# Supplement to "Making summer matter: The impact of youth employment on academic performance"

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## Appendix A: Nonidentification of dosage effect

Consider a standard potential outcomes model in which there are three possible "dosages" of SYEP participation: $p = 0, 1, 2$ for 0, 1, or 2 times participating, respectively.[1] Potential outcomes for each state $p$ are given by

$$Y_p = \delta_p + U_p, \tag{1}$$

where by normalization $E(U_p) = 0$ for all $p$. The average effect of participating in SYEP once (relative to never participating) is given by $\delta_1 - \delta_0$, and the average effect of participating twice (versus once) is given by $\delta_2 - \delta_1$.

We define a *Dosage Effect* as

$$DE_{21} = (Y_2 - Y_1) - (Y_1 - Y_0)$$

and, therefore, the average dosage effect is $ADE_{21} = (\delta_2 - \delta_1) - (\delta_1 - \delta_0)$. We are interested in testing the whether $ADE_{21} = 0$. Rejecting this restriction with a positive (negative) $ADE_{21}$ would be evidence of supermodularity (submodularity) in SYEP participation: Students who participate twice enjoy a larger (smaller) effect of the second participation.

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[1] Although we do consider three-time applicants in the main analyses, here we restrict our attention to participating at most twice. The point at hand is made no clearer by considering higher "dosages."

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Next, consider attempting to identify $ADE_{21}$ using the data generated by SYEP. For simplicity, we assume full compliance (winning the lottery implies participation). Let $W_p = 1$ denote winning the $p^{\text{th}}$ lottery and 0 otherwise, and let $A_p = 1$ denote applying to the $p^{\text{th}}$ lottery with 0 otherwise. We can identify at least two local effects with the following estimands:

$$\beta_1 = E(Y \mid W_1 = 1, A_1 = 1) - E(Y \mid W_1 = 0, A_1 = 1), \tag{2}$$

$$\beta_2 = E(Y \mid W_2 = 1, W_1 = 1, A_2 = 1, A_1 = 1) - E(Y \mid W_2 = 0, W_1 = 1, A_2 = 1, A_1 = 1). \tag{3}$$

As seen below, $\beta_1$ and $\beta_2$ correspond to the average treatment effects of the first and second lottery for Groups 1 and 2, respectively, defined in the main text (see equation (5)). Group 1 of first time appliers who have never participated and Group 2 who apply twice after having won and participated once.

$\beta_2$ may be written as

$$\begin{aligned}
\beta_2 &= E(Y_2 \mid W_2 = 1, W_1 = 1, A_2 = 1, A_1 = 1) - E(Y_1 \mid W_2 = 0, W_1 = 1, A_2 = 1, A_1 = 1) \\
&= \delta_2 + E(U_2 \mid W_2 = 1, W_1 = 1, A_2 = 1, A_1 = 1) \\
&\quad - \left\{\delta_1 + E(U_1 \mid W_2 = 0, W_1 = 1, A_2 = 1, A_1 = 1)\right\} \\
&= (\delta_2 - \delta_1) + E(U_2 - U_1 \mid W_1 = 1, A_2 = 1, A_1 = 1),
\end{aligned}$$

where the last equality is given by lottery randomization, which implies that $E(U_p \mid W_p = 1, \cdot) = E(U_p \mid W_p = 0, \cdot)$ for all $p$ (and conditioning variables prior to $p$). Therefore, $\beta_2$ does indeed identify the average treatment effect of winning the second lottery for Group 2. $(\delta_2 - \delta_1)$ is the average effect of participating twice relative to once, and $E(U_2 - U_1 \mid W_1 = 1, A_2 = 1, A_1 = 1)$ is the selection effect for Group 2, who apply twice after having won and participated once.

In general, the application decision is likely endogenous, and so

$$E(U_2 - U_1 \mid W_1 = 1, A_2 = 1, A_1 = 1) \neq E(U_2 - U_1) = 0.$$

Therefore, comparing the outcomes of the second lottery winners and losers in Group 2 does not identify the average effect of participating twice over once. Further, we see from decomposing $\beta_1$ that

$$\beta_1 = (\delta_1 - \delta_0) + E(U_1 - U_0 \mid A_1 = 1).$$

The difference in these two estimands identifies

$$\begin{aligned}
\beta_2 - \beta_1 = (\delta_2 - \delta_1) - (\delta_1 - \delta_0) &+ E(U_2 - U_1 \mid W_1 = 1, A_2 = 1, A_1 = 1) \\
&- E(U_1 - U_0 \mid A_1 = 1).
\end{aligned}$$

And it is clear that assuming that the selection terms are equal in magnitude is extremely stringent and unlikely to obtain. We conclude that the average dosage effect is not identified.

## Appendix B: Additional tables

Table B.1. Lottery randomization results by covariate.

| | Win Coef | SE |
|---|---|---|
| Female | −0.004 | 0.003 |
| White | 0 | 0.001 |
| Asian | −0.003 | 0.001 |
| Black | 0.002 | 0.002 |
| Hispanic | 0 | 0.002 |
| Free lunch | −0.004 | 0.003 |
| Reduced lunch | 0.002 | 0.002 |
| LEP | 0.001 | 0.001 |
| ESL not LEP | 0.001 | 0.001 |
| Spec ed | 0.003 | 0.002 |
| Grade 8 | −0.001 | 0.002 |
| Grade 9 | 0.002 | 0.003 |
| Grade 10 | 0.002 | 0.003 |
| Grade 11 | −0.001 | 0.002 |
| Alt grade | −0.001 | 0.001 |
| Age | −0.006 | 0.007 |
| Zread | −0.003 | 0.005 |
| Zmath | −0.005 | 0.005 |

*Note*: Point estimates and hetereoskedastic robust standard errors (clustered at student level) for separate regressions of each student covariate on full set of indicators for winning each lottery (2005–2008).

Table B.2. Likelihood of winning SYEP lottery by matching to DOE data.

| | Matched | Not Matched | Total |
|---|---|---|---|
| 2005 | 63.7 | 64.0 | 63.7 |
| 2006 | 60.8 | 61.2 | 60.9 |
| 2007 | 50.5 | 51.1 | 50.7 |
| 2008 | 48.5 | 48.0 | 48.4 |

*Note*: Applications to vulnerable youth programs, programs based out of the city, or programs with a greater than 99% or less than 0% selection rate are omitted.

TABLE B.3. Probability of being matched to DOE data (2006–2008).

| | *Dependent Variable:* |
|---|---|
| | Matched |
| Select | 0.003 |
| | (0.003) |
| CBO × year FE? | Y |
| Grade FE? | Y |
| Observations | 120,817 |
| $R^2$ | 0.037 |

*Note*: Heteroskedastic robust standard errors clustered at the lottery-level. Grade is last grade before application which includes 7–12th grade and an additional category for alternative programs. Sample includes all unmatched applications to SYEP in years 2006–2008 and all first-time applicants in those years. 2005 is excluded since we cannot see applications made before 2005 and thus we cannot distinguish first-time applicants from repeat applicants in 2005.

TABLE B.4. Attrition in year following application.

| Grade | Frac Attrite Winners | Frac Attrite Losers | Frac Attrite All | N Applications |
|---|---|---|---|---|
| 8 | 2.8 | 2.9 | 2.8 | 20,855 |
| 9 | 4.1 | 4.5 | 4.3 | 50,613 |
| 10 | 2.5 | 2.8 | 2.6 | 42,227 |
| 11 | 4.1 | 4.0 | 4.1 | 23,327 |
| Alt. program | 31.7 | 30.8 | 31.2 | 1137 |
| Total | 3.6 | 3.9 | 3.8 | 138,159 |

*Note*: Attrition is defined as not appearing in NYCDOE administrative data in the year following the SYEP lottery. Main analyses condition on nonattrition, so number of analyzed applications is mechanically smaller than total presented here. Sample includes all applications for students expected to be in high school following SYEP. Applications are omitted if the student submits multiple applications or in ungraded special education following SYEP. Applications to vulnerable youth programs, programs based out of the city, or programs with a greater than 99% or less than 0% selection rate are omitted.

TABLE B.5. Impact of winning lottery on attrition (2006–2009).

| | *Dependent Variable:* | | | | | |
|---|---|---|---|---|---|---|
| | 8th Grade (1) | 9th Grade (2) | 10th Grade (3) | 11th Grade (4) | Alt Program (5) | All Grades (6) |
| Select | 0.0003 | −0.001 | 0.001 | 0.0003 | 0.026 | 0.0003 |
| | (0.002) | (0.002) | (0.002) | (0.003) | (0.033) | (0.001) |
| CBO × year FE? | Y | Y | Y | Y | Y | Y |
| Cohort FE? | Y | Y | Y | Y | Y | Y |
| Grade FE? | N | N | N | N | N | Y |
| Observations | 20,855 | 50,613 | 42,227 | 23,327 | 1137 | 138,159 |
| $R^2$ | 0.037 | 0.021 | 0.032 | 0.040 | 0.207 | 0.038 |

*Note*: Outcome variable is attrition in years 2006–2009. Attrition is defined as not appearing in DOE administrative data in the year following the SYEP lottery. Main analyses condition on nonattrition, so number of analyzed applications is mechanically smaller than total presented here. Sample includes all applications for students expected to be in high school following SYEP. Applications are omitted if the student submits multiple applications or in ungraded special education following SYEP. Applications to vulnerable youth programs, programs based out of the city, or programs with a greater than 99% or less than 0% selection rate are omitted.

TABLE B.6. Fraction of NYC DOE students attempting at least one regents exam 2006–2009.

| Grade | Fraction |
|---|---|
| 8 | 12.8 |
| 9 | 50.4 |
| 10 | 76.9 |
| 11 | 84.3 |
| 12 | 53.3 |
| Alt. program | 17.7 |

*Note*: NYC DOE students include all students with nonmissing grades who appear in administrative data.

TABLE B.7. Comparing ITT effect size.

| | Any Attempt | N. Attempts | Any Pass 65 | N. Pass 55 | N. Pass 65 | N. Pass 75 | ZScore |
|---|---|---|---|---|---|---|---|
| Panel A: ITT estimates | | | | | | | |
| Select | 0.004 | 0.021 | 0.007 | 0.026 | 0.018 | 0.007 | 0.008 |
| Black | 0.011 | −0.007 | −0.019 | −0.067 | −0.123 | −0.204 | −0.149 |
| Free Lunch | −0.036 | −0.079 | −0.053 | −0.105 | −0.115 | −0.078 | −0.074 |
| Zread | 0.001 | −0.002 | 0.051 | 0.092 | 0.171 | 0.221 | 0.245 |
| Panel B: SYEP effect/Covariate coefficient | | | | | | | |
| Perc black | 0.369 | 3.004 | 0.383 | 0.380 | 0.148 | 0.037 | 0.052 |
| Perc free lunch | 0.111 | 0.261 | 0.137 | 0.243 | 0.158 | 0.096 | 0.105 |
| Perc Zread | 4.772 | 10.901 | 0.144 | 0.278 | 0.107 | 0.034 | 0.032 |

*Note*: For each outcome, the percent of covariate effect (Panel B) is defined as the ITT effect of SYEP divided by the absolute value of the coefficient on a given covariate in the estimated ITT model.

TABLE B.8. Comparing TOT effect size.

| | Any Attempt | N. Attempts | Any Pass 65 | N. Pass 55 | N. Pass 65 | N. Pass 75 | ZScore |
|---|---|---|---|---|---|---|---|
| Panel A: ITT estimates | | | | | | | |
| Worked | 0.005 | 0.026 | 0.009 | 0.033 | 0.023 | 0.010 | 0.010 |
| Black | 0.011 | −0.008 | −0.019 | −0.069 | −0.124 | −0.205 | −0.150 |
| Free lunch | −0.036 | −0.079 | −0.053 | −0.105 | −0.115 | −0.078 | −0.074 |
| Zread | 0.001 | −0.002 | 0.051 | 0.092 | 0.171 | 0.221 | 0.245 |
| Panel B: SYEP effect/Covariate coefficient | | | | | | | |
| Perc black | 0.485 | 3.345 | 0.484 | 0.480 | 0.189 | 0.047 | 0.066 |
| Perc free lunch | 0.143 | 0.336 | 0.177 | 0.313 | 0.204 | 0.124 | 0.132 |
| Perc Zread | 6.095 | 14.351 | 0.185 | 0.358 | 0.137 | 0.044 | 0.040 |

*Note*: For each outcome, the percent of covariate effect (Panel B) is defined as the TOT effect of SYEP divided by the absolute value of the coefficient on a given covariate in the estimated TOT model.

TABLE B.9A. Heterogeneous treatment-on-the-treated estimates.

| | *Dependent Variable:* | | | | | | |
|---|---|---|---|---|---|---|---|
| | Any Attempt | N. Attempts | Any Pass 65 | N. Pass 55 | N. Pass 65 | N. Pass 75 | ZScore |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Worked | −0.024 | −0.121 | 0.042 | −0.111 | −0.083 | −0.103 | 0.081 |
| | (0.055) | (0.151) | (0.055) | (0.138) | (0.122) | (0.093) | (0.105) |
| Worked × Female | 0.005 | 0.038 | 0.005 | 0.034 | 0.023 | 0.011 | −0.004 |
| | (0.006) | (0.019) | (0.006) | (0.017) | (0.015) | (0.011) | (0.011) |
| Worked × Black | −0.012 | −0.017 | −0.019 | 0.007 | 0.015 | 0.015 | −0.008 |
| | (0.017) | (0.051) | (0.018) | (0.049) | (0.046) | (0.040) | (0.030) |
| Worked × Asian | −0.002 | −0.024 | −0.015 | −0.003 | 0.015 | 0.028 | −0.026 |
| | (0.018) | (0.056) | (0.019) | (0.055) | (0.052) | (0.048) | (0.033) |
| Worked × Hispanic | −0.001 | 0.002 | −0.008 | 0.036 | 0.049 | 0.043 | 0.016 |
| | (0.017) | (0.053) | (0.018) | (0.050) | (0.047) | (0.041) | (0.031) |
| Worked × Free lunch | 0.007 | −0.027 | −0.003 | −0.042 | −0.030 | 0.026 | −0.010 |
| | (0.010) | (0.032) | (0.011) | (0.030) | (0.027) | (0.022) | (0.018) |
| Worked × Red lunch | 0.010 | −0.036 | −0.008 | −0.062 | −0.041 | 0.048 | −0.017 |
| | (0.013) | (0.041) | (0.014) | (0.039) | (0.036) | (0.030) | (0.023) |
| Worked × LEP | −0.007 | −0.006 | −0.021 | −0.034 | −0.060 | −0.035 | −0.065 |
| | (0.022) | (0.084) | (0.028) | (0.076) | (0.068) | (0.049) | (0.048) |
| Worked × ESL not LEP | −0.013 | 0.030 | −0.003 | 0.106 | 0.055 | −0.051 | 0.069 |
| | (0.030) | (0.098) | (0.030) | (0.086) | (0.075) | (0.054) | (0.062) |
| Worked × Spec ed | 0.016 | 0.046 | 0.033 | 0.063 | 0.054 | 0.012 | 0.048 |
| | (0.011) | (0.033) | (0.011) | (0.028) | (0.023) | (0.015) | (0.024) |
| Worked × Age | 0.002 | 0.009 | −0.001 | 0.009 | 0.006 | 0.003 | −0.003 |
| | (0.003) | (0.008) | (0.003) | (0.008) | (0.007) | (0.005) | (0.006) |
| Worked × Zread | 0.019 | 0.049 | 0.010 | 0.024 | 0.024 | 0.025 | −0.004 |
| | (0.005) | (0.015) | (0.005) | (0.013) | (0.012) | (0.010) | (0.009) |
| Worked × Zmath | −0.006 | 0.017 | 0.001 | 0.011 | 0.003 | −0.014 | −0.003 |
| | (0.005) | (0.015) | (0.005) | (0.013) | (0.012) | (0.010) | (0.009) |
| CBO × year FE? | Y | Y | Y | Y | Y | Y | Y |
| Cohort FE? | Y | Y | Y | Y | Y | Y | Y |
| Grade FE? | Y | Y | Y | Y | Y | Y | Y |
| Observations | 134,366 | 134,366 | 134,366 | 134,366 | 134,366 | 134,366 | 96,200 |
| $R^2$ | 0.06 | 0.064 | 0.133 | 0.117 | 0.169 | 0.214 | 0.325 |

*Note*: Heteroskedastic robust standard errors clustered at the student-level. Students in 12th grade, below 8th grade, and in ungraded special education are excluded. Cohort is an indicator for the year of first application to SYEP interacted with the grade of the student when first applied. There are 24 unique cohorts in the sample. Limited English Proficiency (LEP) is determined by score on the Language Assessment Battery exam. Zread and Zmath are 8th grade state test scores, standardized by grade and year of administration. Grade is current grade level in school, which includes 8–11th grade and an additional category for alternative specialized programs (e.g., GED programs).

TABLE B.9B. Joint test of treatment interactions.

| | Any Attempt | N. Attempts | Any Pass 65 | N. Pass 55 | N. Pass 65 | N. Pass 75 | ZScore |
|---|---|---|---|---|---|---|---|
| F-Stat | 1.635 | 2.537 | 1.364 | 1.558 | 1.392 | 1.180 | 1.311 |
| P-Value | 0.052 | 0.001 | 0.149 | 0.071 | 0.135 | 0.275 | 0.179 |

*Note*: F-statistics and p-values from test of joint restriction that all treatment-by-covariate coefficients are zero.

TABLE B.10. Expected benefit moments-apply less nonapply.

| | Any Attempt | N. Attempts | Any Pass 65 | N. Pass 55 | N. Pass 65 | N. Pass 75 | ZScore |
|---|---|---|---|---|---|---|---|
| Avg. EB | −0.522 | −0.497 | −0.089 | −0.061 | 0.135 | −0.056 | 0.35 |
| | (−7.404, 6.679) | (−3.126, 0.827) | (−0.678, 0.377) | (−0.786, 0.574) | (−0.834, 1.42) | (−7.38, 4.857) | (−0.272, 1.621) |
| P01 EB | −0.119 | −0.114 | −0.237 | −0.376 | −0.436 | −0.202 | −0.498 |
| | (−0.375, 0.032) | (−0.374, 0.03) | (−0.515, 0.051) | (−0.562, 0.027) | (−0.505, 0.02) | (−0.422, 0.012) | (−0.629, −0.091) |
| P10 EB | 0.108 | 0.112 | −0.354 | −0.195 | −0.377 | −0.204 | −0.778 |
| | (−0.5, 0.226) | (−0.344, 0.217) | (−2.997, 0.271) | (−1.268, 0.221) | (−1.463, 0.091) | (−1.205, 0.166) | (−2.229, −0.261) |
| P50 EB | −0.845 | −0.644 | −0.117 | −0.061 | 0.016 | −0.249 | 0.019 |
| | (−9.061, 7.301) | (−6.317, 3.2) | (−1.119, 0.208) | (−0.836, 0.42) | (−1.324, 0.688) | (−4.478, 5.173) | (−1.296, 1.007) |
| P90 EB | −0.111 | −0.118 | −0.136 | −0.134 | −0.065 | −0.097 | −0.034 |
| | (−0.497, 0.011) | (−0.426, 0.002) | (−0.515, 0.028) | (−0.404, 0.02) | (−0.316, 0.041) | (−0.406, 0.018) | (−0.302, 0.123) |
| P99 EB | −0.114 | −0.12 | −0.137 | −0.147 | −0.052 | −0.07 | −0.118 |
| | (−0.255, −0.014) | (−0.27, −0.025) | (−0.268, −0.012) | (−0.338, −0.012) | (−0.293, 0.002) | (−0.319, 0.035) | (−0.425, 0.017) |

*Note*: Estimate presented is moment computed on appliers less that computed on nonappliers, expressed as a percentage of applier moment. Bootstrap 95% percentile intervals in parentheses. For each outcome, expected benefit (EB) is the predicted treatment effect of SYEP given student covariates and the 2SLS estimates of heterogeneous treatment effects by student covariates. Bootstrap standard errors in parentheses are calculated with 1000 bootstrap iterations, block clustered at the student level.

TABLE B.11A. 90th–10th EB quantile differential in mean covariates (appliers).

| | Any Attempt | N. Attempts | Any Pass 65 | N. Pass 55 | N. Pass 65 | N. Pass 75 | ZScore |
|---|---|---|---|---|---|---|---|
| Age | 0.189 | 0.364 | −0.645 | 0.685 | 0.276 | 0.337 | −0.525 |
| | (0.163, 0.215) | (0.338, 0.39) | (−0.674, −0.616) | (0.659, 0.712) | (0.248, 0.304) | (0.31, 0.364) | (−0.553, −0.496) |
| Asian | 0.199 | 0.193 | 0.034 | −0.004 | −0.007 | 0.035 | −0.384 |
| | (0.192, 0.207) | (0.185, 0.201) | (0.027, 0.042) | (−0.012, 0.004) | (−0.015, 0.001) | (0.028, 0.042) | (−0.393, −0.376) |
| Black | −0.614 | −0.406 | −0.486 | −0.43 | −0.463 | −0.534 | 0.04 |
| | (−0.623, −0.605) | (−0.417, −0.396) | (−0.497, −0.476) | (−0.44, −0.419) | (−0.473, −0.452) | (−0.543, −0.524) | (0.028, 0.052) |
| ESL not LEP | −0.041 | 0.016 | −0.007 | 0.135 | 0.083 | −0.091 | 0.127 |
| | (−0.044, −0.037) | (0.013, 0.019) | (−0.01, −0.004) | (0.13, 0.141) | (0.078, 0.087) | (−0.096, −0.086) | (0.121, 0.132) |
| Female | 0.454 | 0.634 | 0.278 | 0.7 | 0.563 | 0.433 | −0.205 |
| | (0.443, 0.464) | (0.625, 0.644) | (0.267, 0.289) | (0.692, 0.709) | (0.553, 0.572) | (0.423, 0.444) | (−0.217, −0.194) |
| Free lunch | −0.009 | −0.265 | −0.016 | −0.193 | −0.175 | 0.012 | 0.02 |
| | (−0.021, 0.003) | (−0.277, −0.252) | (−0.028, −0.004) | (−0.206, −0.181) | (−0.187, −0.162) | (−0.002, 0.026) | (0.009, 0.031) |
| Hispanic | 0.319 | 0.118 | 0.276 | 0.419 | 0.501 | 0.588 | 0.324 |
| | (0.309, 0.329) | (0.108, 0.128) | (0.266, 0.287) | (0.409, 0.429) | (0.491, 0.511) | (0.579, 0.598) | (0.314, 0.335) |
| LEP | −0.029 | −0.046 | −0.253 | −0.155 | −0.245 | −0.085 | −0.27 |
| | (−0.034, −0.024) | (−0.05, −0.042) | (−0.26, −0.245) | (−0.161, −0.148) | (−0.252, −0.238) | (−0.09, −0.08) | (−0.277, −0.262) |
| Red lunch | 0.128 | 0.003 | −0.122 | −0.187 | −0.134 | 0.389 | −0.109 |
| | (0.119, 0.137) | (−0.006, 0.012) | (−0.131, −0.113) | (−0.195, −0.178) | (−0.143, −0.126) | (0.378, 0.4) | (−0.118, −0.1) |
| Spec ed | 0.12 | −0.004 | 0.561 | 0.257 | 0.27 | 0.044 | 0.781 |
| | (0.114, 0.127) | (−0.01, 0.002) | (0.553, 0.569) | (0.25, 0.265) | (0.262, 0.277) | (0.037, 0.051) | (0.774, 0.788) |
| Zmath | 0.91 | 2.075 | 1.052 | 1.358 | 1.203 | 0.049 | −1.525 |
| | (0.886, 0.933) | (2.055, 2.095) | (1.026, 1.077) | (1.333, 1.383) | (1.177, 1.228) | (0.024, 0.074) | (−1.563, −1.486) |
| Zread | 2.497 | 2.611 | 1.776 | 1.801 | 1.947 | 1.626 | −1.686 |
| | (2.478, 2.516) | (2.595, 2.628) | (1.75, 1.803) | (1.776, 1.827) | (1.921, 1.972) | (1.601, 1.651) | (−1.73, −1.642) |

*Note*: Displayed are differences in mean covariates between between top and bottom deciles of expected benefit: $E[X \mid \text{EB quantile} = 90, \text{outcome} = Y] - E[X \mid \text{EB quantile} = 10, \text{outcome} = Y]$. 95% confidence intervals in parentheses. Appliers only.

TABLE B.11B. 90th–10th EB quantile differential in mean covariates (nonappliers).

| | Any Attempt | N. Attempts | Any Pass 65 | N. Pass 55 | N. Pass 65 | N. Pass 75 | ZScore |
|---|---|---|---|---|---|---|---|
| Age | 0.152 | 0.661 | −1.318 | 1.38 | 0.524 | 1.014 | −0.954 |
| | (0.14, 0.164) | (0.648, 0.674) | (−1.331, −1.305) | (1.367, 1.392) | (0.511, 0.537) | (1, 1.028) | (−0.97, −0.939) |
| Asian | 0.129 | 0.089 | −0.142 | −0.141 | −0.144 | −0.03 | −0.4 |
| | (0.127, 0.132) | (0.087, 0.092) | (−0.145, −0.14) | (−0.144, −0.138) | (−0.147, −0.141) | (−0.033, −0.028) | (−0.403, −0.398) |
| Black | −0.521 | −0.38 | −0.331 | −0.242 | −0.173 | −0.233 | 0.01 |
| | (−0.524, −0.518) | (−0.383, −0.377) | (−0.334, −0.328) | (−0.245, −0.239) | (−0.176, −0.171) | (−0.236, −0.23) | (0.007, 0.013) |
| ESL not LEP | −0.099 | 0.046 | −0.026 | 0.378 | 0.208 | −0.208 | 0.373 |
| | (−0.101, −0.097) | (0.045, 0.048) | (−0.027, −0.024) | (0.375, 0.381) | (0.206, 0.21) | (−0.211, −0.206) | (0.371, 0.376) |
| Female | 0.417 | 0.582 | 0.267 | 0.565 | 0.488 | 0.405 | −0.11 |
| | (0.414, 0.421) | (0.579, 0.585) | (0.263, 0.271) | (0.561, 0.568) | (0.484, 0.491) | (0.402, 0.409) | (−0.114, −0.106) |
| Free lunch | −0.121 | −0.444 | −0.298 | −0.231 | −0.272 | 0.031 | −0.05 |
| | (−0.126, −0.116) | (−0.449, −0.44) | (−0.302, −0.293) | (−0.235, −0.226) | (−0.276, −0.268) | (0.025, 0.036) | (−0.054, −0.046) |
| Hispanic | 0.111 | −0.024 | −0.033 | 0.346 | 0.382 | 0.578 | 0.326 |
| | (0.108, 0.115) | (−0.028, −0.021) | (−0.036, −0.029) | (0.343, 0.35) | (0.379, 0.386) | (0.574, 0.581) | (0.322, 0.329) |
| LEP | −0.092 | −0.124 | −0.604 | −0.437 | −0.615 | −0.173 | −0.64 |
| | (−0.094, −0.09) | (−0.126, −0.122) | (−0.607, −0.601) | (−0.44, −0.434) | (−0.618, −0.612) | (−0.175, −0.17) | (−0.643, −0.637) |
| Red lunch | 0.123 | −0.009 | −0.069 | −0.164 | −0.095 | 0.373 | −0.049 |
| | (0.12, 0.126) | (−0.012, −0.006) | (−0.072, −0.066) | (−0.167, −0.161) | (−0.098, −0.093) | (0.368, 0.377) | (−0.052, −0.047) |
| Spec ed | 0.093 | 0.006 | 0.393 | 0.174 | 0.214 | 0.039 | 0.545 |
| | (0.091, 0.095) | (0.004, 0.008) | (0.391, 0.396) | (0.172, 0.176) | (0.212, 0.217) | (0.037, 0.041) | (0.542, 0.548) |
| Zmath | 0.926 | 2.16 | 1.448 | 1.372 | 1.178 | −0.247 | −0.314 |
| | (0.917, 0.935) | (2.152, 2.167) | (1.438, 1.458) | (1.361, 1.382) | (1.167, 1.188) | (−0.257, −0.237) | (−0.326, −0.301) |
| Zread | 2.798 | 2.856 | 2.464 | 2.13 | 2.364 | 1.606 | −0.485 |
| | (2.791, 2.805) | (2.85, 2.863) | (2.454, 2.474) | (2.118, 2.142) | (2.352, 2.375) | (1.596, 1.617) | (−0.531, −0.438) |

*Note*: Displayed are differences in mean covariates between between top and bottom deciles of expected benefit: $E[X \mid \text{EB quantile} = 90, \text{outcome} = Y] - E[X \mid \text{EB quantile} = 10, \text{outcome} = Y]$. 95% confidence intervals in parentheses. Nonappliers only.

TABLE B.12. Joint test of zero treatment effect on outcomes 1–6.

| | Full Sample | Group 1 | Group 2 | Group 3 |
|---|---|---|---|---|
| F-Stat | 2.731 | 1.322 | 2.511 | 1.102 |
| P-Value | 0.012 | 0.243 | 0.020 | 0.359 |

*Note*: For each group, statistics generated from F-test of joint restriction that treatment effect is zero for all outcomes other than average Z-score. Average Z-score is omitted as students who attempt no exams have no defined average score. Group 1 consists of all first-time applicants in years 2006–2008. Group 2 is all students who applied for the second time in 2006–2008 and had applied, won, and participated in the prior year. Group 3 is all students who applied for the third time in 2006–2008 and had applied, won, and participated in each of the two years prior. Full Sample is identical to that analyzed in Tables 6–7.

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