardees, two of the 72 had enrolled in the spring but not in the fall, and we dropped these two students from the comparison, leaving us with 70. For the comparison group, not all campuses included 10 control students for each KCS student.

Nonetheless, these 70 KCS students and 677 comparison students formed the basis for our matching procedure. The first two columns of Table A.1 compare the characteristics of these two groups. There are several notable differences across characteristics. First, the KCS students are two-and-one-half years older than the comparison students, on average. Second, the KCS students are less likely to be married with children (16 vs. 29 percent), even though the shares with dependents overall are similar.

Third, KCS students have higher EFCs, indicating marginally higher financial resources. Perhaps the largest difference, however, is that KCS adults are much more likely to be African American (64 vs. 23 percent) and less likely to be either white (23 vs. 55 percent) or Latinx (6 vs. 13 percent).

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[6] These students must have enrolled in the fall term, although they may or may not have enrolled at the same institution in the spring term.

[7] We asked each of the five campuses whether they had retained the same set of comparison students used for the first-year analysis, but only one answered affirmatively. Thus, we treat this second-year request as an independent sample of comparison students.

Table A.1 Characteristics of KCS C1 Adult Learners and Controls, Before and After Matching (Year 2)

	All eligible individuals		After coarsened exact matching		+ After kernel matching	
	Treated	Controls	Treated	Controls	Treated	Controls
Female	0.743	0.706	0.714	0.662	0.714	0.714
White	0.229	0.548***	0.254	0.616***	0.254	0.206
African American	0.643	0.229***	0.651	0.327***	0.651	0.730
Hispanic/Latino	0.057	0.134**	0.048	0.016	0.048	0.048
Other/unknown	0.071	0.089	0.048	0.042	0.048	0.016
Married w/ kids	0.157	0.287***	0.111	0.137	0.111	0.127
Married w/o kids	0.029	0.030	0.032	0.009	0.032	0.000
Single, dependents	0.429	0.353	0.476	0.450	0.476	0.492
Single, no depndts	0.371	0.329	0.381	0.404	0.381	0.381
Missing family status	0.014	0.002	0.000	0.000	0.000	0.000
Age	36.8	34.2**	36.0	33.6**	36.0	36.3
EFC ($)	2347	1605*	2362	1661	N/A[a]	N/A[a]
Zero EFC	**0.507**	**0.574**	0.492	0.585	0.492	0.603
$1–$2,000 EFC	0.174	0.164	0.175	0.146	0.175	0.079
$2,001–$5,000 EFC	0.087	0.139	0.095	0.137	0.095	0.095
$5,001+ EFC	0.232	0.123**	0.238	0.132*	0.238	0.223
Sample size	70	677	63	453	63	453

NOTE: The table shows demographic characteristics of KCS Cohort 1 adult learners and anonymous individuals used as possible controls; all are drawn from the five campuses with the greatest number of adult learners (see text for details). The first pair of data columns includes all individuals who meet the minimum requirements for eligibility—they are at least age 24, had enrolled in college previously, and had completed the FAFSA with an EFC of no more than $12,000—and who were enrolled in the fall of 2017. The second pair of data columns includes individuals who could be matched, treatment to control, within cells defined by age group (25–44, 45–64, 65+), race/ethnicity (as shown in the table), and household structure (as shown in the table). The third pair of data columns shows characteristics of the analytic sample, which applies kernel-weighted matching techniques to individuals in the second pair of columns to find the best set of controls for each KCS adult learner according to propensity score. * significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level.

[a] EFC is entered as a categorical variable during kernel matching; thus means are not calculated.

To the extent that any of these differences in characteristics are also correlated with college outcomes, comparing the two groups may not yield the true impact of the KCS scholarship. To make the groups more comparable, we implement a two-step matching procedure. The first step involves a process called coarsened exact matching, or CEM.[8] This process creates cells based on several characteristics of the "treated" group—in this case, KCS adults. We define cells based on all combinations of sex, age groups (24–44, 45-64, 65 and older), racial groups (white, African American, Hispanic/Latino, and other), and household structure groups (married with kids, married without kids, single with dependents, single without dependents, and another category for those with missing information).[9] For example, one such cell would be women who were between the ages of 24 and 44, were African American, and were single without dependents. CEM ensures that there is at least one "treated" (KCS

[8] See Iacus, King, and Porro (2012).
[9] We infer household structure from the reported number of adults and dependents in the household.

adult) and at least one "control" (comparison student) in each cell; cells that contain treated individuals but no control individuals, or vice versa, or are completely empty, are flagged as incomplete and are excluded from subsequent analysis.[10] In this way, we are more confident that the controls are good counterfactual comparisons for the treated.

Not all KCS adults or comparison students are in overlapping cells: 63 of 70 KCS adults and 453 of 677 comparison students qualify according to the procedure. The distribution of characteristics of the individuals selected by CEM are shown in the middle columns of Table A.1. Although there are still large differences between the groups for race/ethnicity and age, the differences by household structure have narrowed and some are no longer statistically significant. Moreover, the exclusion of seven individuals from the KCS adults sample did not appreciably affect the distribution of characteristics, as can be seen by comparing the first and third columns. Thus, there should be little concern that the sample used for the analysis is not representative of all KCS adults at the five campuses.

The second step of the matching procedure applies a technique called kernel matching to the KCS adults and comparison students selected by CEM. Kernel matching is a form of propensity score matching, which uses observable characteristics to predict the likelihood of being in the treated group (e.g., KCS adults) for both KCS adults and the comparison students. The statistical technique yields a propensity score between 0 and 1 for all individuals, and the intuition is that individuals with propensity scores close to one another are more similar. If every treated individual is compared to the control (comparison) individual with the closest propensity score, the approach is called "nearest-neighbor matching." If every treated individual is instead compared to the k control individuals with the closest proximity score, where k is a positive integer, the approach is called "k-nearest-neighbor matching." Generally, a larger k results in a more precisely estimated treatment effect, but since some of the comparisons are not as close of a match, the estimate may be biased. Kernel matching tries to improve on this tradeoff by using multiple control individuals but giving more weight to the controls with the propensity scores closest to the treated individual.

To calculate the propensity score, we use several of the characteristics from the CEM procedure, including the intersection of sex, race/ethnicity, and household structure, but we also incorporate a quartic polynomial in age and categorical EFC groupings, including an EFC of $0, $1–$2,000, $2,001–$5,000, and $5,001–$12,000. After the propensity score is calculated and the kernel weights applied, one can compare the characteristics again between the 63 KCS adults and the 453 matched comparison students, as shown in the last pair of columns in Table A.1.[11] By weighting the control group, all remaining differences in characteristics—notably the differences in age and race/ethnicity from the preceding column pairs—are now small and statistically insignificant. Put differently, the characteristics between the two groups are now balanced, which should give credence for the matching estimates that compare the postsecondary outcomes between the two groups.

In Table A.2, we show that the kernel-matching estimates are robust to alternative matching estimators, including nearest-neighbor (especially when multiple neighbors are used) and Mahalanobis matching, which finds neighbors based on standardized differences in characteristics rather than on a propensity score.

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[10] We attempted to also include the campus in the CEM cells, but some campuses had too few KCS adults to allow for viable comparisons when the other characteristics were also included.

[11] To calculate the propensity scores and the matching treatment effects of the KCS program, we use the Stata command -psmatch2- (Leuven and Sianesi 2003).

Table A.2 KCS C1 Adult Learner Results: Robustness to Different Matching Techniques

	Kernel		1 nearest neighbor		5 nearest neighbors		1 NN Mahalanobis		5 NN Mahalanobis	
	Effect	SE	Effect	SE	Effect	SE	Effect	SE	Effect	SE
Enrolled: Fall 2018	0.284***	(0.069)	0.175*	(0.098)	0.260***	(0.072)	0.333***	(0.091)	0.283***	(0.070)
Full-time: Fall 2018	0.177***	(0.063)	0.127	(0.082)	0.162**	(0.065)	0.143*	(0.085)	0.165**	(0.065)
Enrolled: Spring 2019	0.234***	(0.073)	0.143	(0.101)	0.216***	(0.079)	0.238**	(0.097)	0.200***	(0.072)
Full time: Spring 2019	0.163***	(0.058)	0.175**	(0.069)	0.175***	(0.060)	0.159**	(0.074)	0.165***	(0.058)
Credits attempted: F18	3.458***	(0.822)	2.381**	(1.053)	3.451***	(0.812)	3.222***	(1.058)	3.421***	(0.800)
Credits earned: F18	2.596***	(0.732)	1.646*	(0.996)	2.654***	(0.753)	2.281**	(0.971)	2.431***	(0.742)
Credits attempted: S19	2.701***	(0.836)	1.944*	(1.091)	2.592***	(0.874)	2.754***	(1.015)	2.697***	(0.784)
Credits earned: S19	2.531***	(0.762)	2.112**	(1.019)	2.486***	(0.796)	2.779***	(0.924)	2.493***	(0.746)
GPA: Fall 2018	−0.148	(0.163)	0.005	(0.224)	−0.085	(0.166)	−0.114	(0.172)	−0.220	(0.145)
GPA: Spring 2019	0.109	(0.271)	−0.255	(0.412)	0.032	(0.311)	0.384	(0.370)	0.418	(0.416)
Continuous enroll: F17–S19	0.220***	(0.072)	0.111	(0.100)	0.216***	(0.076)	0.254**	(0.100)	0.232***	(0.078)
Continuous FT enroll: F17–S19	0.063	(0.051)	0.079	(0.066)	0.064	(0.052)	0.048	(0.066)	0.070	(0.053)
Earned credential: F17–S19	0.009	(0.069)	0.079	(0.091)	−0.013	(0.073)	0.079	(0.096)	0.006	(0.073)
Earned AA/BA: F17–S19	0.038	(0.067)	0.111	(0.086)	0.041	(0.071)	0.127	(0.089)	0.048	(0.070)

NOTE: The table displays the impact of KCS on adult learners for the same outcomes shown in Figures 1 through 3, but for alternative matching techniques. The matching technique used in Figures 1 through 3, kernel matching, is shown in the first pair of data columns; the effects correspond to the difference between treated and matched control students, and standard errors are shown in parentheses. The next four pairs of columns show the alternative matching techniques: single nearest neighbor based on propensity score, five nearest neighbors based on propensity score, single nearest neighbor based on Mahalanobis distance, and five nearest neighbors based on Mahalanobis distance. For explanations of these techniques, please see the text. * significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level.

Cohort 2. For the second cohort of adults, using the same approach that was just described yielded 1,116 comparison students for the 113 KCS adult awardees[12]. However, we learned that not all comparison students actually met the eligibility criteria. Due to some confusion about the age criterion, about one-fifth of the students provided by the five campuses were younger than 24. Since age was one of the requested characteristics, along with other demographics intended for the matching procedure, we could impose the age criterion ourselves, and when we did so, we were left with 825 comparison students.

Table A.3 Characteristics of KCS C2 Adult Learners and Controls, Before and After Matching

	All eligible individuals		After coarsened exact matching		+ After kernel matching	
	Treated	Controls	Treated	Controls	Treated	Controls
Female	0.912	0.733***	0.908	0.933	0.916	0.911
White	0.150	0.489***	0.147	0.323***	0.149	0.151
African American	0.646	0.239***	0.661	0.349***	0.654	0.643
Hispanic/Latino	0.053	0.122***	0.046	0.139***	0.047	0.049
Other/unknown	0.150	0.151	0.147	0.189	0.150	0.157
Married w/ kids	0.186	0.248	0.193	0.319***	0.196	0.205
Married w/o kids	0.009	0.051***	0.009	0.008	0.010	0.009
Single, dependents	0.575	0.311***	0.596	0.476**	0.607	0.591
Single, no depndts	0.195	0.382***	0.202	0.196	0.187	0.195
Missing family status	0.035	0.009	0.000	0.000	0.000	0.000
Age	38.4	32.6***	38.6	34.5***	38.0	38.2
EFC ($)	1562	1843	1562	1261	N/A[a]	N/A[a]
Zero EFC	**0.642**	**0.560***	0.642	0.675	0.645	0.632
$1–$2,000 EFC	0.092	0.141	0.092	0.113	0.093	0.088
$2,001–$5,000 EFC	0.128	0.140	0.128	0.113	0.122	0.140
$5,001+ EFC	0.138	0.160	0.138	0.099	0.140	0.140
Sample size	113	825	109	504	109	504

NOTE: The table shows demographic characteristics of KCS Cohort 2 adult learners and anonymous individuals used as possible controls; all are drawn from the five campuses with the greatest number of adult learners (see text for details). The first pair of data columns includes all individuals who meet the minimum requirements for eligibility—they are at least age 24, had enrolled in college previously, and had completed the FAFSA with an EFC of no more than $12,000—and who were enrolled in the fall of 2018. The second pair of data columns includes individuals who could be matched, treatment to control, within cells defined by age group (25–44, 45–64, 65+), race/ethnicity (as shown in the table), and household structure (as shown in the table). The third pair of data columns shows characteristics of the analytic sample, which applies kernel-weighted matching techniques to individuals in the second pair of columns to find the best set of controls for each KCS adult learner according to propensity score. * significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level.

[a] EFC is entered as a categorical variable during kernel matching; thus means are not calculated.

These 113 KCS students and 825 comparison students formed the basis for our matching procedure. The first two columns of Table A.3 compare the characteristics of these two groups. Although their measures of financial need are quite similar, with an average EFC of between $1,500 and $1,900, there

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[12] One of the awardees was deleted from analysis because her EFC exceeded $12,000.

are several notable differences across other demographics. First, the KCS students are five years older than the comparison students, on average. Second, the KCS students are more likely to have dependents (76 vs. 56 percent), but much less likely to be married (20 vs. 30 percent) and more likely to be single parents (58 v. 31 percent). Third, and perhaps the largest difference, KCS adults are much more likely to be African American (65 vs. 24 percent) and less likely to be either white (15 vs. 49 percent) or Latinx (5 vs. 12 percent). The KCS awardees are also more likely to be women (91 vs. 73 percent).

The sample size reductions that occurred with the coarsened exact matching resulted in 109 of 113 KCS adults and 504 of 825 comparison students "qualifying" for the kernel matching. The distribution of characteristics of the individuals selected by CEM are shown in the middle columns of Table A.3. Although there are still large differences between the groups for race/ethnicity and age, the differences by household structure and sex have narrowed and some are no longer statistically significant. Moreover, the exclusion of four individuals from the KCS adults sample did not appreciably affect the distribution of characteristics, as can be seen by comparing the first and third columns. Thus, again, there should be little concern that the sample used for the analysis is not representative of all KCS adults at the five campuses.

The second step of the matching procedure applied kernel matching—described above—to the KCS adults and comparison students selected by CEM. After the propensity score is calculated and the kernel weights applied, one can compare the characteristics again between the 109 KCS adults and the 504 matched comparison students, as shown in the last pair of columns in Table A.3. By weighting the control group, all remaining differences in characteristics—notably the differences in age and race/ethnicity from the preceding column pairs—are now small and statistically insignificant. Put differently, the characteristics between the two groups are now balanced, which should give credence for the matching estimates that compare the postsecondary outcomes between the two groups.

In Table A.4, we show that the kernel-matching estimates are robust to alternative matching estimators, including nearest-neighbor (especially when multiple neighbors are used) and Mahalanobis matching.

Table A.4 KCS C2 Adult Learner Results: Robustness to Different Matching Techniques

	Kernel		1 nearest neighbor		5 nearest neighbors		1 NN Mahalanobis		5 NN Mahalanobis	
	Effect	SE	Effect	SE	Effect	SE	Effect	SE	Effect	SE
Full time: Fall 2018	0.133**	(0.056)	0.101	(0.080)	0.117*	(0.061)	0.147*	(0.085)	0.105*	(0.059)
Enrolled: Spring 2019	0.139***	(0.048)	0.193**	(0.078)	0.134**	(0.054)	0.202***	(0.069)	0.147***	(0.053)
Full time: Spring 2019	0.123**	(0.053)	0.138*	(0.071)	0.134**	(0.056)	0.138*	(0.072)	0.123**	(0.054)
Full time: Spring 2019, if enrolled	0.116*	(0.064)	0.136	(0.082)	0.109	(0.067)	0.112	(0.081)	0.088	(0.068)
Credits attempted: F18	0.303	(0.463)	0.120	(0.710)	−0.015	(0.514)	0.306	(0.701)	0.072	(0.484)
Credits earned: F18	−0.421	(0.518)	−0.065	(0.815)	−0.378	(0.573)	0.343	(0.696)	−0.370	(0.533)
Credits attempted: S19	1.283**	(0.554)	1.317	(0.850)	1.394**	(0.601)	1.881**	(0.882)	1.353**	(0.591)
Credits earned: S19	0.535	(0.581)	0.894	(0.864)	0.675	(0.623)	1.083	(0.887)	0.619	(0.625)
Credits att.: S19, if enr.	0.078	(0.464)	1.068*	(0.576)	0.126	(0.494)	0.124	(0.687)	−0.299	(0.490)
Credits earn.: S19, enr.	−0.631	(0.605)	0.455	(0.735)	−0.465	(0.646)	−0.303	(0.869)	−0.966	(0.638)
GPA: Fall 2018	−0.339***	(0.127)	−0.399**	(0.161)	−0.366***	(0.135)	−0.559***	(0.154)	−0.404***	(0.128)
GPA: Spring 2019	−0.113	(0.105)	−0.067	(0.126)	−0.156	(0.103)	−0.159	(0.123)	−0.152	(0.099)

NOTE: The table displays the impact of KCS on adult learners for the same outcomes shown in Figures 4 through 6, but for alternative matching techniques. The matching technique used in Figures 4 through 6, kernel matching, is shown in the first pair of data columns; the effects correspond to the difference between treated and matched control students, and standard errors are shown in parentheses. The next four pairs of columns show the alternative matching techniques: single nearest neighbor based on propensity score, five nearest neighbors based on propensity score, single nearest neighbor based on Mahalanobis distance, and five nearest neighbors based on Mahalanobis distance. For explanations of these techniques, please see the text. * significant at the 0.10 level; ** significant at the 0.05 level; *** significant at the 0.01 level.