IABA
INTERNATIONAL ASSOCIATION OF BLACK ACTUARIES

Assessment of IABA's Scholarship & Boot Camp Programs: An Empirical Analysis

Core Research Team:

Stephen Abrokwah, Ph.D., FSA, CERA, MAAA, IABA Director, VP & Marketing Actuary - Swiss Re

A. Nii-Armah Okine, Ph.D. Candidate, University of Wisconsin-Madison

Ama Kissiwaa Ampadu-Kissi, ASA, Investment Analyst – Prudential

Isaac Owusu, ASA, Actuarial Senior Analyst – Cigna

Other Contributors:

Eliphelet Asare, Actuarial Senior Analyst – Cigna
Charles Amponsah, Graduate Teaching Asst. – University of Nevada-Reno

IABA Board Oversight:

Stephen Abrokwah, Ph.D., FSA, CERA, MAAA, IABA Director, VP & Marketing Actuary - Swiss Re

Kate Weaver, IABA Executive Director

Acknowledgments

We would like to express our profound gratitude to the Corporate Advisory Council and the Board of the IABA for their input and feedback throughout the research process. A special thanks also goes to a number of Scholarship and Boot Camp winners who assisted in the data collection process and early stages of this research.

Executive Summary

The mission of the International Association of Black Actuaries (IABA) is to contribute to an increase in the number of Black actuaries and to influence their successful career development, and civic growth. Since 1992, the organization has sought to achieve this goal through its many programs and partnerships. Two popular programs that have especially been helpful to the student membership of the IABA are the Scholarship and Boot Camp programs. This study evaluates how these IABA programs have impacted students' exam progress and their ability to secure a job or internship, relative to a control group who did not benefit from any of these programs. Overall, the study results show that benefiting from these programs led to an increase in the number of exams passed as well as the likelihood of securing a job or internship. Between the respective programs, either receiving a Scholarship or both Scholarship and Boot Camp participation resulted in more exam passes compared to just participating in the Boot Camp, which is partly due to the focus of the Boot Camp program and the type of candidates it attracts. There was however no statistically significant differences when it comes to securing a job or internship.

Assessment of IABA's Scholarship & Boot Camp Programs: An Empirical Analysis

1. Introduction

Since IABA's first meeting over 25 years ago, the organization has sought to increase the number of credentialed Black actuaries and advance the personal and professional development of its members. Among the IABA's tools for achieving its goals have been the annual Scholarship and Boot Camp programs. The Scholarship program provides different levels of financial assistance to college and graduate student members of the IABA. The goal of the program is to address the financial needs of applicants to assist in covering tuition and education costs, as well as to offer motivation for progress with their actuarial exams. The Boot Camp program, on the other hand, aims at providing an avenue for students and career changers to get help with preparing for the job market and learning about the actuarial industry. This is accomplished by providing various workshops addressing topics like resume building, interviewing skills, communication and presentation skills and exposure to real world actuarial work through case studies.

This study evaluates the impact of the Scholarship and Boot Camp programs (IABA programs) on students' exam progress and their ability to secure a job, relative to a control group who did not benefit from any of these programs.

Previous research on such program impacts have found mixed results with the impact of scholarship programs on student's success. For example, Wolf et al. (2008) studied the impact of the DC Opportunity Scholarship Program after 2 years, and found that though overall parent satisfaction went up, there wasn't a statistically significant difference between outcomes of those who were offered scholarships and the control group. On the other hand, Nagle (2014) found in his study on the Ron Brown Scholar program that current Scholars from the program had much higher impact in professional and community service relative to the control group.

2. Data and Descriptive Statistics

This study uses data collected through the end of 2017. At the end 2017, a total of 173 and 135 IABA Scholarship recipients and Boot Camp participants respectively had benefited from IABA programs. Of these, 30 students benefited from both programs. For the Scholarship program, 46 of the 173 received the Scholarship more than once, and there were no

repeat participants for the Boot Camp program.

This study, however, focuses on the period, 2012-2017 to create a comparable set of data since the Boot Camp was instituted in 2012, while the Scholarship dates back to 1992. This creates a total sample size of 200, made up of 69 Scholarship recipients, 30 Boot Camp participants, 31 who benefited from both, and 70 control group. To be able to assess the impact of IABA's programs, we need a reference group for persons who have not benefited from any of these programs to compare against. To do so, we constructed a control group within the IABA membership between the same year period who had never benefited from any of these programs. The control group had similar characteristics as the treatment group and most had applied for one or both programs in the past.

Data for this study leveraged multiple sources of information, including data collected from the IABA's historical database, survey and interview results from program participants and research from other databases and social media.

Figure 1 provides a graphical illustration of the distribution of total exam passed by study participants, exams passed before applying for IABA programs and exams passed after participating in IABA programs by treatment/control groups. The treatment group refers to Scholarship recipients or both Scholarship recipients and Boot Camp participants and the control group refers to non-participants of IABA programs (unsuccessful applicants). From the box and whisker plots, it's clear from the diagram that people in the treatment group had more exams passed compared to the control group and a two-sample Wilcoxon tests confirm this (results not shown here). In addition, Figure 2 plots the total exam passed by study participants, exams passed before applying for IABA programs and exams passed after participating in IABA programs, but this time across the three IABA program options. The plot shows that Scholarship recipients and those who benefited from both programs had more exams passed relative to the Boot Camp participants.

Both the Scholarship and Boot Camp programs have provided participants an avenue to secure their first internship or entry-level role. For some respondents, benefiting from these programs enhanced their resume, as recruiters placed a high regard on IABA's recognition, whether it be a Scholarship award or completion of the Boot Camp. Figure 3 provides a bar chart for whether the study participant obtained an actuarial internship or entry-level job by treatment/control groups and by program types. The top panel plots a bar chart for securing an internship/job by treatment and control groups. It suggests that people in the treatment group secured more job or internship positions compared to the control group. Also, the bottom panel plots a bar chart for securing an internship/job, but across the three program types to highlight the differences in outcome between the

program types. The plot shows that Scholarship recipients and those who benefited from both programs secured more internship or entry-level job positions relative to the Boot Camp participants.

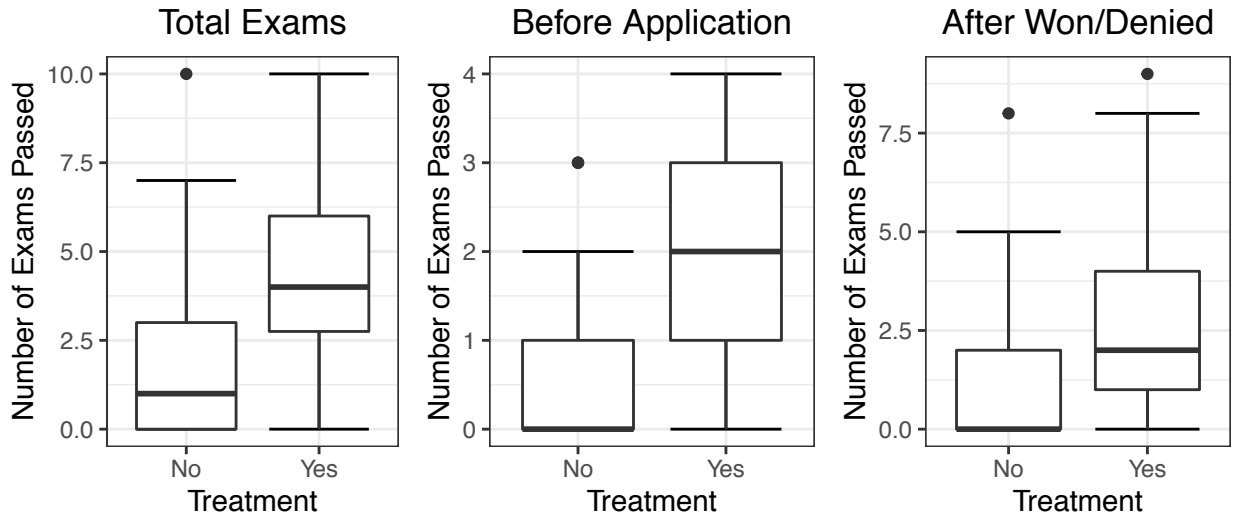

Figure 1: Graphical illustration of the distribution of total exam passed by study participants(left), exams passed before applying for IABA programs (center) and exams passed after participating in or denied IABA programs (right) by treatment/control groups.

Figure 4 shows a graph for actuarial designations (ASA, ACAS, FSA, FCAS, or CERA) attained by the various groups (Boot Camp only, Scholarship only, Both Boot Camp and Scholarship, and the control group) as of the end of 2017. The chart shows that Scholarship recipients had the most designations, with 30% of all designations being Scholarship recipients who had attained ASA. Another 10% each of the Scholarship recipients had attached a CERA and FSA respectively. Individuals who had benefited from both programs came in next with the most credentials. Out of all designees, 10% of the both category had attained their ASA credential. It's clear that the control group had fewer people with credentials compared to the treatment group, particularly when compared to the Scholarship recipients. Finally, the Boot Camp participants had the least proportion of people with credentials, which can be explained by the focus of the Boot Camp program and the stages that these candidates are in their actuarial profession pursuit. To clarify these statistics does not focus on the timing of when they got the credential, whether before they benefited from the IABA program or not, though most of these designations happened after their first participation. Overall, from our survey results, approximately 10% of these IABA program participants who had not yet attained their designation had decided to either change direction to pursue other career paths or take a break from taking exams and were not currently pursuing a designation. Some of the reasons these individ-

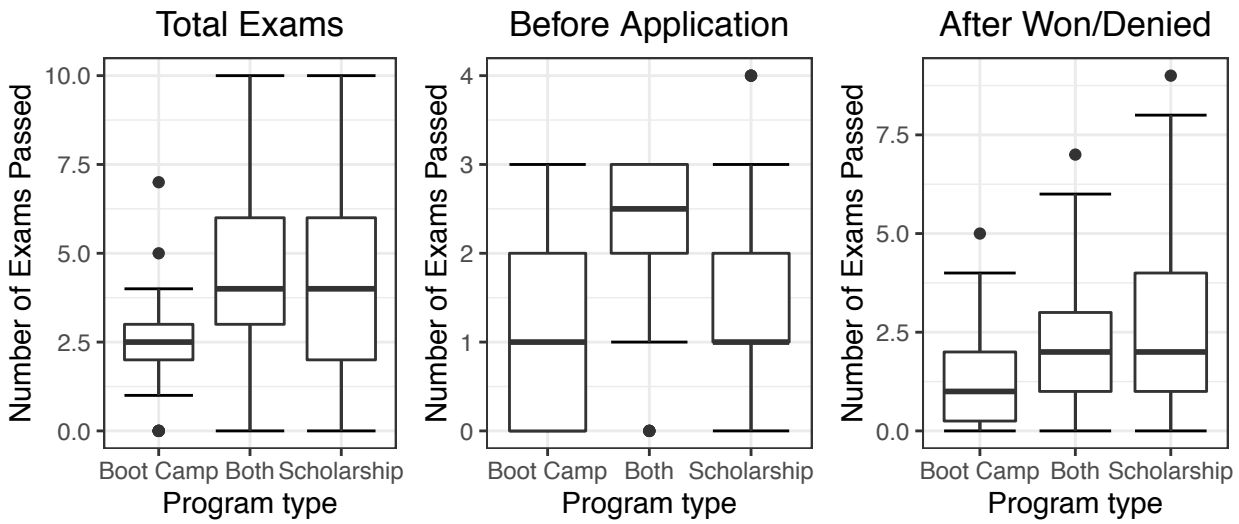

Figure 2: Graphical illustration of the distribution of total exam passed by study participants(left), exams passed before applying for IABA programs (center) and exams passed after participating in or denied IABA programs (right) by IABA program options.

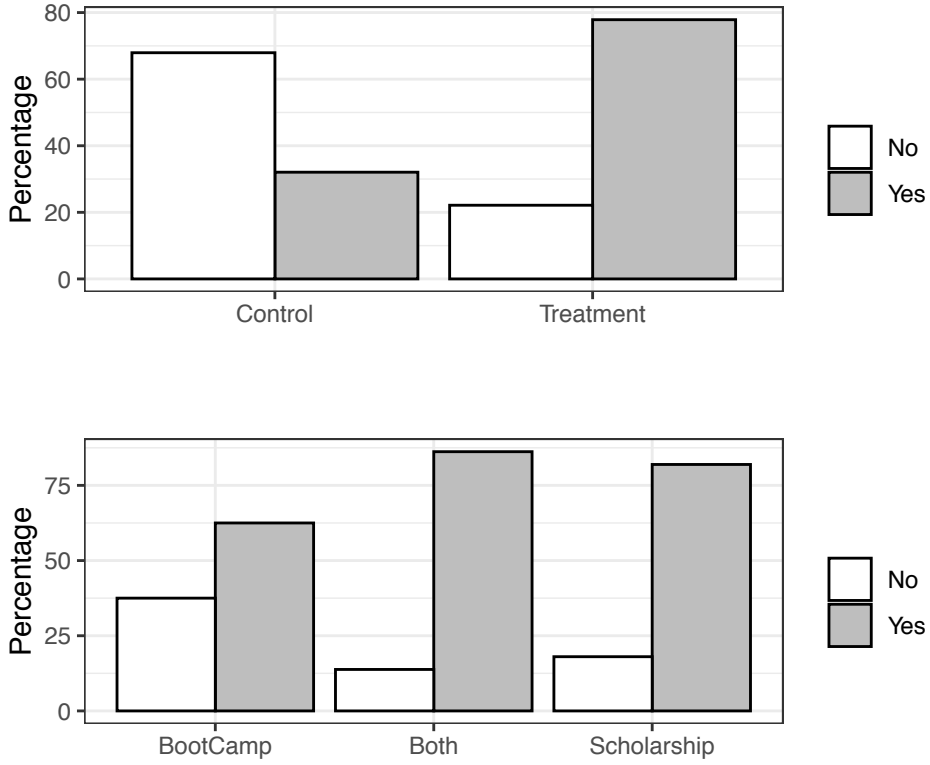

Figure 3: Distribution of whether the study participant obtained an actuarial internship or entry level job .

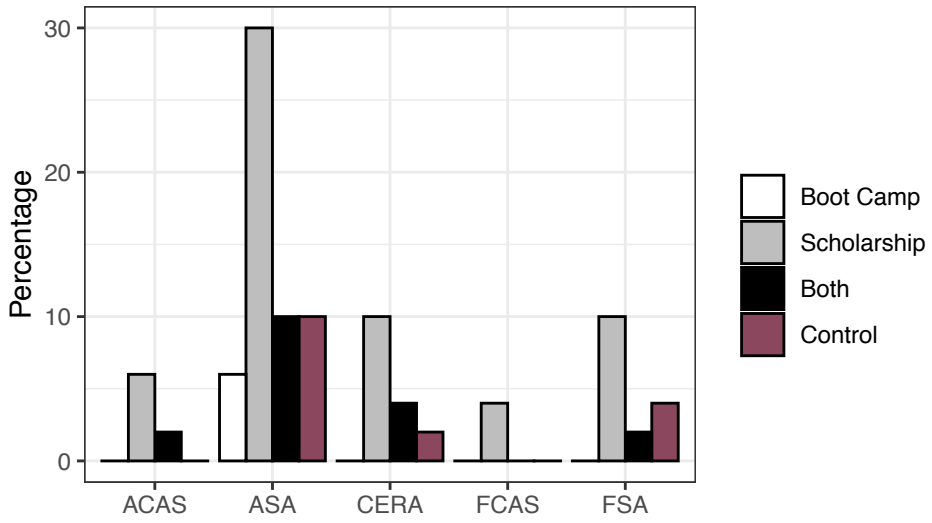

Figure 4: Distribution of designations from IABA program participants and control group.

uals cited included: difficulty in passing exams; difficulty in securing a job (possibly due to visa status); or receiving competitive offers from other industries like Data Science, Data Analytics, Biostatistics, Financial Analyst, etc. There were also a few examples of people who had paused to pursue a Doctoral degree in various quantitative fields, like Statistics, Data Science, Economics, Actuarial Science, etc.

We would like to highlight our constraint of a limited sample size for the analysis. As noted at the beginning of the section, we only had 200 people in our sample for the empirical analysis which was further broken down for various sub analysis.

3. Empirical Strategy

This study seeks to answer two questions: 1) Does benefiting from IABA's programs lead to an increase the number of exams passes, all else equal? and 2) Do IABA's program participants have a higher likelihood of securing an internship or a job relative to the control group? We estimate four models, two for each question to investigate the questions from multiple dimensions. For each question, we study the impact of IABA programs (Scholarship, Boot Camp or both) relative to the control group as well as the differences in impact between the different program options.

Table 1 describes the covariate information and the dependent variables used in the model building.

Table 1: Description of variables

Variable	Description
SchoBene	This is a binary variable indicating whether the study participant is a beneficiary of the IABA scholarship program (Scholarship recipient or both Scholarship and Boot Camp participation)
EducLevel	A Categorical variable of the education level of study participant. (Bachelors, Masters, Ph.D.)
CAEschool	A binary variable indicating whether the study participant's university is on the list of SOA center of actuarial excellence schools
Residency	A binary variable indicating whether the study participant was a citizen or permanent resident in US/Canada
Gender	Gender of study participant
ExamsPassed	Total number of exams passed by study participant
ExamsPassedBefore	Number of exams passed by study participant before applying for IABA programs
	Dependent Variables
ExamsPassedAfter	Number of exams passed by study participant after successful or unsuccessful application to IABA programs
ActInternJob	A binary variable indicating whether the study participant received an actuarial full time job or internship offer during school or after graduation

3.1 Effect of IABA Programs on Exam Passes

3.1.1 Treatment Verses Control Group

To examine effect of the programs by IABA on exam passing rate, the authors estimate an ordinary least squares regression model with the functional form:

$$ExamsPassedAfter_i = \alpha + B_e SchoBene_i + \lambda_e Z_i + \epsilon_i, \tag{1}$$

where B_e is the effect of being a participant of the IABA programs on the number of actuarial exams passed after controlling for other covariates Z_i. Here, Z_i is a vector of explanatory variables with a corresponding vector of coefficients λ_e. Also, ϵ_i is the error term for the ith observation. The model in equation 1 evaluates the number of exams passed after successful or unsuccessful application to IABA programs as a function of being in the treatment/control group, controlling for other individual and program characteristics. The the main explanatory variable or treatment is IABA's programs combined (Scholarship or both =1, Control group =0) represented by *SchoBene*. Other key explanatory variables controlled for include gender, education level, whether an individual had a job or internship, residency status, and whether an applicant attended a school that was an actuarial center of excellence. If B_e is not statistically significant, it can be inferred that the programs do not influence the average number of exams a participant passes. In

contrast, if $B_e < 0$ and statistically significant, it implies that average number of exams participant passes are negatively associated with the IABA programs. Finally, if $B_e > 0$ and statistically significant, then it implies that the programs are positively associated with the number of exams participant passes.

3.1.2 Differences Between IABA Program Types

We also examine the variation in exam passes among participant of the various IABA programs. The estimated model here is equivalent to that in equation 1. As before, the outcome variable is exam passes after successful application to IABA programs, and the same control variables apply, with the exception that the reference group is Boot Camp only participants.

3.2 Effect of IABA Programs on Likelihood of Securing a Job or Internship

3.2.1 Treatment Verses Control Group

Let $e_i = 1$ represent securing an internship or an entry level position. Then, to evaluate the likelihood of securing an internship or an entry level position due to IABAs programs, the authors estimate a logistic regression model of the form:

$$\Pr(e_i = 1) = \pi(B_p SchoBene_i + \lambda_p Z_i) = \frac{1}{1 + \exp(-(B_p SchoBene_i + \lambda_p Z_i))}. \tag{2}$$

Thus, B_p represents the change in the logit of the probability of securing an internship or an entry level position due to IABAs programs holding all other predictors Z_i constant. Similar to the model in equation 1, in the logistic regression model in equation 2, IABA's programs combined (Scholarship or both =1, Control group =0) as the main explanatory variable. Also, the control variables are similar to that in equation 1 except that the total number of exams passed is now a covariate. If B_p is not statistically significant, it can be inferred that participating in IABA programs does not influence the likelihood of securing an internship or an entry level position. In contrast, if $B_p < 0$ and statistically significant, it implies that the likelihood of securing an internship or an entry level position are negatively associated with participating in the IABA's programs. Finally, if $B_p > 0$ and statistically significant, then it implies that the programs are positively associated with the likelihood of securing an internship or an entry level position.

3.2.2 Differences Between IABA Program Types

Furthermore, we examine the variation in the likelihood of securing an internship or a job among participants of the various IABA programs. Here, the estimated model is equivalent to that in equation 2. Again, the outcome variable is securing an internship or an entry level position, and the same control variables apply, with the exception that the reference group is Boot Camp only participants.

3.3 Issue of Randomization & Endogeneity

Randomized control trials are usually considered the gold standard for estimating the effects of treatments or interventions on study outcomes. Without randomization, we usually run into an econometric issue known as endogeneity, and in this case endogeneity between IABA's programs and the study outcomes (exam passes and securing a job or internship). There are a number of sources of endogeneity including, omitted variable bias, simultaneity, and self-selection. In this study, the main concern is selection into IABA programs. Among IABA members, why do some receive a Scholarship or participate in the Boot Camp and others do not? Two potential sources of selection: 1. Students with certain characteristics are more likely to apply 2. Students with certain characteristics are more likely to be awarded these programs. These characteristics could include hardworking, ambitious, talented, high gpa etc. In either case (or even in both cases), it is possible that these features led to their success (study outcomes), and not the program. Random treatment (awarding a Scholarship or being selected to participate in the Boot Camp) assignments would have ensured that these programs will not be confounded with either measured or unmeasured outcomes. To address the effects of confounding (endogeneity) and systematic differences in baseline characteristics between the treatment and control groups, we employ the propensity score matching technique. The propensity score, as defined by Rosenbaum and Rubin (1983a) is the applicant's probability of receiving a treatment (Scholarship or Boot Camp) conditional on measured covariates. The propensity score here ensures that a comparable set of data is created such that the distribution of measured covariates is similar between the treatment and control groups. Put differently, the propensity score matching technique forms a matched set of treatment and control subjects who have comparable values of the propensity score (Austin, 2011), thereby addressing any possible bias in estimates and enable causal inferences.

For an applicant to be awarded a scholarship, the scholarship committee generally needs evidence of an exam attempt or a pass, among other characteristics. As a result, we estimate the propensity score using a logistic regression model in equation 3, in which

treatment status is regressed on observed baseline characteristics including actuarial exams passed at the time of application. Let $s_i = 1$ represent receiving a scholarship. Then we have:

$$\Pr(s_i = 1) = \pi(\gamma W_i) = \frac{1}{1 + \exp(-(\gamma W_i))} \tag{3}$$

Here, W_i is a vector of explanatory variables with a corresponding vector of coefficients γ. The key explanatory variables controlled for include exams passed before application into program, gender, education level,residency status, and whether an applicant attended a school that was an actuarial center of excellence. We use the Nearest Neighbor one-to-one matching technique where a treated subject is first selected at random. The applicants in the control group whose propensity score is closest to that of this randomly selected treated subject is then chosen for matching to this treated subject.

Left panel of Figure 5 shows a non-parametric density estimate of the distribution of the estimated propensity for treated and untreated applicants separately. The chart shows that applicants who did not receive the scholarship(control group) tended to have lower propensity scores. Since the applicants matched on the propensity score tend to have the same distribution of observed covariates, this figure provides further evidence that treatment assignment was confounded with observed covariates. Matching on the logit of the propensity score using calipers equal to 0.2 standard deviations of the logit of the propensity score resulted in the creation of 140 matched pairs of treated and untreated applicants. Thus, for 30 treated applicants, no suitable control was found. The right panel of Figure 5 depicts non-parametric density estimates of the distribution of the propensity score within the matched sample for treated and untreated applicants separately. One observes that matching on the propensity score resulted in a matched sample that is well balanced in terms of the propensity score. In addition, Figure 6, shows the non-parametric density estimate of the distribution of the estimated propensity when the control group is the Boot Camp participants. Again, it's clear that the technique resulted in a better matched set after matching relative to before matching.

3.4 Issue of Multicollinearity

To ensure there wasn't any issue with multicollinearity between the predictor variables, we tested using variance inflation factors, and got the generalized variance inflation factors (GVIF) for each of the of the variables significantly less than 10 (results available upon request), which is the threshold number. Hence, we are able to establish that there is no presence of multicollinearity

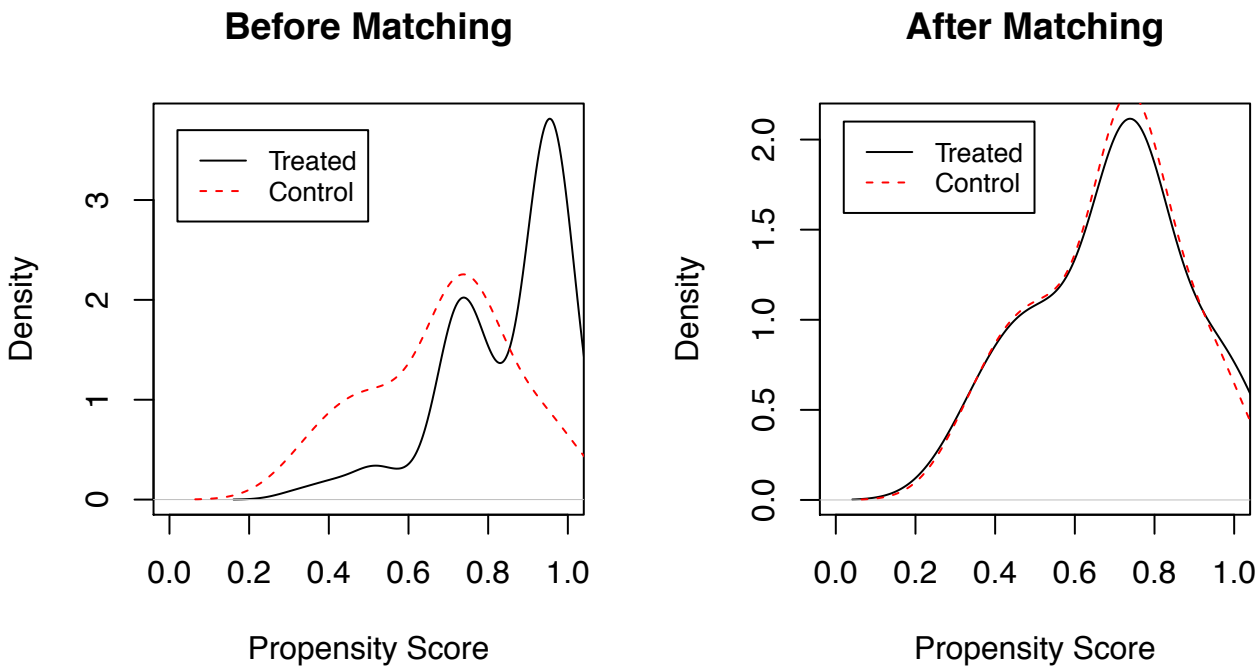

Figure 5: Distribution of propensity score in treated and control group. Control group is unsuccesful scholarship applicants.

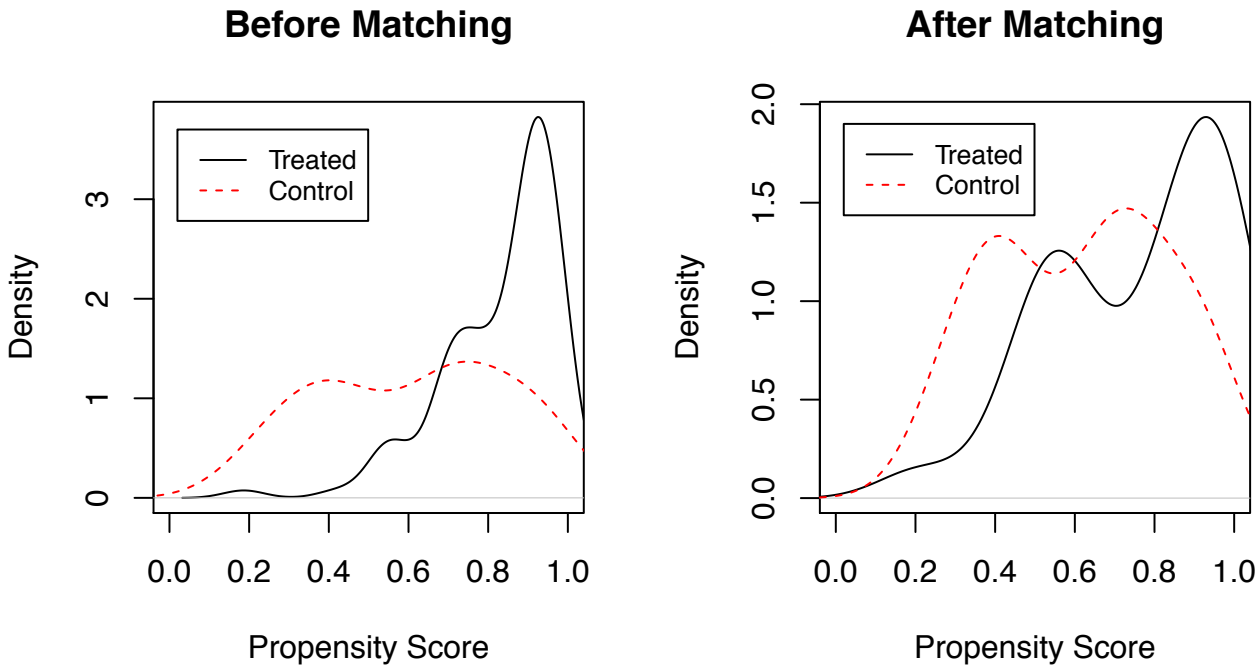

Figure 6: Distribution of propensity score in treated and control group. Control group is Boot Camp participants.

4. Results

We show results of the effect of IABA's programs on target outcomes (exam passes and ability to secure an internship or a job), controlling for individual and program characteristics and address the issue of randomization (self-selection) to be able to establish causal inferences.

4.1 Effect of IABA Programs on Exam Passes

Table 2 contains results for model 1, which estimates the effect of IABA's programs on the number of exam passes. The table shows the parameter coefficient estimates, with robust standard errors and an indication of the level of statistical significance shown in the number of the asterisks. Results show that benefiting from IABA's programs leads to between one to two extra exam passes relative to the control group and is statistically significant at the 5% significance level. Of the control variables, having a previous internship, attending a school that was designated an actuarial center of excellence, and pursuing a PhD program also lead to an increase in the exam passes at a statistically significant level. Coefficients for gender and Candidate residency status came in as not statistically significant.

Table 2: Estimation results evaluating effect of IABA Programs on Exam Passes(treatment verses control group)

Variable	Coef	Std Err.
Intercept	0.466	0.782
SchoBene	1.659	0.634**
GenderM	-0.443	0.542
EducLevelDoctorate	2.977	0.832***
EducLevelMasters	0.176	0.601
ActInternJobYes	2.294	0.627***
CAEschoolYes	1.233	0.524*
ResidencyYes	0.204	0.622

significance at 0.01, 0.05, and 0.10 levels indicated by ***, **, and * respectively.

To test the hypothesis that the impact of IABA program types are heterogeneous, we estimated a model similar to equation 1 with the exception that the reference group is Boot Camp only participants. Results from Table 3 shows that relative to Boot Camp only participants, individuals who benefited from the Scholarship program or both programs had 1 more exams. This is intuitive given the different candidates attracted to

these programs. For example, there are several new entrants to the profession in the Boot Camp group as well as career changers who are yet to commence their actuarial career pursuit compared to the Scholarship group. Again, having a previous internship or job and attending a school with center of actuarial excellence lead to increased outcomes at statistically significant levels.

Table 3: Estimation results evaluating effect of IABA Programs on Exam Passes (between IABA program types: reference group is Boot Camp only participants)

Variable	Coef	Std Err.
Intercept	1.506	0.618**
SchoBene	0.885	0.445**
GenderM	0.006	0.542
EducLevelDoctorate	0.093	0.674
EducLevelMasters	-0.079	0.507
ActInternJobYes	1.273	0.418***
CAEschoolYes	0.913	0.485*
ResidencyYes	-0.983	0.473**
significance at 0.01, 0.05, and 0.10 levels indicated by ***, **, and * respectively.		

4.2 Effect of IABA Programs on Likelihood of Securing a Job or Internship

An important part of IABA's mission is to influence the successful career development of Black actuaries. Model 2 addresses this question by estimating the effect of the IABA programs on the likelihood of securing a job or internship. Estimation results from the model in equation 2 is given in Table 4. Here, we present the parameter estimates and standard errors of the main variable of interest (*SchoBene*) and other covariates. The coefficient for *SchoBene*, $B_p = 1.842$, is significant at a 5% significance level. The results mean that compared to non-participants, the odds for participants of IABA programs to secure an internship or an entry level position is significantly higher. Also, the odds of securing an actuarial internship or job increases by 112% ($\exp(0.75) - 1 = 1.12$) with the passing of one more actuarial exams. Furthermore, the odds of securing an actuarial job reduces for doctoral students compared to bachelor degree holders.

In addition, results from the estimation results from the model in equation 2 when reference group is Boot Camp only participants is given in Table 5. We present the parameter estimates and standard errors of the main variable of interest (*SchoBene*) and other covariates. We do not find differences in outcomes between the various programs when it comes to who is likely to secure a job or internship. The coefficient for *SchoBene*,

$B_p = -1.052$, is not statistically significant. The results suggest that on average Boot Camp and Scholarship program participants are equally likely to secure an internship or a job.

Table 4: Estimation results evaluating effect of IABA programs on likelihood of securing a job or internship (treatment verses control group)

Variable	Coef	Std Err.
Intercept	-3.736	1.868**
SchoBene	1.842	0.876**
GenderM	0.875	0.989
EducLevelDoctorate	-15.956	1.650***
EducLevelMasters	0.905	0.933
ExamsPassed	0.750	0.242***
CAEschoolYes	-0.750	1.013
ResidencyYes	-0.281	0.964

significance at 0.01, 0.05, and 0.10 levels indicated by ***, **, and * respectively.

Table 5: Estimation results evaluating effect of IABA programs on likelihood of securing a job or internship (between IABA program types: reference group is Boot Camp only participants)

Variable	Coef	Std Err.
Intercept	0.257	1.116
SchoBene	-1.052	0.710
GenderM	0.749	0.776
EducLevelDoctorate	-17.749	1.157***
EducLevelMasters	-0.317	0.787
ExamsPassed	0.703	0.262***
CAEschoolYes	-0.843	0.820
ResidencyYes	-0.484	0.765

significance at 0.01, 0.05, and 0.10 levels indicated by ***, **, and * respectively.

5. Conclusion

This research evaluated how two of IABA's prominent programs, Scholarship and Boot Camp have contributed to some of IABA's goals, i.e., increase in the number of exam passes and assistance to secure entry level roles and internships. The study uses data collected between 2012 and 2017 to construct a treatment and a control group.

Overall, the study results show that benefiting from these programs led to an increase in number of exams passed as well as the likelihood of securing a job or internship. Between the different programs, either receiving a Scholarship or both Scholarship and Boot Camp participation led to passing more exams compared to just participating in the Boot Camp, though there wasn't any variation between these programs when it comes to securing a job or internship.

In conclusion, results from this study suggests that these IABA programs (Scholarship and Boot Camp) needs be expanded to be able to have an even greater impact. The programs has shown to impact the desired outcomes and objectives of the IABA.

References

Austin, P. 2011. "An Introduction to Propensity Score Methods for Reducing the Effects of Confounding in Observational Studies." *Multivariate Behavioral Research* 46(3):399–424.

Nagle, Barry. 2014. "Ron Brown Scholar Program: Impact Assessment." *Evaluation and Action Research Associates* .

Rosenbaum, R. and B. Rubin. 1983a. "The central role of the propensity score in observational studies for causal effects." *Biometrika* 70:41–55.

Wolf, Patrick, Babette Gutmann, Michael Puma, Brian Kisida, Lou Rizzo, Nada Eissa and Marsha Silverberg. 2008. "Evaluation of the DC Opportunity Scholarship Program." *U.S Department of Education* .