Brains Versus Brawn: Ordinal Rank Effects in Job Training

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Abstract

This paper analyzes ordinal rank across cognitive and physical ability within an initial job training program. Using a rich administrative dataset and conditional random assignment of trainees to peer groups, we test whether rank effects vary across contemporaneous training and long-term career outcomes. We find cognitive ordinal rank, measured by an individual's score on the Armed Forces Qualification Test (AFQT), has a meaningful impact on completing initial training into the U.S. Air Force (USAF). This ranking also affects job specialization for trainees that arrive without a preassigned occupation. We also show physical ordinal rank, measured by an individual's initial fitness score, also affects job training performance. Both sets of ranking effects impact behavioral misconduct outcomes and vary by gender. Finally, the interaction between cognitive and physical ordinal ranking has multiplicative effects on a limited set of outcomes.

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1 Introduction

The literature on social interactions has primarily focused on using mean peer characteristics to explain individual outcomes at school and work (Sacerdote, 2014; Epple and Romano, 2011). Research by Hoxby (2000); Duflo et al. (2011); Booij et al. (2016) have also highlighted the importance of the ability distribution in human capital when analyzing non-linear and heterogeneous peer effects. This work has inspired researchers to explore alternatives to the the workhorse linear-in-means specification. One popular approach leverages ordinal ranking, rather than mean ability, within peer groups to explain differences in outcomes caused by social spillovers.

In a hypothetical scenario, two individuals, A and B, of equal ability are randomly assigned to separate peer groups. Due to the naturally occurring variation in the distribution of peer human capital, individual A acquires a higher ordinal rank in his group than B. These individuals will subsequently achieve different outcomes through potential behavioral (e.g. differences in self-concept and development of non-cognitive skills) and environmental channels (e.g. differences in investment from teachers, supervisors, and family members).[1] As a result, individuals of equal ability may face substantially different outcomes based on the pure chance of possessing a higher rank in their assigned peer group.

In the described scenario, identifying the casual effect of moving up (or down) in ordinal rank exploits idiosyncratic sampling variation in cohort composition. Furthermore, rank must be exogeneous to the individual. Specifically, subjects must be unable to influence placement into groups where they would enjoy higher ranking, and differences in the ability distribution across groups cannot be systematic. Lastly, in order to separate this ordinal ranking effect from other potential confounds, such as average peer ability

[1] These channels are derived from behavioral and social science research by Tversky and Kahneman (1974) on heuristics, Merton (1968) on the "Matthew Effect" and Marsh and Parker (1984); Marsh (1987) on the "big-fish–little-pond effect" (BFLPE). The most popular explanation, BFLPE theory, describes individuals obtaining higher self-perceived skill and self-concept when comparing themselves to less skilled individuals.

and other environmental influences, researchers commonly include controls at the level of ranking (Denning et al., 2021). [2]

This methodology has been widely used to study the impact of ordinal rank on children and early adolescence. The most prominent studies focus on initial cognitive ranking, as measured by early test scores in elementary and primary school, and the subsequent effects on future academic and job performance (Murphy and Weinhardt, 2020; Denning et al., 2021). Other studies have shown rank formation is not limited to early childhood. Researchers have found ordinal ranking within high school impacts the likelihood of engaging in risky and socially deviant behavior (Elsner and Isphording, 2018) and the probability of pursuing postsecondary education Elsner and Isphording (2017). Furthermore, Elsner et al. (2021) demonstrate that rank formation amongst peer groups in college continue to impact academic performance and degree specialization.

There is a lacuna in the literature on whether ordinal ranking outside of traditional academic settings and later in life contributes to individual outcomes. In this paper, we analyze peer formation of young adults entering a job training program in preparation for a new career in the United States Air Force (USAF). We provide empirical evidence showing ordinal rank continues to have a meaningful impact across a wide menu of training and career outcomes. This is important since 52.4 percent of 2021 U.S. high school graduates who do not attend college immediately enter the workforce (U.S. Bureau of Labor Statistics, 2022a), while social interactions in the workplace impact workers' lives on many dimensions as described by Mas and Moretti (2009); Dahl et al. (2014); Cornelissen et al. (2017). With respect to ordinal rank effects at work, Brown et al. (2008); Card et al. (2012) have analyzed the relationship between salary ranking on job satisfaction and overall well-being, yet there has been no studies in job training programs. This is a significant void given recent research by Opper et al. (2022) who find an individual trained

[2]For example, if ranking is measured at the classroom level, then a researcher should control for classroom level fixed effects since the variation in the treatment occurs within, as oppose to across, the classroom level. This naturally brings up questions on the remaining variation. As done by Elsner and Isphording (2018), we provide a detailed description of the identifying variation in the methodology section of this paper.

in a cohort with mean labor market history one standard deviation above the average is 15 p.p. more likely to be employed afterwards compared to groups one standard deviation below.

We analyze ordinal rank effects by leveraging a unique research setting at Basic Military Training (BMT) for the USAF. This introductory program is a formative time for new enlisted trainees. BMT acquaints young adults with the structure and culture of the military, while preparing individuals for follow-on job training in their new careers across a wide spectrum of occupations as described in **figure 1**. This two month intensive training program offers an ideal setting to study rank effects for several reasons. First, new trainees are exogenously assigned to peer groups, known as flights, of 50 people on average. These trainees will be in close proximity of one another throughout the entire program. Conditional on key observables, we also show assignment to flight is almost-as-good as random, which has been used in a limited number of ordinal rank studies (Elsner et al., 2021; Bertoni and Nistico, 2019). This feature allows us to rule out the possibility of trainees self-selecting into groups where they would enjoy higher rank.

Second, our research setting provides a wide menu of short and long-term outcomes for over 200,000 enlisted trainees entering military service from 2011-2017. For the short-term outcomes, we show initial cognitive ranking within flight, measured by prior test scores on the Armed Forces Qualifying Test (AFQT), impacts initial completion of BMT. With a historic attrition rate of 6 percent a year, conditional on own ability, we find an individual ranked in the top 10 percent of the distribution is 2.9 p.p. more likely to complete initial training compared to a trainee at the bottom 10 percent. In addition to rank affecting the likelihood of graduation, we also show a one decile increase in ordinal ranking leads to a 0.6 p.p. increased likelihood of becoming an "honor" graduate (6.2 percent relative to the mean). This finding is important since we show honor graduate status has a significant meaningful correlation with reducing downstream costs for the organization, including trainee academic performance in follow-on technical training.

Third, the majority of research in the rank literature hinges on the rack-and-stack of individuals based on *cognitive* aptitude scores in reading, arithmetic, and STEM related subjects, yet proxying human capital with academic test scores alone appears incomplete by some researchers' standards (Heckman and Zhou, 2022) as social (Deming, 2017) and non-cognitive skills (Edin et al., 2022) have become ever more important in the modern labor force. There lies an unanswered question of whether ordinal ranking on measures other than academic ability have the same, or greater, impact on contemporaneous and long-term outcomes. Previous research has hinted on this relationship, but it has not been fully explored. For example, work by (Chanal et al., 2005) suggests the importance of fitness ranking effects when analyzing physical self-concept among gymnastic students, while Kim (2021) finds a strong meaningful correlation between body mass index (BMI) ordinal ranking and measures for life-satisfaction.

Our paper builds on this framework by demonstrating how rank effects vary across cognitive and *physical* ability later in life. We find an individual ranked in the top 10 percent of the fitness distribution is 1.6 p.p. more likely to complete initial training compared to a trainee at the bottom 10 percent. We show a decile increase in physical ranking, measured by fitness scores taken during the first week of training, leads to 0.4 p.p. increase in obtaining honor graduate status. Additionally, we analyze how these effects differ between men and women, who are segregated into gender specific peer groups. Though our results show rank plays an important role for both groups, we find cognitive and physical rank are negatively correlated for men and positively correlated for women.[3]

Fourth, we analyze behavioral misconduct and disciplinary outcomes of BMT graduates in follow-on technical training and during an enlistee's first 36 months in their career. Previous research has found a strong link between disruptive behavior and class rank. Cicala et al. (2017) finds a 50 percentile decrease in rank among 5th to 6th grade school-

[3]Elsner et al. (2021); Murphy and Weinhardt (2020) demonstrates rank effects may vary across gender. Differential responses to treatments, such as academic probation, has also been shown in previous studies as by Lindo et al. (2010).

mates is associated with a nearly 2.5 p.p. increase in the probability of a serious behavioral incident. Similarly, Elsner and Isphording (2018) shows a one decile increase in high school ordinal rank leads to a 1.4, 1.2, and 0.6 p.p. decrease in the probability of underage drinking, smoking, and unprotected sexual activity. We find effects similar in magnitude on whether an individual receives disciplinary action for behavioral misconduct. This is important because individuals who exit military service with a less-than-honorable (LTH) discharge for minor misconduct risk losing access to critical veteran's benefits (e.g. healthcare, housing, and education) and potentially hindering their civilian labor market opportunities (McClean, 2021).

Finally, our setting provides a novel opportunity to examine how ordinal ranking impacts decisions to specialize in a career. Previous work by Elsner et al. (2021) demonstrated that ordinal ranking within teaching sections altered college students' decisions to specialize and take additional classes within a major. We complement the literature on occupation choice (Antonovics and Golan, 2012; Rothstein and Rouse, 2011) by showing trainees that arrive to BMT without a preassigned job are more likely to be matched with occupations of a higher average ability based on ordinal ranking. Specifically, we find a 1-standard deviation increase in cognitive ordinal ranking leads to a 6% of a standard deviation increase in average AFQT of assigned job. For physical ranking, we estimate small and insignificant effects. This finding contrasts with previous research by Jones and Kofoed (2020) who find peers have little impact on occupation choice. Instead, we show ordinal ranking enhances the technical skill in a matched occupation within randomly assigned peer groups.

The policy implications of the ordinal ranking literature have historically been unclear, yet our results provide evidence supporting efforts to reassign trainees to achieve specific organizational objectives. Previously, Murphy and Weinhardt (2020) showed the gains of moving up in class ranking to be comparable to other education interventions, such as

attending a better school or having an above average teacher.[4] Some researchers argue that heterogeneous effects could lead to potential pareto improvement in overall student outcomes by re-assigning individuals more sensitive to relative ranking. Efforts to improve individual outcomes through intentional peer formation is not new (Bhattacharya, 2009),[5] yet such disruptions could harm the most vulnerable in equilibrium due to unforeseen factors as experienced by Carrell et al. (2013). One such factor could be the unintentional interaction across multiple rankings. In our setting, we find physical and cognitive ranking have an overall negative interaction effect for program completion. However, we show these same interactions act in unison for determining honor graduate status, leading to potential superstar effects (Rosen, 1981).[6] Nonetheless, policy makers can potentially use deliberate assignment processes to improve the outcomes of select groups that may be underrepresented in higher echelons within the organization. For instance, our heterogeneity analysis demonstrates that trainees within certain occupations or subgroups react more strongly to ordinal ranking effects, while others do not. Using assignment rules that aim to improve initial outcomes of targeted groups, instead of leaving rank purely to chance, provides organizational leaders unrealized tools.

The remainder of this paper is structured as follows: Section 2 explains the background of BMT; Section 3 describes the data; Section 4 provides the methodology and identification; Section 5 explains the exogeneous assignment checks; Section 6 provides results; Section 7 discusses; and Section 8 concludes.

[4]Specifically, Murphy and Weinhardt (2020) find moving up one standard deviation in class ranking during primary school is 30% the size of attending a better school and almost 50% the size of being taught by a teacher one standard deviation better than average.

[5]Researchers have also analyzed the benefits of *tracking* students based on prior ability in order to improve academic outcomes (Betts, 2011). Research by Duflo et al. (2011) has found positive benefits for both higher and lower ability individuals, while recent work by Landaud and Maurin (2022) has suggested the benefits are mostly limited to higher ability individuals.

[6]These results are supported by Weingarten et al. (2018) who find people are sensitive to success (and failure) across multiple reference points, such as fitness and academic goals.

2 Background

In order to enter military service within the USAF, all enlistees must complete a nearly two month intensive training program known as BMT at Lackland AFB in San Antonio Texas. Prior to attending BMT, the application process to join the USAF starts at a local recruiting office. Potential enlistees undergo a thorough background check that verifies citizenship and criminal/financial history. Afterwards, they receive a health physical exam at the nearest Military Entrance and Processing Stations (MEPS). They are also required to take a standardized cognitive test known as the Armed Services Vocational Aptitude Battery (ASVAB). Scores on the exam will be used in determining eligibility for military service and occupational assignments (National Academies of Sciences and Medicine, 2021).

Upon passing this rigorous screening process and signing a contract to enlist in either a specific occupation or generalized specialty[7], a trainee will be assigned to a BMT weekly cohort composed of 700 people on average. In our study, we analyze the universe of USAF trainees from 2011-2017 in which approximately 34,000 trainees attended annually. As illustrated in **figure 10**, trainees arrive all across the world and will typically report to their assigned MEPS station on the Monday prior to BMT starting for final screening and paperwork. The following day, trainees are flown to the San Antonio Airport and subsequently transported via bus to BMT at Lackland AFB. Upon arrival, trainees are then placed into same gender segregated peer groups, known as flights, on a first-come, first-served basis.

BMT is designed to prepare enlisted trainees for follow-on technical training in their assigned occupation and instill critical disciplinary habits required for a successful career in the military. A summary of the two month program's syllabus is provided in **figure 2**. Throughout the program, trainees are led by their assigned instructors, who are responsible for daily training and instilling important career principles.[8] Each trainee is

[7] See Cullen et al. (2022) for further discussion about optimal policies for occupation assignment in BMT.

[8] Trainees also receive instruction from other members of BMT staff in coursework such as Sexual Assault Prevention and Response, Combat Arms Training and Maintenance, and many other modules as listed in

responsible for learning important organizational coursework, passing inspections and building physical stamina. At the end of BMT, trainees take a series of physical and cognitive exams required for graduation.

Upon completion of BMT, graduates are then sent to follow-on training assignments. The location and duration of technical training depend on the assigned occupation, known as Air Force Specialty Code (AFSC), which is described in **figure 1**.[9] Many of these positions translate to civilian jobs. Using data from the Defense Manpower Data Center and classifications derived from the Bureau of Labor Statistics (BLS) Occupational Outlook Handbook, **figure 3** provides a breakdown of careers trainees serve under. Despite vast heterogeneity in these occupations, BMT provides a common experience that all USAF enlisted trainees share before they arrive at their first job site at a military installation.

There has been considerable research into what makes a successful military trainee (Marrone, 2020). Predictive information includes ability tests, medical evaluations, background interviews, prior education, and criminal records. There are recent efforts to incorporate non-cognitive personality tests (Trent et al., 2020) and web-based vocational interest tools (Johnson et al., 2020) to improve occupation selection and retention. Chesney et al. (2022) also explains that the assigned instructors, known as Military Training Instructors (MTIs), play a critical role in determining success.[10] However, the role of peer or ordinal ranking effects during this initial training program has been understudied.

This analysis naturally brings up questions on external validity. First, **figure 3** demonstrates that trainee occupations can be compared to jobs in the civilian sector in which U.S. Bureau of Labor Statistics (2022b) provides a detailed technical report on this matter. Second, military service is an important part of the modern U.S. economy. Nearly 1.3 M

figure 2.

[9]For example, an enlistee assigned to a Security Forces (3PO) AFSC will undergo follow-on training for several months learning weaponry, laws, installation security, and other police related skills. Alternatively, individuals selected to work in the weather career field (1W0) spend many months learning how to operate meteorological equipment and employ computer workstations to interrogate current and forecast atmospheric and space weather conditions (Air Force Personnel Center, 2021).

[10]The instructors responsible for training new enlistees must also meet strict qualifications, including passing a mental health evaluation and receiving a recommendation from a superior (Bloem, 2015).

individuals are actively serving in the military in which there has been a strong transition in the services demographics to become more representative of the overall population (Council on Foreign Relations, 2020). More importantly, 7% of working age adults in the U.S. are veterans (Schaeffer, 2021). Despite earlier studies by Angrist (1990) that show a substantial economic penalty for draftees, Angrist (1998) finds volunteer military service is associated with higher employment rates for veterans. Recent analysis by Greenberg et al. (2022) has also highlighted the role of military service as a driver for economic mobility, specifically for underrepresented minorities. However, military members that exit service with a LTH discharge for poor performance and minor misconduct may suffer substantially lower civilian employment opportunities and risk losing access to critical veterans' benefits for housing, health, and education (McClean, 2021).

3 Data

Our population is the universe of USAF enlistees entering basic training from October 2011 through December 2017. We observe follow-on outcomes through 2020. Full summary statistics are described in **table 1**. Data for this study were gathered from Air Education and Training Command (AETC), Air Force Recruiting Services (AFRS), and the Air Force Personnel Center (AFPC). This compiled administrative dataset includes a rich set of covariates measured prior to arrival at BMT, such as race, gender, education history, martial status, assigned occupation, medical history, and whether the trainee required a waiver to join the military. We possess exhaustive information on an individual's experience at BMT. This includes records on a trainee's assigned flight and peers, with a wide range of extensive and intensive measures of success throughout the program.

We measure cognitive ranking within BMT using predetermined scores on the AFQT. Scores on the AFQT are derived from four selected portions of the ASVAB in which a score is calculated and converted into a percentile-rank of 1-99. The AFQT has been used in

many studies to measure cognitive ability of workers (Lang and Manove, 2011; Neal and Johnson, 1996). In our dataset, the distribution of AFQT scores is provided in **figure 4**. Additionally, **figure 5** describes how a trainee's cognitive rank within a flight can vary based on their demeaned AFQT score. For example, an individual with an average AFQT score can have a ranking that ranges from as low as 0.24 to as high as 0.72 by pure chance.

We measure physical fitness ranking using initial test results during the first week of BMT. This physical test score is scored from 0-100 based on aerobic and anaerobic measures shown in **figure 6 and 7**. There are a few features of this measure that make it different than the AFQT. First, as illustrated in **figure 8**, the distribution of scores is bimodal. This is due to the scoring system having significant thresholds that lead to substantial drop offs in score if a trainee fails to meet a minimum number in a category. As a result, we elect to use dummy variables for ventiles of ability in our main specification to control for this non-linearity, as oppose to a polynomial used in other ranking studies. Second, scores are measured at the individual flight level, unlike other test scores that are collected prior to arrival. This could potentially introduce measurement error. Lastly, some individuals do not have initial fitness scores due to being on a waiver upon entry. As a result, we limit our analysis to individuals that have a valid score and only calculate the rank amongst individuals who have initial scores. We also provide ranking of other physical characteristics such as BMI, waist, and height measurements. We only include individuals that have valid measurements for all three categories. Although imperfect, initial physical scores provide the best available proxy for fitness ability of new trainees. Referencing **figure 9**, an individual with an average physical test score can have a ranking near the bottom to as high as 0.70.

Following BMT, we have detailed training records for all active-duty trainees. We record individual's performance in follow-on technical training, specifically observing whether they experience any exam or academic block failures. Additionally, we observe whether individuals receive counseling for disciplinary issues during technical training

that can arise from either poor performance or misconduct.[11]

Post technical training, we follow an individual during their first 36 months in their career. We observe whether an individual receives disciplinary action at work below the threshold of a general courts martial. Specifically, we identify a disciplinary infraction if the individual receives non-judicial punishment from their commander, given an unfavorable information file, or placed on a control roster. Receiving such disciplinary action can be the result of various activities including minor misconduct at work, and any failure to maintain standards of conduct, military bearing, and integrity, both on and off duty (Air Force Instruction 36-2907, 2014).

4 Methodology

We follow a well established methodology presented by Denning et al. (2021); Murphy and Weinhardt (2020); Elsner and Isphording (2017) where ordinal rank is defined within peer group as the following percentile:

$$R = \frac{n_i - 1}{N_i - 1}$$

where n_i is the trainee's ordinal rank of ability measured by test scores in their respective flight and N_i is the total number of trainees assigned to the flight. Ranking is bounded between 0 and 1. Individuals with the highest rank possess a 1, while trainees with the lowest rank are identified with a 0.

This measure naturally brings up questions of whether it is necessary, or even possible, for a trainee knows their exact numerical *rank*. As expressed by Elsner and Isphording (2017), identification does not rely on knowing the precise number as long as sufficient

[11] In our sample, 79% of incoming trainees are active-duty members. The remaining individuals consist of Air Force Reservists and Air National Guardsmen. For this latter group, we have incomplete data for our follow-on outcomes. As a result, we use the full sample of trainees when estimating effects on short-term outcomes and only use active-duty members when analyzing longer-term outcomes. In **appendix A1**, we analyze all outcomes using only active-duty members. Results for short-term outcomes do not differ significantly from our preferred specification with the full sample.

variation in ranking exists and trainees can make assessments on their approximate position in the ability distribution. In our setting, trainees spend more time together than the typical subjects observed in primary school or college study groups. Additionally, trainees have intense daily interactions with their instructors and peers that allow them to make reliable judgements of where they stand in relative cognitive rank. Lastly, an initial fitness test is taken during the first week of training as a flight. Trainees can accurately perceive where they rank in some of the most salient events, such as the aerobic fitness assessment.[12]

To model trainee's outcomes based on ordinal ranking, we begin with the following education-production function described by Delaney and Devereux (2022) to explain both contemporaneous and later career outcomes:

$$Y = f(R, A, \mathbf{X}, \mathbf{F})$$

where R is the trainee's ordinal ranking in BMT, A is their measured human capital, $\mathbf{X}$ is a vector of characteristics, and $\mathbf{F}$ is a vector of flight and cohort specific attributes including peer and instructor quality. We also assume rank is additively separable from all other inputs of the production function.

The identification of the rank effect leverages the idiosyncratic variation of the ability distribution in each flight. We specifically refer to the differences in the shape across flights caused by higher moments such as the variance, skewness, kurtosis, etc. Identifying the causal effect of rank rests on two primary assumptions. First, selection into a specific flight is exogeneous to the individual. We thoroughly explain this matter in the next section. Second, the difference in the ability distribution across flights is not driven by factors that are related to a trainee. For example, if trainees with a specific background

[12]Experimental work by Gill et al. (2019); Klausmann et al. (2021) that directly provides rank assignment to subjects finds similar effects as non-experimental empirical work where students must learn their rank through repeated interactions.

are systematically clustered together and driving the distribution of the flight's ability to look different than other flights, this would violate assumption two. A straightforward way to address this problem is to control for a rich a set of predetermined characteristics. Moreover, if assignment of certain trainees to specific groups is driven explicitly by observable characteristics, such as gender and certain occupations in our research setting, including these variables as controls in our main specification eliminates this concern.

4.1 Empirical Model

With this framework, our preferred specification follows a similar format as Elsner and Isphording (2017) and can be written as:

$$Y_{ifc} = \alpha + \beta R_{ifc} + f(Ability_i) + X_i + \gamma_i + \phi_{fc} + \varepsilon_{ifc} \tag{1}$$

where R_{ifc} is the ordinal ranking of individual i in flight f of cohort c, $f(Ability_i)$ is a function of ventiles of ability measured by test scores, X_i is a vector of attributes including race, age, education, and whether the individual required a waiver to enter BMT, γ_i is a set of randomization controls including MEPs location and assigned occupation, and ϕ_{fc} is a set of flight-by-cohort fixed effects. We cluster our standard errors at the cohort level to account for common shocks in which some cohorts may have a higher ability than others based on the time of year. In order for β to have a causal interpretation, we assume strict exogeneity of the error term ε_{ifc} with respect to the other terms, $E(\varepsilon_{ifc}|R_{ifc}, A_i, X_i, \gamma_i, \phi_{fc}) = 0$. Identification of the causal effect hinges on appropriately controlling for own ability since it is strongly related to rank, and potentially other observables. Previous studies have used higher-order polynomials to adequately capture the full extent of ability. In our setting, we use bin dummies, similar to Denning et al. (2021), since physical fitness scores possess significant non-linearity.

Similar to other ordinal rank studies, we also control for fixed-effects at the level

of ranking. In our setting, this is at the individual flight ϕ_{fc}. Doing so provides two important benefits. First, flight fixed-effects control for any potential confounds and common shocks at the group level that could bias our estimates. Second, the inclusion of flight fixed effects also adjusts for mean differences between peer groups. This ensures that the ability distributions of all peer groups have the same mean, making a straightforward comparison across flights. However, the ability distributions will still vary in their shape, and it is these differences in the higher moments that drive the identifying variation for ordinal ranking.

Including fixed effects at the peer group level (e.g., flight) will naturally lead a careful observer to question how much variation in rank remains. In **table 2**, we provide a thorough breakdown of the standard deviation and remaining R^2 after controlling for flight fixed effects and prior achievement. For instance, cognitive and physical ordinal ranking have an unconditional standard deviation of 0.294 and 0.301. Given the average peer group is 50 people, a standard deviation change in ranking can equate to 14.7 and 15.05 absolute rank positions. After controlling for ability and flight fixed effects, theses standard deviations are reduced to 0.051 and 0.071, respectively, which equates to a change of 2.55 and 3.55 absolute rank positions. Given how small our peer groups are compared to other research studies that typically examine rank effects in much larger class cohorts, we believe these changes in rankings are substantial.

Lastly, in **table 3** we demonstrate how our preferred specification in column 5 compares to other specifications that only control for cohort fixed effects and flight characteristics such as the mean and standard deviation of flight ability, and the interaction between mean and standard deviation. Reassuringly, estimates of the ordinal ranking effect on program completion do not change considerably across these less parsimonious specifications.

4.2 Conditional Random Assignment

Unlike most research settings, we know the exact procedures for individual assignment into peer groups. Since the assignment is quasi-random, this aids in estimating unbias causal effects of rank because trainees are unable to self-select into flights where they would enjoy a more advantageous position. In our setting, trainees are placed into gender segregated flights as they arrive to BMT on a bus in a first-come, first-served basis, irregardless of ability level. Chesney et al. (2022) provides a detailed analysis demonstrating that conditioning on a small set of observables, such as their weekly cohort, MEPS, occupation, and gender, sufficiently describes the assignment process. For this setting, it is adequate to show that rank is uncorrelated with observable characteristics; therefore, by controlling for MEPs, occupation, and gender, assignment to flight, and rank itself, is exogeneous to the member.

We test our identifying assumptions by running the following balance test:

$$R_{ifc} = \alpha + \beta X_i + f(Ability_i) + \gamma_i + \phi_{fc} + \varepsilon_{ifc} \tag{2}$$

where we report the coefficients of X_i for individual i's cognitive and physical ranking in **table 4**. Of the 18 estimated coefficients, only one, the indicator for Asian, is statistically significant at the 5-percent level. Importantly, the magnitudes of all of the coefficients are small in magnitude, with no pattern in the direction of the signs. Hence, these results provide further suggestive evidence of the exogeneity of rank assignments in our setting.

5 Results

5.1 Cognitive Rank Effects

We report our full results of **equation 1** in **table 5** for cognitive ordinal ranking effects. The first row of results shows average effects, while the remaining rows provide an

interaction of ordinal ranking with gender. Overall, we find a one decile increase in rank improves the probability of BMT completion and honor graduate status by 0.3 and 0.6 p.p., respectively. Additionally, while rank has no discernible average effect on receiving "no verbal counseling" during follow-on technical training, we do find that a one decile increase in rank increases the likelihood of "no disciplinary action" by 0.4 p.p.[13] When examining results separately by gender, for women we find a stronger response of rank for completion and honor graduate status. However, we find weaker effects on no verbal counseling and no disciplinary action. In **table 13** we examine the effects of rank at the extremes of the distribution. For contemporaneous outcomes, we show an individual ranked in the top 10 percent of the distribution is 2.9 p.p. more likely to complete initial training, 4.6 p.p. more likely to be an honor graduate, and 4.0 p.p more likely to have no disciplinary action, compared to a trainee at the bottom 10 percent of the rank distribution.

5.2 Physical Rank Effects

For physical ranking effects, measured by initial scores on the fitness exam, we report our results of **equation 1** in **table 6**. Similar to **table 5**, the first row presents average effects and the remaining rows provide an interaction of ordinal ranking with gender. Overall, physical rank shows no significant effects on BMT completion or verbal counseling. However, moving up in physical rank leads to positive and significant increases in the probability of becoming an honor graduate (0.4 p.p) and no disciplinary action (0.6 p.p.). Interestingly, when estimating the effects interacted with gender, we find larger effects for women on BMT completion. For men, we find larger effects with honor graduate and no disciplinary action, compared to the full sample estimates. Finally, our results examining

[13] In **appendix A1**, we conduct robustness checks of our main specification accounting for missing data through attrition. Columns 1 and 2 estimate BMT outcomes while excluding non-active duty members. In the spirit of Horowitz and Manski (2000); Lee (2009), we conduct a bounding exercise for our long-run outcomes in columns 3 through 6 taking into consideration individuals who do not complete BMT. Overall, our findings are consistent with the main results from **tables 5 and 6**. Importantly, the lower bounds of our estimated rank effects all fall within one-half of one standard error of our main estimates, indicating that attrition from the sample is not driving our estimated effects.

the effects of physical rank at the extremes of the distribution are reported in **table 13**. We show that individuals ranked in the top 10 percent of the fitness distribution are 1.6 p.p. more likely to complete initial training, 4.3 p.p. more likely to be an honor graduate, and 6.0 p.p more likely to have no disciplinary action, compared to a trainee at the bottom 10 percent of the rank distribution.

5.3 Heterogeneity Analysis

We augment **equation 1** to include interactions between ordinal rank and race, aptitude, and geographic origin. With respect to race, we provide results in **tables 7 and 10**. Overall, we find underrepresented minorities are less sensitive to rank compared to white trainees for short-term outcomes. We also examine the impact of rank on individuals who arrive at BMT without a declared occupation. These individuals receive an assigned job based on one of four general aptitude areas. The results for both cognitive and physical ranking are reported in **tables 8 and 11**. These trainees appear less sensitive to ordinal ranking on BMT specific outcomes compared to trainees that are assigned an occupation prior to arrival. For follow-on disciplinary outcomes, we show substantial variation in responses across the different skill groups.

We also analyze whether there are differences in response to rank based on home of origin. We include an interaction between rank and whether a trainee arrives from a MEPS located in the West or East Coast of the United States, with the excluded group being the remaining MEPS locations. **Tables 9 and 12** show individuals from the East Cost are generally less sensitive to ordinal ranking than other geographic areas.

Lastly, we examine whether specific occupations exhibit differences in responses to rank. For this portion of the analysis, we take the top-20 most common AFSCs that represent over 60% of the pre-assigned jobs and interact them with the ordinal ranking variable. These occupations range from jobs in law enforcement to highly technical linguistic interpreters. We graph the results in **figures 11 and 12** by average AFQT of the

specific job. With respect to completing BMT, we find that cognitive ordinal ranking has little variation across these occupations. However, **figure 11** shows that there are certain occupations across the ability distribution that respond more highly to physical ordinal ranking. **Figure 12** demonstrates that occupations in the middle of the distribution react strongly to cognitive ordinal ranking for honor graduate status, while those at the ends of the distribution do not. More interestingly, there is a nearly linear relationship with physical ordinal ranking and the various occupations across ability. This finding suggests there are complementary effects between physical and cognitive ordinal ranking that we explore further in this paper.

5.4 Career Specialization

Another unique aspect of our research setting is that almost one-third of trainees that arrive to BMT during this time period do not have a preassigned occupation. Instead, these individuals enlist in the USAF under the Aptitude Index (AI) program in which they are guaranteed a job under one of four specialities known as General, Administrative, Mechanical, and Electrical (National Academies of Sciences and Medicine, 2021). Individuals who meet the requirements and enlist under an aptitude area are then eligible for a list of occupations for which they qualify. As such, trainees arriving at BMT under these contracts receive a list of available jobs in their respective area around the second week of training. During the following weeks of training, these individuals then meet with a job specialist and further discuss the occupations they are qualified for and compile a prioritized list of their job preferences. Prior to graduating BMT, trainees are matched with a job based on their preference ranking, ASVAB scores, and other information about the trainee prior to arrival at BMT. Importantly, occupational match does take into account actual performance during BMT.

Although we do not have access to each trainees prioritized list of occupations, we ultimately observe in our data the occupation with which they are matched. Additionally,

we are able to assess the *skill level* of each matched job using the average ASVAB scores of individuals who were previously assigned these occupations. As such, we examine whether trainees' ordinal ranking in BMT impacts their assigned occupation by studying how it affects the ASVAB scores in their eventual job match. Because actual performance during BMT is not factored into job match, we believe the primary mechanism in how the trainee decides to specialize in a particular job is based on their perceived ability, through ordinal ranking within the flight.[14]

We estimate these effects by again using **equation 1**, but instead normalize the ordinal rank measure to have a mean of 0 and a standard deviation of 1. Results in **table 14** show a one standard deviation increase in cognitive ordinal rank leads to a matched job with a 6% higher standard deviation in average AFQT score. We find similar magnitude effects across all four major components of the ASVAB. With respect to physical ordinal ranking, we estimate small, negative, and statistically insignificant effects on career specialization. These findings are counter to previous literature that show peers have little impact on job selection (Jones and Kofoed, 2020). One potential reason for this discrepancy is the difference in our setting. First, Air Force BMT trainees spend nearly every minute of the day interacting with their peers, with the explicit goal of training for their future job in the Air Force. Second, we specifically analyze ordinal ranking effects in which having a higher position may provide greater confidence to select, and subsequently be matched with, higher skilled jobs. Together, these results imply that decisions to specialize are highly dependent on social interactions, as previously found by Elsner et al. (2021) for academic fields of study.

5.5 Rank Interactions

Given we find positive and significant rank effects for both our cognitive and physical measures, a natural question is how and whether these rank effects interact with one

[14]Chesney et al. (2022) explores other factors affecting occupation matching such as instructor mentorship.

another? Understanding these dynamics may have important policy implications and, to our knowledge, rank interactions have not been studied in the previous literature. We start by examining the correlation between our cognitive and physical rank measures with results shown in **table 15**. These findings illustrate that physical and cognitive ranking is negatively correlated for men. Meaning, on average, men who rank higher in one area tend to rank lower in the other. Interestingly, we find the opposite relationship for for women. We additionally explore how rankings across other physical measures such as BMI, waist, and height measurement covary with cognitive rank. We find that men's BMI is generally uncorrelated with cognitive ability, yet we find a strong negative correlation for women.

Given these findings, we next examine how rank effects interact with one another by estimating the following model for the full sample as well as separately for both men and women:

$$Y_{ifc} = \alpha + \beta_1 R_{ifc}^{Cog} + \beta_2 R_{ifc}^{Fit} + \beta_3 R_{ifc}^{Cog} * R_{ifc}^{Fit} + f(Ability_i) + X_i + \gamma_i + \phi_{fc} + \varepsilon_{ifc} \tag{3}$$

where R_{ifc}^{Cog} is cognitive ranking measured by AFQT scores and R_{ifc}^{Fit} is physical physical ranking measured by the initial fitness test at BMT. The parameter interest β_3 captures the interaction of these ranking measures. This specification controls for ventiles of ability for both cognitive and physical test scores in $f(Ability_i)$. We report the coefficients for β_1, β_2, and β_3 in **table 16**.

For graduation, we find a positive coefficient for β_1 and β_2, but a negative and statistically significant value for β_3. This suggests that cognitive and physical fitness rankings act against one another for an individual completing the program. For example, column one demonstrates that a one decile increase in cognitive ability can be be cancelled out by a two decile increase in physical ability. We see a similar pattern for men in column three and women in column five. For honor graduate status, we find a negative coefficient

for β_1 and β_2, but a large positive and statistically significant value for β_3. These results are similar for both men and women in as shown in columns four and six. These results suggest that cognitive and physical fitness rankings are multiplicative for obtaining honor graduate status from BMT.

These empirical finding on multiple ranking effects playing a dominant role in determining honor graduate status, yet working against each other in program completion, initially suggests ambiguous policy implications. For example, a policy maker who seeks to improve graduation rates for specific trainees would consider moving individuals with lower academic ability to a peer group where they enjoy a higher cognitive ranking. However, if the policy maker does not consider their new physical ordinal rank, they risk harming that individual's graduation prospects. Likewise, if they move into a group where they improve in rank on both categories, a policy maker inadvertently increases the likelihood of making an honor graduate.

6 Discussion

The heterogeneous response across subgroups and occupations to ordinal rank effects, and the interactive effects between different rankings, motivates a deeper discussion on the policy implications. Previous literature by Bhattacharya (2009) has laid the groundwork to exploit heterogeneous peer effects to achieve pareto improving outcomes. More recent work by Opper et al. (2022) further builds on this idea of intentional assignment of trainees in job assignment programs to improve the overall mean. However, there has been little discussion on whether an assignment rule exists that improves every trainees outcome using rank effects. In our research setting, policy makers could tailor peer groups to support specific subgroups and leverage the heterogeneous responses to improve individual outcomes. The most straightforward mechanism is through honor graduate status.

Our prior analysis demonstrates that ordinal ranking increases the likelihood of becoming an honor graduate. BMT designates no more than 10 percent of its trainees for this award. This is calculated using performance in final academics and fitness exams, daily inspections, and serving in leadership roles throughout training. Although not causal, we estimate the following regression to describe the relationship between honor graduate status on long-term outcomes:

$$Y_i = \alpha + \beta Honor + f(Ability_i) + X_i + \gamma_i + \phi_{fc} + \varepsilon_{ifc} \tag{4}$$

where Y_i are a set of outcomes post-BMT, $Honor$ is an indicator of whether individual i is an honor graduate from BMT, $f(Ability_i)$ controls for academic and physical test scores, X_i and γ_i controls for personal characteristics, occupation, and MEPs, and ϕ_{fc} controls for flight-cohort fixed effects. Results are listed in **table 17**. Across all outcomes for both men and women, honor graduate status has a strong positive association with improved academic performance, avoiding misconduct, and retraining into a new career-field after 24 months in the organization. As a result, technical training programs that seek to improve the outcomes of certain trainees that exhibit higher disciplinary or washout rates could use the initial assignment at BMT to *nudge* these trainees favorably.

7 Conclusion

In this paper, we analyzed trainees' ordinal rank across cognitive and physical ability during an initial job training program for the USAF. Rank is measured within peer groups that are assigned in an almost-as-good as random fashion. We find cognitive ordinal ranking, measured by predetermined scores on the AFQT, to have a meaningful impact on completing BMT and becoming an honor graduate. Rank additionally impacts decisions to specialize in a more technical occupation. Physical ordinal ranking, measured by initial fitness scores taken during the first week at BMT, also affects early training outcomes. Both

sets of ranking effects impact follow-on disciplinary outcomes and vary by gender. The interaction between cognitive and physical ordinal ranking is found to have multiplicative effects on honor graduate status, which is associated with important follow-on outcomes. Our heterogeneity analysis also illustrates that certain occupations and subgroups respond more favorably to rank effects. These results can serve as an important policy insight for improving outcomes of at-risk individuals. Future research should investigate how cognitive ranking compares with other descriptions of human capital, such as non-cognitive and social measures.

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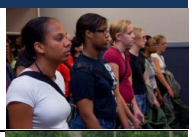
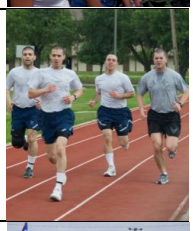
Figure 1: Sample List of Air Force Specialty Codes (AFSC)

AFSC	Description	AFSC	Description	AFSC	Description	AFSC	Description
1A0	In-Flight Refueling Spc	1T0	SERE Specialist	2T2	Air Trans	3N1	Regional Band
1A1	Flight Eng	1U0	Sensor Ops	2T3	Vehicle Mgmt	3N2	Premier Band – The USAF Band
1A2	Aircraft Ldm	1U1	RPA pilot	2W0	Munitions Sys	3N3	USAF Academy Band
1A3	Airborne Mission Sys Spc	1W0	Weather	2W1	Aircraft Armament Sys	3P0	Security Forces
1A6	Flight Attendant	1Z1	Pararescue	2W2	Nuclear Weapons	4A0	Health Services Mgmt
1A8	Airborne ISR	1Z2	Combat Control	3D0	Cyberspace Ops	4A1	Medical Materiel
1A9	Spc Mission Aviator	1Z3	TACP	3D1	Client Sys	4A2	Biomedical Equip
1B0	Cyber Warfare Operations Supt	1Z4	Special Recon	3E0	Facility Sys	4B0	Bioenvironmental Eng
1B4	CW Ops	2A0	Avionics	3E1	HVAC, Refrigeration	4C0	Mental Health Svc
1C0	Aviation Rsc Mgmt	2A2	SOF/PR Integrated Comm/Nav/Mission Sys	3E2	Heavy Repair	4D0	Diet Therapy
1C1	Air Traffic Control	2A3	Fighter/RPA Maint	3E3	Structural	4E0	Public Health
1C3	C2 Ops	2A5	Airlift/Special Mission Aircraft Maint	3E4	Infrastructure Sys	4H0	Cardiopulmonary Lab
1C5	C2 Battle Mgmt Ops	2A6	Aircraft Sys	3E5	Engineering	4J0	Physical Medicine
1C6	Space Sys Ops	2A7	Aircraft Fabrication	3E6	Ops Mgmt	4M0	Aerospace and Ops Physiology
1C7	Airfield Mgmt	2A8	Mobility AF Integrated Comms/Nav/Mission Sys	3E7	Fire Protection	4N0	Aerospace Medical Svc
1C8	Radar, Airfield, and Weather Sys	2A9	Bomber/Spc Integrated Comms/Nav/Mission Sys	3E8	Explosive Ordnance Disposal	4N1	Surgical Svc
1N0	Intelligence	2F0	Fuels	3E9	Emergency Mgmt	4P0	Pharmacy
1N1	Geospatial Intelligence	2G0	Logistics Plans	3F0	Personnel	4R0	Diagnostic Imaging
1N2	SIGINT	2M0	Missile and Space Sys Maint	3F1	Services	4T0	Medical Lab
1N3	Cryptologic Language Analyst	2P0	Precision Measurement Equipment Lab	3F2	Education and Training	4V0	Ophthalmic
1N4	Fusion Analyst	2R0	Maint Mgmt	3F3	Manpower	4Y0	Dental
1N7	HUMINT Spc	2R1	Maint Mgmt Prod	3F4	Equal Opportunity	5J0	Paralegal
1N8	Targeting Analyst	2S0	Materiel Mgmt	3F5	Administration	5R0	Religious Affairs
1P0	Aircrew Flight Equip	2T0	Traffic Mgmt	3H0	Historian	6C0	Contracting
1S0	Safety	2T1	Ground Trans	3N0	Public Affairs	6F0	Financial Mgmt and Comptroller

Data derived from https://www.airforcemag.com/article/2021-usaf-ussf-almanac-specialty-codes/
Current as of September 30, 2020

Figure 2: Description of USAF BMT Training Program in 2015

AIR FORCE BMT WEEKS OF TRAINING (WOT)

0 WOT	BMT Arrival Briefing Health, Morale and Welfare Commander's Arrival Briefing Uniform Code of Military Justice Coping With Stress	BMT Orientation Briefing AF Initial Physical Training Assessment BMT Physical Training Program Drill Movements I Recruit Living Area I	
1 WOT	First Week Briefing Entry Controller Airman's Time Introduction Reporting Procedures Intro to Classroom Entry and Exit Procedures AF History I Nutrition Principles Weapons, Parts ID, Disassembly and Reassembly Weapons Cleaning and Inspection Procedures	Dress and Appearance I AF Organization Human Relations I GI Bill Rendering Courtesies AF Rank Recognition Drill Movements I Recruit Living Area I	
2 WOT	Patio Briefing Warrior Role Suicide Awareness and Prevention Basic Situational Awareness Comprehensive Airman Fitness (Resliency) Joint Ethics AF History II	Healthy Lifestyles & AF ADAPT Program Basic Leadership and Character Forbidden Relationships & Sexual Predator Risk Indicators Military Citizenship Public Relations and the Media Cyber Awareness Drill Movements II	
3 WOT	Law of Armed Conflict Mental Preparation for Combat Joint Warfare Introduction to AF Combatives Dress and Appearance II	Antiterrorism/Force Protection Level I Human Relations II Recruit Living Area II Drill Movements III	
4 WOT	Principles of First Aid SAPR Program FEST	Introduction to Code of Conduct AEF and Deployment Briefing Base Liberty Briefing	
5 WOT	Deployment Line Processing/Equipment Issue Meal Ready to Eat (MRE) Brief BEAST Orientation Zone Orientation Refresher Drills	Creating Leaders Airmen Warriors (CLAW) Mission Field Exercises Pugil Stick Teaching/Application Combative Application Camp Zone Teardown/Remediation	
6 WOT	Environmental Awareness Financial Management Sexually Transmitted Diseases Combat Stress Recovery Base Referral Agencies	AF Portal Familiarization Military Entitlements & Ed Opportunities Career Progression & AF Quality Force Drill Movements IV EOC Written Evaluation/Survey	
7 WOT	Airmanship Core Value Briefing Air Force Fitness Program Town Pass Briefing Airman's Run	Sq CC Departure Briefing Airman's Coin/Retreat Ceremony Parade Graduation	

PROCESSING APPTS	Initial Trainee Pay Clipper Cuts Clothing Issue(s) Initial BX Drug Testing Immunization/Blood Draw Chapel Orientation 737 TRG/CC/CCC Briefing	Records ID Medical/Dental Career Guidance Individual/Flight Photos RAND Survey Hometown News Release Orders Pick-Up	

NOTE: TYPICALLY DUTY HOURS WILL BE FROM 0545 (LIGHTS ON) TO 2100 (LIGHTS OUT)

Figure 3: Description of USAF Enlisted Occupations

	Number	Percentage
Occupational Group		
Administrative	14,145	5.27%
Combat Specialty	720	0.27%
Construction	5,134	1.91%
Electronic and Electrical Equipment Repair	32,259	12.03%
Engineering, Science, and Technical	53,672	20.01%
Healthcare	15,409	5.75%
Human Resource Development	8,621	3.21%
Machine Operator and Production	6,750	2.52%
Media and Public Affairs	5,874	2.19%
Protective Service	36,009	13.43%
Support Service	5,603	2.09%
Transportation and Material Handling	29,623	11.05%
Vehicle and Machinery Mechanic	47,487	17.71%
Non-occupation or unspecified coded personnel	6,859	2.56%
Total enlisted personnel as of 2021	268,165	

Data derived from U.S. Department of Defense, Defense Manpower Data Center, March 2021 and Bureau of Labor Statistics, Occupational Outlook Handbook, Military Careers https://www.bls.gov/ooh/military/military-careers.htm

Figure 4: AFQT Distribution

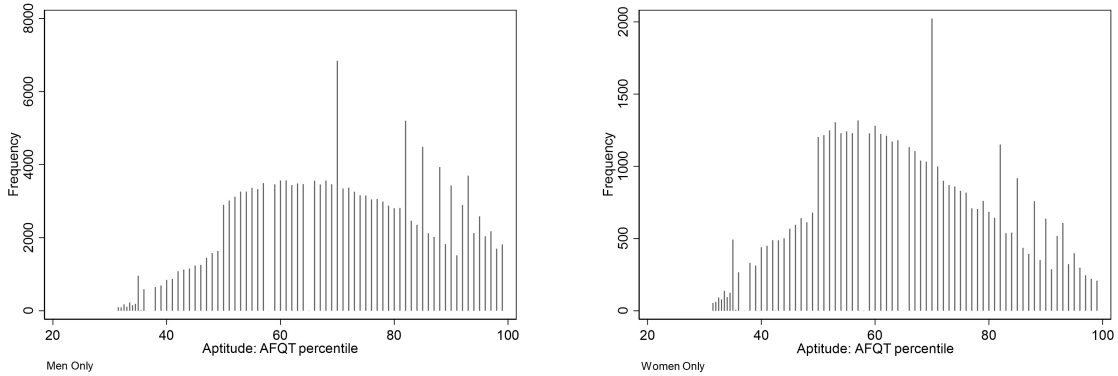


Figure 4 provides a distribution of AFQT scores of all incoming trainees to BMT. **Figure 5** plots ordinal cognitive rank on the y-axis, and demeaned AFQT score on the x-axis. Both graphs are separated by gender.

Figure 5: AFQT Variation in Rank

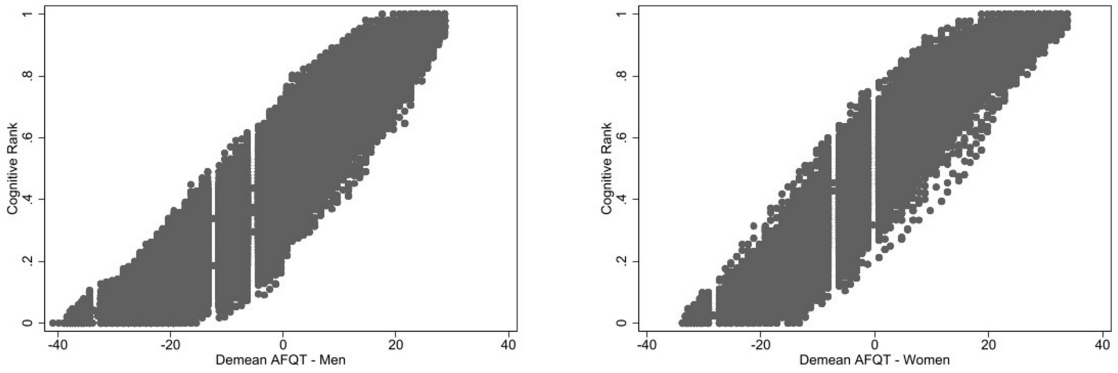


Figure 6: Male Fitness Scores

FITNESS ASSESSMENT CHART – MALE: AGE: < 30

Cardiorespiratory Endurance			Body Composition			Muscle Fitness			
Run Time (mins:secs)	Health Risk Category	Points	AC (inches)	Health Risk Category	Points	Push-ups (reps/min)	Points	Sit-ups (reps/min)	Points
≤ 9:12	Low-Risk	60.0	≤ 32.5	Low-Risk	20.0	≥ 67	10.0	≥ 58	10.0
9:13 - 9:34	Low-Risk	59.7	33.0	Low-Risk	20.0	62	9.5	55	9.5
9:35 - 9:45	Low-Risk	59.3	33.5	Low-Risk	20.0	61	9.4	54	9.4
9:46 - 9:58	Low-Risk	58.9	34.0	Low-Risk	20.0	60	9.3	53	9.2
9:59 - 10:10	Low-Risk	58.5	34.5	Low-Risk	20.0	59	9.2	52	9.0
10:11 - 10:23	Low-Risk	57.9	35.0	Low-Risk	20.0	58	9.1	51	8.8
10:24 - 10:37	Low-Risk	57.3	35.5	Moderate Risk	17.6	57	9.0	50	8.7
10:38 - 10:51	Low-Risk	56.6	36.0	Moderate Risk	17.0	56	8.9	49	8.5
10:52 - 11:06	Low-Risk	55.7	36.5	Moderate Risk	16.4	55	8.8	48	8.3
11:07 - 11:22	Low-Risk	54.8	37.0	Moderate Risk	15.8	54	8.8	47	8.0
11:23 - 11:38	Low-Risk	53.7	37.5	Moderate Risk	15.1	53	8.7	46	7.5
11:39 - 11:56	Low-Risk	52.4	38.0	Moderate Risk	14.4	52	8.6	45	7.0
11:57 - 12:14	Low-Risk	50.9	38.5	Moderate Risk	13.5	51	8.5	44	6.5
12:15 - 12:33	Low-Risk	49.2	39.0 *	Moderate Risk	12.6	50	8.4	43	6.3
12:34 - 12:53	Moderate Risk	47.2	39.5	High Risk	11.7	49	8.3	42 *	6.0
12:54 - 13:14	Moderate Risk	44.9	40.0	High Risk	10.6	48	8.1	41	5.5
13:15 - 13:36 *	Moderate Risk	42.3	40.5	High Risk	9.4	47	8.0	40	5.0
13:37 - 14:00	High Risk	39.3	41.0	High Risk	8.2	46	7.8	39	4.5
14:01 - 14:25	High Risk	35.8	41.5	High Risk	6.8	45	7.7	38	4.0
14:26 - 14:52	High Risk	31.7	42.0	High Risk	5.3	44	7.5	37	3.5
14:53 - 15:20	High Risk	27.1	42.5	High Risk	3.7	43	7.3	36	3.3
15:21 - 15:50	High Risk	21.7	43.0	High Risk	1.9	42	7.2	35	3.0
15:51 - 16:22	High Risk	15.5	≥ 43.5	High Risk	0.0	41	7.0	34	2.5
16:23 - 16:57	High Risk	8.3				40	6.8	33	2.0
≥ 16:58	High Risk	0.0				39	6.5	32	1.5
						38	6.3	31	1.3
						37	6.0	30	1.0
						36	5.8	≤ 29	0.0
						35	5.5		
						34	5.3		
						33 *	5.0		
						32	4.8		
						31	4.5		
						30	4.3		
NOTES:						29	4.0		
Health Risk Category = low, moderate or high risk for current and future						28	3.8		
cardiovascular disease, diabetes, certain cancers, and other health problems						27	3.5		
						26	3.0		
Passing Requirements - member ***must*** : 1) meet minimum value in each of						25	2.8		
the four components, ***and*** 2) achieve a composite point total ≥ 75 points						24	2.5		
						23	2.3		
* Minimum Component Values						22	2.0		
Run time ≤ 13:36 mins:secs / Abd Circ ≤ 39.0 inches						21	1.8		
Push-ups ≥ 33 repetitions/one minute / Sit-ups ≥ 42 repetitions/one minute						20	1.7		
						19	1.5		
Composite Score Categories:						18	1.0		
Excellent ≥ 90.0 pts / Satisfactory = 75.0 - 89.9 / Unsatisfactory < 75.0						≤ 17	0.0		

The following score guide is derived from Air Force Instruction (AFI) 36-2905, *Fitness Program*. It provides a detailed breakdown of how a fitness score is calculated from pushups, situps, run time, and waist measurement.

Figure 7: Female Fitness Scores

FITNESS ASSESSMENT CHART – FEMALE: AGE: < 30

Cardiorespiratory Endurance			Body Composition			Muscle Fitness			
Run Time (mins:secs)	Health Risk Category	Points	AC (inches)	Health Risk Category	Points	Push-ups (reps/min)	Points	Sit-ups (reps/min)	Points
≤ 10:23	Low-Risk	60.0	≤ 29.0	Low Risk	20.0	≥ 47	10.0	≥ 54	10.0
10:24 - 10:51	Low-Risk	59.9	29.5	Low Risk	20.0	42	9.5	51	9.5
10:52 - 11:06	Low-Risk	59.5	30.0	Low Risk	20.0	41	9.4	50	9.4
11:07 - 11:22	Low-Risk	59.2	30.5	Low Risk	20.0	40	9.3	49	9.0
11:23 - 11:38	Low-Risk	58.9	31.0	Low Risk	20.0	39	9.2	48	8.9
11:39 - 11:56	Low-Risk	58.6	31.5	Low Risk	20.0	38	9.1	47	8.8
11:57 - 12:14	Low-Risk	58.1	32.0	Moderate Risk	17.6	37	9.0	46	8.6
12:15 - 12:33	Low-Risk	57.6	32.5	Moderate Risk	17.1	36	8.9	45	8.5
12:34 - 12:53	Low-Risk	57.0	33.0	Moderate Risk	16.5	35	8.8	44	8.0
12:54 - 13:14	Low-Risk	56.2	33.5	Moderate Risk	15.9	34	8.6	43	7.8
13:15 - 13:36	Low-Risk	55.3	34.0	Moderate Risk	15.2	33	8.5	42	7.5
13:37 - 14:00	Low-Risk	54.2	34.5	Moderate Risk	14.5	32	8.4	41	7.0
14:01 - 14:25	Low-Risk	52.8	35.0	Moderate Risk	13.7	31	8.3	40	6.8
14:26 - 14:52	Low-Risk	51.2	35.5 *	Moderate Risk	12.8	30	8.2	39	6.5
14:53 - 15:20	Moderate Risk	49.3	36.0	High Risk	11.8	29	8.1	38 *	6.0
15:21 - 15:50	Moderate Risk	46.9	36.5	High Risk	10.7	28	8.0	37	5.5
15:51 - 16:22 *	Moderate Risk	44.1	37.0	High Risk	9.6	27	7.5	36	5.3
16:23 - 16:57	High Risk	40.8	37.5	High Risk	8.3	26	7.3	35	5.0
16:58 - 17:34	High Risk	36.7	38.0	High Risk	6.9	25	7.2	34	4.5
17:35 - 18:14	High Risk	31.8	38.5	High Risk	5.4	24	7.0	33	4.3
18:15 - 18:56	High Risk	25.9	39.0	High Risk	3.8	23	6.5	32	4.0
18:57 - 19:43	High Risk	18.8	39.5	High Risk	2.0	22	6.3	31	3.5
19:44 - 20:33	High Risk	10.3	≥ 40.0	High Risk	0.0	21	6.0	30	3.0
≥ 20:34	High Risk	0.0				20	5.8	29	2.8
						19	5.5	28	2.5
						18 *	5.0	27	2.0
NOTES:						17	4.5	26	1.8
Health Risk Category = low, moderate or high risk for current and future						16	4.3	25	1.7
cardiovascular disease, diabetes, certain cancers, and other health problems						15	4.0	24	1.5
						14	3.5	23	1.0
Passing Requirements - member ***must*** : 1) meet minimum value in each of						13	3.0	≤ 22	0.0
the four components, ***and*** 2) achieve a composite point total ≥ 75 points						12	2.8		
						11	2.5		
* Minimum Component Values						10	2.0		
Run time ≤ 16:22 mins:secs / Abd Circ ≤ 35.5 inches						9	1.5		
Push-ups ≥ 18 repetitions/one minute / Sit-ups ≥ 38 repetitions/one minute						8	1.0		
						≤ 7	0.0		
Composite Score Categories:									
Excellent ≥ 90.0 pts / Satisfactory = 75.0 - 89.9 / Unsatisfactory < 75.0									

The following score guide is derived from Air Force Instruction (AFI) 36-2905, *Fitness Program*. It provides a detailed breakdown of how a fitness score is calculated from pushups, situps, run time, and waist measurement.

Figure 8: Fitness Score Distribution

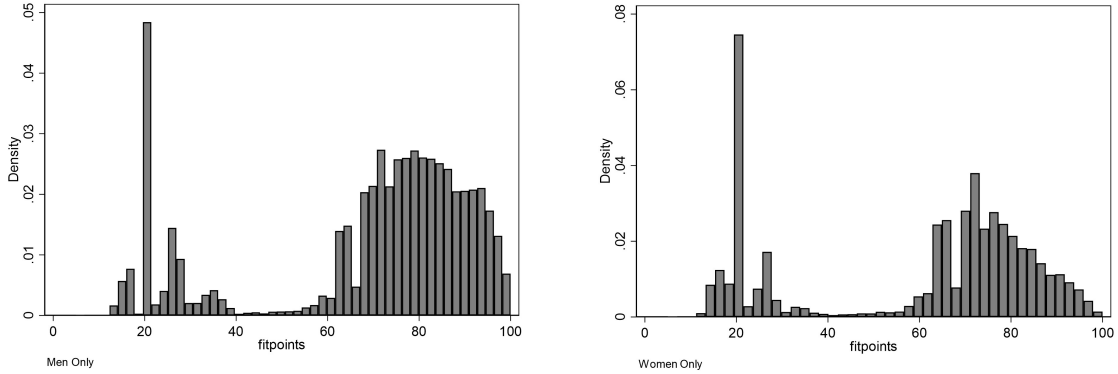


Figure 8 provides a distribution of physical fitness scores of all incoming trainees to BMT. Scores are derived based on performance in fitness exam using **Figure 6 and 7**. **Figure 9** plots ordinal physical rank on the y-axis, and demeaned fitness score on the x-axis. Both graphs are separated by gender.

Figure 9: Variation in Fitness Score Rank

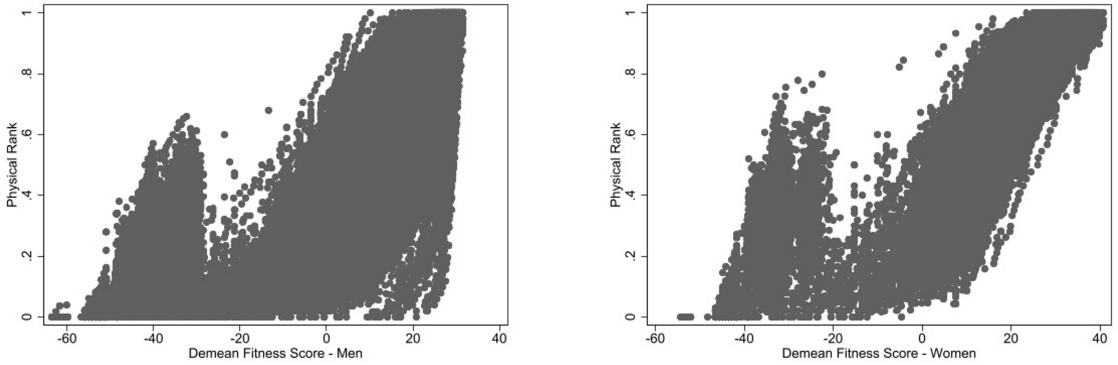
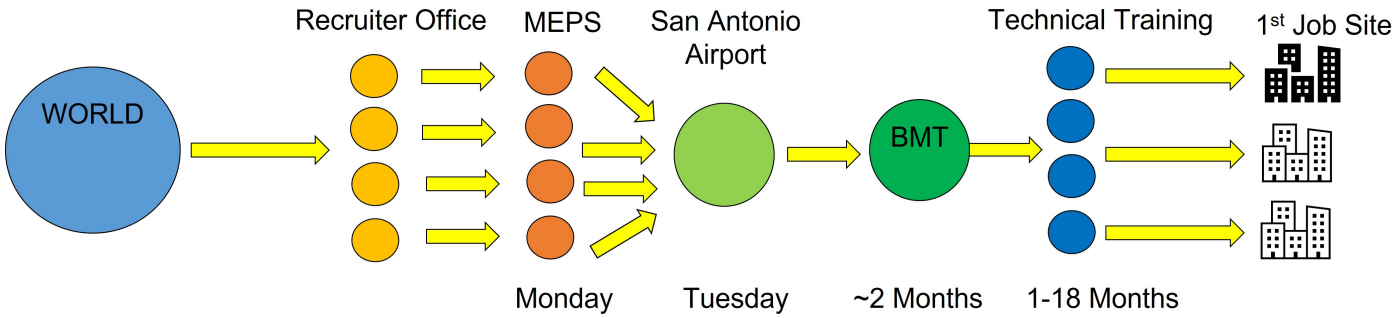
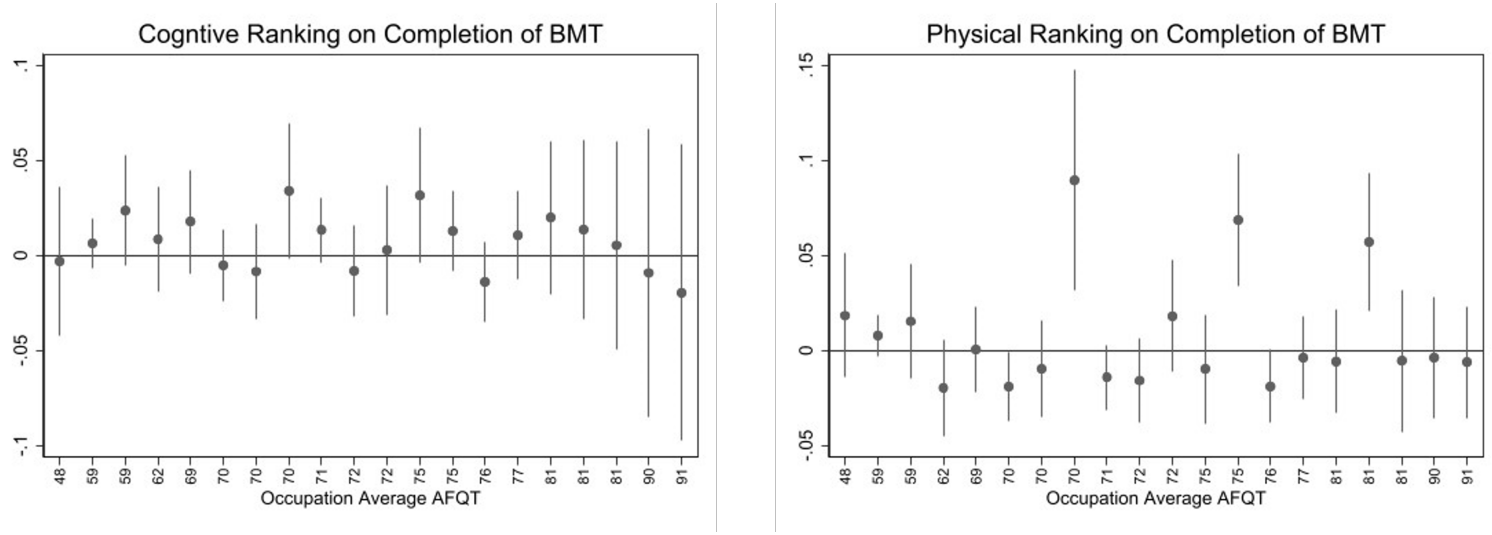


Figure 10: Trainee Arrival to/from Basic Military Training



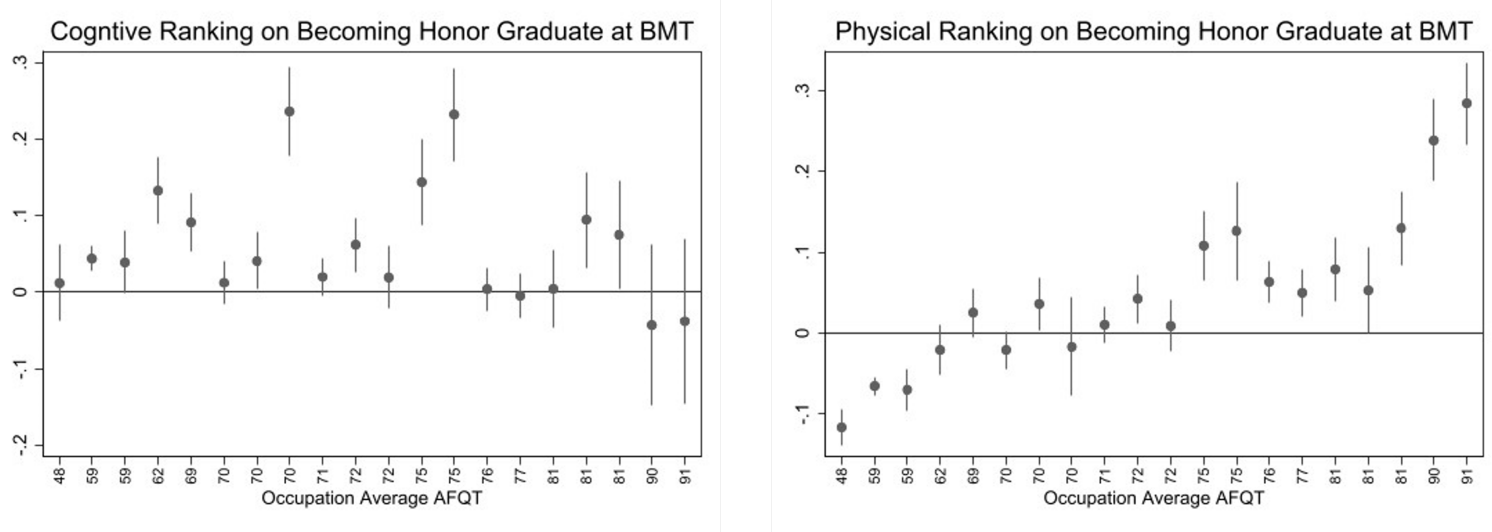
The above picture illustrates how trainees arrive to BMT from their hometown, and depart for follow-on training and their first job site at a military installation.

Figure 11: Ordinal Ranking Outcomes - By Specific Occupation



Note: The dependent variable is an indicator of whether a trainee completes BMT. We estimate **equation 1** and include an interaction between rank and having a specific AFSC from the top-20 most common occupations. These 20 occupations represent over 60% of individuals with assigned jobs. We plot the interaction term between rank and occupation and sort by AFSCs based on technical skill proxied by average AFQT scores. Each regression controls for trainee background characteristics, ventile of achievement, occupation, MEPs station, and cohort-flight fixed effects. Standard errors are clustered at the cohort level. For the graph on the left, the coefficient for cognitive ordinal ranking is 0.028 with a standard error of 0.011, N=215,132, and R^2 =0.040. For the graph on the right, the coefficient for physical fitness ordinal ranking is 0.005 with a standard error of 0.009, N=211,930, and R^2 =0.062.

Figure 12: Ordinal Ranking Outcomes - By Specific Occupation



Note: The dependent variable is an indicator of whether a trainee completes is awarded honor graduate status from BMT. We estimate **equation 1** and include an interaction between rank and having a specific AFSC from the top-20 most common occupations. These 20 occupations represent over 60% of individuals with assigned jobs. We plot the interaction term between rank and occupation and sort by AFSCs based on technical skill proxied by average AFQT scores. Each regression controls for trainee background characteristics, ventile of achievement, occupation, MEPs station, and cohort-flight fixed effects. Standard errors are clustered at the cohort level. For the graph on the left, the coefficient for cognitive ordinal ranking is 0.030 with a standard error of 0.013, N=215,132, and R^2 =0.154. For the graph on the right, the coefficient for physical fitness ordinal ranking is 0.025 with a standard error of 0.009, N=211,930, and R^2 =0.120.

Table 1: USAF Basic Military Trainees Entering from October 2011 - December 2017

	Full	Men	Women
Women	0.227	0	1
	(0.419)	–	–
Age	20.62	20.58	20.76
	(3.201)	(3.130)	(3.428)
Black	0.190	0.172	0.250
	(0.392)	(0.377)	(0.433)
Hispanic	0.145	0.144	0.149
	(0.352)	(0.351)	(0.356)
Asian	0.049	0.049	0.047
	(0.215)	(0.216)	(0.212)
Married	0.101	0.096	0.116
	(0.301)	(0.295)	(0.320)
Some College	0.101	0.096	0.120
	(0.302)	(0.294)	(0.325)
Bachelor's Degree or more	0.045	0.041	0.060
	(0.208)	(0.198)	(0.237)
No Health Issues	0.741	0.749	0.713
	(0.438)	(0.434)	(0.452)
Waiver Required	0.094	0.094	0.094
	(0.292)	(0.292)	(0.291)
Active Duty	0.794	0.813	0.730
	(0.405)	(0.390)	(0.444)
Guaranteed Job (Active Only)	0.656	0.663	0.631
	(0.475)	(0.473)	(0.482)
Armed Forces Qualification Test (AFQT)	69.23	70.40	65.25
	(16.01)	(15.95)	(15.57)
Initial Physical Fitness Score	65.30	67.43	58.05
	(26.66)	(26.01)	(27.54)
Observations	215132	166362	48770

Table 2: Variation in key variables after fixed effect transformations

	(1) raw SD	(2) Flight FE
Cognitive Ordinal Rank	0.294	0.294
		[0.999]
Cognitive Ordinal Rank Conditional on Ability	0.084	0.051
		[0.030]
AFQT Score	16.012	15.570
		[0.946]
Fitness Ordinal Rank	0.301	0.301
		[0.999]
Fitness Ordinal Rank Conditional on Ability	0.125	0.071
		[0.055]
Fitness Score	25.417	23.755
		[0.873]
Graduation from BMT	0.240	0.237
		[0.974]
Honor Graduate from BMT	0.287	0.282
		[0.964]
No Verbal Counseling	0.481	0.474
		[0.966]
No Disciplinary Action	0.475	0.444
		[0.870]

Note: Results from the above table summarize standard deviations of predicted variables after linear regression of variables indicated on the left on sets of fixed effects. In the first column, no fixed effects are included and only the raw standard deviations are reported. In column two, entry flight fixed effects are included. Numbers in the square brackets report the share of remaining variation ($1 - R^2$).

Table 3: Specification Check - Cognitive Ranking on Completion of BMT

	(1) Cohort FE	(2) Cohort FE	(3) Cohort FE	(4) Cohort FE	(5) Flt FE
Cognitive Ordinal Rank	0.026***	0.031**	0.031**	0.038***	0.032**
	(0.008)	(0.010)	(0.010)	(0.011)	(0.010)
$\overline{AFQT_{-i}}$		0.000	0.000	-0.002*	
		(0.000)	(0.000)	(0.001)	
$SD(AFQT_{-i})$			-0.000	-0.014*	
			(0.000)	(0.006)	
$\overline{AFQT_{-i}}$ x $SD(AFQT_{-i})$				0.000*	
				(0.000)	
N	215132	215132	215132	215132	215132
r2	0.020	0.020	0.020	0.020	0.040
r2_a	0.016	0.016	0.016	0.016	0.019

Standard errors are clustered at the cohort level

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

Note: Results from the above table are from **equation 1** on completing BMT. Ordinal cognitive ranking is measured at the flight level based on scores on the AFQT. Each column adds an additional interaction of flight distribution characteristics. All regressions control for trainee characteristics, ventile of achievement, occupation, and MEPs station. In the first four columns, each regression controls for cohort fixed effects and gender. In the last column we control for flight fixed effects. Column 5 is our preferred specification.

Table 4: Exogeneous Assignment

	(1) Cognitive Rank	(2) Physical Rank
Black	-0.001	0.000
	(0.000)	(0.001)
Hispanic	-0.000	0.001
	(0.000)	(0.001)
Asian	-0.001	0.003***
	(0.001)	(0.001)
Age	0.000	0.000
	(0.000)	(0.000)
Any College Plus	0.001	0.001*
	(0.000)	(0.001)
Married	0.000	-0.001
	(0.000)	(0.001)
Health Screening	-0.000	0.000
	(0.000)	(0.000)
Waiver	0.001*	-0.000
	(0.000)	(0.001)
Enlistment Contract	-0.001	-0.001
	(0.000)	(0.000)
N	215132	211930
r2	0.970	0.945
r2_a	0.969	0.944

Robust standard errors are clustered at the cohort level in parentheses.

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

Note: Results are from **equation 2**. The first column regresses cognitive ranking on individual characteristics. The second column regresses physical ranking on individual characteristics. All regressions control for ventile of achievement, occupation, MEPs station, and cohort-flight fixed effects.

Table 5: Cognitive Rank Outcomes

	(1) BMT Completion	(2) Honor Graduate	(3) No Verbal Counseling	(4) No Disciplinary Action
Cognitive Ordinal Rank	0.032**	0.056***	0.009	0.037*
	(0.010)	(0.013)	(0.024)	(0.017)
N	215132	215132	159693	159693
r2	0.040	0.152	0.196	0.056
Cognitive Ordinal Rank	0.023*	0.051***	0.044	0.040*
	(0.010)	(0.014)	(0.024)	(0.017)
Rank x Female	0.018***	0.010	-0.091***	-0.010
	(0.005)	(0.006)	(0.010)	(0.007)
N	215132	215132	159693	159693
r2	0.040	0.152	0.196	0.056
Mean	0.939	0.091	0.663	0.867

Robust standard errors are clustered at the cohort level in parentheses.

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

Note: Results from the above table are from **equation 1** and report the coefficient from the ordinal ranking in cognitive ability. Each regression controls for trainee background characteristics, ventile of achievement, occupation, MEPs station, and cohort-flight fixed effects. Columns 1-2 represent contemporaneous outcomes from Basic Military Training. Columns 3-4 represent disciplinary outcomes from follow-on technical training and the first 36 months at work. In the bottom half of the table, an interaction between rank and female is included.

Table 6: Physical Rank Outcomes

	(1) BMT Completion	(2) Honor Graduate	(3) No Verbal Counseling	(4) No Disciplinary Action
Physical Ordinal Rank	0.013	0.041***	0.013	0.063***
	(0.008)	(0.009)	(0.016)	(0.013)
N	211930	211930	159122	159122
r2	0.061	0.116	0.185	0.059
Physical Ordinal Rank	-0.002	0.045***	0.013	0.071***
	(0.008)	(0.009)	(0.017)	(0.013)
Rank x Female	0.032***	-0.009	-0.002	-0.021**
	(0.005)	(0.005)	(0.010)	(0.007)
N	211930	211930	159122	159122
r2	0.062	0.116	0.185	0.059
Mean	0.949	0.092	0.663	0.867

Robust standard errors are clustered at the cohort level in parentheses.

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

Note: Results from the above table are from **equation 1** and report the coefficient from the ordinal ranking in physical fitness. Each regression controls for trainee background characteristics, ventile of achievement, occupation, MEPs station, and cohort-flight fixed effects. Columns 1-2 represent contemporaneous outcomes from Basic Military Training. Columns 3-4 represent disciplinary outcomes from follow-on technical training and the first 36 months at work. In the bottom half of the table, an interaction between rank and female is included.

Table 7: Cognitive Rank Outcomes - By Race

	(1) BMT Completion	(2) Honor Graduate	(3) No Verbal Counseling	(4) No Disciplinary Action
Cogntive Ordinal Rank	0.036***	0.077***	0.017	0.037*
	(0.010)	(0.013)	(0.024)	(0.017)
Rank x Black	-0.008	-0.071***	-0.036**	0.002
	(0.005)	(0.006)	(0.011)	(0.009)
Rank x Hispanic	-0.012*	-0.025***	-0.000	-0.004
	(0.005)	(0.006)	(0.011)	(0.007)
Rank x Asian	-0.014*	-0.059***	-0.033*	-0.008
	(0.007)	(0.010)	(0.017)	(0.011)
N	215132	215132	159693	159693
r2	0.040	0.153	0.196	0.056
Mean	0.939	0.091	0.663	0.867

Robust standard errors are clustered at the cohort level in parentheses.

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

Note: Results from the above table are from **equation 1** and report the coefficient from the ordinal ranking in cognitive ability and the interaction between ranking and race. Each regression controls for trainee background characteristics, ventile of achievement, occupation, MEPs station, and cohort-flight fixed effects. Columns 1-2 represent contemporaneous outcomes from Basic Military Training. Columns 3-4 represent disciplinary outcomes from follow-on technical training and the first 36 months at work.

Table 8: Cognitive Rank Outcomes - By General Aptitude Area

	(1) BMT Completion	(2) Honor Graduate	(3) No Verbal Counseling	(4) No Disciplinary Action
Cogntive Ordinal Rank	0.036***	0.080***	0.033	0.037*
	(0.010)	(0.013)	(0.023)	(0.017)
Rank x Aptitude Index with Avg. AFQT 54	-0.009	-0.075***	-0.059*	-0.022
	(0.018)	(0.019)	(0.024)	(0.024)
Rank x Aptitude Index with Avg. AFQT 68	-0.016*	-0.065***	-0.209***	0.011
	(0.008)	(0.009)	(0.018)	(0.011)
Rank x Aptitude Index with Avg. AFQT 69	-0.010	-0.087***	0.030*	-0.004
	(0.006)	(0.007)	(0.014)	(0.009)
Rank x Aptitude Index with Avg. AFQT 76	-0.032**	-0.131***	0.071**	-0.016
	(0.011)	(0.012)	(0.024)	(0.015)
N	215132	215132	159693	159693
r2	0.040	0.153	0.197	0.056
Mean	0.939	0.091	0.663	0.867

Robust standard errors are clustered at the cohort level in parentheses.

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

Note: Results from the above table are from **equation 1** and report the coefficient from the ordinal ranking in cognitive ability and the interaction between ranking and one of four aptitude areas for incoming trainees. The excluded group includes all trainees that have an occupation assigned before arrival to BMT. Each regression controls for trainee background characteristics, ventile of achievement, occupation, MEPs station, and cohort-flight fixed effects. Columns 1-2 represent contemporaneous outcomes from Basic Military Training. Columns 3-4 represent disciplinary outcomes from follow-on technical training and the first 36 months at work.

Table 9: Cognitive Rank Outcomes - By Region

	(1) BMT Completion	(2) Honor Graduate	(3) No Verbal Counseling	(4) No Disciplinary Action
Cogntive Ordinal Rank	0.039**	0.087***	0.015	0.045*
	(0.012)	(0.014)	(0.024)	(0.018)
Rank x East Coast	-0.005	-0.023***	-0.009	-0.021**
	(0.005)	(0.006)	(0.010)	(0.007)
Rank x West Coast	-0.008	-0.005	-0.009	-0.007
	(0.005)	(0.006)	(0.009)	(0.008)
N	170294	170294	159115	159115
r2	0.059	0.144	0.196	0.056
Mean	0.934	0.083	0.662	0.867

Robust standard errors are clustered at the cohort level in parentheses.

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

Note: Results from the above table are from **equation 1** and report the coefficient from the ordinal ranking in cognitive ability and the interaction between ranking and arriving from MEPS located on either the West or East Coast of the United States. The excluded group includes all trainees arriving from the rest of the United States and the world. Each regression controls for trainee background characteristics, ventile of achievement, occupation, MEPs station, and cohort-flight fixed effects. Columns 1-2 represent contemporaneous outcomes from Basic Military Training. Columns 3-4 represent disciplinary outcomes from follow-on technical training and the first 36 months at work.

Table 10: Physical Rank Outcomes - By Race

	(1) BMT Completion	(2) Honor Graduate	(3) No Verbal Counseling	(4) No Disciplinary Action
Physical Ordinal Rank	0.024**	0.077***	0.015	0.075***
	(0.008)	(0.009)	(0.017)	(0.013)
Rank x Black	-0.029***	-0.118***	-0.019	-0.040***
	(0.004)	(0.004)	(0.010)	(0.009)
Rank x Hispanic	-0.026***	-0.073***	0.010	-0.021**
	(0.005)	(0.005)	(0.010)	(0.008)
Rank x Asian	-0.047***	-0.017*	-0.021	-0.030**
	(0.007)	(0.009)	(0.016)	(0.011)
N	211930	211930	159122	159122
r2	0.062	0.119	0.185	0.059
Mean	0.939	0.091	0.663	0.867

Robust standard errors are clustered at the cohort level in parentheses.

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

Note: Results from the above table are from **equation 1** and report the coefficient from the ordinal ranking in physical fitness and the interaction between ranking and race. Each regression controls for trainee background characteristics, ventile of achievement, occupation, MEPs station, and cohort-flight fixed effects. Columns 1-2 represent contemporaneous outcomes from Basic Military Training. Columns 3-4 represent disciplinary outcomes from follow-on technical training and the first 36 months at work.

Table 11: Physical Rank Outcomes - By General Aptitude Area

	(1) BMT Completion	(2) Honor Graduate	(3) No Verbal Counseling	(4) No Disciplinary Action
Physical Ordinal Rank	0.012	0.051***	0.018	0.067***
	(0.008)	(0.009)	(0.017)	(0.013)
Rank x Aptitude Index with Avg. AFQT 54	0.003	-0.136***	-0.049*	-0.009
	(0.012)	(0.008)	(0.021)	(0.018)
Rank x Aptitude Index with Avg. AFQT 68	0.004	-0.031***	-0.031*	-0.027**
	(0.007)	(0.007)	(0.013)	(0.010)
Rank x Aptitude Index with Avg. AFQT 69	0.004	-0.035***	0.003	-0.001
	(0.005)	(0.006)	(0.011)	(0.009)
Rank x Aptitude Index with Avg. AFQT 76	-0.010	0.026*	0.019	-0.005
	(0.008)	(0.010)	(0.019)	(0.013)
N	211930	211930	159122	159122
r2	0.061	0.117	0.185	0.059
Mean	0.939	0.091	0.663	0.867

Robust standard errors are clustered at the cohort level in parentheses.

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

Note: Results from the above table are from **equation 1** and report the coefficient from the ordinal ranking in physical fitness and the interaction between ranking and one of four aptitude areas for incoming trainees. The excluded group includes all trainees that have an occupation assigned before arrival to BMT. Each regression controls for trainee background characteristics, ventile of achievement, occupation, MEPs station, and cohort-flight fixed effects. Columns 1-2 represent contemporaneous outcomes from Basic Military Training. Columns 3-4 represent disciplinary outcomes from follow-on technical training and the first 36 months at work.

Table 12: Physical Rank Outcomes - By Region

	(1) BMT Completion	(2) Honor Graduate	(3) No Verbal Counseling	(4) No Disciplinary Action
Physical Ordinal Rank	0.023*	0.050***	0.016	0.069***
	(0.010)	(0.011)	(0.017)	(0.014)
Rank x East Coast	-0.022***	-0.012*	-0.003	-0.012
	(0.005)	(0.005)	(0.009)	(0.008)
Rank x West Coast	-0.013*	-0.003	-0.006	-0.006
	(0.005)	(0.006)	(0.009)	(0.008)
N	167602	167602	158544	158544
r2	0.082	0.117	0.185	0.059
Mean	0.946	0.084	0.663	0.867

Robust standard errors are clustered at the cohort level in parentheses.

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

Note: Results from the above table are from **equation 1** and report the coefficient from the ordinal ranking in physical fitness and the interaction between ranking and arriving from MEPS located on either the West or East Coast of the United States. The excluded group includes all trainees arriving from the rest of the United States and the world. Each regression controls for trainee background characteristics, ventile of achievement, occupation, MEPs station, and cohort-flight fixed effects. Columns 1-2 represent contemporaneous outcomes from Basic Military Training. Columns 3-4 represent disciplinary outcomes from follow-on technical training and the first 36 months at work.

Table 13: Top vs. Bottom Analysis

	(1) BMT Completion	(2) Honor Graduate	(3) No Verbal Counseling	(4) No Disciplinary Action
AFQT Rank - Top 10 percent	0.029**	0.046***	0.004	0.040*
	(0.009)	(0.012)	(0.021)	(0.016)
N	215132	215132	159693	159693
r2	0.040	0.152	0.196	0.056
r2_a	0.019	0.134	0.173	0.029
Fitness Rank - Top 10 percent	0.016*	0.043***	0.012	0.060***
	(0.008)	(0.009)	(0.015)	(0.012)
N	211930	211930	159122	159122
r2	0.061	0.117	0.185	0.059
r2_a	0.041	0.097	0.162	0.032

Robust standard errors are clustered at the cohort level in parentheses.

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

Note: Results from the above table are from a regression on outcomes using deciles of ranking with the bottom decile being excluded. Coefficients for having a ranking in the top 10 percent relative to the bottom 10 percent are reported in this table. Each regression controls for trainee background characteristics, ventile of achievement, occupation, MEPs station, and cohort-flight fixed effects. Columns 1-2 represent contemporaneous outcomes from Basic Military Training. Columns 3-4 represent disciplinary outcomes from follow-on technical training and the first 36 months at work.

Table 14: Occupation Selection

	(1) AFQT	(2) Mechanical	(3) Administrative	(4) General	(5) Electronics
SD in Cognitive Rank	0.062**	0.047*	0.058*	0.066**	0.054**
	(0.024)	(0.020)	(0.024)	(0.023)	(0.020)
N	53881	53881	53881	53881	53881
r2	0.377	0.522	0.367	0.381	0.540
SD in Physical Rank	-0.010	-0.017	-0.008	-0.011	-0.016
	(0.017)	(0.015)	(0.017)	(0.017)	(0.014)
N	53881	53881	53881	53881	53881
r2	0.342	0.501	0.331	0.348	0.517

Robust standard errors are clustered at the cohort level in parentheses.

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

Note: Results from the above table are from **equation 1** and report the coefficients from the rank effect. The rank variable is standardized to have a mean of 0 and a standard deviation of 1. The outcome of interest indicates the average test score from the ASVAB of a matched occupation during BMT. The results are reported for only trainees that arrive to training without a specific occupation assigned. Each regression controls for trainee background characteristics, ventile of achievement for both physical and cognitive test scores, aptitude area, MEPs station, and cohort-flight fixed effects. Column 1 reports average AFQT score of assigned occupation. Columns 2-5 report average Mechanical, Administrative, General, and Electronic scores from the ASVAB of the assigned occupation.

Table 15: Rank Relationship between Cognitive and Physical

	(1) Fitness Rank	(2) BMI Rank	(3) Waist Rank	(4) Height Rank
Cognitive Rank	-0.009***	0.002	0.051***	0.067***
	(0.002)	(0.002)	(0.002)	(0.002)
Rank x Gender	0.006*	-0.014***	-0.011***	-0.001
	(0.003)	(0.003)	(0.003)	(0.003)
N	211930	205378	205288	205378
r2	0.000	0.000	0.003	0.005
r2_a	0.000	0.000	0.003	0.005

Standard errors in parentheses

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

Note: The following table regresses cognitive ranking on physical ranking measured at the flight level. Additionally, the interaction between an indicator for female and cognitive rank are included in the regression.

Table 16: Rank Interactions

	(1 - Full) BMT Completion	(2 - Full) Honor Graduate	(3 - Men) BMT Completion	(4 - Men) Honor Graduate	(5 - Women) BMT Completion	(6 - Women) Honor Graduate
Cognitive Ordinal Rank	0.041***	-0.184***	0.047***	-0.181***	0.047	-0.191***
	(0.010)	(0.014)	(0.011)	(0.017)	(0.024)	(0.022)
Physical Ordinal Rank	0.020*	-0.199***	0.004	-0.194***	0.037	-0.157***
	(0.009)	(0.009)	(0.009)	(0.011)	(0.020)	(0.017)
Cognitive * Physical Rank	-0.016**	0.490***	-0.017**	0.506***	-0.015	0.432***
	(0.006)	(0.010)	(0.007)	(0.010)	(0.013)	(0.015)
N	211930	211930	163797	163797	47905	47905
r2	0.062	0.207	0.051	0.206	0.071	0.211
Mean	0.949	0.092	0.955	0.098	0.936	0.071

Robust standard errors are clustered at the cohort level in parentheses.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: Results from the above table are from **equation 3** and report the coefficients from cognitive and physical ordinal ranking and the interaction. Each regression controls for trainee background characteristics, ventile of achievement for both physical and cognitive test scores, occupation, MEPs station, and cohort-flight fixed effects. Columns 1-2 represent contemporaneous outcomes from Basic Military Training for all observations. Columns 3-4 report only men. Columns 5-6 report only women.

Table 17: Honor Graduate on Long-term Outcomes

	(1) No Failed Exam	(2) No Block Failure	(3) No Counseling	(4) No Disciplinary	(5) Career Change
Honor Graduate at BMT	0.076***	0.012***	0.065***	0.030***	0.004*
	(0.004)	(0.002)	(0.004)	(0.003)	(0.002)
N	159122	159122	159122	159122	156494
r2	0.158	0.354	0.198	0.060	0.102
Mean	0.685	0.849	0.634	0.655	0.033
Men Only	0.075***	0.010***	0.064***	0.031***	0.004*
	(0.004)	(0.002)	(0.005)	(0.003)	(0.002)
N	126608	126608	126608	126608	124440
r2	0.144	0.319	0.193	0.059	0.082
Mean	0.708	0.877	0.645	0.667	0.030
Women Only	0.073***	0.018**	0.066***	0.021***	0.005
	(0.009)	(0.007)	(0.010)	(0.006)	(0.005)
N	32514	32514	32514	32514	32054
r2	0.189	0.393	0.224	0.064	0.157
Mean	0.610	0.758	0.599	0.614	0.044

Robust standard errors are clustered at the cohort level in parentheses.

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

Note: Results from the above table are from **equation 4** and report the coefficients from honor graduate status. Each regression controls for trainee background characteristics, ventile of achievement for both physical and cognitive test scores, occupation, MEPs station, and cohort-flight fixed effects. Columns 1-3 represent outcomes in follow-on training. Columns 4-5 report disciplinary and career change indicators during an individual's first 36 months in the organization.

Appendices

A Robustness Checks

A.1: Active Duty sample and bounding exercise

	BMT Completion	Honor Graduate	(1 - Attrit) No Verbal Counseling	(0 - Attrit) No Verbal Counseling	(1 - Attrit) No Discipline	(0 - Attrit) No Discipline
Cognitive Ordinal Rank	0.036**	0.078***	-0.004	0.032	0.030	0.065***
	(0.012)	(0.014)	(0.023)	(0.023)	(0.016)	(0.018)
N	170698	170698	170698	170698	170698	170698
r2	0.045	0.147	0.180	0.168	0.053	0.051
Physical Ordinal Rank	0.012	0.048***	0.010	0.021	0.056***	0.068***
	(0.009)	(0.010)	(0.016)	(0.016)	(0.012)	(0.014)
N	168051	168051	168051	168051	168051	168051
r2	0.069	0.120	0.173	0.167	0.054	0.068

Robust standard errors are clustered at the cohort level in parentheses.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: Results from the above table are from **equation 1** and report the coefficients from cognitive and physical ordinal ranking. These regressions only include active duty trainees which compose 79% of the total sample. Each regression controls for trainee background characteristics, ventile of achievement, occupation, MEPs station, and cohort-flight fixed effects. Columns 1-2 report contemporaneous outcomes from Basic Military Training. Columns 3-4 report disciplinary outcomes from follow-on technical training. Columns 5-6 report disciplinary outcomes during the first 36 months in the organization. In columns 3 and 5, trainees that do not complete BMT are included and the outcome of interest is coded as 1. In columns 4 and 6, the outcomes are given a value of 0. These columns provide a bound on attrition bias in which our main results reported in **table 5 and 6**. Importantly, the lower bounds of our estimated rank effects all fall within one-half of one standard error of our main estimates, indicating that attrition from the sample is not driving our estimated effects.