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DISSERTATION

Three Essays on Obstacles to Improving Demographic Representation in the Armed Forces

David Schulker

This document was submitted as a dissertation in August 2010 in partial fulfillment of the requirements of the doctoral degree in public policy analysis at the Pardee RAND Graduate School. The faculty committee that supervised and approved the dissertation consisted of Nelson Lim (Chair), Natalie Crawford, and Greg Ridgeway.

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ABSTRACT

Policymakers in the Department of Defense and Congress have expressed a normative goal that all levels of the armed forces ought to represent society, coupled with alarm over whether recruiting and promotion policy can keep up with society's rapidly changing demographics. This dissertation informs manpower policymakers seeking to achieve this goal of social representation by presenting three essays on obstacles to improving demographic representation in the armed forces.

The first essay focuses on the effect of eligibility requirements on the demographic distribution of the population that is able to serve in the Air Force. This essay estimates the race/ethnicity and gender distribution of several populations: (1) the population that is eligible to enlist in the Air Force, (2) the population that meets requirements similar to those met by officers who commission through Reserve Officer Training Corps and Officer Training School, and (3) the population that meets requirements similar to those met by officers commissioning through the US Air Force Academy. Furthermore, this essay incorporates "propensity to serve" as a measure of baseline demographic differences in preferences for military service. In each case, the eligibility benchmark contains a smaller percentage of minority youths than the general US population. This result is primarily driven by education and aptitude requirements, and for officer benchmarks, citizenship requirements. The eligible population tends to contain a high percentage of white females, which in some cases approaches a majority. Preferences for military service tend to work in favor of minority representation and against female representation.

The second essay focuses on Air Force Specialty Code (AFSC, i.e. occupation) assignment at the United States Air Force Academy (USAFA). Historically, Air Force personnel policies have demonstrated a preference for rated (i.e. flying) AFSCs by giving officers assigned to these AFSCs better promotion prospects. If these policies continue, the demographics of future senior leaders will tend to reflect the demographics of cadets who enter into these particular AFSCs. This essay summarizes demographic differences in AFSC assignments for the USAFA classes of 2004-2009 and models the assignments with probit regression and a two-sided logit methodology. The Air Force Academy ranks cadets according to performance and classifies cadets into AFSCs such that higher-performing cadets are more likely to receive their most-preferred AFSCs. The two-sided logit methodology analyzes preferences for AFSCs in multinomial logit fashion, while allowing the available choices to vary according to a cadet's performance ranking. Findings indicate that female cadets, and to a lesser degree minority cadets, are less likely than male and non-minority cadets to enter rated AFSCs. While differences in performance, medical qualification, human capital, family considerations, and background can account for some of this tendency, even female and minority cadets with characteristics that are similar to the male and white cadets are less likely to enter the rated sector and more likely to enter the various non-rated sectors of the Air Force.

The third essay performs a parallel analysis on the 2007 Army ROTC branch (occupation) assignments. Because Army ROTC assigns branches to cadets in a way similar to the Air Force Academy's AFSC classification process, this essay also employs the two-sided logit methodology. This analysis finds that female cadets, and to a lesser degree minority cadets, are more likely to be assigned to combat support and combat service support branches, while male and white cadets are more likely to enter the combat arms sector—the sector which promotes more prolifically to the senior levels. Results from the two-sided logit estimation revealed that some of the tendency for female and minority cadets to submit preferences for combat service support branches may have been attributable to the classification process, as lower performing cadets have fewer opportunities to obtain combat arms assignments. The analysis estimated a two-sided logit specification that included several human capital variables. Although these additional variables, themselves, were significantly associated with branch preferences, they explained very little of the correlation between demographics and branch preferences.

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Any remaining errors in this dissertation are my sole responsibility, and mine alone.

ABBREVIATIONS

ACS	American Community Survey
ADSO	Active Duty Service Obligation
AFQT	Armed Forces Qualifying Test
AFSC	Air Force Specialty Code
AME	Average Marginal Effect
ASVAB	Armed Services Vocational Aptitude Battery
BOM	Board Order of Merit
BRFSS	Behavioral Risk Factor Surveillance System
CA	Combat Arms
CGO	Company Grade Officer
CS	Combat Support
CSS	Combat Service Support
DA	Department of the Army
FGO	Field Grade Officer
GPA	Grade Point Average
MNL	Multinomial Logit
MPA	Military Performance Average
MTF	Monitoring the Future
NLSY	National Longitudinal Survey of Youth
OLS	Ordinary Least Squares
OML	Order of Merit List
OMS	Order of Merit Score
OPA	Overall Performance Average
OTS	Officer Training School
PEA	Physical Education Average
PI	Pacific Islander
PNQ	Potentially Navigator Qualified
PPQ	Potentially Pilot Qualified
ROTC	Reserve Officer Training Corps
TSL	Two-Sided Logit
USAFA	United States Air Force Academy

INTRODUCTION: DEMOGRAPHIC REPRESENTATION IN THE ARMED FORCES

Though concern over demographic representation in the armed forces is actually much older than the recent policy emphasis on diversity, or even the modern civil rights movement[1], many of the contemporary concerns began to emerge at the transition to the All-Volunteer Force (AVF). At the onset of the transition to the AVF, the Senate Armed Services Committee mandated in 1974 that the DoD publish annual statistics on social representation (Asch et al., 2009). While the draft is nationally representative by design, policymakers were worried that this representation would be difficult to maintain with a system that relied on volunteers alone (Armor and Gilroy, 2009). Interestingly, much of the policy concern at the time involved minority *over*-representation. During the Vietnam War, opponents of the draft argued that education-based draft deferments protected the affluent, causing the burdens of war to fall disproportionately on minority youth. Since the transition to the All-Volunteer Force, policies of demographic representation seem to teeter back and forth between the goal of ensuring that all people have access to the beneficial employment opportunities in the armed forces and the fear that the sacrifices of service would be borne unequally by disadvantaged groups.

More recently, DoD leaders have expressed a normative goal that the armed forces ought to represent society, coupled with alarm over whether recruiting can keep up with the quickly changing demographics of the US population. For instance, in a speech at the inaugural meeting of the Military Leadership Diversity Commission, Admiral Michael Mullen, Chairman of the Joint Chiefs of Staff, stated, “My fundamental belief is that we, as a military, must represent our country. We must represent the demographics of it” (Kruzel, 2009). He followed this declaration by expressing concern over population trends, colloquially saying “the clock is ticking here.”

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[1] For a historical review of demographic representation and military personnel policy, see Armor (1996)

The policy concern goes beyond whether the armed forces, in total, represent the demographics of the US population. Indeed, policymakers are especially interested in demographic representation *at all levels* of the armed forces. Policymakers have indicated a specific interest in improving minority (i.e. non-white) and female officer progression through the ranks of military leadership. This research interest in racial/ethnic and gender differences in officer career progression began to gain momentum in 1994 as Secretary of Defense William Perry issued a memorandum of instructions for improving equal opportunity in the DoD. In that memorandum, Secretary Perry tasked the Undersecretary of Defense for Personnel and Readiness to "lead a major study of the Officer 'pipeline'…" and "recommend ways to improve the flow of minority and female officers from recruitment through the general and flag officer ranks" (Office of the Assistant Secretary of Defense, 1995). In 2005, Secretary of Defense Donald Rumsfeld issued a directive to "put much more energy into achieving diversity at senior levels of services." This directive sought to improve minority and female representation among both uniformed and civilian senior DoD leaders (Lim, Cho, and Curry; 2008). This same policy concern was the driving force behind the establishment of a "Military Leadership Diversity Commission," which Congress specifically tasked to "conduct a comprehensive evaluation and assessment of policies that provide opportunities for the promotion and advancement of minority members of the Armed Forces, including…senior officers" (10 U.S.C. 596, 2008). The policy issue of demographic representation in the armed forces, as the law states, encompasses the entire military career from the lowest ranks to the highest.

In sum, demographic representation in accession cohorts and at all levels of the armed forces is an issue that is currently being trumpeted at senior levels of the DoD, and research is being called for directly by Congress. This dissertation provides some insight into this policy need—the first essay dealing with demographic representation in accession cohorts and the second two essays with promotion and advancement.

Race and Ethnicity Definitions

Typically, race (e.g. white, black, Asian) and ethnicity (e.g. Hispanic) data are collected with two separate questions, so that it is often possible for a respondent to select both a race and an ethnicity. Wherever possible, the following essays will simplify the race and ethnicity construct by adopting a mutually exclusive categorization for both. This analysis will consider a person who indicates any Hispanic ethnicity to be "Hispanic," regardless of his or her race. Then, the analysis will classify all of the non-Hispanic persons according to their race. Thus, "white" will refer to persons who are white and not Hispanic, "black" will refer to persons who are black and not Hispanic, etc. At times, there will be a residual category for "persons of other races," which will include all (non-Hispanic) persons who do not fall into a previous category, including persons of more than one race. Finally, for the sake of brevity, this analysis will use the term "minority" to refer collectively to all persons who do not fall into the (non-Hispanic) white category.

FIRST ESSAY: THE EFFECT OF AIR FORCE REQUIREMENTS ON THE DEMOGRAPHIC COMPOSITION OF THE ELIGIBLE POPULATION

INTRODUCTION

The armed forces differ from private firms in several key ways that make the demographics of persons eligible to *begin* a career extremely relevant to whether the armed forces represent the demographics of society. First, the armed forces make a unique qualitative distinction between "officer" and "enlisted" personnel. Though some enlisted personnel are selected to undergo officer training and transition to the officer ranks, this transition is not routine. Most begin and end their careers in one tier or the other. In addition, the armed forces are distinct from private firms in that all new hires enter the organization at a single point. With few exceptions (e.g. dentists), all military personnel must begin their careers at the entry-level pay grades. Even at the highest levels of leadership, the DoD must fill each new position by promoting someone from within. Because of this structure, the population that meets initial eligibility requirements to join either the enlisted or officer tier plays a crucial role in determining the demographic makeup of all levels of the military. All else being equal, the demographic makeup of the higher levels of leadership will be no more diverse than the population that is eligible to serve at the time of entry.

While representing the demographics of society is an explicit policy goal, the population eligible for service in the armed forces tends to be quite different from the general U.S. population. In order to enlist in the armed forces, recruits must successfully navigate a complex system of requirements. For the armed forces to accept an enlisted recruit, he or she must meet standards regarding his or her age, intelligence, health, education, marital status, number of children, and past conduct. In order to become an officer, individuals must meet age and health requirements, be a US citizen, and they must go through a commissioning program which typically requires completion of a college degree (e.g. Reserve Officer Training Corps (ROTC), Officer Training School (OTS)). Officers who commission through the US Air

Force Academy (USAFA) must meet the strictest standards of all—being accepted by the institution itself requires a congressional nomination, to say nothing of the completion of four years rigorous academic, physical, and military training. A tendency for any one of these requirements to disproportionately limit persons in a particular demographic subgroup would limit the ability of the armed forces to represent that group in proportion to its representation in society.

There is evidence that many requirements do, in fact, disproportionately affect minority and/or female youth—that is, they disqualify minority and/or female youth at higher rates than white and/or male youth. For example, Armor (1996) notes that black male applicants for enlistment are accepted at lower rates than white male applicants, attributing the difference in acceptance rates to differences in aptitude test results. In addition, Nolte et al. (2002) demonstrate that women (especially non-Hispanic black and Mexican-American women) tend to meet body composition requirements at lower rates than men. More recently, Asch et al. (2009) analyze the affect of the major enlistment requirements on minority eligibility (specifically focusing on Hispanic enlistments). They find that a lack of a high school diploma, lower AFQT scores, and being overweight disqualify black and Hispanic youth at higher rates than white youth.

The focus of this paper is to build on previous work and estimate the racial/ethnic and gender distribution of the population that meets enlistment requirements and the population that meets requirements similar to those that commissioned officers must meet. This paper will also compare the demographic makeup of these populations to recent accession cohorts, while assessing the impact of requirements on demographic representation. While military policymakers may strive to represent the demographics of the total US population, these estimates will provide a benchmark for them to measure their efforts against. Such a benchmark is vital to recruiting efforts, providing a clear comparison so that policymakers know exactly how much of a demographic over- or under-representation is attributable to eligibility standards.

APPLYING AIR FORCE REQUIREMENTS TO NATIONALLY REPRESENTATIVE DATA

Requirements for Enlistment

The general approach for this analysis is to use nationally representative survey datasets to estimate the proportion of each racial/ethnic and gender group that is ultimately eligible to join the Air Force[2]. Though there is a vast body of specific requirements for enlistment in the Air Force, individual information is only available for the major disqualifying factors. Thus, this analysis will focus on the key eligibility factors that play the largest role in shaping the pool of potential recruits and ignore some of the more minor requirements, which can often be waived. Table 1.1 summarizes the general requirements that this analysis will use to determine eligibility. These requirements come directly from Air Force recruiting regulations.

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[2] This analysis focuses on the Air Force because they are the primary client and because data on accessions cohorts are readily available. Enlistment requirements are similar across the services. For an extensive review, see Asch et al., 2009.

Table 1.1: Air Force Enlistment Eligibility Requirements[3]

Characteristic	Applicant is ineligible when he or she…
Age	Is younger than 18 or older than 27[4]
Dependents	Is a single parent or has more than 2 dependents (including spouse)
Education	Is not a traditional high school graduate[5]
Aptitude	has an Armed Forces Qualifying Test (AFQT) score less than 36
Moral Character	Has questionable moral character, a history of antisocial behavior…, frequent difficulties with law enforcement agencies…[6]
Drug-Use	Has been involved with narcotics or dangerous drugs
Body Composition	Not within the Air Force height/weight requirements[7]
Medical	Has asthma, diabetes, heart disease, or a disability

[3] AFRSI36-2001 *Recruiting Procedures for the Air Force*, and AFI 48-123 Vol 2 *Medical Examinations and Standards Volume 2-Accession, Administration, and Retention*

[4] High School Seniors who are 17 are eligible for enlistment with parental consent

[5] The Air Force also accepts those who hold GEDs and have AFQT scores above 65

[6] Actual requirements depend on the offense, and can be waived for less serious offenses. Since it is impractical to segment offenses based on likelihood of a waiver, this analysis will treat all those who have been convicted of charges as ineligible

[7] Those who exceed height/weight requirements may be eligible if they are within body fat limits

Requirements to Become an Officer

Benchmarking for officers is slightly different from benchmarking for enlisted personnel because becoming an officer is a much longer and more difficult process. Any individual who meets the requirements can decide to enlist, but individuals who desire to become officers must be accepted by and complete a commissioning program that almost always requires successful completion of a college degree.

To capture these aspects of becoming an officer, the officer benchmarks will use criteria that are characteristic of the commissioning programs to define the officer benchmark. However, the benchmarks cannot be interpreted as the population that is truly "eligible" because the individuals in the data have not entered ROTC, a Service Academy, or Officer Training School Programs. Instead, this analysis constructs a benchmark population that meets requirements similar to those officer accession cohorts must meet. For these reasons, these benchmarks will be referred to as the "pseudo-eligible" populations.

This analysis will calculate a separate benchmark for officers who commission through ROTC/OTS and officers who commission through USAFA. There are three main differences to be aware of in constructing these two officer benchmarks. First, the age requirements are different—students must be between the ages of 17 and 23 to enter USAFA, so officers who commission through USAFA will be at least 21 years old, but no older than 26. For ROTC/OTS, persons as old as 34 can still become commissioned officers. The second difference between the benchmarks is that USAFA cadets must be unmarried with no dependents, while there is no similar requirement for those in ROTC/OTS programs. Finally, the USAFA benchmark includes an additional aptitude criterion, designed to capture the fact that USAFA is generally more selective than most civilian universities[8]. The best measure of aptitude available is the

[8] Admission statistics show that the average USAFA cadet tends to score well above the national average, but not as high as the average Ivy League student. For example, the USAFA class of 2013 had average SAT math and verbal scores of 664 and 639, respectively (United States Air Force Academy, n.d.). The national average math and verbal scores

Armed Forces Qualifying Test (AFQT), and this analysis will use a score of 65 (i.e. category II or higher) as the cutoff for eligibility. The choice of the precise cutoff is arbitrary, but considering that USAFA is among the most selective colleges in the US, requiring only that eligible individuals have aptitude scores in the top 35 percent nationally[9] is probably conservative.

Table 1.2 summarizes the criteria this analysis uses to define the pseudo-eligible officer populations.

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in 2008 were 515 and 502, respectively (Marklein, 2008). The 25th percentile score (both math and verbal) for the 2009 entering cohort at Harvard University was 690 (Grove, n.d.). Thus, the average USAFA cadet is above-average nationally speaking, but would fall in the bottom 25 percent of the distribution of Harvard students.

[9] The AFQT score is in the form of a percentile, so a score of 65 is equivalent to scoring in the top 35 percent, or better than 65 percent of the population

Table 1.2: Criteria for Pseudo-Eligible Officer Populations[10]

Benchmark	**Characteristic**	**Applicant is ineligible when he or she…**
USAFA	Age	Is younger than 21 or older than 26
	Education	Is not a college graduate
	Dependents	Is married or has any children
	Citizenship	Is not a US Citizen
	Body Composition	Is not within the Air Force height/weight requirements
	Medical	Has asthma, diabetes, heart disease, or a disability
	Aptitude	Has an AFQT score of less than 65
ROTC/OTS	Age	Younger than 18 or older than 34
	Education	Is not a college graduate
	Citizenship	Is not a US Citizen
	Body Composition	Is not within the Air Force height/weight requirements
	Medical	Has asthma, diabetes, heart disease, or a disability

[10] AFRSI36-2001 *Recruiting Procedures for the Air Force*; AFI 48-123 Vol 2 *Medical Examinations and Standards Volume 2-Accession, Administration, and Retention*; and www.academyadmissions.com

Data Availability and Criteria for Eligibility

Unfortunately, no dataset has all the pertinent information to military eligibility on a single set of individuals, so this analysis is forced to patch together estimated probabilities from several different data sources. The 2008 American Community Survey (ACS) serves as the source for the baseline population estimates in this analysis because it has the biggest sample size (about 3 million individuals). Among other things, it includes information on age, education, citizenship, marital status, and number of children[11].

The 2008 Behavioral Risk Factor Surveillance System (BRFSS), conducted by the Centers for Disease Control, contains information on height, weight, and the various medical conditions used in this analysis. The survey includes individuals age 18 and up and also includes information on education, race/ethnicity, gender, marital status, and number of children[12].

Information on AFQT eligibility and criminal convictions comes from the 1997 National Longitudinal Survey of Youth (NLSY97). The NLSY contains yearly information on individuals who were age 12-16 in 1996. Notably, respondents in the NLSY take the Armed Services Vocational Aptitude Battery, including the AFQT[13]. This analysis uses the 2005 wave to estimate AFQT, moral character, and drug use eligibility. This wave included individuals from ages 20-26.

Table 1.3 summarizes the specific criteria that this analysis uses to define the eligible enlisted population and the data sources that were used for each requirement. Table 1.4 summarizes the same information used in constructing the pseudo-eligible officer benchmarks.

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[11] For more information about the ACS, refer to http://www.census.gov/acs/

[12] For more information about the BRFSS, refer to http://www.cdc.gov/brfss/

[13] For more information about the NLSY97, refer to http://www.bls.gov/nls/ and *NLSY97 User's Guide*, 2005

Table 1.3: Summary of Criteria and Data Sources for Eligible Enlisted Population[14]

Requirement	Data Source
Age = 17-27	ACS 2008
Education = HS Diploma or greater	ACS 2008
Dependents = no single parents, no more than 2	ACS 2008
Body Composition = meet AF Requirements	BRFSS 2008
Medical = no asthma, diabetes, heart cond., or disability	BRFSS 2008
AFQT > 36	NLSY 2005
Conviction = none	NLSY 2005
Drug History = no "hard" drugs (e.g. cocaine)	NLSY 2005

Table 1.4: Summary of Criteria and Data Sources for Pseudo-Eligible Officer Populations[15]

Requirement	Benchmark	Data Source
Age = 18-34	ROTC/OTS	ACS 2008
Age = 21-26	USAFA	ACS 2008
Education = BA/BS or greater	BOTH	ACS 2008
Citizenship = US	BOTH	ACS 2008
Dependents = none	USAFA	ACS 2008
Body Composition = meet AF Requirements	BOTH	BRFSS 2008
Medical = no asthma, diabetes, heart cond., or disability	BOTH	BRFSS 2008
AFQT > 65	USAFA	NLSY 2005

This analysis will also compare recent Air Force accessions data to the eligible population estimates. The accessions data include all

[14] The analysis broke up the population into race/ethnicity and gender groups, so each requirement implicitly conditions on these characteristics as well

[15] See previous footnote

FY2008 Air Force enlisted accessions and FY2009 Air Force officer accessions (by commission source).

Statistical Methodology

The goal of this analysis is to estimate the fraction of the eligible population that falls into each demographic category. This analysis will use 10 mutually exclusive categories—one for each race/ethnicity (white, black, Hispanic, Asian/Pacific Islander, and other) and gender combination. Since the eligible population is defined as the population that meets the criteria in Tables 1.3 and 1.4, the number of eligible individuals in each demographic group (denoted by the subscript *g*) is simply the number of people in that demographic group multiplied by the probability that an individual in the respective group meets each requirement (denoted by the subscript *r*), or

$$N_{eligible} = N_g \prod_{r=1}^{R} P_{gr}$$

The fraction of group *g* in the eligible population is the number of eligible individuals in group *g* divided by the total number in the eligible population:

$$Frac_g = \frac{N_g \prod_{r=1}^{R} P_{gr}}{\sum_{g=1}^{10} N_g \prod_{r=1}^{R} P_{gr}}$$

It is important to note that for these estimates to be correct, the requirement probabilities must be independent. Of course, the likelihood that an individual meets any two requirements is correlated (e.g. education and AFQT score), so this analysis will estimate each P_{gr} conditional on the previous requirements (to the extent that the data permit it). Under the assumption that the covariances between the probabilities are asymptotically negligible (conditional on race/ethnicity, gender, and previous requirements), as well as the assumption that the sample is large enough to invoke asymptotic theory, the delta method can be used to derive the following approximation to the variance of the fraction of each group in the eligible population, which forms the basis of the confidence intervals presented below:

$$V(Frac_g) = \sum_{r'=1}^{R} \sigma_{gr'}^{\,2} \left[\frac{N_g \prod_{r=1, r \neq r'}^{R} P_{gr}}{\sum_{g=1}^{10} N_g \prod_{r=1}^{R} P_{gr}} \left(1 - \frac{N_g \prod_{r=1, r \neq r'}^{R} P_{gr}}{\sum_{g=1}^{10} N_g \prod_{r=1}^{R} P_{gr}} \right) \right]^2 ,$$

where $\sigma_{gr}^{\,2}$ is the variance of P_{gr}.

Limitations

As acknowledged earlier, this approach is limited in several important ways. First, the survey data that the analysis uses were collected at different times. For example, there are no recent data on AFQT scores, so the analysis must assume that the distribution of AFQT scores has not changed since the year it was administered by the NLSY, and that the 2005 sampling weights (the most recent year available) are still close to what they would be for 2008. In other words, results that come, in part, from 2005 data must still hold in 2008.

In addition, not all surveys include the full range of eligible ages. The 2005 wave of the NLSY, for example, only includes individuals from ages 20-26. The analysis must assume, then, that the probabilities calculated from the NLSY cohort generalize to the entire eligible age range.

A third limitation arises from the fact that some information is self-reported (e.g. history of drug-use), and thus, may not be accurate. Respondents may be reluctant to admit their drug-use history, causing this methodology to overestimate the number of eligible individuals, all else being equal.

Finally, the analysis is limited by the fact that only certain variables were available in each dataset. Thus, the analysis must assume that the probability of meeting each requirement is independent of variables that were unavailable in the respective dataset. For example, there is only limited health information in the NYSY, so the analysis must assume that the probability of meeting AFQT requirements is independent of medical eligibility (conditional on age, education, dependent eligibility, and demographic group).

Despite these limitations, there is good reason to believe that the estimates are representative of the true eligible population. The overall eligibility rates that I find are consistent with previous work that used less recent data on more limited age ranges. In addition, every probability is estimated conditional on a number of important factors (race/ethnicity, gender, education, etc.) so the unaccounted for correlation across requirements is likely negligible.

Finally, it is important to note that these estimates are limited by differences between the requirements in Table 1.3 and Table 1.4 and the actual set of requirements individuals must meet. This is especially true for the officer requirements, as there are not enough college graduates in the NLSY to estimate probabilities of criminal history and drug-use. To be sure, if a moral character flaw disqualifies an individual for enlistment, that individual would also be ineligible to become an officer. The severity of this limitation depends on the size of the college educated youth population that would be disqualified for legal infractions. This analysis assumes this population is small and can be ignored.

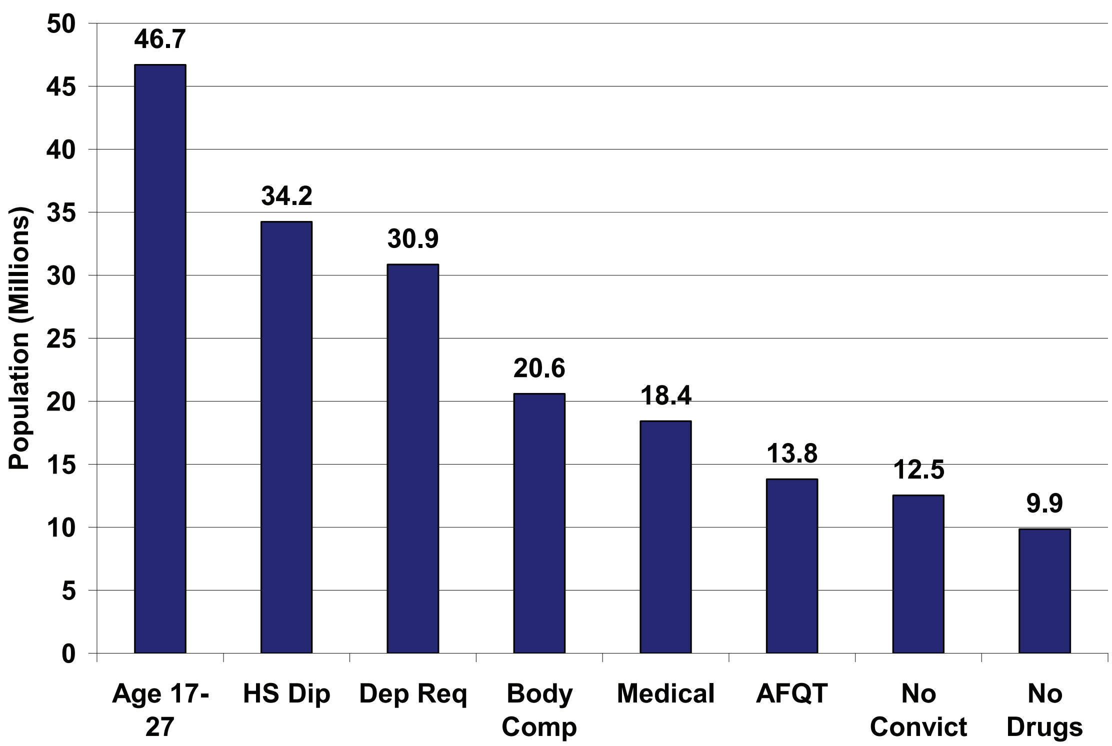
More generally, the information in the available data is usually more general than the stipulations of recruiting regulations. The waiver process for enlistment is a bit of a "black box," and it is possible that this analysis may disqualify some people who would receive a waiver for medical or criminal history. All else being equal, this reality would cause the methodology to underestimate the size of the eligible population. Thus, the estimates should be interpreted with all these limitations in mind.

RESULTS: ELIGIBLE ENLISTED POPULATION

Total Eligible Population Declines With Each Requirement

Figure 1.1 shows the number of eligible youth that meet each enlistment requirement. The requirements are cumulative in the sense that each bar represents the population that meets the particular requirement and all previous requirements (i.e. all requirements to the left). While there are 46.7 million people from ages 17-27 in the US, only 9.9 million people meet all the major requirements to enlist in the Air Force. Figure 1.1 demonstrates that a relatively small fraction of people in the relevant age range—rougly one-in-five—are actually eligible for military service.

Figure 1.1: Population Eligible to Enlist Given Air Force Requirements



The Demographic Distribution of the Eligible Population

Figure 1.2 shows the demographic distribution of the total US population, the estimated distribution of the population eligible to enlist in the Air Force, and the demographic distribution of the FY2008

Air Force enlisted accession cohort. The error bars for the eligible population represent 95 percent confidence intervals for the estimated percentages of each demographic group in the eligible population. Taking the first set of bars as an example, Figure 1.2 shows that 32 percent of the people in the US in 2008 were white males, but white males made up 33 percent of the population that was eligible to enlist in the Air Force at that time. The percentage of white males in the FY2008 accession cohort was much higher—52 percent of the people who joined the Air Force in FY2008 were white males.

The eligible population contains a smaller percentage of black and Hispanic persons than the total US population, but a higher percentage of white and Asian/PI persons. Interestingly, the percentage of white males in the eligible population is similar to—and judging by the confidence intervals, not statistically different from—the percentage of white males in the US population. The eligible population contains a higher percentage of white persons than the US population almost entirely because white *females* are more likely to meet all enlistment requirements than persons in other demographic groups.

If policymakers were to compare the FY2008 accession cohort to the US population, they would conclude that the Air Force over-represents males and under-represents females in each racial/ethnic group. Figure 1.2 demonstrates that the over-representation for black and Hispanic males is greater when the FY2008 accession cohort is compared to the eligible population, while the percentage of Asian/Pacific Islander (PI) males is very similar to the respective percentage in the eligible population. The FY2008 Accession Cohort slightly over-represents black females, relative to the eligible population. For Hispanic females, the under-representation is less extreme when the FY2008 Accession Cohort is compared to the eligible population, while this comparison exacerbates the under-representation of Asian/PI females.

Figure 1.2: Demographic Distribution of US Population, Population Eligible to Enlist, and the FY2008 Enlisted Accession Cohort[16]

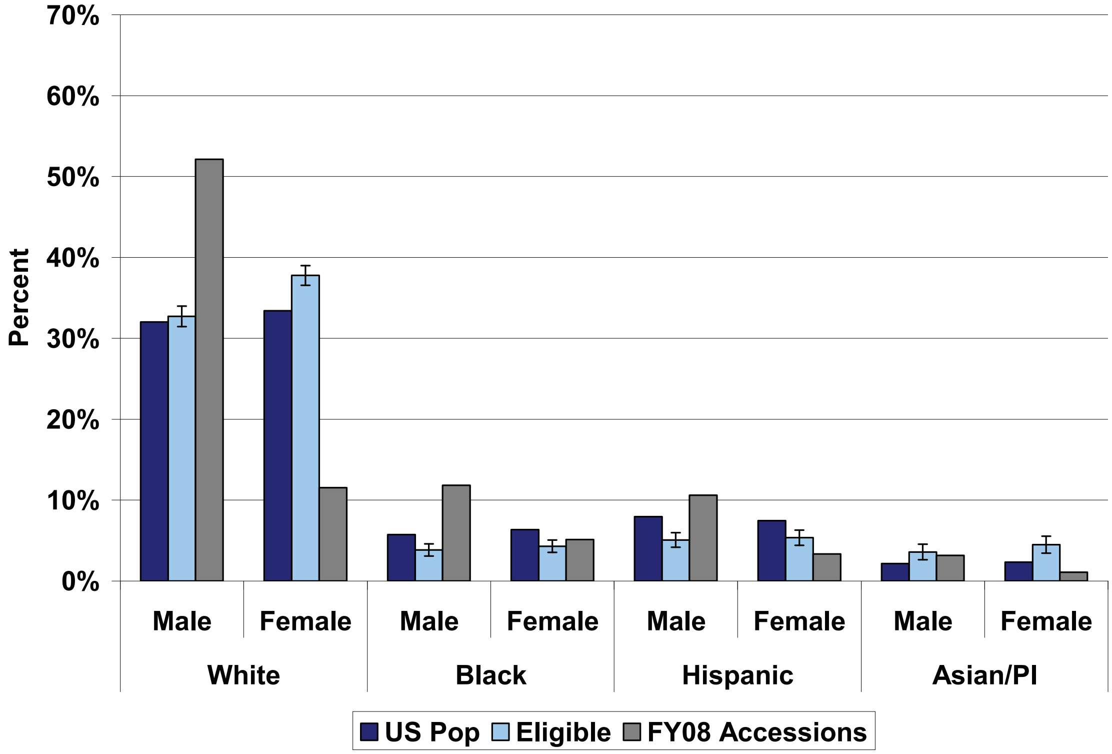


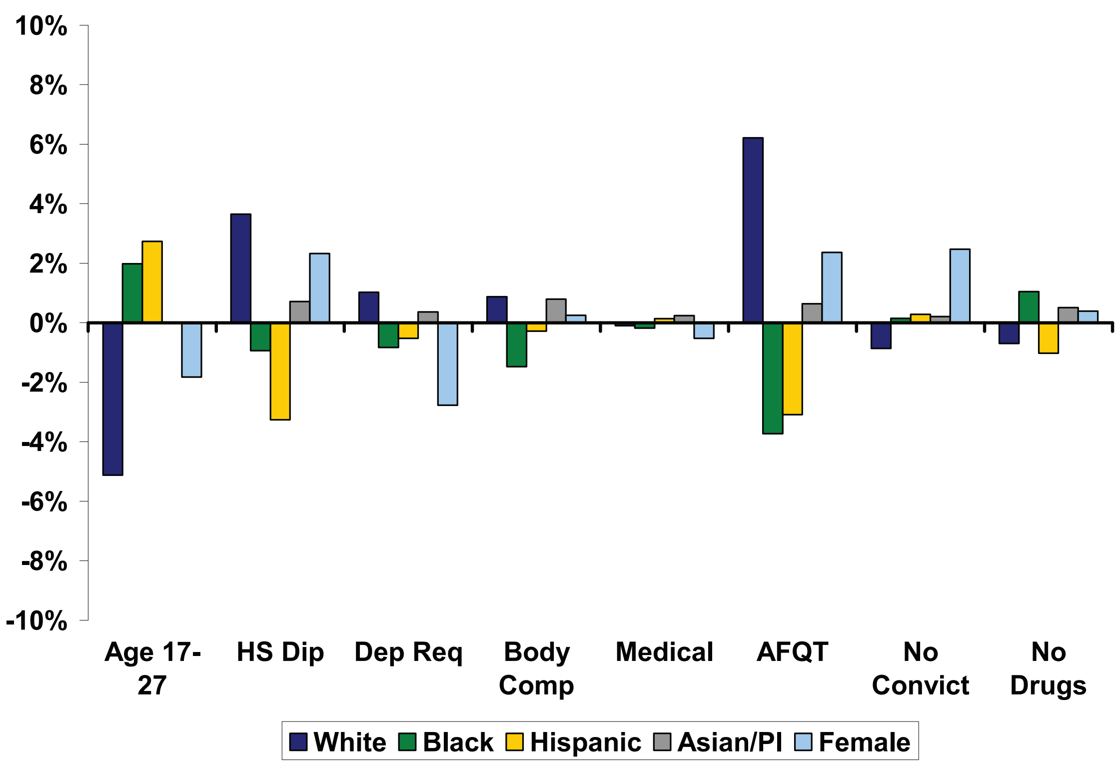
Figure 1.3 shows how racial/ethnic and gender representation changes with the addition of each requirement. The bars in Figure 1.3 denote the difference between each demographic group's percentage in the population meeting the respective requirement (and all previous requirements) and the group's percentage in the population meeting all previous requirements. For example, 65 percent of the total US population was white in 2008, but only 60 percent of the age 17-27 population was white, so the first bar shows a change of minus 5 percent. In other words, the first bar shows that white representation decreased by 5 percentage points with the application of the age requirement. The order of the requirements is arbitrary, so requirements that are applied later could show a smaller impact in

[16] Other/Unknown races/ethnicities not shown

Figure 1.3 simply because many individuals that these requirements would affect have already been disqualified. For example, the total impact of the AFQT requirement alone is likely greater in magnitude than the impact of the AFQT requirement among the population that meets education and dependent requirements (shown below).

Figure 1.3 shows that most requirements tend to work against black and Hispanic representation. Notably, the high school diploma and AFQT requirements each decrease Hispanic representation by 3 percentage points, and they decrease black representation by 1 percentage point and 4 percentage points, respectively. Education, AFQT, and moral character requirements tend to increase female representation, while dependent requirements decrease female representation.

Figure 1.3: Change in Racial/Ethnic and Gender Representation with Addition of Each Enlistment Requirement



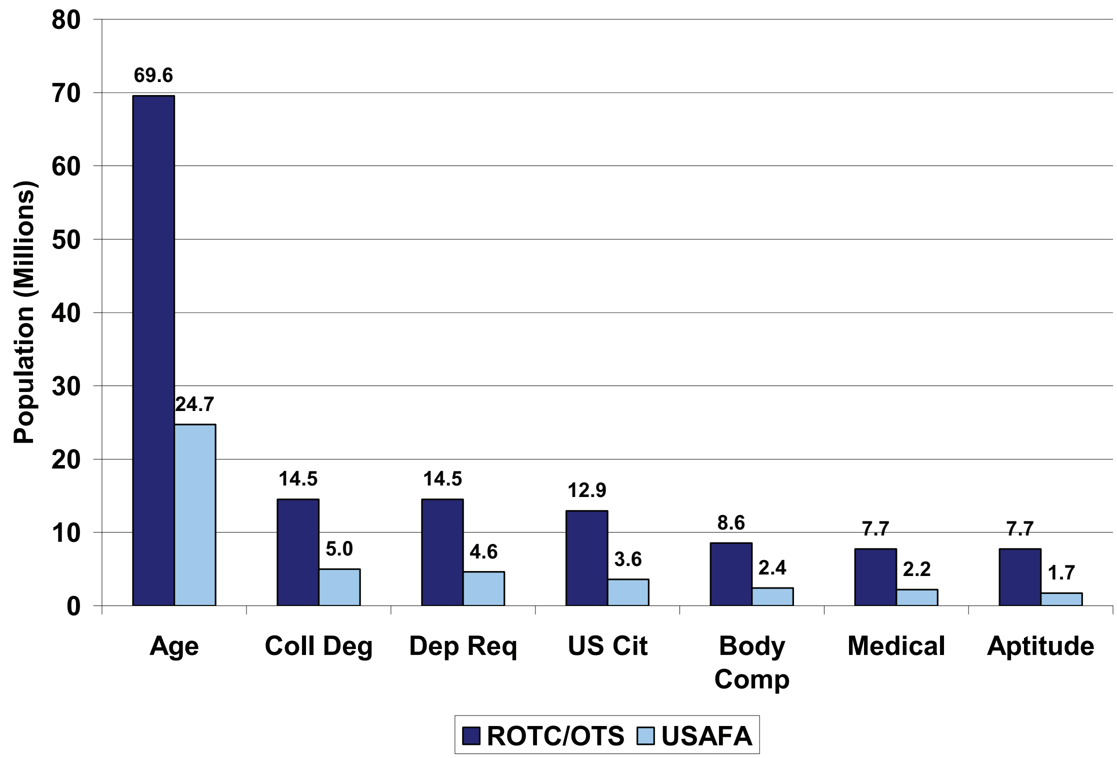
RESULTS: PSEUDO-ELIGIBLE OFFICER POPULATION

Total Pseudo-Eligible Population Declines with Each Requirement

Figure 1.4 shows the number of individuals that meet each officer requirement. Again, the requirements are cumulative, so each bar represents the population that meets the respective requirement and all previous requirements (i.e. all requirements to the left). Since the ROTC/OTS benchmark calculations apply no dependent or aptitude requirements, the population shown in Figure 1.4 that meets these requirements is the same as the population that meets the previous requirement (i.e. no one is eliminated).

By far, the requirement with the biggest impact on the size of the eligible population is the college degree requirement. There are 69.6 million persons ages 18-34 in the US population, but only 14.5 million are college graduates. Similarly, there are 24.7 million persons ages 21-26, but only 5 million of those persons are college graduates. While Figure 1.1 showed that a relatively small fraction of individuals in the relevant age range are eligible to enlist, an even smaller fraction of people, roughly one-in-ten, are comparable to those who serve as officers via ROTC/OTS, and roughly one-in-fifteen are comparable to those who serve as officers via USAFA.

Figure 1.4: Population Eligible to Serve as Officers Given Air Force Requirements



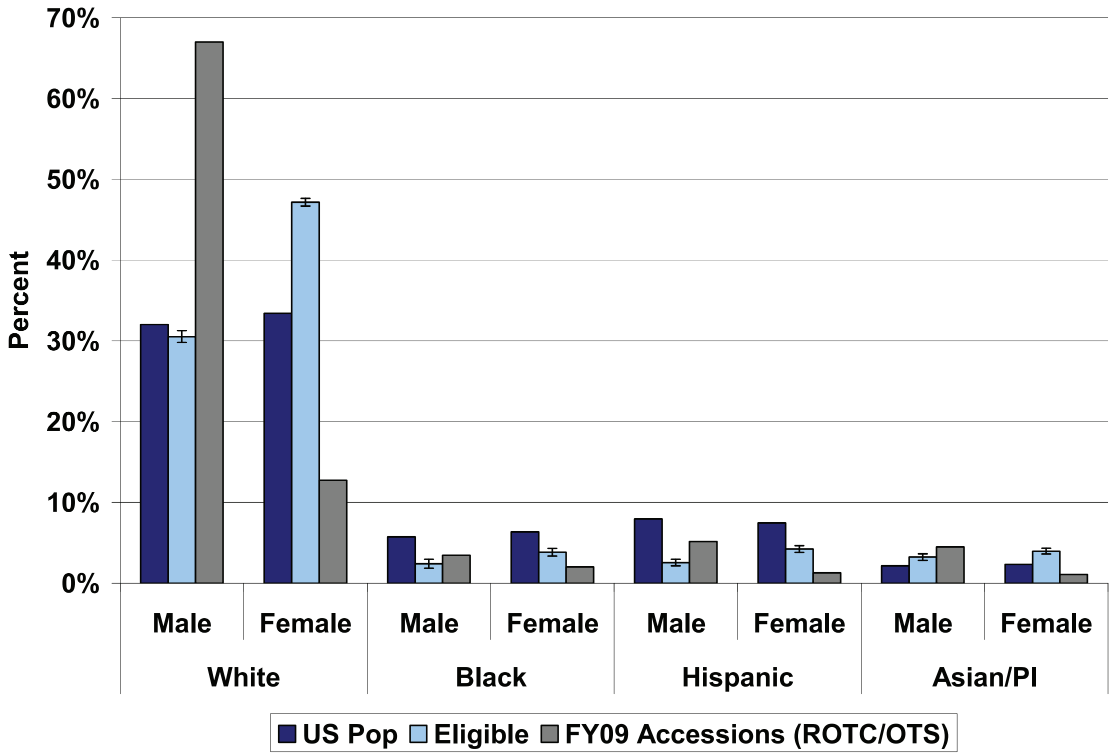
The Demographic Distribution of the Pseudo-Eligible Officer Population

Figure 1.5 shows the demographic distribution of the US population, the estimated distribution of the pseudo-eligible ROTC/OTS officer population, and the demographic distribution of the FY2009 Air Force line officer accession cohort from ROTC/OTS. Figure 1.6 shows a similar picture, comparing the estimated distribution of the pseudo-eligible USAFA officer population to the demographic distribution of the FY2009 line officer accession cohort from USAFA. The error bars on the pseudo-eligible officer population bars represent 95 percent confidence intervals for the estimated percentage of each racial/ethnic and gender group.

Again, compared to the US population, the population that meets Air Force officer requirements for either ROTC/OTS or USAFA has smaller percentage of black and Hispanic persons of both genders and a slightly higher percentage of Asian/PI persons of both genders. However, the most striking difference between the general US population and the pseudo-eligible officer population is in the percentage of white females. While white females make up 33 percent of the total US population, both eligible officer populations are 47 percent white female. Indeed, if Air Force Accession cohorts were drawn randomly from the eligible population, one would expect nearly half of the officers to be white females.

Officer requirements can explain the fact that the FY2009 officer accession cohorts under-represent black and Hispanic males (relative to the US population). Relative to the eligible population, the FY2009 officer accession cohorts actually over-represent both of these groups. The FY2009 officer accession cohort under-represents black and Hispanic females relative to the eligible officer population, though this under-representation is not as extreme as the one suggested by comparisons with the general US population.

Figure 1.5: Demographic Distribution of the US Population, Pseudo-Eligible ROTC/OTS Population, and the FY2009 ROTC/OTS Line Officer Accession Cohort[17]



[17] Other/Unknown races/ethnicities not shown

Figure 1.6: Demographic Distribution of the US Population, Pseudo-Eligible USAFA Population, and the FY2009 USAFA Line Officer Accession Cohort

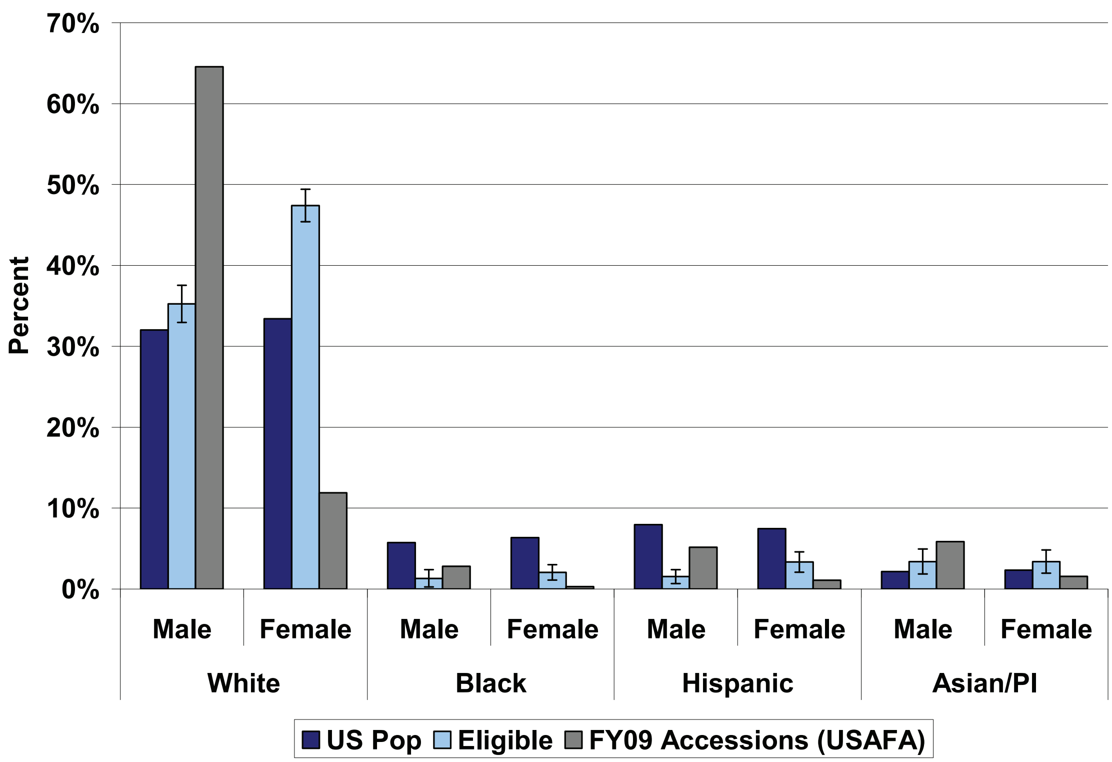


Figure 1.7 shows how racial/ethnic and gender representation changes with the addition of each ROTC/OTS officer requirement. As before, the bars in Figure 1.7 denote the difference between the demographic group's percentage in the population meeting the respective requirement (and all previous requirements) and the group's percentage in the population meeting all previous requirements. Figure 1.8 shows the same picture for the USAFA officer requirements.

The imposition of a college degree requirement drastically affects the demographics of the eligible population, decreasing black and Hispanic representation by 5 and 11 percentage points, respectively, in either the ROTC/OTS age range or the USAFA age range. While the college degree requirement increases Asian/PI representation in both populations, the US citizenship requirement all but erases this increase. The US citizenship requirement decreases Hispanic representation only slightly, presumably because many Hispanic non-citizens do not have college degrees (and were eliminated by the college degree requirement). Female representation increases with most requirements, especially the college degree and body composition requirements; though USAFA's marital status and dependent requirements decrease female representation. The positive effects of most requirements on female representation are driven by white and Asian/PI females—the two groups with the highest overall eligibility rate with the ROTC/OTS requirements (Asian/PI males have a slightly higher overall eligibility rate by USAFA standards). The aptitude requirement further decreases black and Hispanic representation in the pseudo-eligible USAFA population, conditional on previous requirements.

Figure 1.7: Change in Racial/Ethnic and Gender Representation with Addition of Each Officer Requirement (ROTC/OTS)

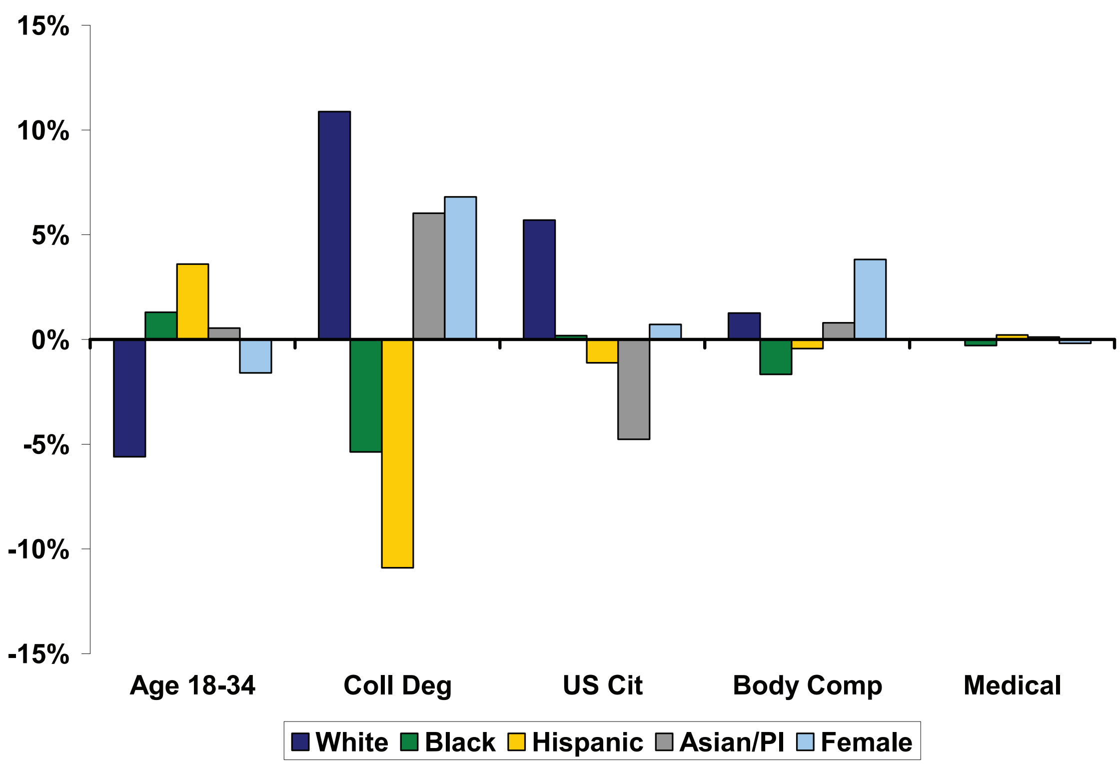
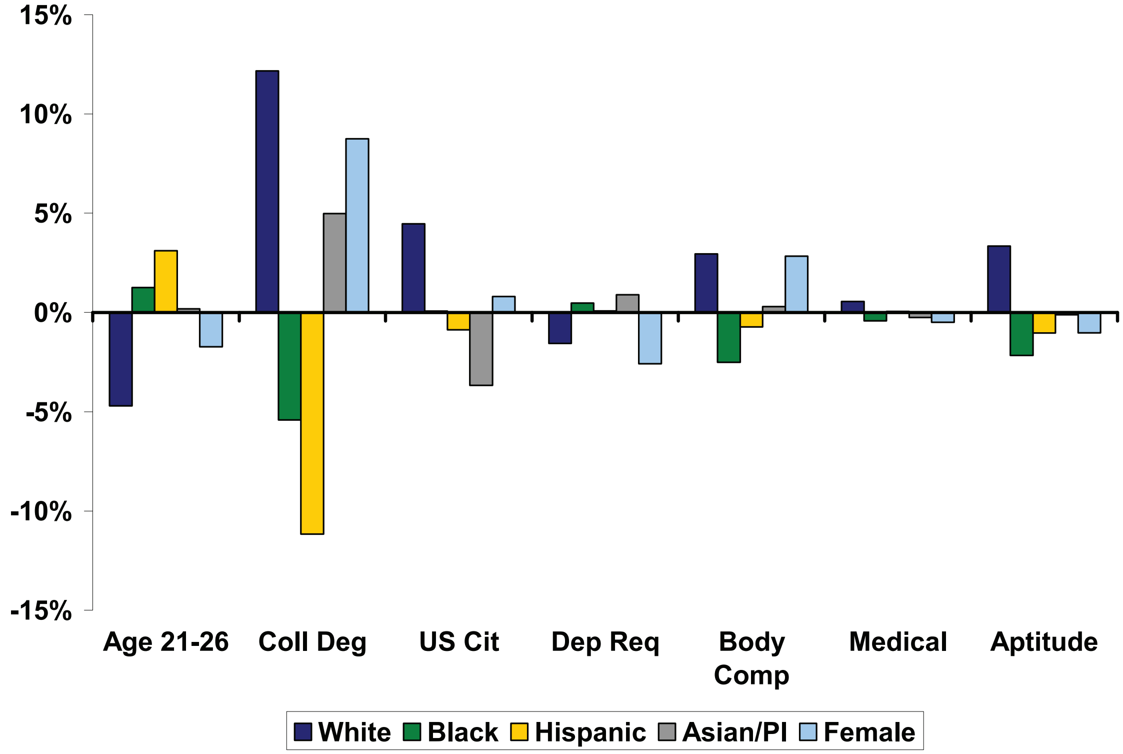


Figure 1.8: Change in Racial/Ethnic and Gender Representation with Addition of Each Officer Requirement (USAFA)



PREFERENCES FOR MILITARY SERVICE AND THE DIVERGENCE BETWEEN THE ELIGIBLE POPULATION AND ACCESSION COHORTS

Any differences between demographic representation in the eligible population and the recent accession cohorts must be due to either (1) some requirement that the analysis did not account for, (2) differential rates of acceptance among eligible persons of different demographic groups, or (3) demographic differences in the appeal of military service versus other career alternatives. This section will explore how demographic differences in baseline preferences for military service impact representation in accession cohorts.

In some sense there is no need to estimate the demographics of the population that is both eligible and desiring to serve in the armed forces, as this population *is the accession cohort* (to the degree that *eligible* people in each demographic group are accepted at similar rates). Furthermore, preferences for service are determined by the relative attractiveness of recruiting incentives. In this sense, demographically divergent preferences for service may not really "explain" the remaining differences between the eligible populations and recent accessions cohorts. If data on preferences are reliable, then the estimated demographic distribution of the population that is eligible to serve and prefers to serve should match accession cohorts almost perfectly.

Still, incorporating preferences for military service may still be insightful, either as a description of the current state of affairs or as a test for the earlier estimates. Policymakers should be aware of what the baseline appeal of military service is (indeed the DoD has collected this data on its own initiative for many years). Additionally, if the demographic distribution of the population that is eligible to serve and prefers to serve very nearly matches the accession cohorts, it would indicate that the estimates regarding the eligible population are somewhat reliable. Any remaining large gaps would mean either that the preference data are not reliable, or a significant requirement is missing.

This section explores demographic differences in preferences for military service with data from *Monitoring the Future: A Continuing Study of American Youth*[18] (MTF), conducted by the University of Michigan's Institute for Social Research. MTF is an ongoing survey of high school seniors that asks respondents, "How likely is it that you will serve in the armed forces after high school?" This analysis will consider anyone who answered "probably will" or "definitely will" as preferring to serve. Orvis and Asch (2001) show that this measure of service preferences (sometimes referred to as "propensity to serve") is significantly correlated with actual enlistment—indicating that it is a valid measure of preferences for service.

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[18] For more information about *Monitoring the Future*, refer to http://monitoringthefuture.org/

In addition, the survey asks, “How likely is it that you will graduate from college after high school?” This analysis will use all high school seniors in the sample to estimate the preference rates for enlistment, and those who answered that they “definitely will” attend college to estimate the preference rates for officers.

Admittedly, this construct is a crude measure of actual preferences for several reasons. First, the survey only includes high school seniors (and not the entire eligible age range). Second, it is likely that some fraction of the high school seniors in the sample would not be eligible (which would violate the basic methodological assumptions). Finally, high school seniors’ responses on what they “probably will” do are likely to be a very imprecise measure for what they actually end up doing. Still, the focus of this analysis is on the racial/ethnic and gender differences in preferences, and the hope is that this rough measure captures the demographic differences in preference rates (even though it may not perfectly measure whether an individual actually serves in the armed forces).

Results

Figure 1.9 incorporates preferences for military service into the earlier estimates. It shows the estimated demographic distribution of the population eligible to enlist, the estimated distribution of the population that is eligible and prefers to serve, and as before, the FY2008 enlisted accession cohort. For example, the first set of bars in Figure 1.9 show that 33 percent of the people in the eligible population are white males, but 48 percent of the people in the population that is eligible and prefers to serve are white males. As shown in previous figures, the FY2008 enlisted accession cohort was 52 percent white male.

First, adding preferences to the calculations accounts for the fact that white females tend to prefer not to serve in the armed forces, while minority males tend to prefer the military at relatively high rates. Furthermore, this result supports the validity of the methodology, since the demographic distribution of the most recent accession cohort can be very closely approximated by the combination of eligibility requirements and preferences.

The only major difference between the FY2008 accession cohort and the population that is eligible and willing to serve is that the FY2008 accession cohort has a smaller fraction of Asian/PI persons of either gender and a larger fraction of black and white males. This divergence could be the result of a limitation in the data on Asian/PI individuals. In the MTF data on race/ethnicity, there is no specific Asian/PI category. There is only a residual category that includes all races/ethnicities other than white, black, or Hispanic. These calculations used this group to approximate Asian/PI preferences, which could be biased by anyone in the sample who falls into the "other" category that is not Asian/PI (e.g. American Indians/Alaskan Natives).

Figure 1.9: Demographic Distribution of the Eligible Population, the Population that is Eligible and Prefers to Enlist, and the FY2008 Enlisted Accession Cohort

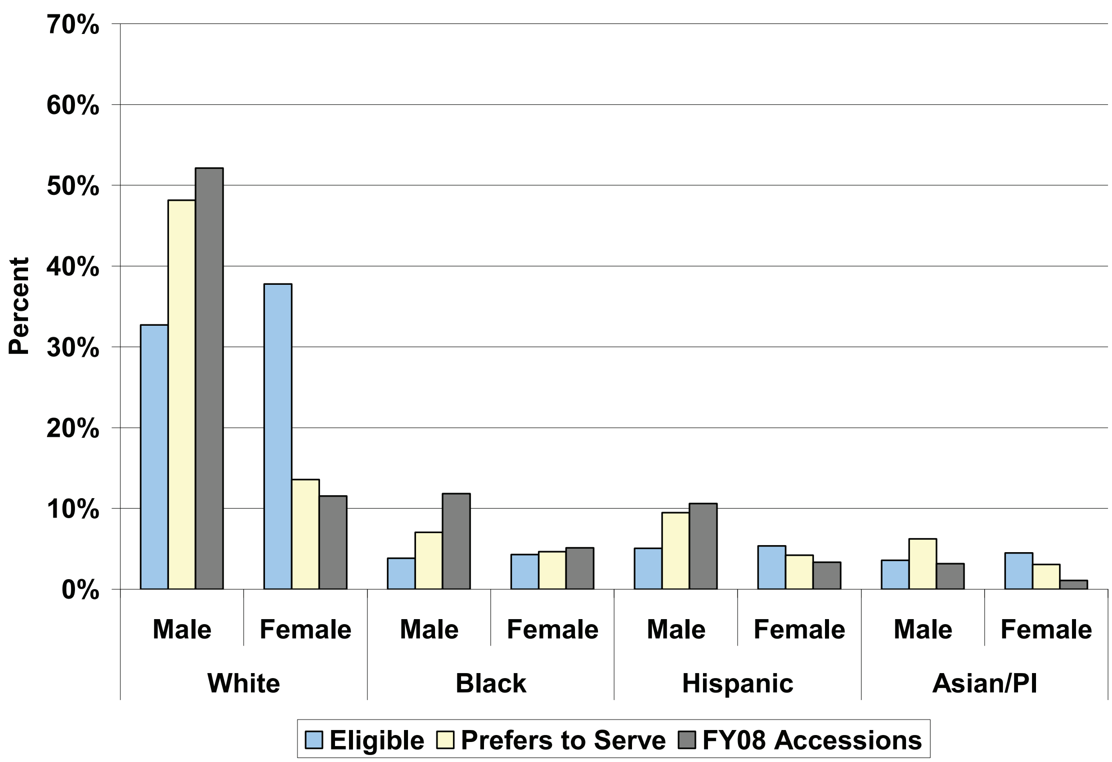


Figure 1.10 makes the same comparison as Figure 1.9, but for the pseudo-eligible ROTC/OTS officer population. Figure 1.11 shows the

corresponding comparison for the eligible USAFA officer population. Again, propensity to serve can account for the lack of white females and the over-representation of black and Hispanic males in recent accession cohorts. However, the FY2009 accession cohort still has a higher percentage of white males and a lower percentage of black females, Hispanic females, and Asian/PI males than the estimates predict. Admittedly, measuring preferences for military service is primarily used in research on enlisted recruiting, and it has never been validated as a predictor for entering a commissioning program. Still, common sense would suggest that it may capture something about demographic differences in plans to serve as an officer (what else would an individual who "definitely will" attend college and "probably will" serve in the armed forces intend to do, other than pursue a commission?).

Figure 1.10: Demographic Distribution of Pseudo-Eligible Officer Population, the Population that is Pseudo-Eligible and Prefers to Serve, and the FY2009 ROTC/OTS Line Officer Accession Cohort

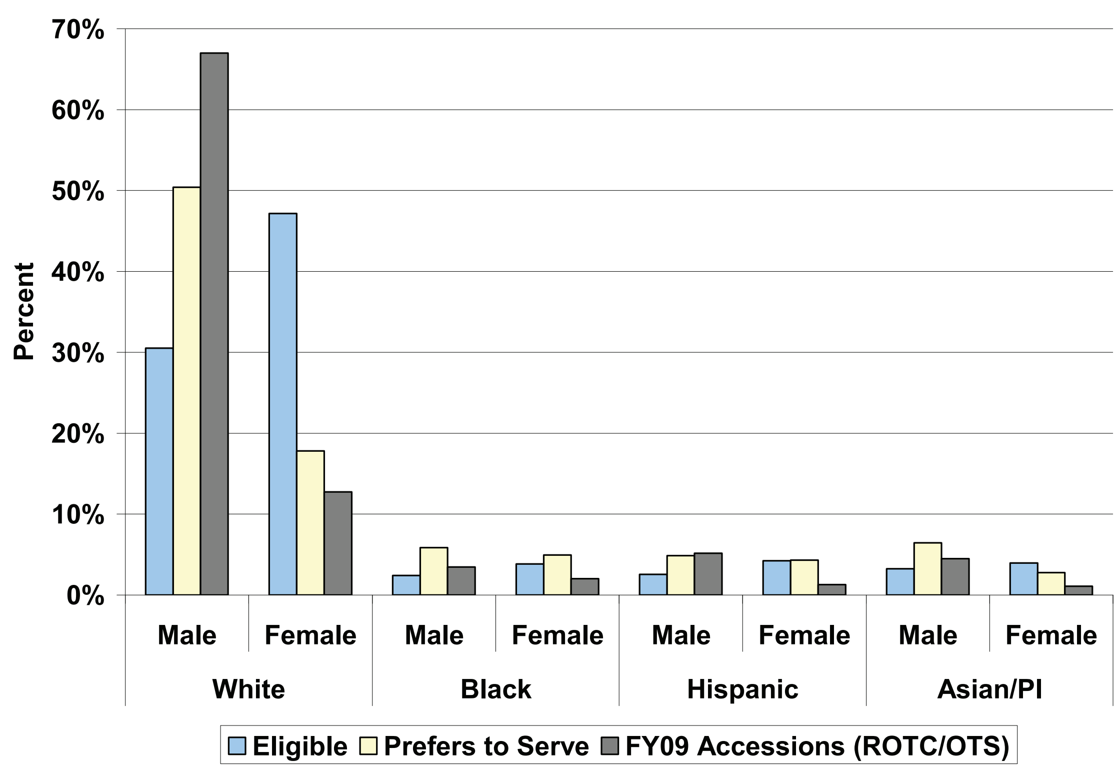
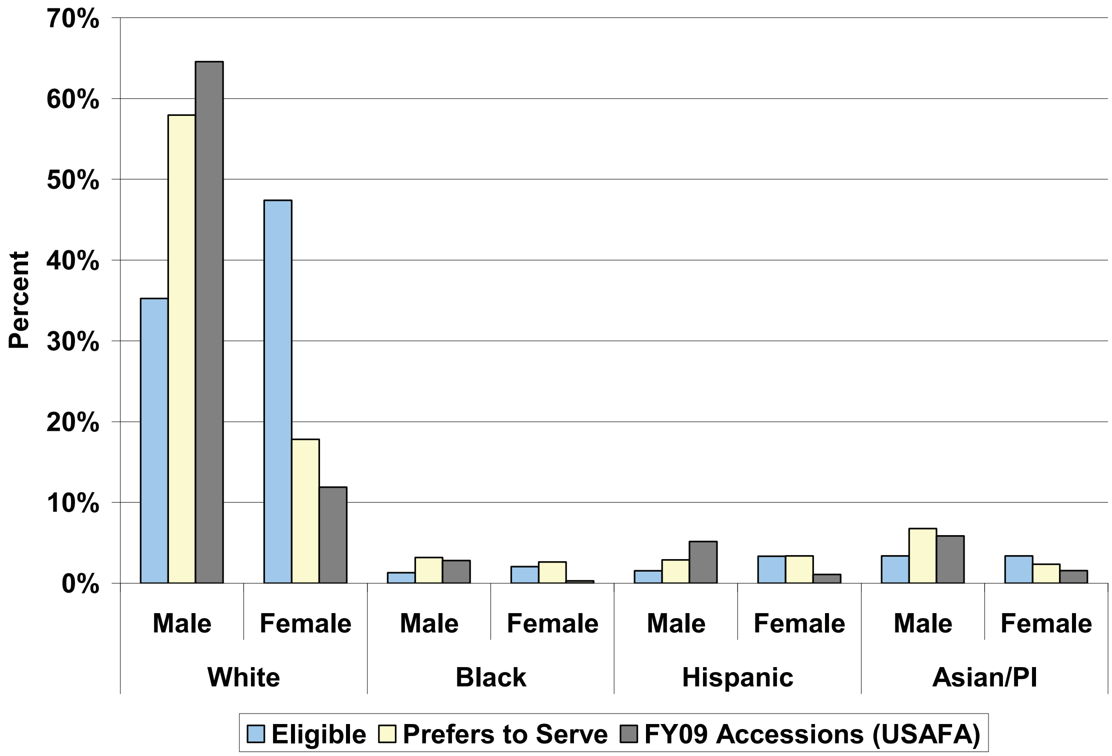


Figure 1.11: Demographic Distribution of Pseudo-Eligible Officer Population, the Population that is Pseudo-Eligible and Prefers to Serve, and the FY2009 USAFA Line Officer Accession Cohort



POLICY IMPLICATIONS

These results demonstrate several key implications for policy. First, the racial/ethnic makeup of accession cohorts tends to reflect the eligible population as determined by Air Force requirements. Accession requirements limit representation of minority races/ethnicities, especially in the case of officer accessions. However, minorities are well-represented in accession cohorts when these requirements are taken into consideration. Thus, if policymakers seek a force that represents the demographics of society, they can either identify recruiting incentives that appeal disproportionately to minority groups and increase the availability of these incentives, or policymakers can push for changes in the basic requirements. Given that the requirements are driven by military necessity, changes in the requirements would be costly in terms of military effectiveness. Thus, policymakers must approach the problem by weighing the costs of changing requirements against the benefits of achieving their social representation goals. If policymakers desire to improve representation through changing requirements, further research should identify the most cost-effective path.

Secondly, the high concentration of males in accession cohorts is not due to accession requirements. If anything, the requirements tend to limit male representation, as white females are often the most likely to meet requirements. Therefore, if policymakers seek to improve female representation in accession cohorts, further research should identify potential recruiting techniques and incentives to appeal to eligible female youth.

Finally, this analysis has shown that it is possible to closely approximate the demographic distribution of the population eligible to enlist or become an officer, creating an accurate benchmark to compare accession cohorts against. Appendix A lists the numbers behind Figures 1.2, 1.5, and 1.6 for this purpose, and the methodology is transparent and replicable so that these benchmarks can be updated as necessary.

SECOND ESSAY: DEMOGRAPHIC DIFFERENCES IN AIR FORCE SPECIALTY CODE CLASSIFICATION AT THE UNITED STATES AIR FORCE ACADEMY

INTRODUCTION

From the beginning of the policy emphasis on minority and female officer advancement, research has acknowledged that an officer's occupational specialty plays a major role in advancement to the senior ranks. In 1994, Secretary of Defense William Perry tasked the Undersecretary of Defense for Personnel and Readiness to "lead a major study of the Officer 'pipeline'…" and "recommend ways to improve the flow of minority and female officers from recruitment through the general and flag officer ranks" (Office of the Assistant Secretary of Defense, 1995). This officer pipeline study affirms the importance of officer occupations, as it states the following:

> Occupational assignments are important because the path to general and flag officer status traditionally has been through the tactical operations field—which includes almost all combat related skills. Although only about one-third of the officer jobs are in this occupational field, almost two-thirds of the promotions to general and flag officer rank come from this group (Gilroy et al., 1999).

At the same time, this report acknowledges that "women and minority officers tend to be concentrated in administrative and supply areas, and underrepresented in tactical operations" and that "achieving increased representation [in the senior ranks]…will largely depend on increasing their numbers in career-enhancing occupations" (Gilroy et al., 1999). A companion RAND study, which was co-written by some of the pipeline study authors, echoes this sentiment: "minorities were less likely to be in tactical (combat) occupations and more likely to be in supply occupations."

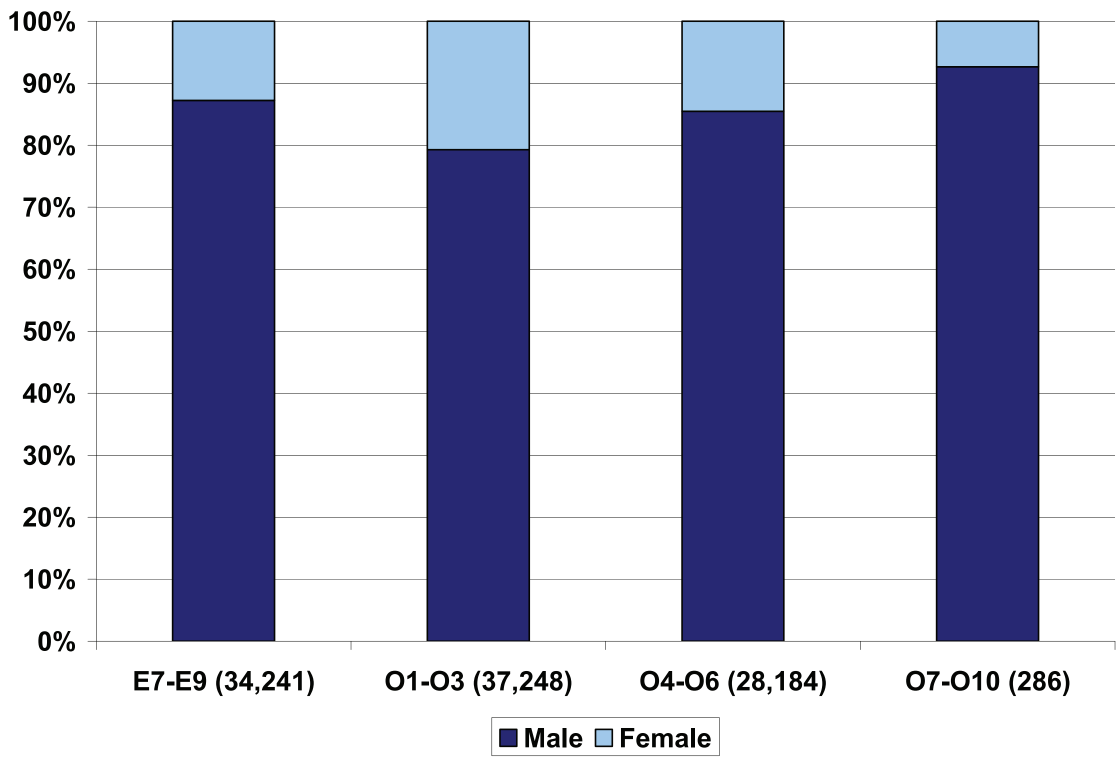
Recent data confirm the continuation of these trends in the Air Force. That is to say that (1) the flag ranks (O7 and above) contain a small fraction of minority and female officers relative to the lower ranks (even relative to experienced enlisted ranks), (2) a majority of flag officers arise from tactical occupations, and (3) minority and female officers are less likely to be in tactical occupations.

First, Figures 2.1-2.3 demonstrate that that the lower ranks have a greater representation of minority and female members than the flag ranks. Figure 2.1 shows the gender breakdown of the Air Force's senior enlisted members (pay grades E7-E9), company grade officers (CGOs, pay grades O1-O3), field grade officers (FGOs, pay grades O4-O6), and flag officers (pay grades O7-O10) in FY2007. Figures 2.2 and 2.3 show the racial and ethnic[19] makeup of the same pay grade groupings. The number in parenthesis on the x-axis label represents the total number of personnel in the respective pay grade grouping.

Figure 2.1 shows that female representation generally decreases with increasing rank. While the CGO pay grades were 21 percent female in FY2007, female officers made up 15 and 7 percent of the FGO and flag pay grades, respectively. Similarly, minority representation tends to decrease with increasing rank as well. While minority personnel made up 28 and 22 percent of the senior enlisted and CGO pay grades (respectively) in FY2007, minority officers made up only 5 percent of the flag ranks. The ethnic pattern in Figure 2.3 is analogous, but there is less contrast between the different pay grade groupings. 4 percent of the CGO and FGO pay grades were Hispanic in FY2007, while Hispanic officers made up 1 percent of the flag ranks.

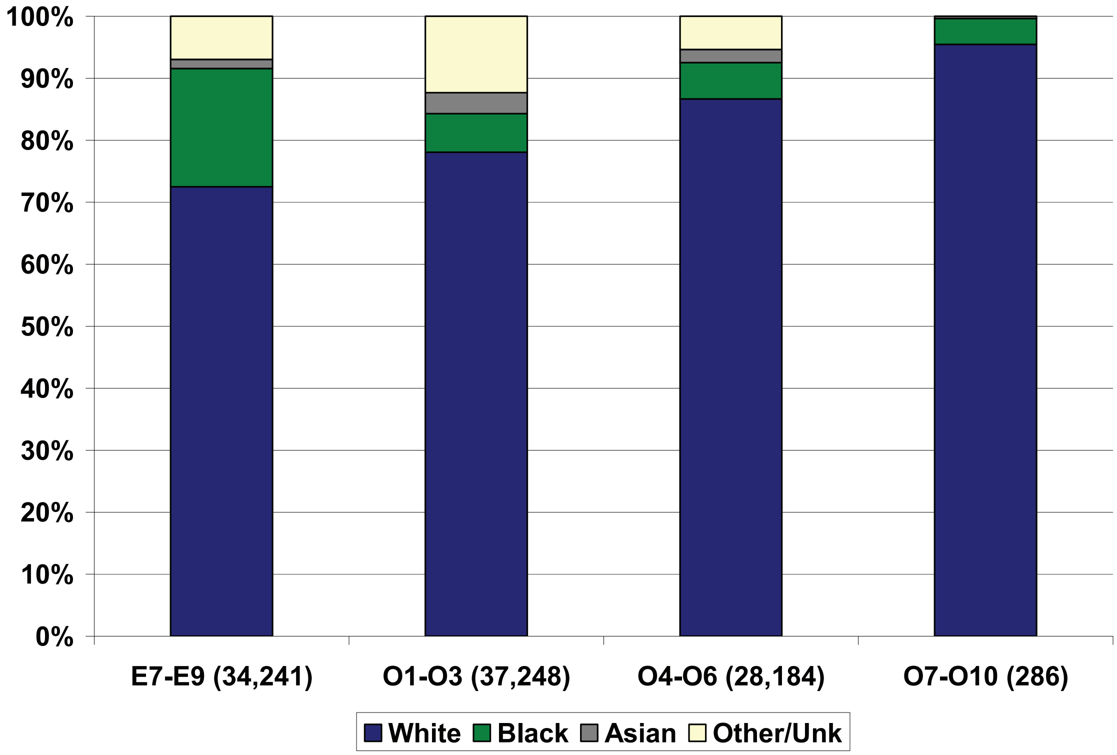
[19] The personnel data used here reported race and ethnicity separately. As described in the dissertation introduction, this paper will create mutually exclusive race/ethnicity categories for the analysis portion.

Figure 2.1: Gender of Air Force Personnel in FY2007, by Pay Grade



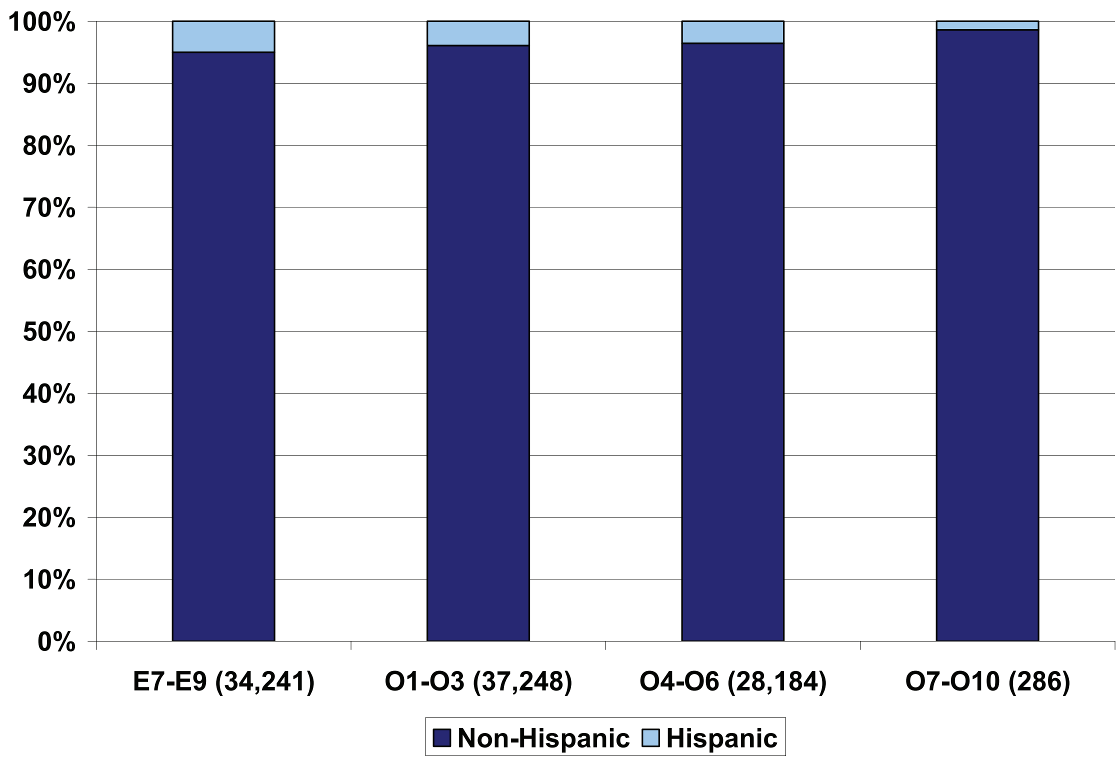
Source: Office of the Undersecretary of Defense, 2007

Figure 2.2: Race of Air Force Personnel in FY2007, by Pay Grade



Source: Office of the Undersecretary of Defense, 2007

Figure 2.3: Ethnicity of Air Force Personnel in FY2007, by Pay Grade



Source: Office of the Undersecretary of Defense, 2007

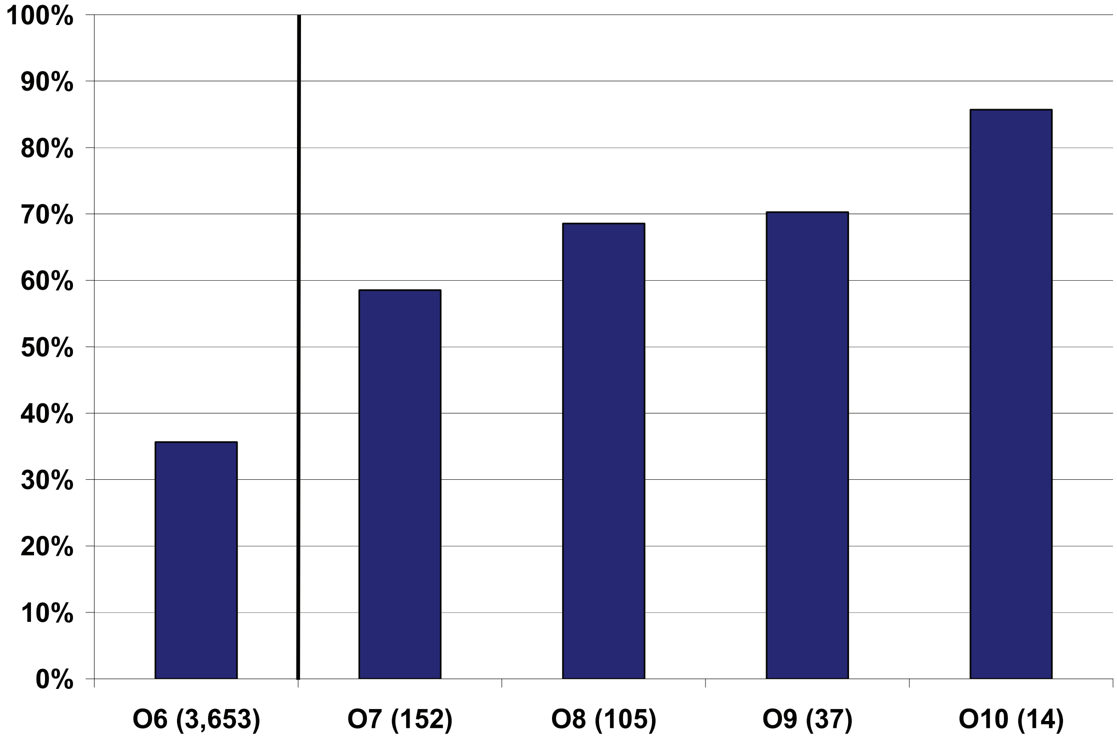
It is important to note, however, that Figures 2.1-2.3 do not prove that minority and female officers have lower continuation rates. Because the Air Force promotes exclusively from within, the demographic makeup of the flag ranks will always reflect the demographics of the accession cohorts at the time that the flag officers joined the Air Force 25 to 30 years prior (demographics which tend to differ from those in the lower ranks who accessed more recently). However, previous research has found evidence of racial differences in promotion. In a study on racial and gender differences in officer continuation, Hosek et al. (2001) find evidence of "persistent racial differences (for women as well as men) in promotion[20]." In their exploration of the differences

[20] Hosek et al. (2001) do include occupation variables in some of their analysis, and they find that tactical occupations are often more likely to be promoted than other occupational sectors.

through interviews and focus groups, the first suggestion for change that officers made was often to "recruit more women and minorities into the officer corps and into underrepresented occupations."

Second, a look at recent Air Force generals confirms what the original officer pipeline study (Gilroy et al., 1999) suggested—Air Force general officers arise disproportionately from the tactical subset of occupations. The Air Force partitions its officer corps into *rated* (i.e. flying) and *non-rated* (i.e. everything else) occupations. Historically, rated occupations (pilot, in particular) have supplied a vastly disproportionate share of the General Officers. To demonstrate this pattern, Figure 2.4 shows the percent of General Officers in November 2009 who entered into rated occupations upon commissioning for each pay grade. As a benchmark, Figure 2.4 includes the percent of Colonels (O6) in November 2009 who were in rated occupations. The numbers in parenthesis on the x-axis labels indicate the number of officers in the respective pay grade. While rated officers made up 36 percent of the Colonels (O6) in 2009, 59 percent of the Brigadier Generals (O7) had initially entered into a rated occupation. Furthermore, about 70 percent of the Major (O8) and Lieutenant (O9) Generals entered into rated occupations upon commissioning, and of the 14 Air Force four-star Generals (O10), 12 entered the rated sector at the beginning of their officer careers.

Figure 2.4: Percent of General Officers in Nov 2009 Who Entered Into Rated Occupations Upon Commissioning, by Pay Grade



Source: Air Force Personnel Center, n.d.; United States Air Force, n.d.

Finally, recent data show that white and/or male officers tend to be concentrated in tactical occupations. Table 2.1 summarizes this tendency, showing the percentage of all Air Force officers in each demographic group that were in tactical[21] occupations in FY2007. Male officers had a much higher tendency to be in tactical occupations than female officers—39 percent, compared to 12 percent. Furthermore, 37 percent of white officers in the Air Force were in tactical occupations, compared to 18 percent of black officers and 19 percent of Asian/PI

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[21] The "tactical" designation is a DoD occupational grouping that includes all of the rated Air Force occupations, but also includes Space/Missiles and Special Operations Forces. The data that these statistics relied upon only provided occupational breakdowns according to the DoD classification system.

officers. The differences between Hispanic and non-Hispanic officers of all races were less extreme—32 percent of the Hispanic officers were in tactical occupations, compared to 35 percent of the non-Hispanic officers.

Table 2.1: Percent of Air Force Officers in Tactical Occupations by Demographic Group in FY2007

Demographic	Group	Number of Officers	Percent in Tactical Occupations
Gender	Male	53,577	39%
	Female	11,812	12%
Race	White	53,457	37%
	Black	3,973	18%
	Asian	1,854	19%
	Other/Unk	6,105	24%
Ethnicity	Hispanic	2,464	32%
	Non-Hispanic	62,925	35%

Source: Office of the Undersecretary of Defense, 2007

Therefore, data on Air Force personnel and prior research confirm the existence of an important interaction between demographics, occupation, and advancement. This interaction is the subject of explicit policy concern. Thus, the focus of this paper is a better understanding of occupational classification in the Air Force.

A Case Study of US Air Force Academy Cadets

This essay will explore the relationship between demographics and occupational classification by examining recent data on US Air Force Academy (USAFA) cadets. There are several good reasons to focus on USAFA cadets as a case study. First, there are few gender-related combat exclusions in the Air Force. While female cadets in the Army are barred from serving in some combat occupations and female Midshipmen in the Navy (until recently) could not serve on submarines (Commander, 2010), only Special Operations Forces occupations in the Air Force are limited to only male cadets. Second, while USAFA is not the largest commission source for Air Force officers, USAFA receives the most pilot slots per cadet. Since classification into flying AFSCs is the primary focus of this essay, it makes sense to study the commission source with the most per capita flying opportunities. Third, there are advantages to the fact that the entire USAFA population is centrally located and evaluated. Important performance metrics (e.g. GPA) are bound to be more standardized among USAFA cadets than across the spectrum of universities with ROTC programs. Finally, a practical but nonetheless important reason to focus on USAFA cadets is that classification data are readily available.

The primary drawback of the case study approach is that the findings will be specific to this population and not necessarily generalizable to other services or commission sources. For example, Air Force ROTC cadets or candidates going through Officer Training School may have different motivations behind their career choices and may face different rules and constraints in their classification processes. In addition, the incentives that draw minority cadets into particular Air Force occupations could be completely different from the incentives that draw minority midshipmen and cadets into similar Army, Navy, or Marine Corps occupations. Therefore, although there is useful empirical insight to be gleaned from a quantitative analysis of USAFA cadet occupational assignment, the findings may not be robust enough to inform DoD-wide or even Air Force-wide policy.

THE USAFA AFSC CLASSIFICATION PROCESS

At USAFA, cadets that are near graduation are matched to occupations (known as an Air Force Specialty Codes (AFSCs)) by an optimization-based classification model. USAFA receives quotas for each AFSC from the Air Force, and the classification model fills these quotas by taking cadets' stated preferences and rationing preferred AFSCs in accordance with their performance. Generally speaking, cadets who accomplish more (by a variety of performance metrics) have a greater likelihood of receiving their most-preferred AFSC.

The Board Order of Merit

During the fall semester, USAFA convenes a board of ten senior Academy leaders to evaluate all cadets in a given cohort according to their performance. The board members are strategically chosen to represent different dimensions of achievement—academics, athletics, and leadership. The ten board members are split into two separate panels and each panel evaluates half of the cohort. The board reviews a gamut of performance data, including objective criteria (e.g. GPA) and subjective criteria (e.g. commanding officer performance evaluations). Each member assigns to each cadet a score between 6 and 10, and the cadet's overall rating is the sum of the panel's scores. After the panels are finished rating their respective portions, the panel ratings are standardized (in case a particular panel tended to rate all cadets higher or lower), and the standardized rating is then used to rank all cadets in the cohort (Armacost and Lowe, 2005). The final ranking is known as the *Board Order of Merit* (BOM).

Stated AFSC Preferences and AFSC Classification

At the time of AFSC classification, cadets may submit two sets of ranked preferences—one set for rated AFSCs and another for non-rated AFSCs. Cadets who wish to be considered for a rated AFSC submit a ranking of the three possibilities—pilot trainee, navigator trainee, or air battle manager trainee. All cadets submit a ranking of their top six non-rated preferences. Because the assignment model considers all rated preferences first, cadets who want only non-rated AFSCs submit no rated preferences. There is no way to cross-rank rated and non-rated AFSCs. In other words, if a cadet's top rated preference is unavailable, the cadet receives his or her second rated preference rather than his or her first non-rated preference.

In addition to the preference rankings, cadets also assign a percentage weight to each preference according to how strongly the cadet desires the AFSC, relative to the others. For example, a cadet who assigns 100 percent to both of his or her top two preferences indicates that he or she is indifferent between these two choices. A cadet who assigns 100 percent to preference one and 50 percent to preference two indicates that he or she will be half as satisfied to receive the second AFSC as he or she would be to receive the first.

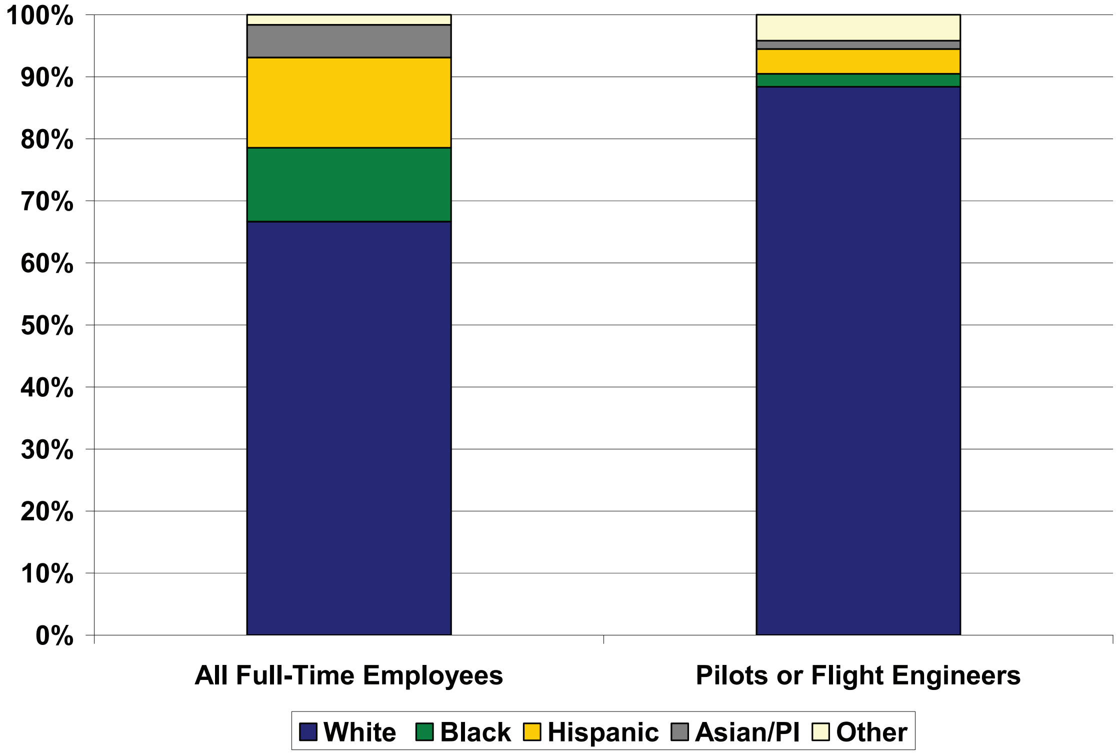
The concept behind the classification model is described in detail by Armacost and Lowe (2005). The basic goal of the classification model is to find the set of AFSC assignments that maximizes satisfaction while filling all required quotas. The model places more importance on the satisfaction of higher ranking cadets, so that cadets with more merit are more likely to receive their most-preferred AFSC.

POTENTIAL EXPLANATIONS FOR DEMOGRAPHIC DIFFERENCES IN OCCUPATIONS

The first thing to note in understanding demographic differences in occupations in the Air Force is that the phenomenon is not unique to the Air Force. Similar patterns of demographic sorting are an empirical regularity in the civilian labor market. For example, the *Handbook of Labor Economics* notes that black and Hispanic men tend to be in less skilled jobs than white men, while women are more likely to be in the clerical or service occupational sectors. In addition, the *Handbook* notes that black men and women also have a tendency to work in public administration (Altonji and Blank, 1999).

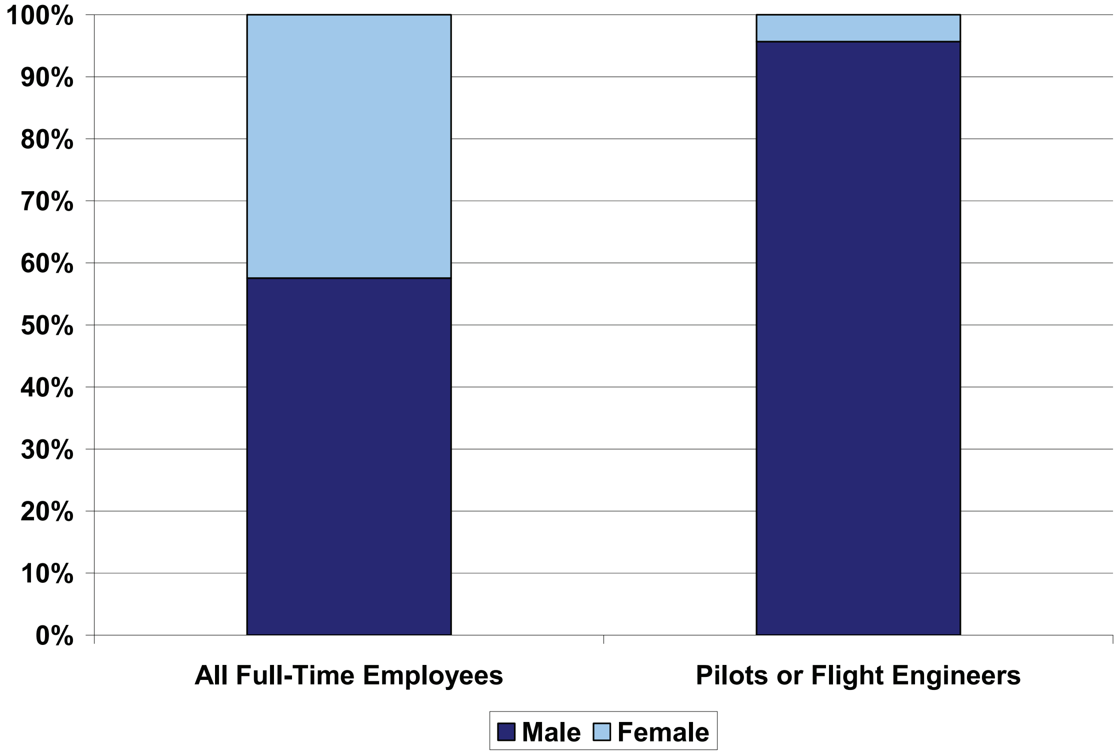
Flying occupations in the civilian labor market tend to be particularly uniform, demographically speaking. Figure 2.5 demonstrates this by showing the race/ethnicity composition of all full-time employees in the civilian labor force from 2004-2008 compared to the race/ethnicity composition of workers who were either aircraft pilots or flight engineers (i.e. occupations that are analogous to rated AFSCs in the Air Force). While 67 percent of all full-time employed civilians were white, white workers made up a full 88 percent of the aircraft pilots and flight engineers. Figure 2.6 shows the gender composition of each population and presents an equally stark contrast. While 42 percent of the full-time employees in the civilian labor force were female over the time period, female workers comprised only 4 percent of the pilots and flight engineers.

Figure 2.5: Race/Ethnicity Composition of Full-Time Civilian Employees vs. Pilots and Flight Engineers, 2004-2008



Source: March Current Population Survey, 2004-2008

Figure 2.6: Gender Composition of Full-Time Civilian Employees vs. Pilots and Flight Engineers, 2004-2008



Source: March Current Population Survey, 2004-2008

Thus, the tendency for rated AFSCs to be mostly populated with white and/or male officers is reflective of general societal trends and is not something that is unique to the Air Force (acknowledging, of course, that the two are related to the degree that some civilian pilots are former Air Force pilots).

In order to understand the mechanisms behind occupational differences across demographic groups in the Air Force, it is important to recognize a key difference between allocating labor through a price system (e.g. wages in the civilian labor market) and allocating labor via the USAFA classification model. The wages offered in a standard labor market match individuals to occupations by solving a two-sided problem—employers pay more for desirable worker characteristics in the form of a wage premium, while workers pay (by accepting higher or lower wages) for the desirableness of the occupation's characteristics (Rosen, 1987). Thus, the occupational wage tends to equalize the expected benefit across the occupations—workers are compensated for their skills and for the agreeableness/disagreeableness of the occupation. Economists refer to this concept as the theory of compensating wage differentials. This is why the there is no need for an occupation classification algorithm in a regular labor market.

Unlike occupation wages in the civilian labor market, officer wages are roughly constant across AFSCs (though pilots receive a wage premium in the form of Aviation Career Incentive Pay). In theory, this could mean that tastes for the non-pecuniary AFSC characteristics will play a large role in sorting people into occupations because there is no market-clearing wage to compensate individuals for the undesirable aspects of their jobs or to entice individuals into difficult AFSCs where their skills might be more productive. With this in mind, the main theories for why minority and female cadets might have less of a tendency to prefer rated AFSCs fall into the following general categories: demographic differences in skills, demographic differences in risk preferences, background differences between demographic groups, occupational norms, asymmetric information about the AFSC characteristics, and family considerations.

First, it is possible that minority and female cadets tend to have different skills that make them relatively more productive in the non-rated sector. To take a generic and trivial example, if physical strength were an asset in flying certain types of aircraft, strength differences across genders could make men, on average, relatively more productive in the rated sector, giving women the comparative advantage in the non-rated sector. There could be demographic differences in pre-USAFA education quality or differences in individual investments in academics or military training across the various demographic groups. These skills would fall under the realm of what economists call *investments in human capital*—activities that affect future monetary or psychic income by imbedding resources in people (Becker, 1964). Academic major is one example of a human capital difference that could affect AFSC preferences. Cadets who major in astrophysics, for instance, would probably be more productive in a space-related AFSC than cadets who major in management. Any such demographic differences in human capital could lead to occupational sorting as a rational response, reflecting differences in productivity.

An important part of human capital theory is the distinction between firm-specific knowledge and general knowledge. As Nobel Laureate economist Gary Becker stated in his Nobel lecture:

> By definition, firm-specific knowledge is useful only in the firms providing it, whereas general knowledge is useful also in other firms. Teaching someone to operate an IBM-compatible personal computer is general training, whereas learning the authority structure and the talents of employees in a particular company is specific knowledge. This distinction helps explain why workers with highly specific skills are less likely to quit their jobs and are the last to be laid off during business downturns (Becker, 1993).

It is useful to view the different types of cadet training in this way. Cadets who invest in military training acquire knowledge that is specific to the Air Force, while those who focus their efforts on becoming better engineers or computer scientists acquire more general knowledge. Given that Air Force career prospects and active duty service commitments differ across occupations, one would expect the type of human capital that cadets invest in to affect which occupations they prefer.

Second, different demographic groups may have different levels of tolerance for risk, causing minority and female cadets to prefer less risky non-rated AFSCs over the (presumably) riskier rated sector. While research has shown that men have a higher tendency than women to engage in a gamut of risky behaviors, DeLeire and Levy (2004) show specifically that women have less of a tendency to trade risk of death for wages. In addition, DeLeire and Levy estimate that in the US civilian labor market "differences in the risk of death across occupations explain about one-quarter of occupational gender segregation." Other research has suggested that minority officers may be less tolerant of combat risk, as minority youth are more likely to mention risk of death as a reason against joining the armed forces (Lim et al., 2009).

It also is possible that demographic differences in AFSC preferences are rooted in some aspect of the cadet's family or background. This is, of course, a very broad hypothesis, but there are a number of reasons that an individual's background may play a role in their choice of occupation. First, parents could play a role in an individual's occupational choice, either by transmitting innate abilities and habits or by swaying their children's preferences in the direction of their own (for a review of theories of intergenerational cultural transmission, see Saez-Marti and Zilibotti (2008)). Both the direct transmission of traits and indirect influence would produce a correlation between parents' occupations and those of their children, a correlation that has been empirically documented (Croll, 2008; Tsukahara, 2007; Sjorgen, 2000). In addition to the influence of parents, cadets from some demographic groups may benefit from additional social approval of choosing rated AFSCs. Nobel Laureate economist George Akerlof summarized this point when he wrote, "While my network of friends and relatives are not affected in the least by my choice between apples and oranges, they will be affected by my educational aspirations…As a consequence, the impact of my choices on my interactions with other members of my social network may be the primary determinant of my decision" (1997).

In an interesting theoretical paper, Mani and Mullin (2004) suggest that social approval for an occupation could depend on how aware an individual's community is of the skill that the occupation requires. Individuals from communities with a history in flying occupations would, then, benefit from a greater awareness of the individual's achievements in those occupations. Harrell et al. (1999) note the following anecdotal examples, taken from focus groups with Navy SEALs, which illustrate this phenomenon vividly:

> In contrast to a majority [white] enlisted discussant who was asked, "Are you going to be a SEAL?" when he mentioned that he was joining the Navy, one minority officer said, "Kids in the inner city schools ask, 'why are you going to swab decks?'" Another discussant said: I go home and people don't know anything about

it. I talk to people in my church—Italians and whites, they know all about it, but blacks don't."

Akin to differences in social approval, it is also possible that occupational norms differ by race/ethnicity or especially by gender. As George Akerlof and Rachel Kranton write in their recent work on the economics of identity, "Jobs have tags. There are men's jobs and women's jobs. Thus, *female nuclear engineer* and *female marine* seem contradictory, as do *male nurse* and *male secretary*" (2010). If cadets have a tendency to view or associate rated AFSCs with a certain race/ethnicity or gender, such a tendency could directly affect choices by giving cadets an incentive to pick occupations that are viewed as more socially appropriate for their demographic group.

Demographic differences in AFSC preferences could result if different demographic groups received different information about AFSCs or AFSC characteristics. This hypothesis overlaps somewhat with the others, as people may get information from their parents or their social community. Any differences across demographic groups in the information (or lack of information) about the aspects of serving in particular AFSCs could generate demographic differences in AFSC preferences.

Finally, there are several reasons to think that family considerations may generate gender differences in preferences for AFSCs. First, research has documented that women have traditionally had higher turnover rates than men in the labor market. For example, Sicherman (1996) uses personnel records from a large company to show that women are more likely than men to quit their jobs, and a higher proportion of women than men leave their jobs for reasons that are not related to employment (e.g. household duties). Whatever the forces behind gender differences in quit behavior, the existence of this tendency might lead female cadets to avoid rated AFSCs because they require additional commitment and may come with less flexibility in the availability of assignments. Additionally, Hosek et al. (2001) note that female military personnel are more likely than male personnel to have spouses that are employed in general, and spouses that are employed by the military specifically. Both these realities may lead female cadets to prefer non-rated AFSCs. For female cadets who plan to have civilian or military spouses, geographic flexibility could make lengthy separations less likely. For cadets who plan to marry another Air Force officer, opting for a non-rated AFSC could be a rational response to the potential difficulty of finding co-located assignments.

EMPIRICAL ANALYSIS OF USAFA AFSC CLASSIFICATION DATA

Data and Variables

The data for this analysis, which USAFA provided on 4 February 2010, consist of all USAFA graduates in the classes of 2004-2009. The data include each cadet's assigned AFSC, as well as their rated and non-rated preferences. The data also include a multitude of individual characteristics—race/ethnicity and gender, grade point average (GPA), military performance average (MPA) and physical education average (PEA), indicators for cadets who attended the USAFA preparatory school, cadets who were enlisted prior to coming to the academy or were recruited for athletics, each cadet's academic major, whether each cadet filed for joint spouse upon graduation (i.e. marriage to another military officer) and a measure of pre-USAFA academic aptitude known as academic composite[22].

The modern AFSC classification process went into effect for the class of 2005, which means that the data do not include a BOM rank for the class of 2004. Thus, the parts of the analysis that require BOM rank will exclude the class of 2004, but other parts may include the class of 2004 to augment the sample size.

Finally, the data also include a zip code for each cadet's home of record, which was used to link cadets to hometown demographic and economic variables from the census (median income and the percentage of residents currently or formerly serving in the armed forces). Table 2.2 summarizes the data, showing the mean of each variable for the total cadet population and for each demographic group. For example, the

[22] Academic composite is a combination of each cadet's best standardized test score (SAT/ACT), a standardized version of his/her high school GPA, and his/her high school class rank.

second row of Table 2.2 shows that 62 percent of white cadets were deemed potentially pilot qualified by their entry physical, compared to 31 percent of black cadets, 41 percent of Hispanic cadets, etc.

Table 2.2: Variable Means for All Cadets and Minority Subgroups, USAFA Classes of 2004-2009

Variable	White	Black	Hispanic	Asian/PI	Male	Female
Female	0.16	0.23	0.20	0.28	0.00	1.00
Entry Pilot Qual	0.62	0.31	0.41	0.39	0.62	0.38
Entry Nav Qual	0.11	0.12	0.13	0.12	0.11	0.11
AFA Prep	0.07	0.51	0.43	0.16	0.12	0.12
Prior Enlisted	0.06	0.36	0.26	0.11	0.09	0.09
Recruited Athlete	0.24	0.31	0.14	0.10	0.22	0.26
Walk-on Athlete	0.15	0.37	0.28	0.21	0.17	0.23
Joint Spouse	0.04	0.03	0.03	0.04	0.02	0.14
Academic Comp	3292	3120	3203	3293	3277	3278
GPA	3.01	2.70	2.79	2.92	2.97	3.00
MPA	2.95	2.90	2.90	2.92	2.93	2.97
PEA	2.69	2.70	2.63	2.62	2.68	2.67
Major: Engineer	0.35	0.17	0.26	0.29	0.36	0.18
Major: Bas Sci	0.13	0.11	0.13	0.20	0.12	0.20
Major: Soc Sci	0.39	0.53	0.44	0.39	0.39	0.44
Major: Humanities	0.14	0.18	0.17	0.11	0.13	0.18
Home: Med Income	54,256	49,703	51,051	57,021	53,828	54,901
Home: % Mil/Vet	5.24	9.54	7.33	7.64	5.69	5.90
Number of Cadets	4,547	265	355	322	4,669	979

Grouping AFSCs into Categories

For certain parts of the analysis, grouping similar AFSCs together helps to simplify both estimation and the presentation of results. Parts of this analysis will group the AFSCs into four general categories: rated, operations, engineering/acquisition, and support.

While the AFSC system already groups similar occupations together, there are a few cases where the groupings for this analysis will depart from those inherent in the AFSC system. The operations category for this analysis includes AFSCs that are mostly applicable to the military, tend to place officers in a supervisory role, and do not require a particular academic major. Thus, this analysis will include logistics readiness and maintenance with the operations category, though they are not typically considered part of the operations sector of the Air Force.

The support category for this analysis includes non-rated AFSCs that have a clear civilian occupational counterpart (e.g. security forces, public affairs). The engineering/acquisition category differs from the other non-rated categories in that it mostly includes AFSCs that have degree requirements (hence, weather is grouped with engineering/acquisition and not with operations). Table 2.3 lists the possible AFSCs that cadets may enter into upon graduation, and denotes the categories to which these AFSCs are assigned.

Table 2.3: Grouping of AFSCs into General Categories

Rated	Operations	Engineering/ Acquisition	Support
Pilot Trainee	Control/Recovery	Weather	Security Forces
Nav Trainee	Airfield Ops	Civil Engineer	Communications
ABM Trainee	Space & Missiles	Scientist	Services
	Intelligence	Devel Engineer	Public Affairs
	Aircraft MX	Acquisitions	Manpower-Personnel
	Mun/Misl MX	Contracting	Health Serv Admin
	Logistics Read	Finance	Biomedical Spec
	Cross Commission	Cost Analysis	Spec Investigator
			Medical School

Summary of AFSC Assignments

Table 2.4 lists the possible AFSCs that cadets could enter into, the corresponding alpha-numeric codes, and the mean overall performance average (OPA, which is used to determine graduation order), GPA, MPA, and PEA for the cadets assigned to each AFSC. The AFSCs in Table 2.3 are listed in order of mean OPA.

Table 2.4 shows that the majority of cadets in the classes of 2004-2009 went on to pilot training. No other single AFSC even comes close, and more cadets went into pilot trainee than all other AFSCs combined. Thus, the mean characteristics of the cadets who went into pilot trainee are similar to the overall averages, which in conjunction with the large number of slots suggests that the average cadet had no trouble obtaining a pilot slot.

Among the other AFSCs, the differences in the average performance of incoming cadets suggest that some AFSCs were much more difficult to obtain than others. For instance, the average cadet who went to medical school upon commissioning had an OPA of 3.42 and a GPA of 3.58, which was considerably higher than the overall average OPA of 2.96 and average GPA of 2.97. Similarly, the average cadet who went into special investigations had an OPA of 3.26, and special investigations had the highest average MPA of any AFSC (3.20). By contrast, many of the cadets whose performance was below average went into rated AFSCs other than pilot trainee. The average OPAs for navigator trainees and air battle manager trainees were 2.80 and 2.58, respectively. Communications, space & missiles, and logistics readiness were among the least competitive non-rated AFSCs (judging by OPA). These three AFSCs had mean OPAs of 2.77, 2.75, and 2.73, respectively.

Table 2.4: Summary of AFSC Assignments and Mean Characteristics, USAFA Classes of 2004-2009

AFSC	Code	N	%	OPA	GPA	MPA	PEA
Medical School	92M	95	2%	3.42	3.58	3.09	2.88
Special Investigations	71S	30	1%	3.26	3.30	3.20	2.94
Health Services Admin	41A	34	1%	3.19	3.29	3.01	2.82
Public Affairs	35P	5	0%	3.15	3.25	3.01	2.87
Scientist	61S	189	3%	3.15	3.24	2.96	2.71
Intelligence	14N	219	4%	3.10	3.15	3.02	2.66
Biomedical	42-43	22	0%	3.08	3.14	2.97	2.85
Devel Engineer	62E	293	5%	3.08	3.15	2.95	2.63
Cost Analysis	65W	30	1%	3.06	3.11	2.96	2.76
Weather	15W	25	0%	3.00	3.05	2.94	2.54
Services	34M	15	0%	2.99	2.96	3.04	2.76
Pilot Trainee	92T0	3,086	55%	2.97	2.98	2.96	2.69
Civil Engineer	32E	168	3%	2.97	3.00	2.92	2.69
Control/Recovery	13D	33	1%	2.94	2.88	3.02	3.24
Manpower-Personnel	37F	83	1%	2.91	2.90	2.95	2.65
Cross Commission	CC	25	0%	2.90	2.89	2.92	2.77
Security Forces	31P	59	1%	2.89	2.85	2.98	2.73
Acquisitions	63A	206	4%	2.88	2.88	2.87	2.76
Munitions/Missile MX	21M	15	0%	2.85	2.84	2.87	2.49
Contracting	64P	118	2%	2.84	2.83	2.87	2.73
Finance	65F	67	1%	2.81	2.81	2.82	2.71
Airfield Ops	13M	28	0%	2.81	2.77	2.92	2.55
Aircraft MX	21A	112	2%	2.80	2.76	2.92	2.60
Navigator Trainee	92T1	72	1%	2.80	2.78	2.85	2.57
Communications	33S	302	5%	2.77	2.74	2.83	2.56
Space & Missiles	13S	214	4%	2.75	2.72	2.82	2.54
Logistics Readiness	21R	82	1%	2.73	2.69	2.84	2.60
Air Battle Mgr Trainee	92T2	21	0%	2.58	2.48	2.82	2.45
Rated		3,179	56%	2.96	2.97	2.95	2.69
Operations		728	13%	2.88	2.87	2.92	2.63
Engineering/Acquisition		1,096	19%	2.99	3.03	2.92	2.70
Support		645	11%	2.96	2.97	2.93	2.68
	Total	5,648	100%	2.96	2.97	2.94	2.68

Figure 2.7 summarizes the demographic differences in assignment to pilot trainee (92T0). While the majority of white and Hispanic cadets received pilot slots (57 and 52 percent, respectively), only 43 percent of the Asian/PI cadets and 38 percent of the black cadets went into 92T0. A larger difference exists between the two genders. 60 percent

of the male cadets in the classes of 2004-2009 went into 92T0, compared to 30 percent of the female cadets.

Figure 2.7: Percent of Each Demographic Group Assigned to 92T0 AFSC, USAFA Classes of 2004-2009

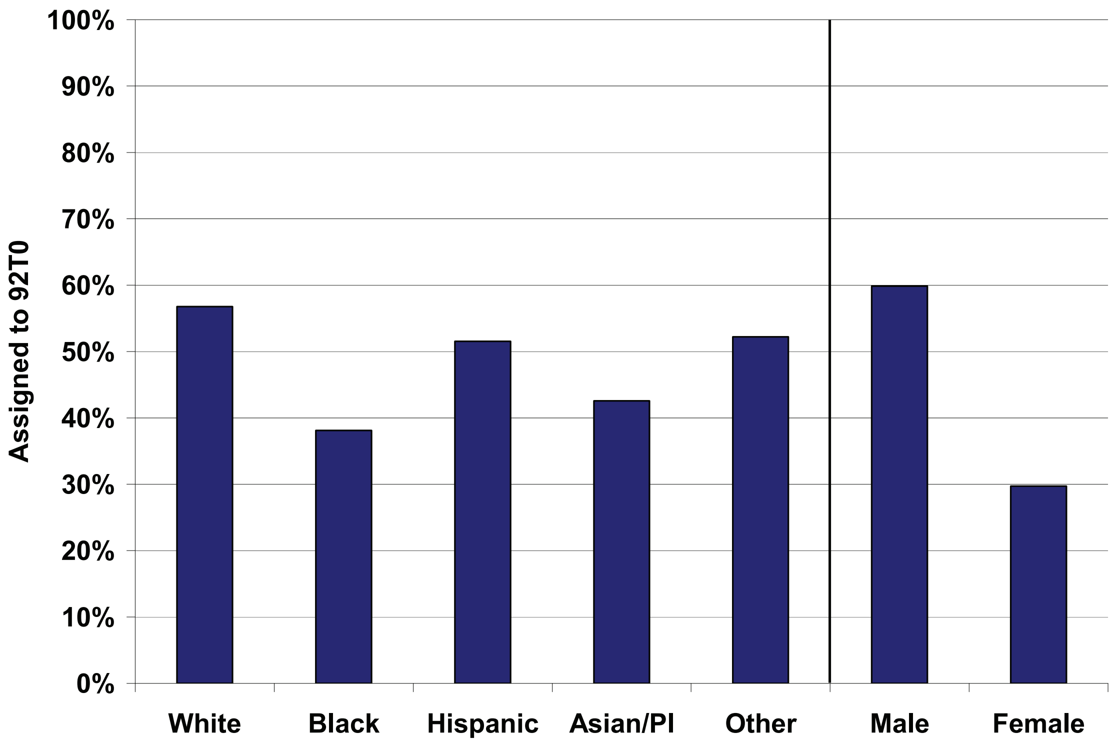


Figure 2.8 further summarizes the racial/ethnic differences in AFSC assignments by showing the percentage of cadets in each racial/ethnic group who went into other AFSCs besides 92T0. Several AFSCs stand out as having received a higher percentage of the minority cadets than white cadets. While 5 percent of the white cadets went into communications (33S), 13 percent of the black cadets went into this AFSC. Black cadets were also more likely to go into logistics readiness (21R, 5 percent), acquisitions (63A, 7 percent), and contracting (64P, 5 percent) than white cadets (1, 3, and 2 percent, respectively). Hispanic and Asian/PI cadets had AFSC assignments that were more similar to white cadets, with some differences. Asian/PI cadets had a higher tendency than white cadets to go into intelligence (14N, 8 percent vs. 4 percent).

Figure 2.8: Percent of Each Racial/Ethnic Group Assigned to Each AFSC, USAFA Classes of 2004-2009 (92T0 not Shown)

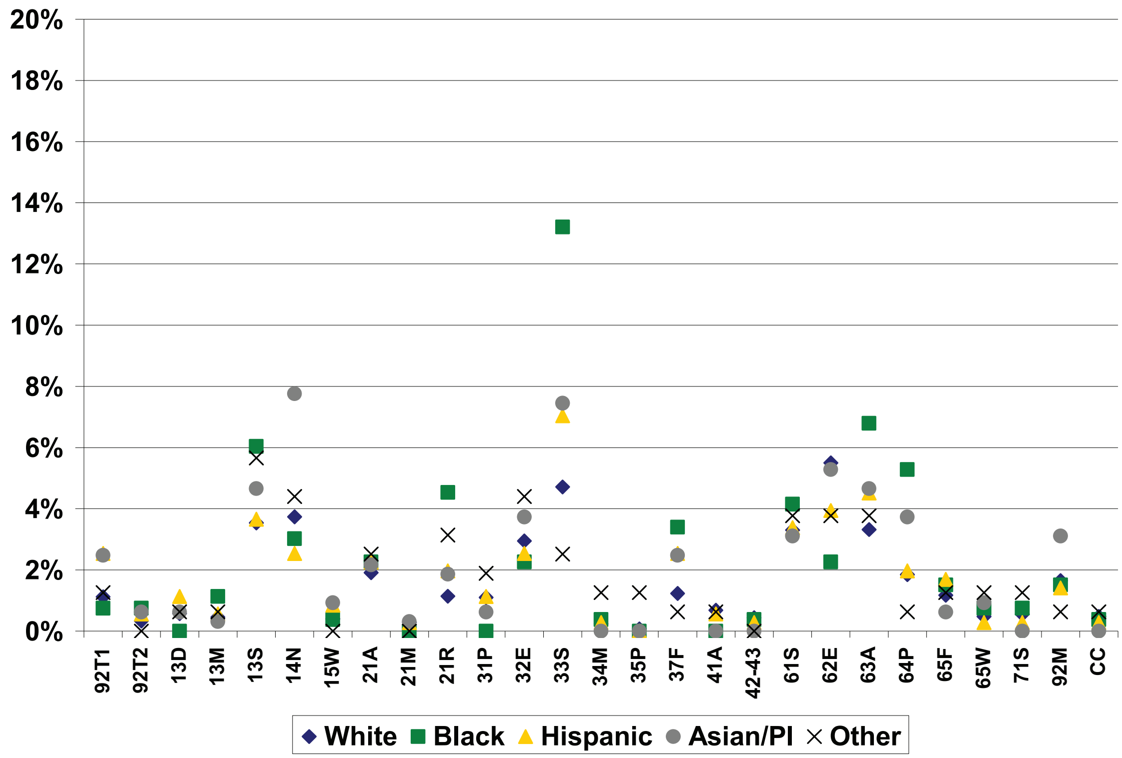
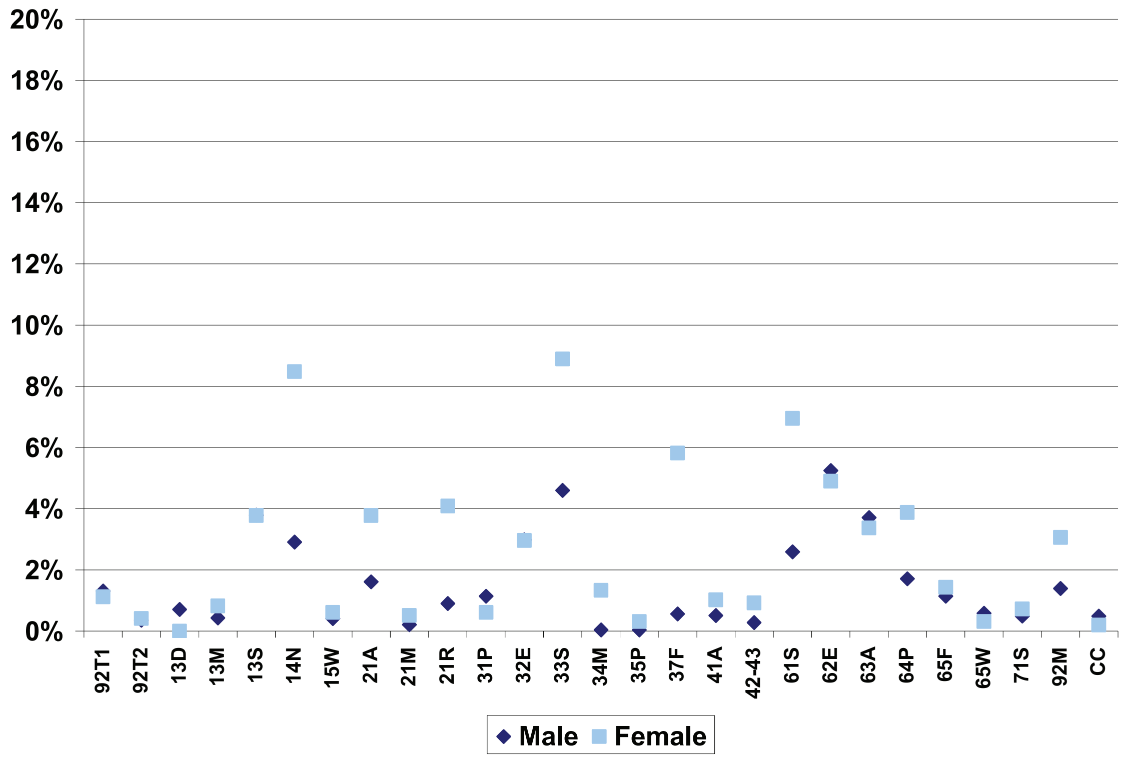


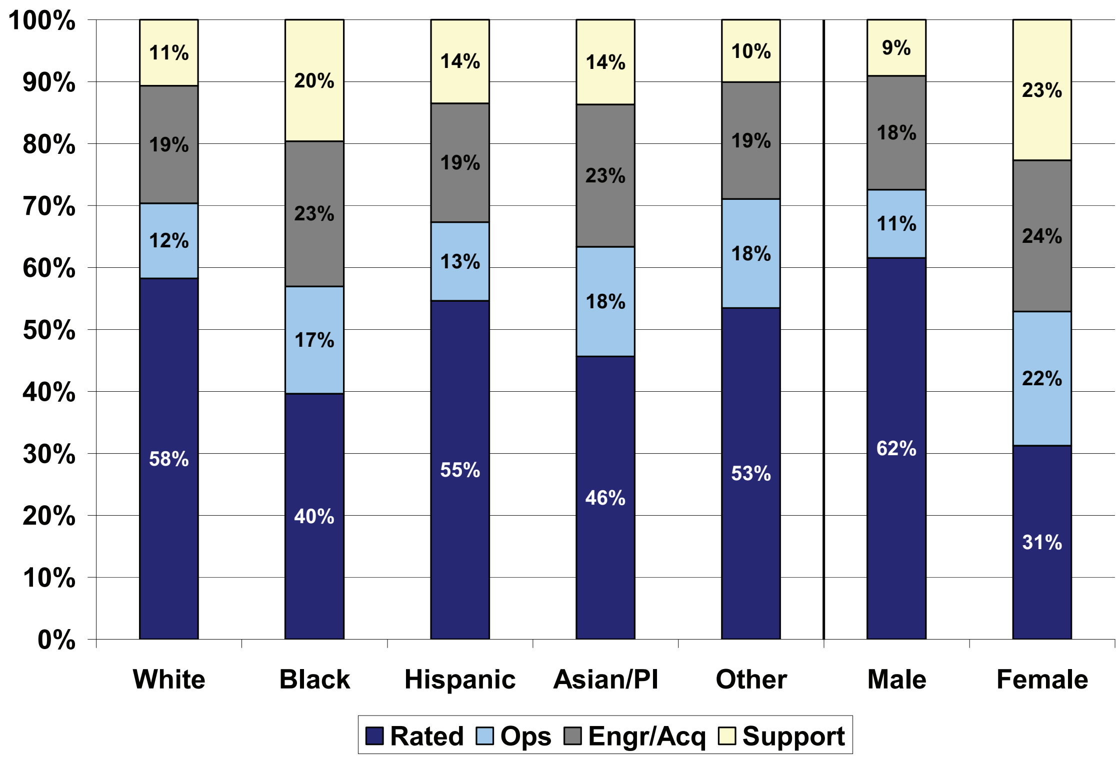
Figure 2.9 summarizes the gender differences in AFSC assignments, showing the percent of male and female cadets assigned to each AFSC (92T0 not shown). Female cadets had a higher tendency than male cadets to enter into most non-rated AFSCs, but several AFSCs had particularly large differences across genders. Eight percent of female cadets went into intelligence, compared to only 3 percent of male cadets. Female cadets were also more likely than male cadets to go into manpower-personnel (37F, 6 percent vs. 1 percent). The logistics readiness, communications, and scientist (61S) AFSCs also tended to receive a higher fraction of female cadets than male cadets. A total of 20 percent of the female cadets went into these three AFSCs, compared to 8 percent of the male cadets.

Figure 2.9: Percent of Each Gender Assigned to Each AFSC, USAFA Classes of 2004-2009 (92T0 not Shown)



Finally, Figure 2.10 displays the AFSC assignments for each demographic group—aggregated into general categories. The bars in Figure 2.10 are divided into sections that represent the fraction of the respective demographic group who received an AFSC in each of the four categories. The results are similar to those previously displayed—white and Hispanic cadets were more likely to receive rated AFSC assignments, while black and Asian/PI cadets had a higher tendency to receive operations, engineering/acquisition, and support assignments. Black cadets stand out as having a particularly high percentage that went into support AFSCs—20 percent, compared to 11 percent of white cadets and 14 percent of Hispanic and Asian/PI cadets. Aggregate male and female cadet assignments were almost complete inverses of one another—the majority of male cadets went into rated AFSCs, while a similar majority of female cadets went into the coalition of non-rated AFSCs. Female cadets who went into non-rated AFSCs do not seem to favor any particular non-rated sector. These assignments were evenly distributed across operations, engineering/acquisition, and support AFSCs.

Figure 2.10: Percent of Each Race/Ethnicity and Gender Assigned to Each AFSC Category, USAFA Classes of 2004-2009



Pre-USAFA Characteristics the Predict Entry into 92T0

Previous sections have outlined the reality that entry into rated AFSCs, 92T0 in particular, is of primary importance because of the long-term career implications of being a pilot. With this reality in mind, it is useful for recruiting purposes to identify which characteristics, if any, correlate with ultimately entering the 92T0 AFSC vs. entering other rated or non-rated AFSCs. Because the focus in this part of the analysis is recruiting, the potential predictors will be limited to what is known about each cadet prior to his or her time at USAFA.

The probit model is a logical technique for this prediction exercise. Probit regression jointly analyzes the relationship between all of the potential predictors and the probability that a cadet enters into 92T0. Including all the predictors jointly permits the model to calculate the partial effect of each while accounting for other variables that could confound the comparison. Furthermore, the probit model accounts for the binary nature of the outcome variable and constrains the probability that a cadet enters into 92T0 to be between zero and one.

This analysis specifies the model linearly, except that it includes polynomial terms for academic composite and interacts them with race/ethnicity. The specification includes these polynomial interactions to capture a nonlinear relationship between academic composite and the probability that a cadet enters 92T0, which differs depending on a cadet's race/ethnicity (discussed below).

Table 2.5 summarizes the results from the probit model by showing the average marginal effect (AME) for each variable. One ought to interpret each AME as the average change in the probability that a cadet enters 92T0 associated with an incremental change in the variable of interest, conditional on everything else in the model. Categorical variables should be interpreted as the average change in probability associated with being in the respective category, relative to the base category and conditional on other variables included in the model.

The AMEs in Table 2.5 show that many pre-USAFA characteristics significantly affect the probability of entering into 92T0 upon commissioning. Not surprisingly, cadets who were potentially pilot qualified (PPQ) and potentially navigator qualified (PNQ) prior to coming to USAFA were significantly more likely to go into the 92T0 AFSC. On average, the probability of entering 92T0 was 25 percentage points higher for PPQ cadets and 13 percentage points higher for PNQ cadets than for cadets who were neither PPQ nor PNQ. In addition, cadets who attended the USAFA preparatory school were significantly less likely to enter 92T0. The probability of entering 92T0 for these cadets was 15 percentage points lower than cadets who did not attend the USAFA preparatory school, on average. Furthermore, even conditional on USAFA preparatory school attendance among other things, the probability of entering 92T0 was 9 percentage points lower for cadets who were recruited for athletics vs. those who were not, on average.

Table 2.5: Average Marginal Effects for Probit Model Predicting Entry into 92T0, USAFA Classes of 2004-2009

Variable	Average Marginal Effect
White (base category)	
Black	-0.047
	(0.035)
Hispanic	0.04
	(0.028)
Asian/PI	-0.064**
	(0.028)
Other	-0.004
	(0.04)
Male (base category)	
Female	-0.24***
	(0.017)
Academic Composite	-0.001
(divided by 100)	(0.002)
Pilot Qualified (Entry)	0.246***
	(0.015)
Navigator Qualified (Entry)	0.128***
	(0.02)
USAFA Prep	-0.153***
	(0.03)
Prior Enlisted	0.055*
	(0.031)
Recruited Athlete	-0.09***
	(0.017)
Home Median Income	0.006**
(divided by 10,000)	(0.003)
Home % Military/Veteran	0.004
(divided by 10)	(0.007)

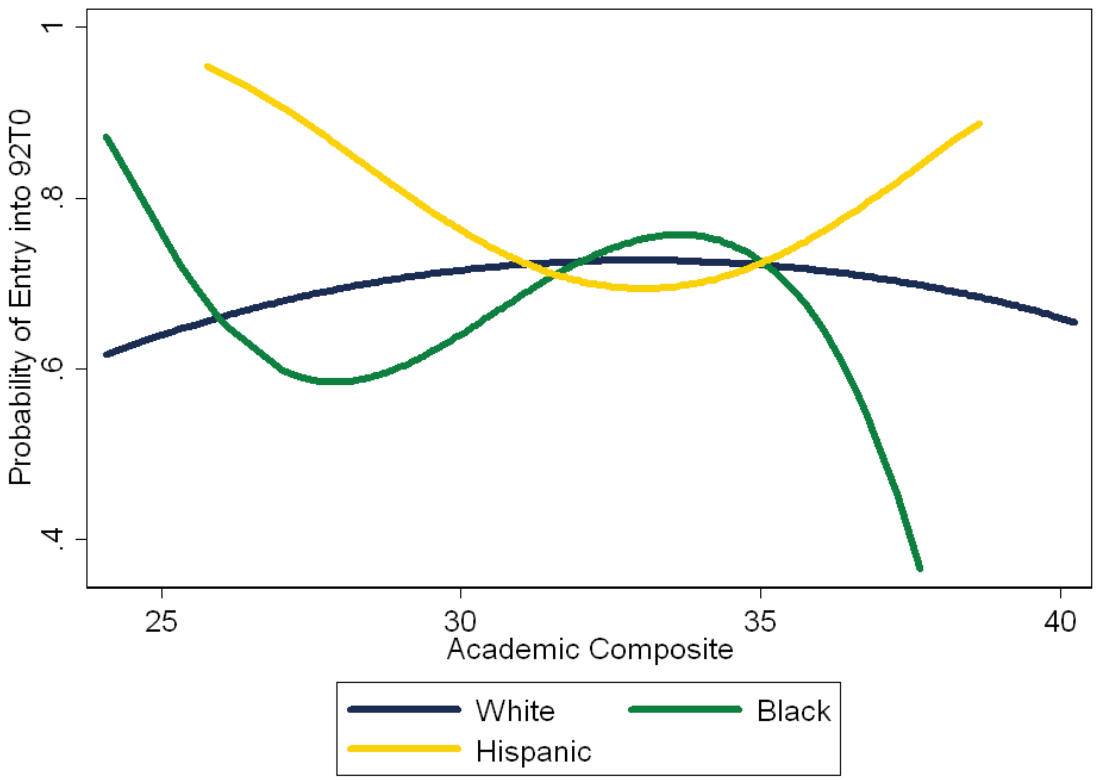
Notes: Standard errors in parenthesis, calculated from 3000 nonparametric bootstrap samples. ***, **, and * denote statistical significance at the 1, 5, and 10 percent levels, respectively. Academic composite specified as a quadratic polynomial for white and Hispanic cadets, and a cubic polynomial for black cadets.

These relationships have important implications for demographic diversity because the characteristics that predict entry into 92T0 differ greatly across demographic groups. For example, 62 percent of the white cadets in the classes of 2004-2009 were PPQ prior to entering USAFA, compared to 31 percent of black cadets, 41 percent of Hispanic cadets, and 39 percent of Asian/PI cadets. Overall, 62 percent of the male cadets were PPQ, compared to 38 percent of the female cadets.

Additionally, 51 percent of black cadets and 43 percent of Hispanic cadets attended the USAFA preparatory school, compared to 7 percent of white cadets. Black cadets were also more likely than white cadets to be recruited for athletics (31 percent vs. 24 percent). All else being equal, these patterns will tend to produce differential rates of 92T0 accession across demographic groups.

While the AME of academic composite was small and statistically insignificant, this result does not mean that there is no relationship between academic composite and the probability of entering 92T0. Rather, there is a complex and nonlinear relationship that varies by race/ethnicity. To illustrate this relationship, Figure 2.11 shows how the predicted probability of entering 92T0 varies with academic composite for white, black, and Hispanic cadets (there was no significant relationship for Asian/PI and cadets of other races). For white cadets, the relationship is relatively flat and concave. For black cadets, the probability increases steeply from an academic composite of about 2800 to a peak at about 3400, where it sharply decreases. The relationship for Hispanic cadets appears to be just the opposite—the probability decreases sharply to a valley at around 3400, increasing thereafter. Figure 2.11 shows that academic aptitude does affect the probability of entering the 92T0 AFSC, but the AME is not the best statistic to capture this relationship.

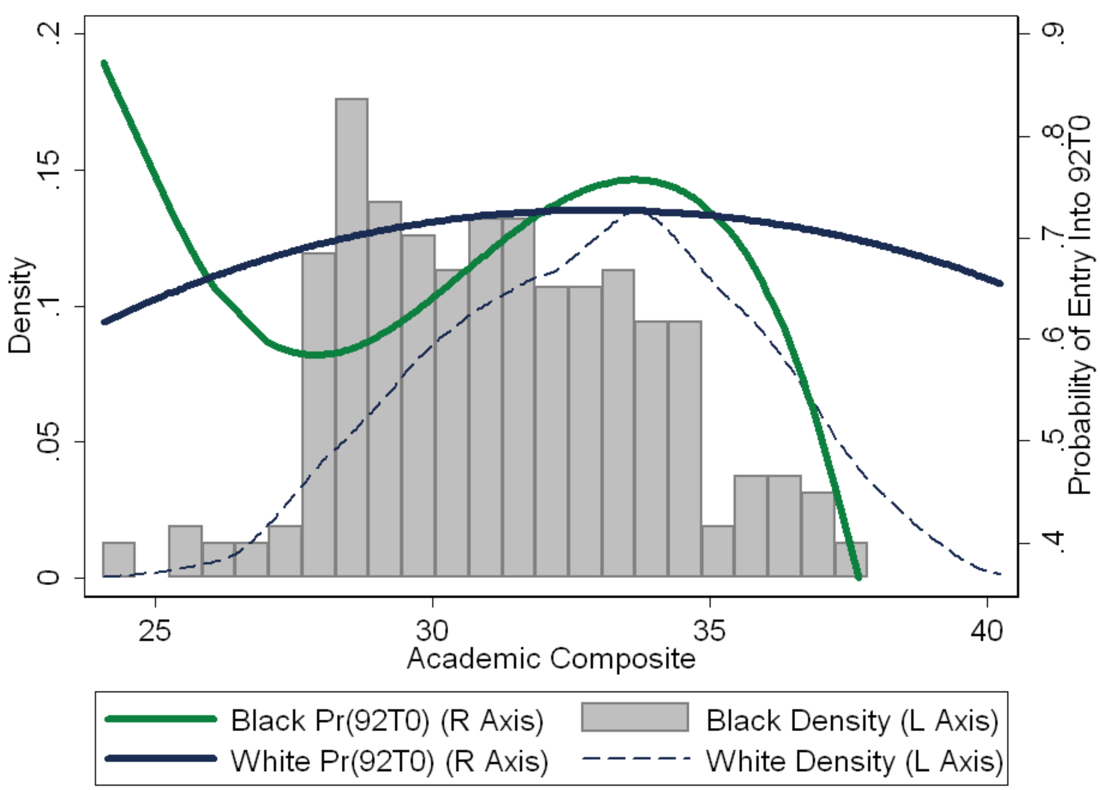
Figure 2.11: Predicted Probability of Entering 92T0 vs. Academic Composite by Race/Ethnicity, USAFA Classes of 2004-2009



Notes: Asian/PI and Other not shown because the relationship was not statistically significant. These curves would shift depending on categorical variables, so this graph shows the probability for a male cadet who is PPQ, did not attend the preparatory school, was not prior enlisted or recruited for athletics, and had an average home median income and percent military/veteran value.

While it is not immediately clear why these relationships exist in the data, they may have important implications for recruiting policy. Figure 2.11 shows that the probability that a black cadet goes into 92T0 tends to be less than the probability that a similar white cadet goes into 92T0 for academic composite values below about 3200. However, from about 3200-3500, the probabilities for black and white cadets are similar. Therefore, a hypothetical omniscient recruiting policy that sought to have similar fractions of black and white cadets go into the Pilot Trainee AFSC, would have recruited mostly black cadets who fell into the 3200-3500 range for academic composite (ignoring the lower tail where very few cadets of any demographic group tend to fall). However, the actual distributions of academic composite for black and white cadets follow a different pattern that nearly maximizes the divergence between the two groups, as Figure 2.12 shows. Figure 2.12 depicts the same probability vs. academic composite picture that Figure 2.11 showed for black and white cadets, along with the density of each group (as a histogram for black cadets, and a smoothed kernel density estimate for white cadets). Compared to the white cadets, a relatively large proportion of the black cadets fall in the 2700-3000 range, and a relatively small portion fall in the peak 3200-3500 range. All else being equal, these patterns in aptitude would tend to produce differential rates of flying for black and white cadets.

Figure 2.12: Predicted Probability of Entering 92T0 vs. Academic Composite and Academic Composite Density for White and Black Cadets



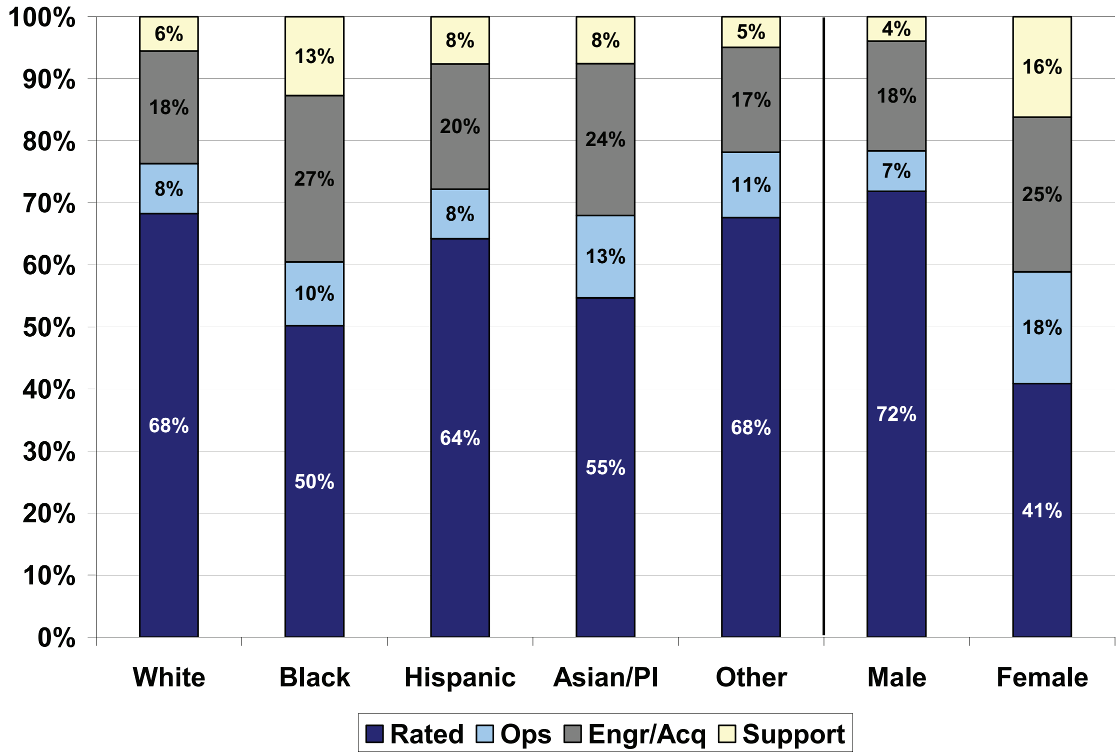
Finally, the results in Table 2.5 describe the demographic differences in entry into 92T0 that remain after conditioning on a number of other important variables. The AMEs for each race/ethnicity indicator variable and the female indicator variable can be interpreted as the average difference between a cadet in the respective demographic group and a cadet in the base group who are similar in other respects. Thus, the AMEs show that much of the difference between white and black cadets can be attributed to other characteristics. While the raw difference between these two groups was about 19 percentage points, the AME shows only a statistically insignificant 5 percentage point gap, conditional on the other pre-USAFA characteristics. Other characteristics account for some of the differences between white and Asian/PI cadets. The raw gap between these two groups was 14 percentage points, but conditional on other characteristics, the gap shrinks to 6 percentage points. A large and statistically significant difference remains between the genders. Even conditional on medical qualification, which differed greatly across genders, female cadets were 24 percentage points less likely to enter into 92T0 than male cadets on average.

Stated Preferences vs. Board Order of Merit Ranking

This section begins to break down the mechanics of AFSC classification at USAFA by looking at the two sides of the process—cadets' stated preferences and the BOM ranking process. Because the modern assignment process was first implemented with the class of 2005, these and subsequent results will only include the classes of 2005-2009.

First, Figure 2.13 shows the distribution of cadets' first-ranked preferences by race/ethnicity and gender. The demographic differences in stated preferences mirror the previously discussed differences in actual assignments. While the majority of cadets in each racial/ethnic group entered a rated preference (any of which becomes the first choice by default), white and Hispanic cadets did so at a higher rate than black and Asian/PI cadets. Similarly male cadets were much more likely than female cadets to enter a rated preference. Engineering/acquisition tended to be the most popular non-rated category among each group, but Figure 2.13 shows that minority and female cadets were more likely than white and male cadets, respectively, to enter an engineering/acquisition AFSC as their top preference. Black cadets submitted preferences for support AFSCs at over twice the rate of white cadets. Similarly, female cadets submitted preferences for support AFSCs at four times the rate of male cadets.

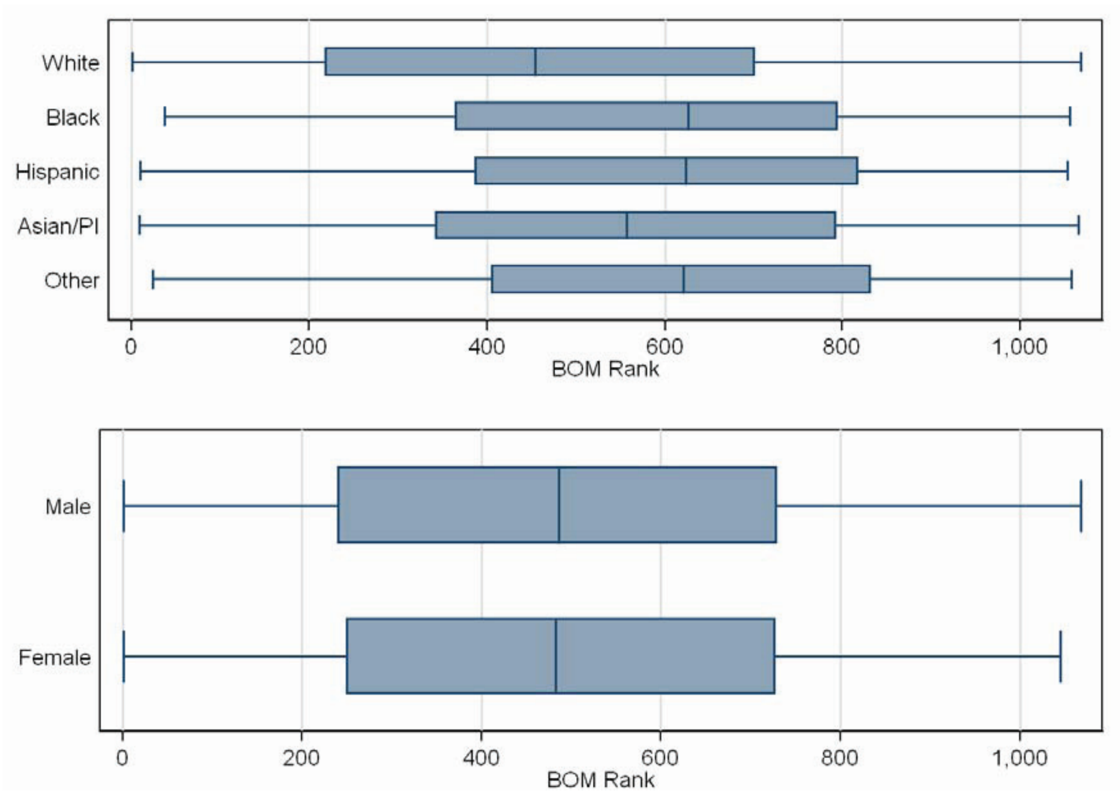
Figure 2.13: Percent of Each Race/Ethnicity and Gender that Submitted an AFSC in Each Category as Top Preference, USAFA Classes of 2005-2009



Aggregate BOM rankings differed by race/ethnicity, but did not differ greatly across the genders. Figure 2.14 presents these differences by showing a box plot of BOM rankings, separately by race/ethnicity and by gender. The line bisecting each box is the median value, and the ends of the box represent the 25th and 75th percentile ranks for each demographic group.

Minority cadets tended to rank lower on the BOM than white cadets. The median BOM rank for white cadets was 454, over 100 places higher than the next-closest median rank (558 for Asian/PI cadets). Black, Hispanic, and cadets of other races had similar distributions of BOM rank, with median ranks of 626, 624, and 621, respectively. As indicated above, there was virtually no aggregate difference between the genders. The median male cadet ranked 486, compared to a rank of 483 for the median female cadet.

Figure 2.14: Board Order of Merit Rank Distribution by Race/Ethnicity and Gender, USAFA Classes of 2005-2009

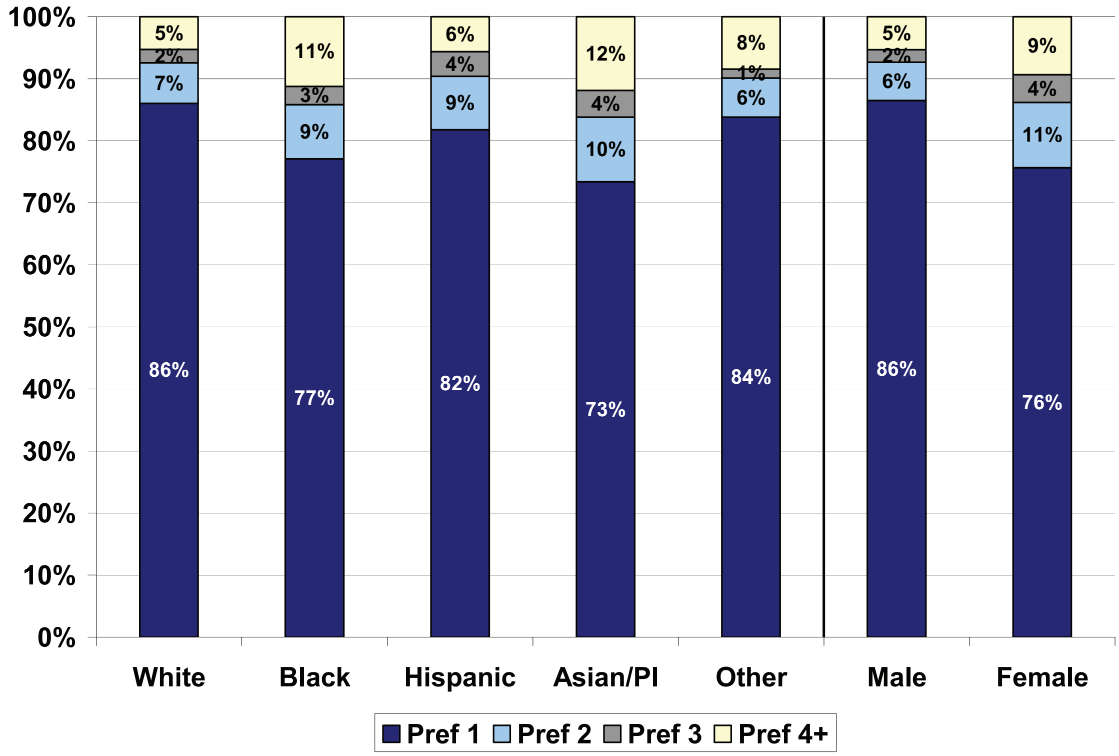


These two sides of the classification process interact to produce a set of AFSC assignments. The fact that minority cadets tend to rank lower than white cadets means that white cadets should tend to receive their preferred AFSCs at higher rates. However, the demographic differences in stated preferences suggest that different groups do not necessarily compete for the same types of AFSCs.

Figure 2.15 shows the rates at which cadets in each demographic group receive their preferred AFSCs. It is worth mentioning that several aspects of the classification system complicate the determination of which preference a cadet received. For the purposes of this analysis, any cadet who received Control/Recovery, Special Investigator, any of the medical AFSCs, or who commissioned into another service is automatically considered to have received his or her top preference. USAFA assigns these AFSCs in an atypical way such that no cadets receive them without actually preferring them. Any cadet who received an AFSC that he or she indicated 100 percent satisfaction with is also considered to have received his or her top preference. Finally, cadets who indicated they were indifferent between one or more AFSCs are classified as receiving the highest preference at the indicated level of satisfaction. For example, if a cadet indicated the same level of satisfaction with preferences 3-5 and received preference 5, this cadet is considered to have received his or her third preference.

As expected from the differences in BOM rank, white cadets received their top preference at the highest overall rate (86 percent). However, the patterns in Figure 2.15 indicate that this high rate may not have resulted from the tendency for white cadets to rank higher on the BOM, but rather from their higher tendency to prefer rated AFSCs. For example, Asian/PI cadets tended to rank higher on the BOM than Hispanic cadets, but Hispanic cadets received their top preference at a higher rate, presumably because they tended to go for rated AFSCs at high rates as well. Similarly, there was virtually no difference between male and female cadet BOM rankings, but male cadets received their preferred AFSCs at a higher rate than female cadets.

Figure 2.15: Percent of Each Race/Ethnicity and Gender that Received Each Preference Ranking, USAFA Classes of 2005-2009



Determinants of Board Order of Merit

While the previous section described the demographic-specific distributions of BOM rank, this section will give a more complete understanding of the classification process by briefly addressing the determinants of BOM rank. There is no systematic rule for converting a cadet's performance into a BOM rank because a panel of individual judges determines the scores used to generate the rank. However, the data include each cadet's BOM rank and a number of important performance criteria. Thus, this section will use Ordinary Least Squares (OLS) regression to identify the performance variables that have the greatest impact on a cadet's BOM rank.

Table 2.6 presents the OLS estimates from three models. The first model includes only race/ethnicity and gender. The second model includes only the variables factored into graduation order—GPA, MPA, and PEA. The third model includes all performance variables in the data set that could potentially relate to a cadet's BOM rank. All models include squadron-class fixed effects, which will capture any unobserved factors that affect all cadets in a given squadron and year. Each estimate can be interpreted as the average change in rank associated with a marginal change in the variable of interest, conditional on squadron-class group and the other variables in the model. It is also important to note that a negative coefficient indicates an *improvement* in BOM rank, since an increase in nominal BOM rank moves a cadet towards the bottom.

Little discussion is required regarding model 1, as these estimates reflect the earlier demographic patterns. There is no significant difference between genders, and cadets from all minority race/ethnicity groups tended to rank significantly lower than white cadets, on average.

Model 2 shows that the determinants of graduation order of merit explain most of the variation in BOM rank. The R-squared value for this model, which includes only these variables (and the fixed effects), indicates that GPA, MPA, and PEA alone explain 88 percent of the variation in BOM rank. GPA has the biggest impact of the three, followed by MPA and then PEA. A standard deviation increase in GPA was associated with an average increase of 184 places on the BOM, while similar increases in MPA and PEA were associated with 93 and 55 place increases, respectively.

Model 3 includes all the variables that might relate to BOM rank, and the impact of any one of these variables is small compared to the impact of GPA, MPA, and PEA. The demographic variables from this model, though, reflect the average difference between similarly competitive cadets in the various groups. Interestingly, while there was no significant difference across genders conditional on just squadron-class group, the estimates from model 3 indicate that female cadets ranked about 23 places lower (i.e. worse), on average, than similarly competitive male cadets. Additionally, model 1 estimated that black cadets ranked 132 places lower than white cadets, on average, but model 3 estimates that black cadets ranked 22 places better, on average, than similarly competitive white cadets. Only small and statistically insignificant differences remain between other racial/ethnic groups and white cadets, conditional on other performance variables.

It is difficult to say what may be causing these demographic differences. It could very well be that there are omitted variables that also differ by gender or race. For instance, suppose there is some variable, X, that male cadets have a higher tendency to possess than their female classmates within their squadron, and further suppose that X factors into the BOM ranking process. For X to cause bias in model 3, it would also have to be the case that X is not captured by MPA, or any of the other performance metrics in the model. Given that most military achievements that might factor into BOM rank are reflected in cadet MPAs (e.g. cadet leadership positions), it is difficult to imagine an omitted variable that drives the demographic differences in model 3.

Table 2.6: OLS Regressions of BOM Rank on Cadet Performance Variables and Demographics

Variable	Model 1	Model 2	Model 3
Female	-7.79		22.66***
	(11.74)		(4.19)
Black	132.11***		-21.52***
	(19.29)		(7.17)
Hispanic	127.61***		2.63
	(17)		(6.72)
Asian/PI	79.48***		2.7
	(17.56)		(6.36)
Other	123.34***		7.87
	(25.88)		(9.3)
GPA (normed)		-184.43***	-184.09***
		(2.48)	(2.48)
MPA (normed)		-93.47***	-95.16***
		(2.2)	(2.26)
PEA (normed)		-55.45***	-52.61***
		(1.67)	(1.72)
USAFA Prep			4.03
			(6.81)
Other Prep			-9.27*
			(4.84)
Prior Enlisted			-18.05**
			(7.69)
Recruited Athlete			-18.17***
			(4.21)
Walk-on Athlete			-8.36**
			(4.18)
Soaring Instructor			-2.95
			(3.33)
Major: Engineering			-18.55***
			(3.87)
Major: Basic Sci			-11.57**
			(5.14)
Major: Humanities			-0.80
			(4.96)
Minor: For Lang			-13.53***
			(4.38)
N	4718	4718	4718
R-Squared	0.066	0.883	0.885

Notes: Cluster-robust standard errors in parenthesis. ***, **, and * denote statistical significance at the 1, 5, and 10 percent levels. All models include squadron-class fixed effects. Base categories: Male (gender), White (race/ethnicity), Social Science (major)

Empirical Model of AFSC Classification

The final portion of this analysis will focus on attempting to model both sides of the AFSC assignment process—that is, to understand cadet preferences for AFSCs while accounting for the fact that cadets who rank lower on the BOM will generally have fewer options.

In standard economic theory, individuals choose from among the possible occupations by weighing all of the benefits and costs of each and choosing the occupation with the greatest net benefit. Economists often describe this decision process through a construct known as utility, which is a sort of index that captures how an individual measures different alternatives against one another. Individuals are assumed to choose the option which maximizes their utility, an assumption that actually imposes very little structure on human behavior. For two occupations to be comparable, they must have something in common (which, in economics jargon, is known as utility). To say that cadets choose the AFSC that maximizes their utility is simply to say that they have some criteria for comparing different options and they choose the best option available according to those criteria.

To convert this theory into an empirical specification, suppose a cadet's utility for each AFSC is a linear function of his or her characteristics. This function can be written in the following way:

$$U_{ij} = X_i'\beta_j + \varepsilon_{ij}$$

Where U_{ij} represents cadet *i*'s utility for AFSC *j*, X_i' is a vector of cadet *i*'s characteristics, β_j is a vector of model parameters representing the effect of each characteristic on cadet *i*'s utility for alternative *j*, and ε_{ij} represents the unobservable determinants of cadet *i*'s utility. The ε_{ij} are assumed to be random. Cadet *i* will prefer AFSC *j* if this AFSC has the highest level of utility, or:

$$U_{ij} > U_{ik}, \forall k \neq j$$

Then, under the assumption that the ε_{ij} are extreme value distributed, the probability that alternative *j* maximizes cadet *i*'s utility is

$$\Pr(U_{ij} > U_{ik}, \forall k \neq j) = \frac{e^{X_i'\beta_j}}{\sum_{k=1}^{m} e^{X_i'\beta_k}}, j = 1...m$$

This is the familiar multinomial logit model (McFaddon, 1984). This econometric model forms the foundation for the estimates in this paper.

In the research literature on military recruiting, the utility maximization framework has been used in this way to motivate econometric models that analyze individual enlistment decisions as a function of the individual's characteristics (e.g. AFQT score) or characteristics of the occupation (e.g. military wage). Hosek and Peterson (1985; 1990) employ the binary logit model, as they analyze individual decisions of whether or not to enlist. Kilburn and Klerman (1999) and Kleykamp (2006) use the multinomial logit model to look at decisions to enlist vs. other options, such as attend college or get a civilian job. All of these papers motivate the individual decisions by assuming individuals choose the option that maximizes their utility. Then, the estimation techniques use the observed choices in the data to infer about the effect of each variable on individual utility for each option.

However, a good empirical model of the AFSC classification system will also reflect the reality that the opportunity to enter different branches will depend on a cadet's BOM rank. Namely, cadets at the top of the BOM have more options to choose from than those at the bottom. Therefore, suppose that the probability that cadet *i* has the opportunity to enter AFSC *j*, $\Pr(O_j)$, takes the binary logit form and depends on cadet *i*'s BOM ranking and a AFSC-specific intercept (capturing the fixed availability of slots for AFSC *j*):

$$\Pr(O_{ij}) = \frac{e^{\alpha_j + \beta_j OML_i}}{1 + e^{\alpha_j + \beta_j OML_i}}$$

If the opportunities available to each cadet were directly observable, it would be possible to estimate the parameters of cadet *i*'s utility function by conditioning on opportunities in his or her choice set, S. Similarly, these observable opportunities could also be used to estimate the parameters of the opportunity equations. Then, the unconditional probability that cadet *i* enters AFSC *j* (P_{ij}) would be the probability that AFSC *j* maximizes cadet *i*'s utility given the choice set multiplied by the probability that cadet *i* faces that particular choice set.

Since the set of available AFSCs is not directly observable, the unconditional probability that cadet *i* enters AFSC *j* (P_{ij}) can be obtained by taking the expectation (over all possible choice sets) of the probability that cadet *i* prefers AFSC *j* given S times the probability that cadet *i* has that particular set of opportunities, or

$$P_{ij} = \sum_{S} \frac{e^{X_i'\beta_j}}{\sum_{k \in S} e^{X_i'\beta_k}} \prod_{k \in S} \frac{e^{\alpha_k + \beta_k OML_i}}{1 + e^{\alpha_k + \beta_k OML_i}} \prod_{l \notin S} \frac{1}{1 + e^{\alpha_l + \beta_l OML_i}}$$

These unconditional probabilities can be inserted into the log-likelihood function and used to estimate the parameters of the utility function as well as the parameters of the opportunity function via maximum likelihood. This model is a variation of the two-sided logit (TSL) model, which was first introduced by Logan (1996) and further developed in Logan (1998).

The TSL model presents a useful tool for estimating the relationship between cadet characteristics and their preferences while at the same time accounting for the fact that cadets that rank lower on the OML generally have fewer opportunities to enter the AFSC of their choice.

Model Identification

Logan (1998) gives a very satisfying description of the restrictions necessary for the TSL model to be identified, but it will help in interpreting the results to briefly address two identification considerations. First, as is the case in any discrete choice econometric model, the TSL model must be normalized to account for the fact that the level and scale of utility are irrelevant (Train, 2003). The assumption of extreme value errors implicitly normalizes the scale, but the utility of one alternative must be fixed at zero in order to anchor the level of utility. Practically, this means that all model parameters (on the utility side) will be estimated in reference to a base category. Second, it is not possible to include alternative-specific intercepts on the utility side of the model, because such intercepts would not be distinguishable from the alternative-specific intercepts on the opportunity side. As Logan (1998) notes, this is not a drawback of the model, since there is usually no substantive interest in the values of the intercepts, themselves. This restriction simply means that the intercepts on the opportunity side will tend to pick up the net effect of the availability of a given AFSC and the attractiveness of the AFSC to cadets.

Implied Preferences vs. Stated Preferences

Lastly, in order to understand the results of the TSL model in this context, it is important to note that cadets' stated preferences (i.e. the preferences that cadets submit to the classification algorithm) may differ from their actual preferences. While some of the preference rankings that cadets submit may reflect their actual preferences, there is reason to think that cadets may adjust their stated preferences according to an assessment of which AFSCs they are likely to receive. For example, suppose that a cadet would be very satisfied to receive 92T0, slightly less satisfied to receive his or her top non-rated preference, and very dissatisfied to receive 92T1 or 92T2. If this cadet thinks his or her probability of receiving 92T0 is low, he or she may rank only non-rated AFSCs rather than risk receiving 92T1 or 92T2. This is one example, but it is not difficult to imagine many scenarios where cadets do not rank AFSCs that they know they are unlikely to receive.

Therefore, the TSL model will describe the preferences implied by the AFSC assignments and BOM rankings rather than the stated preferences that cadets actually submit. This gives the TSL estimates the advantage of being robust to any differences between what cadets submit and what they actually might prefer if they had unlimited opportunity. Furthermore, analyzing preferences in this way has the added advantage of being able to incorporate AFSCs that are assigned separately from the AFSC algorithm (e.g. 71S, 92M).

TSL Model Results

Table 2.7 presents the results from the preference side of the TSL estimation. Because the TSL model specifies the preference side as a multinomial logit, the exponentiated preference parameters can be interpreted as odds ratios—the change in the odds of preferring a given category over the base category (rated) associated with a change in the respective characteristic. The interpretation of each column of odds ratios is no different from a binary logit regression on the outcome of whether each cadet prefers the respective category over the rated category.

Table 2.8 presents the results from the opportunity side of the TSL estimation. Since the TSL specifies the opportunity side as a binary logit for each category, the exponentiated parameters can also be interpreted as odds ratios, except that they describe the odds of having the opportunity to enter a given category.

The results in Table 2.7 show that several types of human capital are significantly associated with AFSC preferences. In every case, cadets with more academic ability are more likely to choose non-rated AFSCs over rated AFSCs. A standard deviation increase in GPA (i.e. an increase of about 0.45) was associated with 83 percent higher odds of preferring an operations AFSC to a rated AFSC, while roughly tripling and doubling the odds of preferring an engineering/acquisition and a support AFSC to a rated AFSC, respectively. Military performance seems to mainly affect the odds of preferring an engineering/acquisition AFSC to a rated one—a standard deviation increase in MPA (i.e. an increase of about 0.22) was associated with a 35 percent decrease in the odds of preferring an engineering/acquisition AFSC over a rated AFSC. Academic major[23] is also significantly associated with AFSC preferences. Basic Science and Humanities majors were significantly less likely than Social Science majors to prefer an operations AFSC over a rated AFSC. Humanities majors were significantly less likely than Social Science majors to prefer an engineering/acquisition AFSC over a rated AFSC.

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[23] Some of the coefficients for engineering major indicator variables were extreme, which may reflect the degree constraints of some AFSCs, since only engineering majors can go into civil or developmental engineer AFSCs. While the coefficients were extreme, the predicted probabilities were reasonable (see Table B.2 in Appendix B—Average Marginal Effects from Two-Sided Logit Estimation), which suggests that this is not a reason to doubt the overall model fit.

Finally, cadets who majored in engineering were far less likely than Social Science majors to prefer a support AFSC over a rated one, while Basic Science majors were more likely than Social Science majors to prefer the support sector.

There is also some evidence that aspects of a cadet’s background have an impact on their AFSC decisions. The two hometown demographic variables included in the model were significantly related to AFSC preferences. Cadets from wealthier areas were more likely to prefer rated AFSCs, all else being equal. In each case, a $10,000 increase in hometown median income significantly decreases the odds of preferring a non-rated AFSC to a rated one. Also, cadets from areas with higher concentrations of military personnel were more likely to prefer rated AFSCs. A 10 point increase in the percentage of a cadet’s hometown population that is either in the military or a military veteran is associated with a statistically significant 17 percent decrease in the odds of preferring an engineering/acquisition AFSC to a rated AFSC.

Cadets who attended the USAFA preparatory school were significantly more likely to prefer engineering/acquisition or support AFSCs over rated AFSCs. These cadets were about 3.7 times more likely to prefer an engineering/acquisition AFSC and 6.2 times more likely to prefer a support AFSC over a rated AFSC, compared to cadets who did not attend the USAFA preparatory school. Similarly, recruited athletes were more likely to prefer these two sectors to the rated sector than cadets who were not recruited for athletics.

The TSL model also shows evidence that family considerations may play a role in shaping AFSC decisions. Cadets who filed for joint spouse (that is, who planned to marry another military member) were nearly 10 times more likely than those who did not to prefer the support sector to the rated sector.

Finally, the results in Table 2.7 show that there are significant demographic differences in preferences, even conditional on all the other variables included on the preference side. Female cadets were significantly more likely than male cadets to prefer every non-rated category to a rated AFSC, holding all else constant. Black cadets were 2.6 times more likely than white cadets to prefer an engineering/acquisition AFSC over a rated AFSC, and 3.4 times more likely than white cadets to prefer a support AFSC over a rated AFSC. While Asian/PI cadets were also significantly more likely than white cadets to prefer an engineering/acquisition AFSC over a rated AFSC, there is no statistically significant difference between Asian/PI and white cadets in preferences for support AFSCs vs. rated AFSCs. Conditional on everything else in the model, there was no statistically significant difference between the preferences of Hispanic cadets and white cadets. The subsequent sections will break down these race/ethnicity differences in more detail.

Before moving on, it is worthwhile to discuss the meaning behind the estimates on the opportunity side of the model. Table 2.8 shows that there is no statistically significant relationship between BOM rank and the probability that a cadet has an opportunity to enter each of the non-rated AFSC categories. While particular AFSCs may be extremely selective, the estimates show that there are at least some AFSCs in each group that lower-ranking cadets can obtain.

For rated AFSCs, the estimates show that cadets who rank lower on the BOM are less likely to have an opportunity in the rated sector. On its face, this result seems difficult to reconcile with the earlier data showing that the characteristics of cadets who entered into navigator or air battle manager trainee were below average. There are two potential explanations for this negative and significant correlation between BOM rank and the odds of having an opportunity to enter the rated sector. First, it could be that cadets who are unlikely to receive a pilot slot choose to rank only non-rated AFSCs to avoid receiving one of the other rated AFSCs. This would produce the observed correlation, despite the fact that rated AFSCs other than pilot seem quite easy to obtain. The second potential explanation is that part of BOM is actually measuring preferences for flying. If people who like flying tended to rank higher on the BOM than people who do not (e.g. by participating in extracurricular activities that involve flying), and this taste is not picked up elsewhere in the model (for example, by MPA), then the opportunity side would read this correlation as decrease in opportunity for those who rank lower on the BOM.

Table 2.7: Two-Sided Logit Estimation Results, Preference Side

Variable	AFSC Category		
	Operations	Engr/Acq	Support
Male (base)			
Female	5.40***	4.52***	8.49***
	(1.21)	(0.984)	(2.54)
White (base)			
Black	1.17	2.6**	3.38**
	(0.576)	(1.06)	(1.771)
Hispanic	0.52	0.90	0.53
	(0.231)	(0.326)	(0.249)
Asian/PI	2.03**	2.47***	1.06
	(0.704)	(0.842)	(0.461)
Other	1.31	1.02	0.94
	(0.671)	(0.5)	(0.599)
GPA (normed)	1.83***	3.08***	2.08***
	(0.256)	(0.443)	(0.357)
MPA (normed)	0.92	0.65***	0.87
	(0.1)	(0.069)	(0.108)
PEA (normed)	0.85	0.91	1.02
	(0.09)	(0.081)	(0.12)
USAFA Prep	1.48	3.67***	6.21***
	(0.782)	(1.563)	(3.29)
Prior Enlisted	1.16	0.70	0.46
	(0.65)	(0.333)	(0.265)
Recruited Athlete	1.12	3.35***	1.86**
	(0.286)	(0.69)	(0.506)
Joint Spouse	1.81	1.62	9.58***
	(0.686)	(0.644)	(6.594)
Major: Soc Sci (base)			
Major: Engineering	<0.001	0.75	0.004***
	(<0.001)	(0.188)	(0.009)
Major: Basic Sci	0.40***	0.76	5.45***
	(0.119)	(0.18)	(1.897)
Major: Humanities	0.51**	0.09***	0.85
	(0.152)	(0.032)	(0.252)
Home Median Income	0.60***	0.66***	0.69***
(divided by 10,000)	(0.034)	(0.044)	(0.039)
Home Pct Mil/Veteran	1.03	0.83**	0.91
(divided by 10%)	(0.103)	(0.074)	(0.104)

Notes: Odds ratios are shown with standard errors in parenthesis. Base outcome category is rated. Statistical significance was determined by a Wald test of the null hypothesis that the coefficient (not the odds ratio) was equal to zero. ***,**, and * denote statistical significance at the 1, 5, and 10 percent levels, respectively.

Table 2.8: Two-Sided Logit Estimation Results, Opportunity Side

Variable	**AFSC Category**			
	Rated	**Operations**	**Engr/Acq**	**Support**
BOM Rank	0.85***	1.03	0.97	0.99
(divided by 100)	(0.025)	(98.915)	(0.047)	(0.027)
PPQ or PNQ	3.41***			
(Entry)	(0.352)			

Notes: Odds ratios are shown with standard errors in parenthesis. Statistical significance was determined by a Wald test of the null hypothesis that the coefficient (not the odds ratio) was equal to zero. ***,**, and * denote statistical significance at the 1, 5, and 10 percent levels, respectively. Intercepts for each category were included on the opportunity side but are not shown.

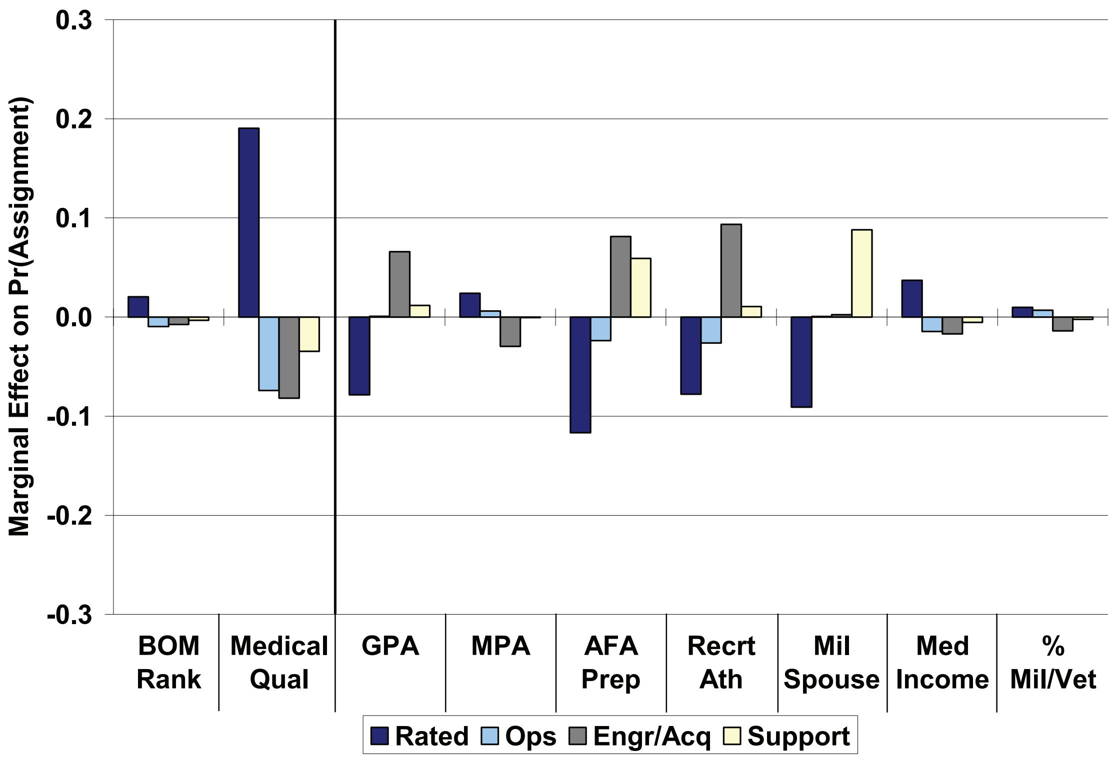
Figure 2.16 presents these results on the probability scale, as it shows the average effect of an incremental change in each statistically significant variable on the probability that a cadet is assigned to each AFSC category. It is important to note that while the interpretation of the odds ratios in Table 2.7 depended on the particular side of the TSL model (preference vs. opportunity), the values in Figure 2.16 are the average effect of each variable on the unconditional probability that cadets receive an assignment in each category. Each set of bars in Figure 2.16 sums to zero, since an increase in the probability of receiving an assignment to one category must necessarily correspond to an equivalent decrease in the probability of receiving an assignment to other categories.

The AMEs in Figure 2.16 show that medical qualification tends to matter more than BOM rank in determining cadets' final assignments. A 100 place improvement on the BOM was associated with a relatively small increase of 0.02 in the probability of being assigned to a rated AFSC. Medical qualification, though, has a large impact on whether a cadet is assigned to the rated sector, as the average effect of being medically qualified on the overall probability of receiving a rated AFSC was 0.19 (holding all else constant). In sum, given the existing preferences, opening up more opportunities to lower ranking cadets has a modest effect compared to opening up more opportunities to medically disqualified cadets.

While the model results showed that cadets with higher GPAs had a higher tendency to prefer all non-rated AFSC categories to rated AFSCs, the AMEs for GPA show that academic ability mostly affects assignment to the engineering/acquisition AFSCs vs. rated AFSCs. Since the engineering/acquisition category encompasses the more technical AFSCs with degree requirements, this pattern probably reflects differences in comparative advantage—that is, cadets with more academic ability seek occupations where they are relatively more productive.

Finally, as implied by earlier results, the AMEs show more clearly that cadets who attended the USAFA preparatory school and cadets who were recruited for athletics structure their preferences in such a way as to avoid the operational side of the Air Force, even conditional on their human capital investments and background characteristics.

Figure 2.16: Average Marginal Effect of Each Variable on the Probability of Being Assigned to Each AFSC Category



Notes: Bars for BOM rank show the AME of an incremental decrease in the nominal value of the rank (i.e. an improvement). Academic major not shown. See Appendix B for full table of AMEs.

Summary of Racial/Ethnic and Gender Differences in AFSC Assignments

This section will summarize the TSL model results in two ways. First, this section predicts the AFSC assignment distribution for a "look-alike" population of each demographic group that matches the white or male cadets in the data set on all observable characteristics except for race/ethnicity or gender. For each demographic group, this calculation will attempt to capture what assignments the cadets in the group would have received if they had the same opportunities and characteristics as the cadets in the base category.

Second, this section will follow the example of DeLeire and Levy (2004) and use the Duncan index of dissimilarity (a.k.a. the index of segregation) to measure the differences in AFSC assignments between white/male cadets and their minority/female counterparts—both their actual assignments and the predicted assignments for the look-alike group. This calculation is helpful because it allows differences across multiple categories to be summarized in a single statistic. The Duncan index is calculated in the following way:

$$D = 0.5 \cdot \sum_{j=1}^{J} \left| \frac{b_j}{B} - \frac{m_j}{M} \right|$$

Where b_j is the number of cadets in the base group who received an assignment in AFSC category *j*, B is the total number of cadets in the base group, m_j is the number of minority cadets assigned to AFSC category *j*, and M is the total number of cadets in the respective minority group. The Duncan index also has an intuitive interpretation—the fraction of cadets in either group that would have to change assignments in order for there to be no difference. A Duncan index of zero means that there is no demographic segregation (i.e. $\frac{b_j}{B}$ is always equal to $\frac{m_j}{M}$), while a Duncan index of one means there is complete demographic segregation.

Figure 2.17 compares the AFSC assignments of white cadets (the base category) to the actual assignments of the black cadets in the classes of 2005-2009 and the predicted assignments for “look-alike” black cadets. The predicted assignments of the “look-alike” black cadets are similar to the assignments of the white cadets, suggesting that much of the racial differences can be attributed to differences in opportunities and other characteristics. A cohort of black cadets who matched the white cadets in other respects would have a higher tendency to go into rated AFSCs than the observed cohort, but would also have a higher tendency to go into engineering/acquisition AFSCs. The “look-alike” black cadets still have a higher tendency than non-Hispanic white cadets to receive support AFSC assignments as well.

The Duncan index for the actual AFSC assignment differences between white and black cadets is 0.19, meaning about 19 percent of the black cadets would have to switch assignments to match the distribution for the white cadets. However, the Duncan index comparing the white cadets to the "look-alike" black cadets is 0.10. Thus, differences in other characteristics explain about 46 percent of white vs. black differences in AFSC assignments.

Figure 2.17: AFSC Assignments of White and Black Cadets Compared to "Look-Alike" Black Cadets, USAFA Classes of 2005-2009

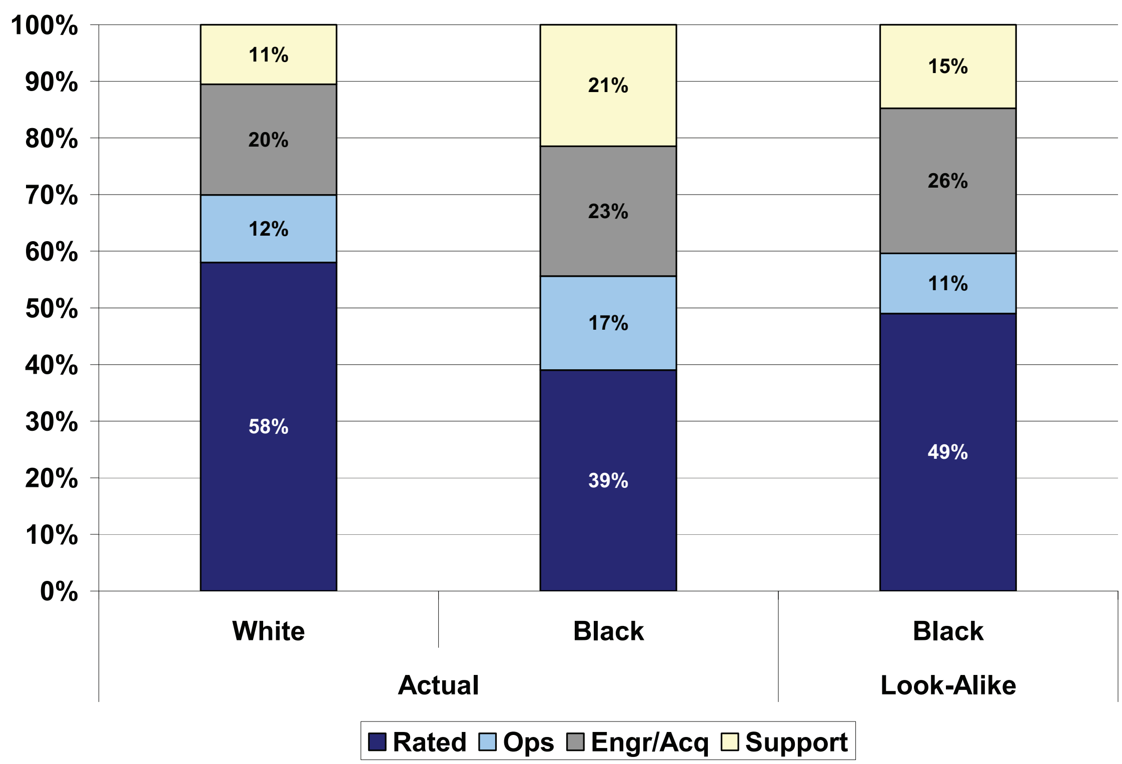


Figure 2.18 presents the same comparison for Hispanic cadets. In this case, there was hardly any raw difference between white and Hispanic cadets. Furthermore, the predicted "look-alike" Hispanic cadets have a slightly higher tendency to enter rated AFSCs than white cadets (though all three AFSC breakdowns are very similar). The Duncan index for white vs. Hispanic AFSC assignments is 0.034—substantially smaller than the index for white vs. black cadets. The index decreases slightly to 0.027 when comparing white cadets to "look-alike" Hispanic cadets. All of this evidence drives at the same point—ethnic differences in AFSC assignments are small compared to gender and racial differences.

Figure 2.18: AFSC Assignments of White and Hispanic Cadets Compared to "Look-Alike" Hispanic Cadets, USAFA Classes of 2005-2009

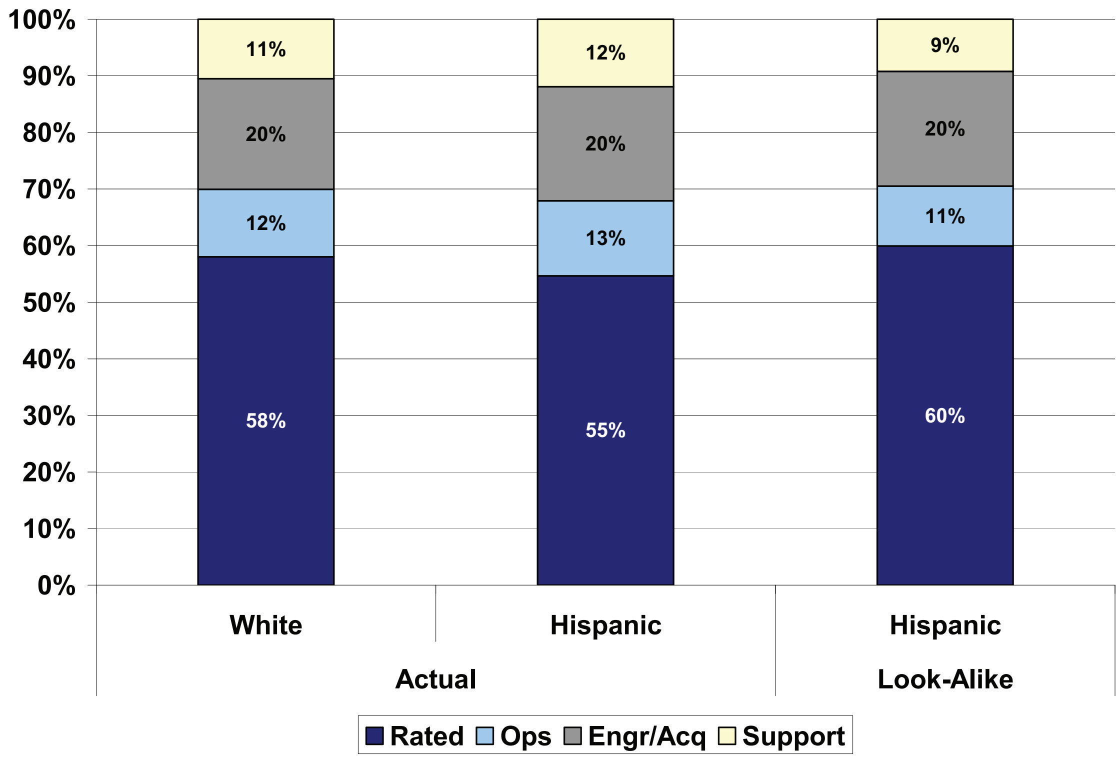
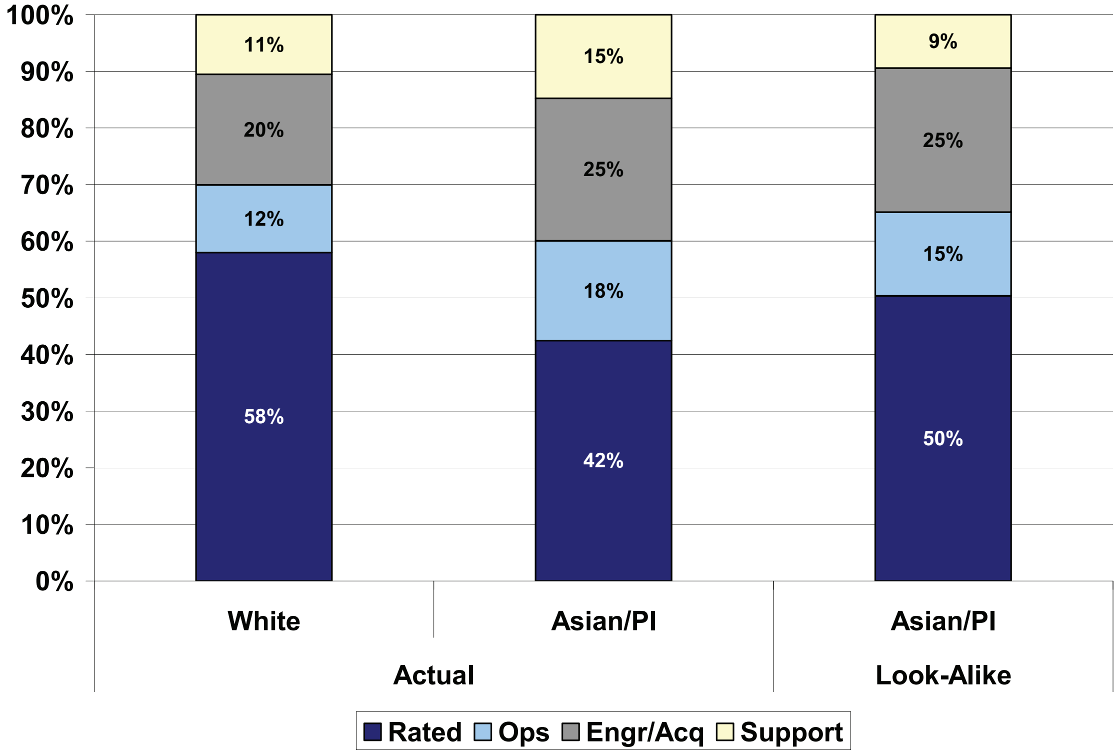


Figure 2.19 shows the same assignment comparison for Asian/PI cadets, and the main result is similar to the case of black vs. white cadets—other variables can account for some, but not all, of the racial differences in AFSC assignments. The predicted assignments of "look-alike" Asian/PI cadets are more similar to the assignments of white cadets. However, even the "look-alike" Asian/PI cadets still had a higher tendency than white cadets to go into operations and engineering/acquisition AFSCs and a lower tendency to go into rated AFSCs.

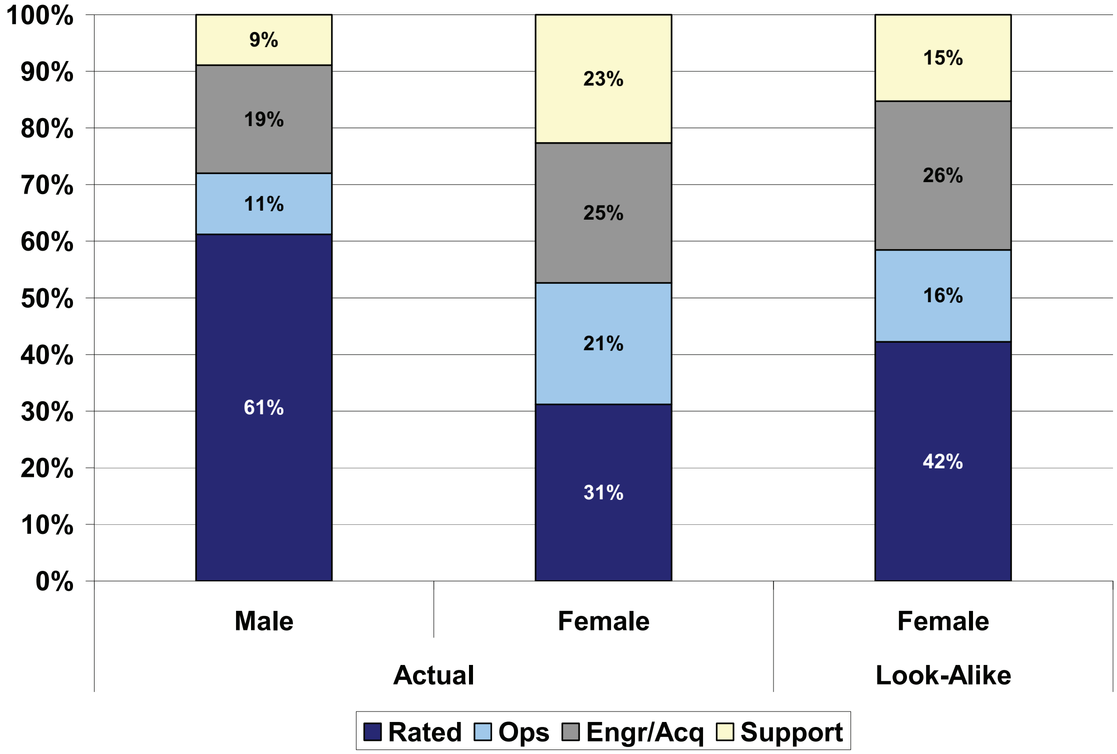
The Duncan index for white and Asian/PI AFSC assignments is 0.16—that is, 16 percent of Asian/PI cadets would have to change assignments to achieve the same distribution as the white cadets. However, the Duncan index for the white and "look-alike" Asian/PI assignments is only 0.09. Thus, differences in other characteristics can account for about 43 percent of white vs. Asian/PI differences in AFSC assignments.

Figure 2.19: AFSC Assignments of White and Asian/PI Cadets Compared to "Look-Alike" Asian/PI Cadets, USAFA Classes of 2005-2009



Finally, Figure 2.20 presents the comparison of AFSC assignments by gender, along with the predicted assignments of "look-alike" females that have the same distribution of characteristics as the male cadets. The predicted "look-alike" female cadets have a higher tendency to go into rated AFSCs and a lower tendency to go into operations and support AFSCs than the actual female cadets, but they still have a higher tendency than the male cadets to go into every non-rated category. The Duncan index for the actual male vs. female cadet AFSC assignments is 0.30, which is the largest of any comparison. When comparing male cadets to the predicted assignments of "look-alike" female cadets, the Duncan index shrinks to 0.19. This difference indicates that the other characteristics in the TSL model explain about 37 percent of the observed gender differences in AFSC assignments.

Figure 2.20: AFSC Assignments of Male and Female Cadets Compared to "Look-Alike" Female Cadets, USAFA Classes of 2005-2009



POLICY IMPLICATIONS

Motivated by a strong relationship between an officer AFSCs and advancement in the Air Force, this analysis sought both to summarize demographic differences in AFSC assignments and model cadet AFSC decisions as a function of their characteristics. The results that have been presented point to several important policy implications.

First, the biggest demographic differences in AFSCs are between male and female cadets, followed by differences between races—namely, differences between white, black, and Asian cadets. Differences between white and Hispanic cadets (i.e. ethnic differences) were small in comparison and non-existent after accounting for other variables that relate to AFSC preferences. Thus, while AFSC assignment may be an obstacle to gender and racial representation at the senior levels, it is not an obstacle to Hispanic representation. Furthermore, it is important to note that gender and race are not independent. The fact that a higher percentage of minority cadets were female will tend to compound the racial differences in AFSC assignments, all else being equal.

Second, this analysis shows that recruiters must consider more than the demographic composition of accession cohorts, since subsequent decisions may work against diversity gains in recruiting. The best example of this point is the USAFA preparatory school. The USAFA preparatory school is the source of 51 percent of the non-Hispanic black cadets and 43 percent of the Hispanic cadets in the data set (compared to 7 percent of the non-Hispanic white cadets). Thus, the USAFA preparatory school is clearly a key tool for minority recruiting. However, this analysis consistently found USAFA preparatory school attendance to be negatively correlated with both assignment to 92T0 and assignment to rated AFSCs as a group. Thus, the gains in demographic diversity that were made possible by the USAFA preparatory school may not fully translate to long run gains in the demographic makeup of Air Force senior leaders.

Still, this analysis did find in each case that minority and female cadets with characteristics that were similar to white and male cadets were more likely to be assigned to 92T0 and to rated AFSCs as a group. The fact that some of the observed demographic differences were attributable to differences in pre-USAFA characteristics shows that changes in recruiting policy might be somewhat effective in shaping the demographics of future Air Force senior leaders. Specifically, recruiting policy might focus on recruiting more minority and female cadets who are medically qualified to for the rated sector and have the aptitude to be directly admitted.

This analysis provides some support to the theories that demographic differences in occupations are partly the result of differences in human capital, background, and family considerations. In most cases, however, the majority of the demographic differences in AFSC assignments remain unexplained. If policymakers seek to increase the flow of minority and female cadets into rated AFSCs, further research should focus on identifying the factors that influence cadet AFSC choices. Based on this evidence alone, it is difficult to recommend a policy that would successfully increase the number of minority and female cadets in a given cohort who desire to fly, but such research would be a logical next step.

Finally, even if research could identify policies that would increase the flow of minority and female cadets into key AFSCs, there is no guarantee that such policies would significantly change the demographic composition of the senior levels of the Air Force. Patterns in the past suggest that such a policy has the potential to be effective, but its effectiveness would depend on the multitude of other factors affecting the trajectory of officer careers. Therefore, policymakers might consider changing the occupational mix at the senior levels as an alternative to attempting to affect entry-level officer AFSC assignments. Changing the occupational mix at the senior levels will likely come with costs in Air Force effectiveness, so policymakers should evaluate these costs and weigh them against the benefits of improving demographic representation at the senior levels. If the costs in leadership effectiveness from marginal changes in the occupational mix at the top are estimated to be relatively small, then this option would permit policymakers to move toward their policy goal of demographic representation at the senior levels in less time and with a higher probability of success.

THIRD ESSAY: DEMOGRAPHIC DIFFERENCES IN ARMY RESERVE OFFICER TRAINING CORPS BRANCH CLASSIFICATION

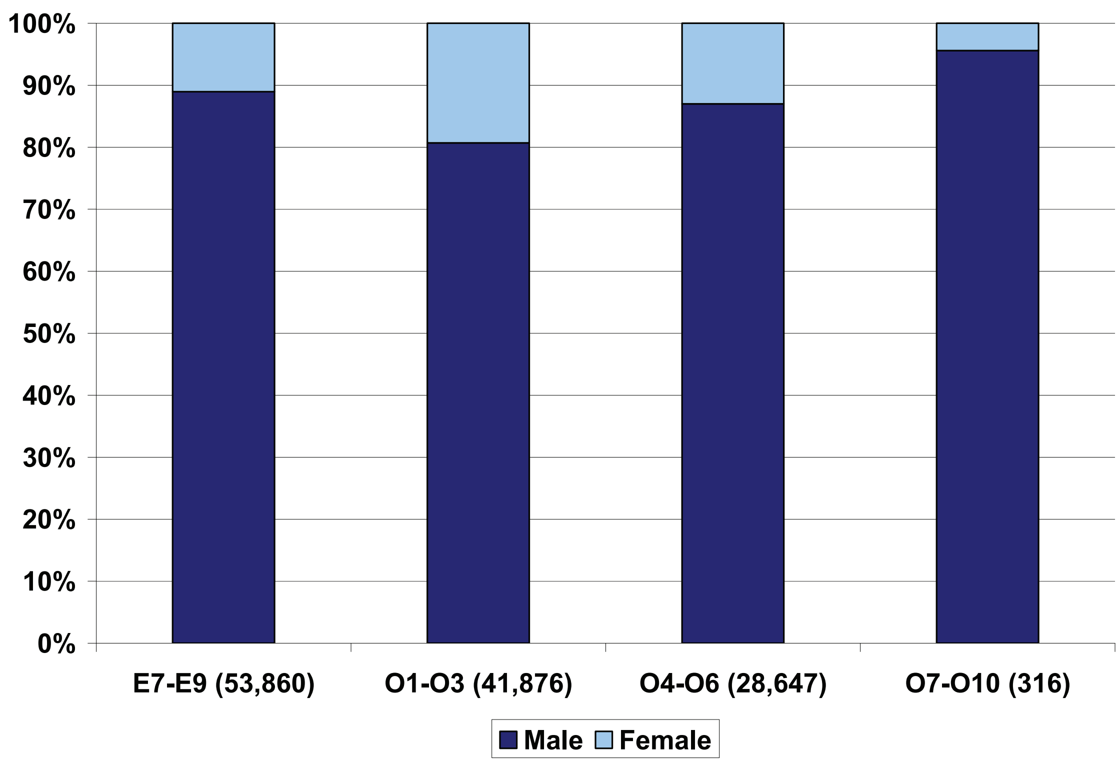
INTRODUCTION

Senior leaders in the Army have traditionally risen through the subset of occupations that deal directly with combat operations. As pilots have tended to populate the senior ranks in the Air Force, officers from infantry and other combat occupations have tended to populate the senior ranks of the Army. Furthermore, minority and female officers are less likely to be in combat occupations and more likely to work in the support sectors of the Army. The interaction of these two trends is a major reason why Army senior leaders have traditionally been white and traditionally been male.

Recent Army data confirm the continuation of these trends. That is to say that (1) minority and female officers are still scarce at the flag ranks (07 and above) relative to the lower ranks, (2) flag officers arise disproportionately from combat occupations, and (3) minority and female officers are less likely to be in combat occupations.

First, Figures 3.1-3.3 demonstrate that that the lower ranks have a greater representation of minority and female members than the flag ranks. Figure 3.1 shows the gender breakdown of the Army's senior enlisted members (pay grades E7-E9), company grade officers (CGOs, pay grades O1-O3), field grade officers (FGOs, pay grades O4-O6), and flag officers (pay grades O7-O10) in FY2007. The number in parenthesis on the x-axis label represents the total number of personnel in the respective pay grade grouping. While the officer corps as a whole tends to have a high fraction of male officers, there is still a greater representation of female officers at the senior enlisted, CGO, and FGO levels than at the flag level. 11 percent of senior enlisted members, 19 percent of CGOs, and 13 percent of FGOs were female in FY2007, compared to 4 percent of the flag officers. Figure 3.2 shows the racial breakdown of the same pay grade groupings and has a similar pattern of increasing white representation with increasing rank. While 50 percent of the senior enlisted members, 73 percent of the CGOs, and 79 percent of the FGOs in the Army were white in FY2007, a full 90 percent of the flag officers in FY2007 were white. Finally, Figure 3.3 shows the same picture, but for ethnicity[24]. The ethnic differences over the different pay grades appear less drastic than the racial or gender differences (largely because the Army as a whole is mostly non-Hispanic), but the general pattern holds. While 9 percent of the Army's senior enlisted members were Hispanic in FY2007, only 1 percent of the flag officers were Hispanic.

Figure 3.1: Gender of Army Personnel in FY2007, by Pay Grade



Source: Office of the Undersecretary of Defense, 2007

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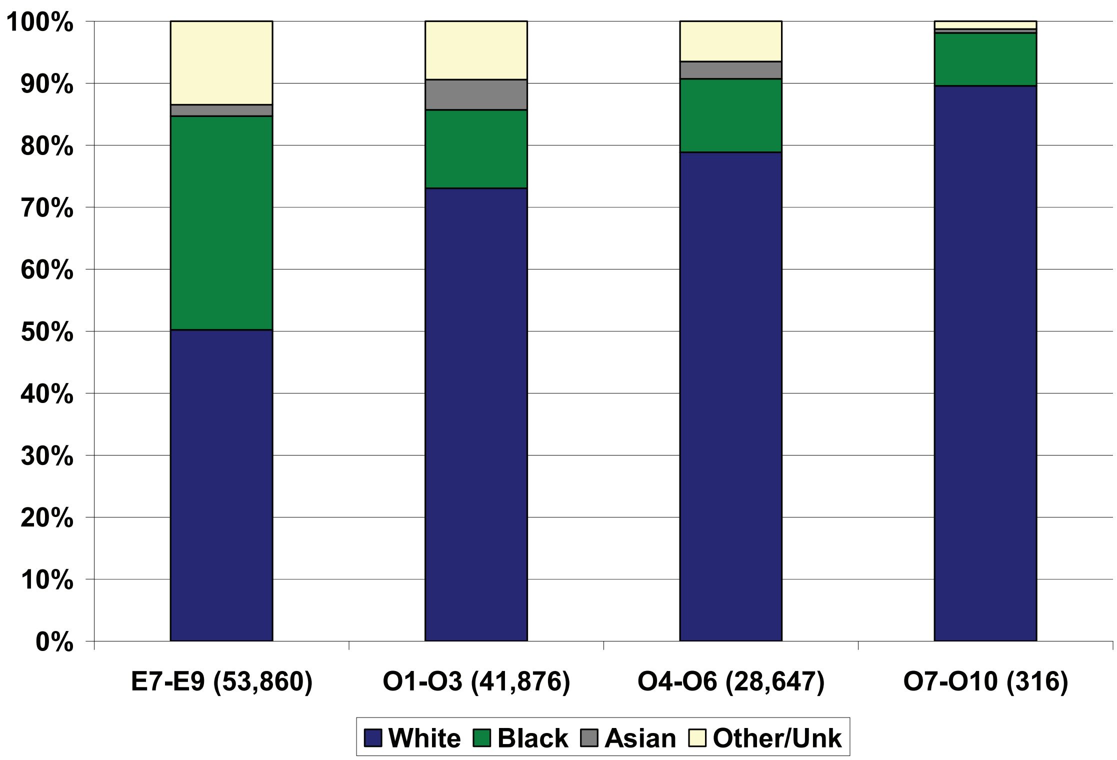
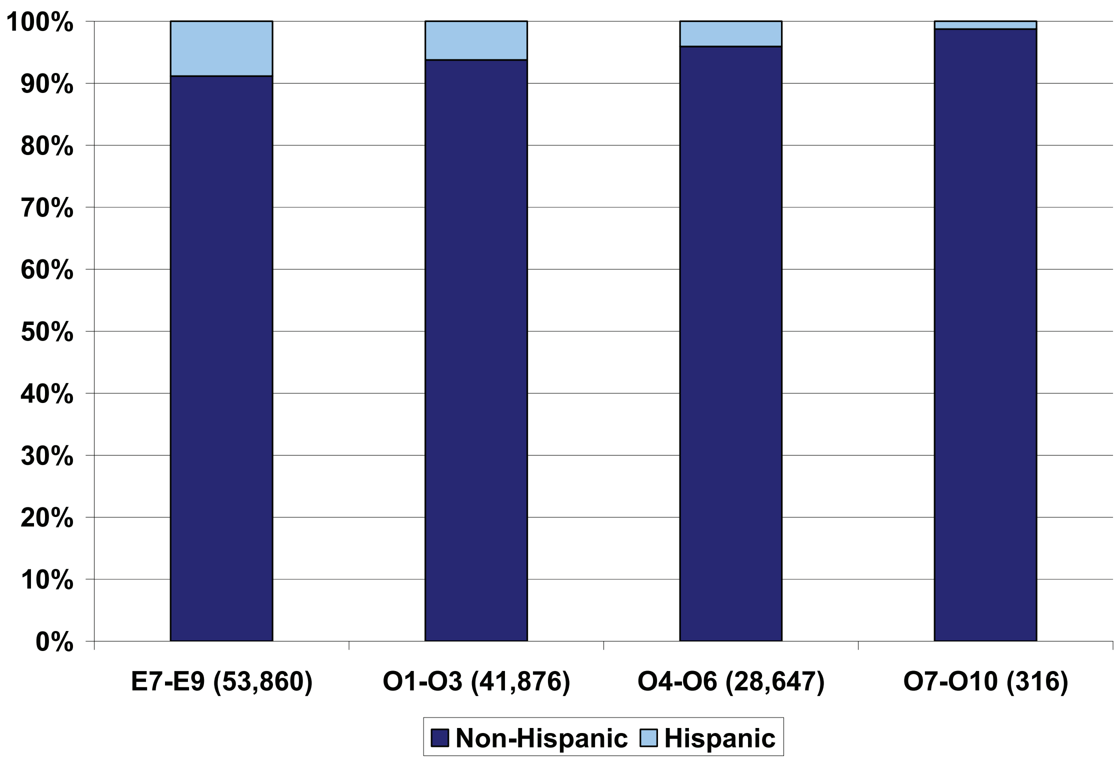
[24] The personnel data used here reported race and ethnicity separately. As described in the dissertation introduction, this paper will create mutually exclusive race/ethnicity categories for the analysis portion.

Figure 3.2: Race of Army Personnel in FY2007, by Pay Grade



Source: Office of the Undersecretary of Defense, 2007

Figure 3.3: Ethnicity of Army Personnel in FY2007, by Pay Grade



Source: Office of the Undersecretary of Defense, 2007

It is important to note, however, that Figures 1-3 do not necessarily indicate that minority and female officers have lower continuation rates. The Army must promote exclusively from within, so the demographic makeup of the flag ranks will always reflect the demographics of the accession cohorts at the time that the flag officers joined the Army—25 to 30 years prior (which will always tend differ from the demographics of recent accession cohorts). However, previous research has found evidence of racial differences in promotion. In a study on racial and gender differences in officer continuation, Hosek et al. (2001) find evidence of "persistent racial differences (for women as well as men) in promotion[25]." In their exploration of the differences

[25] Hosek et al. (2001) do include occupation variables in some of their analysis, and they find that tactical occupations are often more likely to be promoted than other occupational sectors.

through interviews and focus groups, the first suggestion for change that officers made was often to "recruit more women and minorities into the officer corps and into underrepresented occupations."

Second, recent data on the Army confirm what the original officer pipeline study suggested—Army generals arise disproportionately from combat occupations. While the pipeline study (Gilroy et al., 1999) stated that two-thirds of the flag officers in the DoD had tactical backgrounds, recent work by Lim et al. (2009) documents that 80 percent of the Army's flag officers in 2006 originated in combat occupations. If anything, the relationship between occupation and advancement is particularly strong in the Army.

Finally, recent data show that white and/or male officers tend to be concentrated in tactical (i.e. combat) occupations. Table 3.1 summarizes this tendency, showing the percentage of Army officers in each demographic group that were in tactical[26] occupations in FY2007. Male officers have a much higher tendency than female officers to be in tactical occupations; 39 percent of male officers were classified as tactical compared to 6 percent of female officers in FY2007. White officers have the highest tendency to be classified as tactical, as 36 percent of the white officers in the Army in FY2007 were in tactical occupations, compared to 21 and 26 percent of black and Asian officers, respectively. The aggregate differences by ethnicity are smaller, as 31 percent of Hispanic officers were in tactical occupations in FY2007, compared to 33 percent of non-Hispanic officers.

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[26] The "tactical" designation is a DoD occupational grouping that includes all of the major Army combat occupations: aviation, infantry, combat engineer, field artillery, special forces, armor, cavalry, and air defense artillery (among others).

Table 3.1: Percent of Army Officers in Tactical Occupations by Demographic Group in FY2007

Demographic	Group	Number of Officers	Percent in Tactical Occupations
Gender	Male	59,013	39%
	Female	11,824	6%
Race	White	53,460	36%
	Black	8,719	21%
	Asian	2,855	26%
	Other/Unk	5,803	27%
Ethnicity	Hispanic	3,787	31%
	Non-Hispanic	67,050	33%

Source: Office of the Undersecretary of Defense, 2007

Therefore, data on Army personnel and prior research confirm the existence of an important interaction between demographics, occupation, and advancement. This interaction is the subject of explicit policy concern. Thus, the focus of this paper is a better understanding of occupational classification in the Army.

A Case Study of Army ROTC Cadets

This essay will further explore the relationship between demographics and occupational classification by examining recent data on Army Reserve Officer Training Corps (ROTC) cadets. There are several good reasons to focus on Army ROTC cadets as a case study. First, there are few entry prerequisites attached to Army occupations. In theory, any cadet is free to pursue the occupation of their choice (excepting the case that current policy bars women from becoming infantry or armor officers). Second, the Army has the largest officer corps (in terms of number of personnel), and ROTC is the largest single commission source—accounting for 42 percent of the FY2007 accession cohort (Office of the Undersecretary of Defense, 2007). Finally, a practical but nonetheless important reason to focus on Army ROTC is that classification data are readily available.

The primary drawback of the case study approach is that the findings will be specific to this population and not necessarily generalizable to other services or commission sources. For example, cadets at the United States Military Academy and Army Officer Candidate

School may have different motivations behind their career choices and may face different rules and constraints in their classification processes. In addition, the incentives that draw minority cadets into particular Army branches could be completely different from the incentives that draw minority midshipmen and cadets into similar Navy, Marine Corps, or Air Force occupations. Therefore, although there is useful empirical insight to be gleaned from a quantitative analysis of Army ROTC cadet occupational assignment, the findings may not be robust enough to inform DoD-wide or even Army-wide policy.

THE ARMY ROTC BRANCHING PROCESS

Occupational assignment in the Army (hereafter "branching," as the Army refers to its occupations as "branches") follows a basic blueprint that is customary throughout the armed forces. A fixed number of available slots for each branch are allocated to ROTC each year. The Army ranks the graduating cohort of cadets according to merit-based criteria, and cadets receive their preferred branch in merit order. The better a cadet performs in various areas of training over the course of his or her ROTC tenure, the more likely he or she is to obtain his or her preferred branch.

Cadet Preferences and the Order of Merit List

In the fall of each year, all Army ROTC cadets expecting to graduate submit their ranked branch preferences. Cadets are free to try for any of the branches they choose, with the exception that women cannot enter the infantry or armor branches. The Army then calculates each cadet's order of merit score (OMS), which is a function of academic performance (40 percent), leadership (45 percent) and physical fitness (15 percent). The academic component is the cadet's cumulative grade point average (GPA). The leadership component includes various evaluations by the local ROTC commander as well as performance in military training exercises. The physical fitness component is mostly made up of the cadet's Army Physical Fitness Test score, but also assigns a small weight to participation in athletic competition (e.g. intercollegiate or intramural sports). The OMS is the single criterion that is used to generate the order of merit list (OML), ranking all cadets from top to bottom according to merit.

Cadets in the top ten percent of the OML automatically receive their top branch preference. After that, cadets generally receive their preferred branches in order, until a branch fills up (subject to other constraints, discussed below). If a cadet's top preference is full, the cadet receives the most preferred branch with slots remaining.

The Branch for Service Program, the 65 Percent Rule, and Selection Boards

There are a few idiosyncrasies that go into the branching process, so that it does not proceed exactly according to the OML. At the time that the Army first collects cadet preferences, cadets have the opportunity to volunteer for the Branch for Service program. The program allows cadets to extend their service commitment by three years in exchange for an enhanced likelihood of obtaining their preferred choices. After the first half of each branch's slots are filled, those who prefer that branch and volunteered for an extra commitment bypass all the higher ranked cadets who did not volunteer. If a cadet volunteers for the program, but would have received his or her top choice regardless, he or she is not required to serve the extra three years.

The second major quirk in the branching system is that no more than 65 percent of any one branch can be filled from the top half of the OML. The Army designed this rule to distribute quality across the occupational sectors. Once 65 percent of a branch is filled from the top half, the system skips to the bottom half and begins assigning Branch for Service volunteers from the bottom half (ahead of branch for service volunteers from the top half who are not yet assigned).

Finally, selection boards play a greater role in the classification of lower-ranking cadets. Once 50 percent of each branch is full and the Branch for Service volunteers are classified, the Department of the Army (DA) branching model classifies the remaining cadets—maximizing the number of cadets who receive one of their preferred branches subject to the 65 percent rule. The DA Selection and Branching Board reviews all of these allocations and makes the final decision about branching assignments.

This description of the Army ROTC branching process shows that its two major inputs—cadet preferences and the OML—interact in a complex way to match cadets to branches.

EMPIRICAL ANALYSIS OF ARMY ROTC CLASSIFICATION DATA

Data and Variables

The data for this analysis come from the 2007 Army ROTC branching board results. These data include individual information on each graduating cadet's stated preferences, OML ranking (and its components), final branch assignment, and some individual demographics (including, of course, race/ethnicity and gender). The Army G-1 Officer Accessions Policy Branch Division provided the data, and RAND obtained them on June 1, 2007.

These data are especially rich because they include complete information on each part of the branch classification process, permitting the analysis to link demographics to both stated preferences and final branch outcomes. The data are limited, however, in that they include very little individual background information and no information about the characteristics of the branches, themselves. Thus, there is not enough information to really test the hypothesis that demographically divergent outcomes are caused by some aspect of the individual's family or background, nor is it possible to identify group differences in tastes for particular aspects of combat branches (e.g. risk).

This analysis will classify cadets into one of four mutually exclusive race/ethnicity groups: non-Hispanic white, non-Hispanic black, Hispanic, and non-Hispanic other. In addition, most of the analysis will group the Army's branches into three main categories: Combat Arms (CA) branches, Combat Support (CS) branches, and Combat Service Support (CSS) branches. The Combat Arms category includes air defense artillery, armor, aviation, corps of engineers, field artillery, and infantry. The Combat Support category includes the chemical corps, military intelligence corps, military police corps, and signal corps branches. Finally, the Combat Service Support category includes the adjutant general's corps, army nurse corps, finance corps, medical service corps, ordnance corps, quartermaster corps, and transportation corps.

Summary of Branch Assignments

Table 3.2 summarizes the results of the 2007 ROTC branching process, by branch as well as by branch category. The individual branches in Table 3.2 are sorted in the order of the mean OML rank of cadets assigned to the branch.

The CA branches made up the majority of all branch assignments and, judging by the mean OML rank of the cadets accepted, tended to be more difficult to obtain than either the CS or CSS branches. Four of the six most competitive branches fall into the CA category (aviation, infantry, armor, and corps of engineers). However, not all CA branches appear difficult to obtain—field artillery was the eleventh most competitive branch and air defense artillery was the least competitive branch.

The CA branches also tended to be mostly male (96 percent), and they contain a lower fraction of minority cadets than the CS and CSS branches. The tendency for CA branches to be mostly male is, no doubt, partly driven by the infantry and armor branches which, by rule, must be exclusively male and which account for 690 of the 1,433 CA assignments. However, the CA branches that are accessible to female cadets still tend to contain high fractions of male cadets, relative to CS and CSS branches. In addition, while Hispanic representation in CA branches is similar to the overall proportion of Hispanic cadets in the cohort, black representation is relatively low in most CA branches and several CS and CSS branches stand out as having a relatively high percentage of black cadets. Black cadets made up 9 percent of the graduating cohort, but black representation was at least twice that high in finance corps (CSS), adjutant general's corps (CSS), quartermaster corps (CSS), and signal corps (CS).

Table 3.2: Summary of 2007 Branching Results by Branch and Branch Category (CA Branches in Bold)

Branch	Assigned	Mean OML Rank	Mean GPA	Male	Black	Hispanic	Other
Aviation	168	1167	3.29	89%	4%	7%	4%
Infantry	444	1291	3.21	100%	6%	7%	5%
Medical Service	116	1292	3.29	69%	12%	7%	6%
Finance	13	1390	3.27	62%	31%	15%	0%
Armor	246	1452	3.22	100%	6%	7%	7%
Corps of Eng	213	1657	3.10	93%	4%	8%	6%
Chemical Corps	126	1717	3.19	49%	13%	9%	10%
Nurse Corps	141	1726	3.29	22%	7%	5%	11%
Military Intel	156	1784	3.17	72%	10%	11%	10%
Military Police	129	1828	3.08	83%	9%	6%	6%
Field Art	295	1915	3.08	95%	4%	5%	9%
Adj General	52	2098	3.13	42%	38%	10%	4%
Quartermaster	189	2187	3.05	80%	18%	9%	5%
Transportation	181	2305	2.96	81%	6%	6%	9%
Ordnance	168	2365	2.92	83%	14%	7%	10%
Signal	87	2403	2.97	72%	26%	10%	10%
Air Defense Art	67	2463	2.92	76%	12%	9%	9%
Combat Arms	1,433	1542	3.16	96%	5%	7%	6%
Combat Support	498	1887	3.12	69%	13%	9%	9%
Combat SS	860	2033	3.08	67%	13%	7%	8%
Total	2,791	1755	3.13	82%	9%	7%	7%

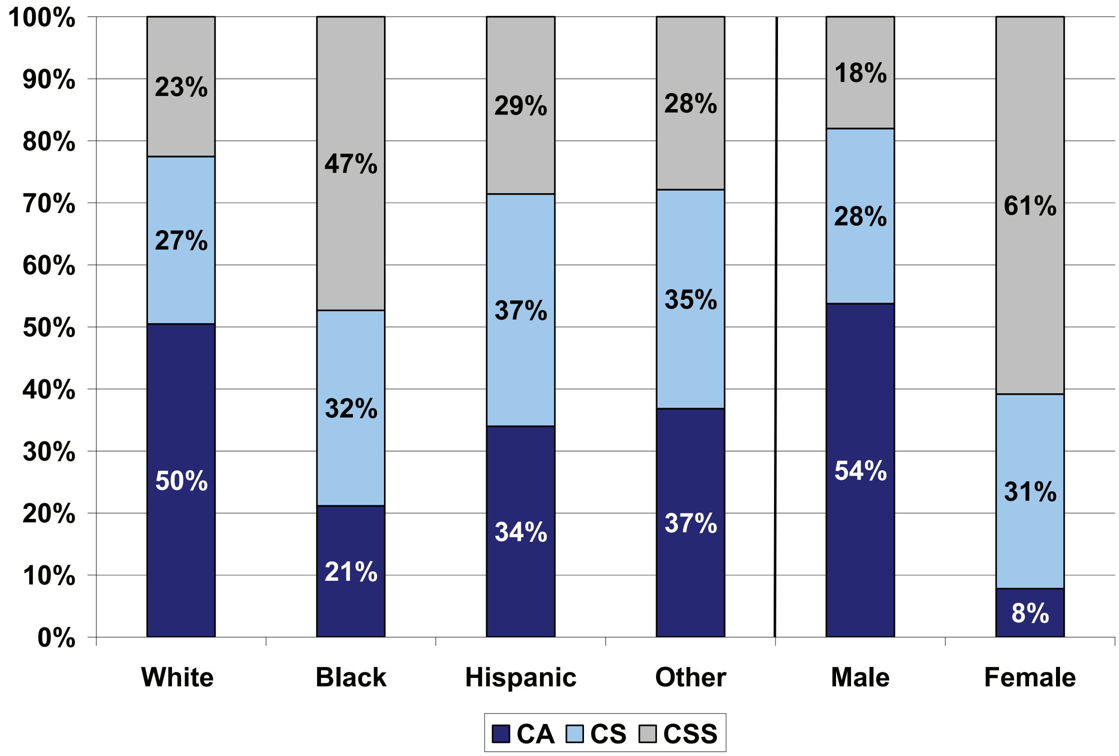
Demographic Differences in Stated Preferences and Order of Merit

Because the ROTC classification process rations available slots via the OML queue, demographic differences in branch assignments could result from either differences in stated preferences or differences in OML rank (or some combination). For example, the under-representation of black cadets in CA branches might occur if all cadets entered the same preferences but black cadets tended to rank lower on the OML. Cadets who rank lower on the OML may be forced to accept a CS or CSS branch because the CA branch they wanted is unavailable. It could also be the case, however, that black cadets have less of a tendency to enter preferences for CA branches. In this case, the OML rank would play less of a role, because black cadets would not be competing for the same branches as higher-ranking white cadets. Finally, it could be some combination of these two possibilities. That is, black cadets may have less of a tendency to enter preferences for CA branches, while the cadets who do enter a CA branch preference may also lack the OML rank to receive their most-preferred branch assignment.

The data show, first, that stated preferences differ along racial/ethnic lines. Figure 3.4 demonstrates these differences, as it shows the distribution of cadets' top preferences by race/ethnicity and gender. White cadets had the highest tendency to enter a CA branch as their top preference. In contrast, black cadets were almost as likely to submit a preference for a CSS branch as white cadets were to prefer a CA branch. 47 percent of the black cadets in the 2007 cohort entered a CSS branch as top choice, while only 21 percent of the black cadets entered a CA branch as top choice. Hispanic cadets and cadets of other races had less of a tendency to enter a CA branch as their top choices as well, as 34 and 37 percent (respectively) did so in 2007. These two groups also showed more of a tendency than white or black cadets to list CS branches as their top preference.

Preferences are even more divergent when broken out by gender. While over half of the male cadets listed a CA branch as their top choice, only 8 percent of the female cadets had a similar preference. A full 61 percent of the female cadets entered a CSS branch as top choice, which is higher than the percent of male cadets who listed a CS or CSS branch combined.

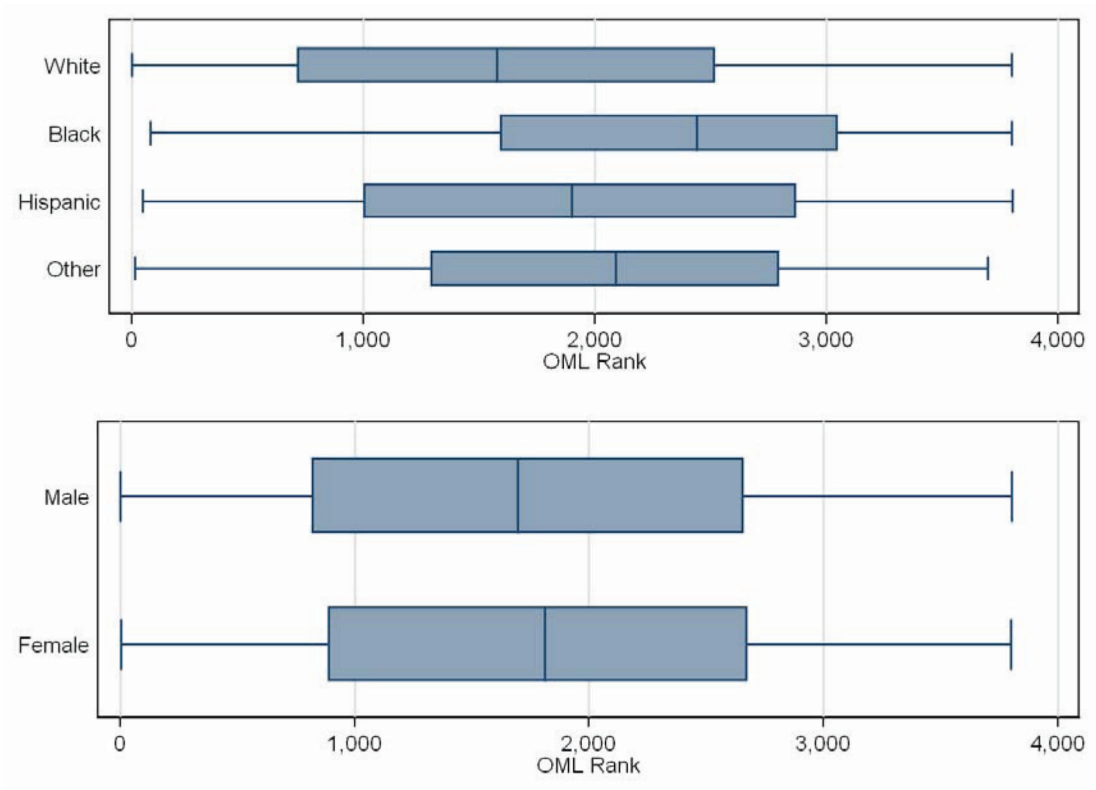
Figure 3.4: Category of Top Branch Preference in 2007, by Race/Ethnicity and Gender



At the same time, the data also show that there are demographic differences in OML rank, which determines the order that cadets receive their branch assignments. Figure 3.5 shows the race/ethnicity- and gender-specific distributions of OML rank with a box plot for each demographic group. The direction of OML rank on the x-axis goes from highest (i.e. first to receive a branch) to lowest, left-to-right. White, Hispanic, and cadets of other races tended to rank higher on the OML than black cadets. The median rank for white cadets (represented by the line in the center of the box) was 1578—862 places higher than the median rank for black cadets. The median OML rank for Hispanic cadets was 1900, which was 322 spots lower than the median white cadet rank. Cadets of other races tended to rank lower than white and Hispanic cadets. The median cadet in the other race category was 512 places lower than the median white cadet and 190 places lower than the median Hispanic cadet.

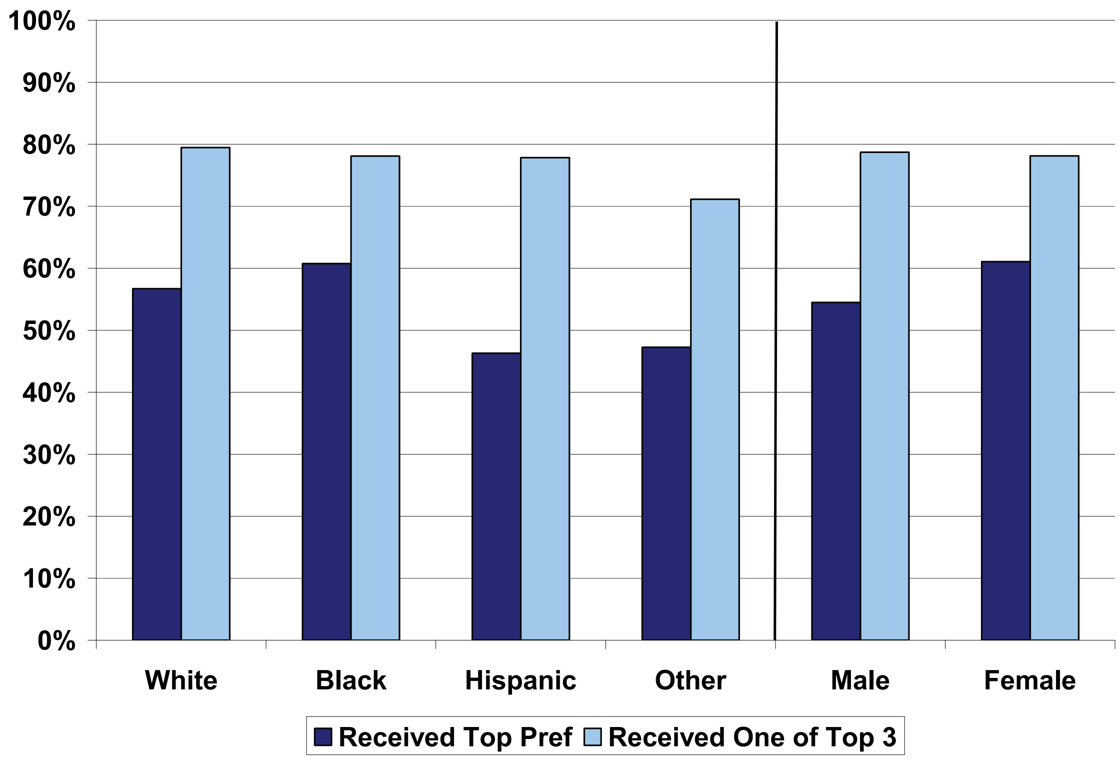
Male and female cadets, in total, had very similar distributions of OML rank in 2007, though men tended to rank slightly higher. The median male rank was 1695, while the corresponding value for female cadets was 1812.

Figure 3.5: Distribution of OML Rank in 2007, by Race/Ethnicity and Gender



Finally, Figure 3.6 shows how the demographic differences in stated preferences interact with the differences in OML rank. The first set of bars in Figure 3.6 represents the percent of the respective group that received their first branch choice, and the second set of bars represents the percent that received one of their top 3 choices. Interestingly, though black cadets tended to rank lowest on the OML, they received their top preference at the highest rate (61 percent). This result probably derives from the differences in preferences shown in Figure 3.4—black cadets do not seem to be competing for the same branches as cadets from other racial/ethnic groups. Hispanic cadets and cadets of other races, whose preferences are more similar to white cadets but who rank lower, received their top preferences at lower rates (46 and 47 percent, respectively). Female cadets receive their top choice at a higher rate than male cadets despite their tendency to rank slightly lower on the OML, again presumably due to the different structure of their stated preferences. Also, cadets in all demographic groups receive one of their top three preferences at roughly the same rate (with the possible exception of cadets of other races). Thus, the classification system tends to give most cadets one of their preferred branches, despite differences in OML rank.

Figure 3.6: Percent Who Received Top Preference and One of Top Three Preferences in 2007, by Race/Ethnicity and Gender



Two-Sided Logit Regression Results

At this point, it is tempting to conclude that minority and female cadets tend to have different branch tastes (which are mostly honored by the classification system), leading to the observed high concentration of white officers in CA branches. It could be true that minority and female cadets happen to have tastes for occupations that are less difficult to obtain. However, one might expect cadets to adjust their stated preferences according to their place on the order of merit list, not wanting to waste preferences on branches they are unlikely to obtain. In other words, some part of the differences in stated preferences could be a rational response to the differences in OML ranking. If this were the case, the assumption that a cadet's top choice is actually his or her favorite branch might be overly simplistic.

The two-sided logit (TSL) regression methodology was designed to analyze occupation assignments as a two-sided matching problem. The model assumes that employers determine whether to offer jobs to applicants by evaluating each applicant's characteristics, while applicants are presented with a set of offers and they accept their most-preferred job. The model uses the observed matching to infer about the unobserved preference criteria of both employers and applicants. The ROTC occupational classification system can be viewed in this way—cadets are generally assigned to their most-preferred occupation that is available, and availability is determined by their characteristics. In addition, these data have the superb advantage that the "employer's" preferences are explicit—each occupation "prefers" cadets with higher OML rank to those who rank lower. The TSL estimates, then, allow the set of branch opportunities to vary with a cadet's position on the OML, estimating the racial/ethnic and gender components of unobserved preferences for the different branch categories conditional on the opportunities available.

More details about the TSL model can be found in the discussion in the second essay. In short, if cadets actually submit their true preferences and the classification system works as advertised, then estimating a TSL model on the final branch assignments would be more or less equivalent to running a multinomial logit (MNL) regression on the cadets' stated preferences. If cadets actually adjust their stated preferences so that they maximize their chances of receiving their most-preferred occupation that is likely to be available, the TSL model would be robust to the possibility of strategic preferences.

Table 3.3 presents the regression results from two models—a standard MNL regression with a cadet's top preference as the outcome and a TSL regression with a cadet's final assignment as the outcome. Each model includes indicator variables for the cadet's gender and race as well as the cadet's age[27], and the TSL model specifies the opportunity side as a function of an intercept and the cadet's OML rank. Recall that the TSL model is similar to the MNL model, except that the TSL model now adjusts the choice set depending on the probable opportunities available. Table 3.3 shows the exponentiated coefficients (known as "odds ratios"), which can be interpreted as the relative change in the odds of a positive outcome associated with a change in the covariate of interest. For categorical variables, the odds ratio is the relative change in odds of a positive outcome associated with being in the respective category, relative to the base category. For the opportunity side of the TSL models, the outcome is simply whether or not a branch from the respective category was in a cadet's choice-set. On the preference side (in either the MNL or TSL), the interpretation is complicated by the fact that the outcome is multinomial and that the utility of the base outcome category is set to zero for identification. In essence, each characteristic has an estimate for each branch category that represents the odds ratio for preferring a branch the respective category (either CS or CSS) over a CA branch (the base category).

The first thing to note about the results in Table 3.3 is that differences in opportunity are significantly related to OML rank. In particular, the TSL estimates show decreasing opportunity in the CA sector as OML rank increases. Moving 100 places down on the OML translates into a 25 percent decrease in the odds of having the opportunity to enter a CA branch. The positive relationship between OML rank and opportunity in the CS and CSS categories may seem strange, but

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[27] Age was included because the model generally performed better when there is at least one continuous covariate.

it is not unexpected. This relationship captures the reality that all cadets must receive a branch assignment, and so the less competitive branches—which tend to accept cadets at the bottom of the OML who have little opportunity—will appear to the TSL model as if they prefer cadets who rank lower on the OML over cadets who rank higher.

On the preference side, the differences between the MNL and TSL rows capture the differences between cadets' stated preferences and what the TSL model infers were their true preferences (after accounting for differences in opportunity). For example, female cadets were about 8 times more likely than male cadets to submit a CS branch as their top preference rather than a CA branch, but the TSL results show that they were actually 15 times more likely to prefer a CS branch to a CA branch.

More generally, a portion of the tendency of minority and female cadets to enter preferences for CSS branches appears to be attributable to their position on the OML. Female cadets were about 26 times more likely than male cadets to enter a CSS branch as top preference (vs. a CA branch), but they were 18 times more likely than male cadets to actually prefer a CSS branch to a CA branch. Similarly, black cadets were 3.6 times more likely than white cadets to enter a preference for a CSS branch, but only about twice as likely to actually prefer a CSS branch to a CA branch. While Hispanic cadets were significantly more likely than white cadets to submit preferences for both CS and CSS branches, the actual differences in preferences between these two groups from the TSL model are smaller and statistically insignificant. To be sure, large and significant demographic differences in preferences remain, especially across genders, but some of the higher tendency of minority and female cadets to prefer CSS branches appears to stem from a lack of opportunity in other sectors and not a true preference.

Table 3.3: Multinomial and Two-Sided Logit Regression Results

		Branch Category		
Variable	**Model Type**	**CA**	**CS**	**CSS**
Side: Preference				
Male (Base)				
Female	MNL		7.93***	25.79***
			(1.483)	(4.723)
	TSL		14.9***	18.15***
			(4.452)	(4.73)
NH White (Base)				
NH Black	MNL		2.42***	3.6***
			(0.451)	(0.682)
	TSL		2.27***	1.9***
			(0.498)	(0.365)
Hispanic	MNL		1.78***	1.39
			(0.321)	(0.288)
	TSL		1.38	0.93
			(0.324)	(0.199)
NH Other	MNL		1.77***	1.62**
			(0.315)	(0.331)
	TSL		1.6**	1.16
			(0.381)	(0.239)
Age	MNL		1.11***	1.22***
			(0.024)	(0.027)
	TSL		0.95***	0.97***
			(0.01)	(0.005)
Side: Opportunity				
OML Rank/100	TSL	0.75***	1.05	1.17***
		(0.077)	(0.029)	(0.037)
Log Likelihood	MNL	-2637.11		
	TSL	-2556.24		
N		2,791		

Notes: Odds ratios are shown, with standard errors in parenthesis. Base preference category is CA. Statistical significance was determined with a Wald test of the null hypothesis $\beta_j=0$. *, **, and *** denote statistical significance at the 10, 5, and 1 percent levels, respectively. Category-specific intercepts were included on the opportunity side, but are omitted from this table.

Table 3.4 contains the results from a TSL model that also includes variables capturing a cadet's human capital stock—the cadet's Grade Point Average (GPA), indicator variables for a cadet's academic major, and an indicator variable for whether the cadet attended a military-academy-type ROTC program (e.g. Texas A&M, Virginia Military Institute, etc.). As in the previous table, Table 3.4 presents the results as odds ratios.

Table 3.4 shows that several human capital measures are significantly related to occupational preferences. A standard deviation increase in GPA is associated with a 39 percent increase in the odds of preferring a CS branch over a CA branch, and a 47 percent increase in the odds of preferring a CSS branch to a CA branch. In addition, cadets who attended military schools were 46 and 44 percent less likely than cadets from regular universities to prefer CS or CSS branches to a CA branch.

Despite the fact that human capital measures were significantly related to occupational preferences, these variables do not account for the observed demographic differences in branch preferences. The magnitude of the racial/ethnic and gender components on the preference side is similar across the TSL models, and only in the case of female preferences for CSS occupations does the magnitude decrease with the inclusion of these additional covariates.

Table 3.4: Full Two-Sided Logit Regression Results

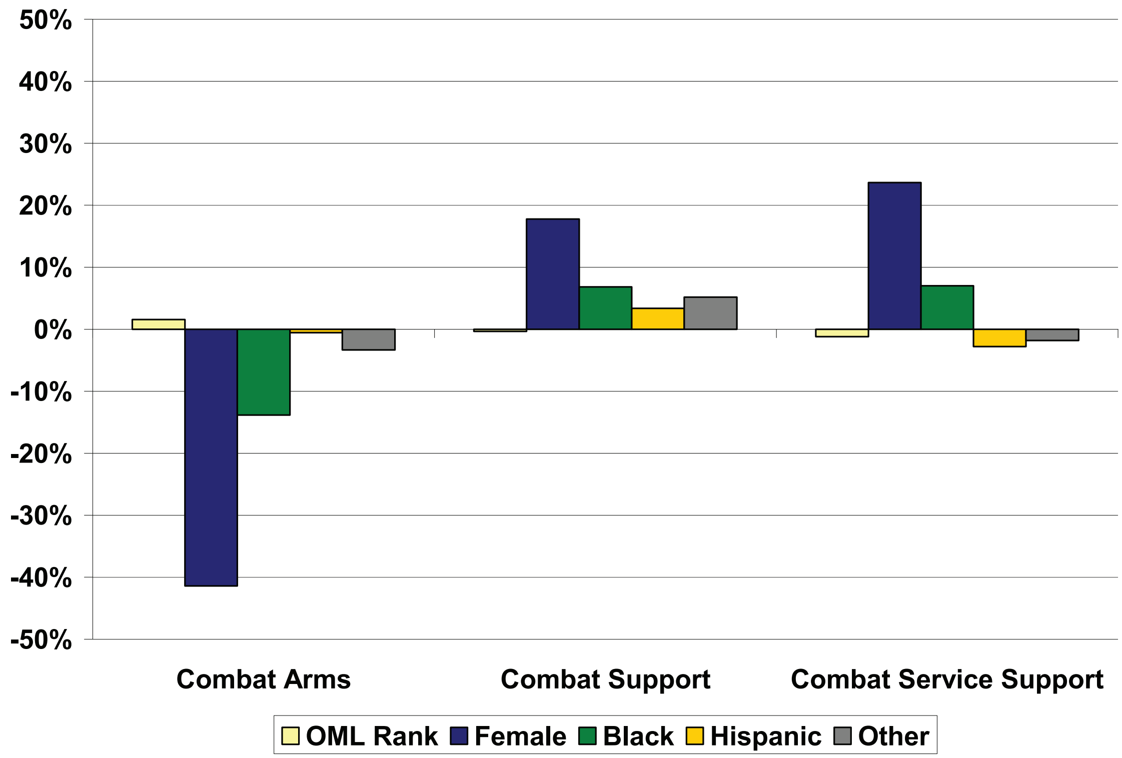
	Branch Category		
Variable	**CA**	**CS**	**CSS**
Side: Preference			
Male (Base)			
Female		13.85***	14.2***
		(3.267)	(3.197)
NH White (Base)			
NH Black		2.4***	2.2***
		(0.547)	(0.467)
Hispanic		1.24	0.9
		(0.3)	(0.21)
NH Other		1.5*	1.04
		(0.363)	(0.234)
Age		0.94***	0.96***
		(0.008)	(0.006)
GPA (Normed)		1.39***	1.47***
		(0.135)	(0.14)
Major: Humanities (Base)			
Major: Engineering		0.72	0.58***
		(0.145)	(0.113)
Major: Professional		0.62**	2.32***
		(0.118)	(0.354)
Major: Sciences		1.25	1.4*
		(0.251)	(0.263)
Military School		0.54**	0.56**
		(0.144)	(0.137)
Side: Opportunity			
OML Rank/100	0.82***	1.12**	1.2***
	(0.04)	(0.061)	(0.032)
Log Likelihood	-2493.54		
N	2,791		

Notes: Odds ratios are shown, with standard errors in parenthesis. Base preference category is CA. Statistical significance was determined with a Wald test of the null hypothesis $\beta_j=0$. *, **, and *** denote statistical significance at the 10, 5, and 1 percent levels, respectively. Category-specific intercepts were included on the opportunity side, but are omitted from this table.

While the TSL model results find that OML rank is significantly related to the opportunities available to cadets, the TSL models show that demographic differences in preferences rather than OML rank play the dominant role in creating the differences in representation across the branches and branch sectors. Figure 3.7 illustrates this point, as it shows the average marginal effect (AME) of OML rank, gender, and race/ethnicity for each branch category from the full TSL model (including human capital variables). The AME for a given branch category and demographic group variable is the average change in the probability that a cadet is assigned to that branch category associated with being in that group, relative to the base group (white or male). For OML rank, the AME shown is the average change in probability of being assigned to each category associated with an incremental improvement on the OML.

While the AME for OML rank goes in the expected direction—a 100 place improvement increases the probability of being assigned to a CA branch by 2 percentage points—this effect is dwarfed by the differences between male and female cadets, and between white and black cadets. Holding OML rank and human capital constant, being female is associated with an average decrease of 41 percentage points in the probability of receiving a CA branch and a corresponding increase of 18 and 24 percentage points in the probability of receiving a CS and CSS branch, respectively. The probability of receiving a CA branch for Black cadets, relative to white cadets, was an average 14 percentage points lower all else being equal. While Hispanic cadets are more likely than white cadets to prefer a CS branch, the AMEs show that this effect stems mainly from a lower tendency to prefer CSS branches, rather than a lower tendency to prefer CA branches.

Figure 3.7: Average Marginal Effect of OML Rank Improvement, Gender, and Race from Full TSL Model

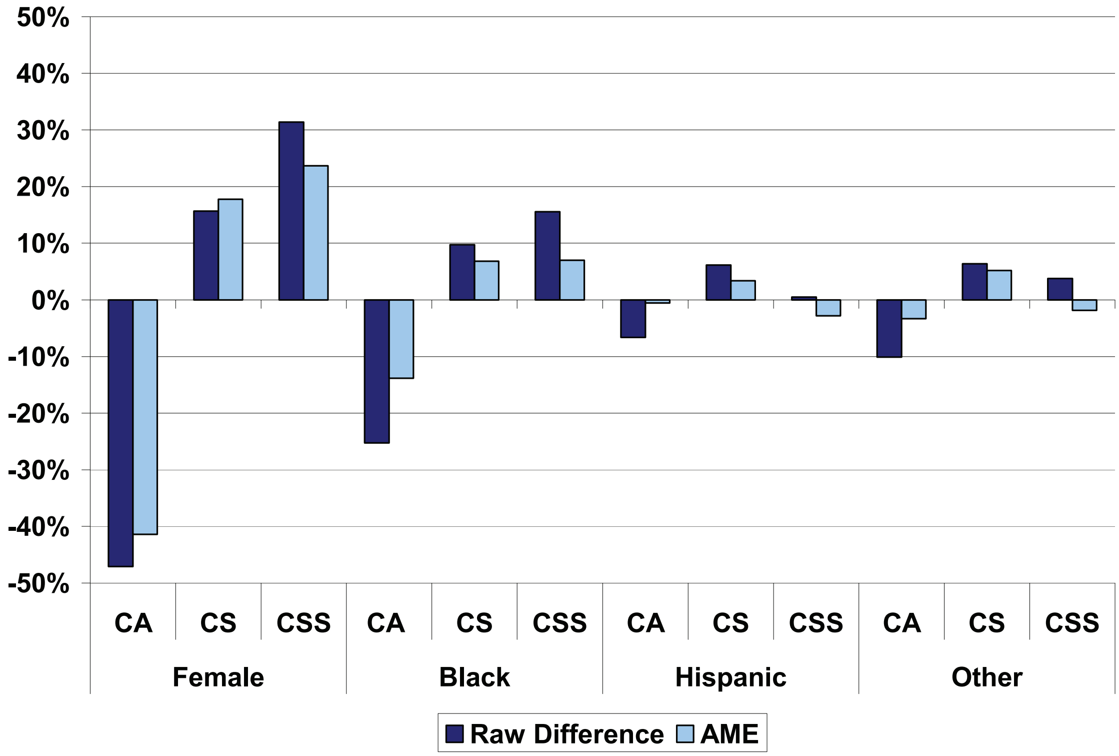


Finally, Figure 3.8 illustrates the degree that differences in opportunity and human capital explain the demographic differences in branch assignments. The first set of bars shows the raw difference between the fraction of each demographic group assigned to a given branch category and fraction of the base demographic group assigned to the category, while the second set of bars shows the AME of being in each demographic group vs. the base demographic group (holding opportunity and human capital variables constant). The gap between the two sets of bars captures the amount of the respective demographic difference that is explained by opportunity and human capital differences.

Differences in opportunity and human capital explain very little of the gender differences in branch assignments. While the raw difference between male and female cadets in assignment to CA branches was 47 percentage points, the average difference between male and female cadets, conditional on opportunity and human capital variables was 41 percentage points. Differences in opportunity and human capital, then, account for 12 percent of the gender differences in assignment to CA branches.

Much smaller differences remain between minority cadets and white cadets after accounting for opportunity and human capital variables. While the raw difference between black and white cadets was 25 percentage points, the average difference between these two groups conditional on other variables was 14 percentage points. This means that differences in opportunity and human capital account for about 45 percent of the gap in CA branch assignments between black and white cadets. Furthermore, other characteristics explain almost all of the difference in CA branch assignments between white and Hispanic cadets, as only 1 percentage point of the original 7 percentage point gap remains after accounting for opportunity and human capital variables. Finally, most of the difference between cadets of other races and white cadets can be attributed to differences in opportunity and human capital. There was a 10 percentage point raw difference between these two groups in CA assignments, but the average difference between these two groups, holding everything else constant, was only 3 percentage points.

Figure 3.8: Raw Demographic Differences in Branch Assignments vs. Average Marginal Effect from Full TSL Model



CONCLUSION

Recent data on Army ROTC branch classification show that, as is typical in the civilian labor market, demographic representation tends to differ depending on the occupational sector. Specifically, female cadets and, to some degree, minority cadets tend to have higher representation in the CS and CSS sectors of the Army and lower representation in the CA branches than their white male counterparts.

The branch assignment process awards cadets their preferred branches according to their rank on the OML, which means that demographic differences in OML rank or differences in stated preferences (or some combination thereof) could produce the patterns where branch assignments tend to be correlated with race/ethnicity or gender. The data show that the distribution of OML rank differs by demographic group—white cadets tend to rank higher than minority cadets and male cadets tend to rank slightly higher than female cadets. However, the data also show differences in stated preferences. Minority and female cadets enter preferences for CS and CSS branches at much higher rates than white and male cadets. These two trends interact in such a way that cadets from all demographic groups receive their preferred branches at similar rates.

Because less-competitive cadets, in general, have less of a tendency to enter preferences for CA branches, perhaps because they are unlikely to receive these branches, the stated preferences may not be a reliable indicator of the true differences in preferences between demographic groups. Thus, the analysis employed a multiple regression technique called Two-Sided Logit regression that analyzes demographic differences in preferences while accounting for the fact that opportunities may differ depending on a cadet's OML rank. Analysis with the TSL model showed that differences in OML rank explained some of the tendency for female and minority cadets to submit preferences for CSS branches. In addition, no statistically significant differences remained between Hispanic and white cadets after accounting for OML rank. However, large and significant gender differences remained, and differences in OML rank accounted for very little of the tendency for black cadets or cadets of other races to prefer CS branches, rather than CA branches.

As a test of the hypothesis that human capital differences between demographic groups play a role in generating the observed racial/ethnic and gender differences in preferences, the analysis estimated a TSL specification that included several human capital variables—GPA, academic major, and an indicator variable for whether or not the cadet completed ROTC at a military school. Although these additional variables, themselves, were significantly associated with branch preferences, they explained almost none of the correlation between demographics and branch preferences.

This analysis shows that even in a very homogenous population (compared to the civilian labor force), occupational preferences still tend to differ along demographic lines, the largest differences being between male and female cadets and between black and white cadets. The fact that these differences remain after including measures of human capital points to other potential explanations for the observed phenomenon—namely, demographic differences in tastes for some aspect of the various branches, demographic differences in important aspects of a cadet's background, or demographic differences in information about Army branches. Further research should focus on these potential explanations with more extensive data, either about the characteristics of the various branches or the characteristics and background of the cadets, themselves. While it is useful to know that preferences differ along demographic lines for reasons other than OML competitiveness, there remains much uncertainty about the decision process that cadets use to identify their top branch choices. Because these decisions play the dominant role in branch assignments, understanding them is the key to understanding demographic occupational segregation in the Army.

POLICY IMPLICATIONS

The main finding of this essay is that minority and female cadets self-select out of the dominant Army branches, and that this selection is not easily attributable to differences in basic measures of human capital. Taking the demographic composition of accession cohorts as given, this finding means that policymakers who seek a socially representative Army senior leadership have two potential options: either promote more officers from CS and CSS branches to the flag ranks or find ways to encourage minority and female officers to choose CA branches at higher rates.

The first option is likely at odds with Army effectiveness. It is not difficult to imagine reasons why officers who thrive in the combat environment would be effective leaders in the Army. Thus, policymakers must weigh the benefits of additional social representation against the potential costs incurred by a change in promotion policy. Still, this option would have the advantage of seeing results more quickly and with a higher probability of success than any policy implemented among contemporary cadets.

The second option will require additional research, because the evidence presented here is not enough to recommend ways to *affect* minority and female cadet preferences. Further research must be broad enough to include the Army's other commission sources, testing whether similar self-selection occurs at West Point and in Officer Candidate School. This research must also focus on identifying the reasons why minority and female cadets do not prefer CA branches and potential incentives that might affect the decisions of cadets in these demographic groups.

However, supposing that the Army could increase the flow of minority and female officers into key branches, this policy would not guarantee significant changes in the demographic composition at the highest levels of Army leadership. The effectiveness of such a policy would depend on the other factors that affect the length and trajectory of an officer's career, which adds to the complexity of engineering a socially representative leadership in this way.

Appendix

APPENDIX A: POPULATION BENCHMARKS

Table A.1: Eligible Population Estimates, Total

Gender	Race/Eth	US Pop	Eligible to Enlist	Eligible to be Officers (ROTC/OTS)	Eligible to be Officers (USAFA)
Male	White	96,966,292	3,224,455	2,363,669	600,540
Female	White	101,200,000	3,721,525	3,649,867	807,447
Male	Black	17,384,377	376,433	185,648	22,347
Female	Black	19,202,069	422,916	296,807	35,072
Male	Hispanic	24,090,216	497,955	198,120	26,033
Female	Hispanic	22,584,116	526,897	327,251	56,901
Male	Asian/PI	6,540,991	348,602	249,698	57,839
Female	Asian/PI	7,042,360	436,507	307,574	57,806
Male	Other	3,829,082	134,502	67,000	18,731
Female	Other	4,002,506	173,609	95,626	21,054
	total	302,842,009	9,863,401	7,741,260	1,703,771

Table A.2: Estimated Demographic Distribution of Population Eligible to Enlist

Gender	Race/Ethnicity	US Pop	Eligible to Enlist	95% LB	95% UB
Male	White	32.0%	32.7%	31.4%	34.0%
Female	White	33.4%	37.7%	36.5%	39.0%
Male	Black	5.7%	3.8%	3.1%	4.6%
Female	Black	6.3%	4.3%	3.5%	5.1%
Male	Hispanic	8.0%	5.0%	4.2%	6.0%
Female	Hispanic	7.5%	5.3%	4.4%	6.3%
Male	Asian/PI	2.2%	3.5%	2.6%	4.5%
Female	Asian/PI	2.3%	4.4%	3.4%	5.5%
Male	Other	1.3%	1.4%	0.9%	1.9%
Female	Other	1.3%	1.8%	1.3%	2.3%

Table A.3: Estimated Demographic Distribution of Pseudo-Eligible ROTC/OTS Officer Population

Gender	Race/Ethnicity	US Pop	Eligible to be ROTC/OTS Officers	95% LB	95% UB
Male	White	32.0%	30.5%	29.8%	31.3%
Female	White	33.4%	47.1%	46.7%	47.6%
Male	Black	5.7%	2.4%	1.8%	3.0%
Female	Black	6.3%	3.8%	3.4%	4.3%
Male	Hispanic	8.0%	2.6%	2.2%	3.0%
Female	Hispanic	7.5%	4.2%	3.8%	4.6%
Male	Asian/PI	2.2%	3.2%	2.8%	3.6%
Female	Asian/PI	2.3%	4.0%	3.6%	4.3%
Male	Other	1.3%	0.9%	0.7%	1.0%
Female	Other	1.3%	1.2%	1.1%	1.4%

Table A.4: Estimated Demographic Distribution of Pseudo-Eligible USAFA Officer Population

Gender	Race/Ethnicity	US Pop	Eligible to be USAFA Officers	95% LB	95% UB
Male	White	32.0%	35.2%	33.0%	37.5%
Female	White	33.4%	47.4%	45.4%	49.4%
Male	Black	5.7%	1.3%	0.2%	2.4%
Female	Black	6.3%	2.1%	1.1%	3.0%
Male	Hispanic	8.0%	1.5%	0.7%	2.4%
Female	Hispanic	7.5%	3.3%	2.1%	4.6%
Male	Asian/PI	2.2%	3.4%	1.8%	4.9%
Female	Asian/PI	2.3%	3.4%	2.0%	4.8%
Male	Other	1.3%	1.1%	0.7%	1.5%
Female	Other	1.3%	1.2%	0.6%	1.9%

APPENDIX B: SECOND ESSAY REGRESSION RESULTS

Table B.1: Probit Regression Predicting Entry Into 92T0 AFSC

Variable	Coefficient	Std Error	P-Value
Male (base)			
Female	-0.656	0.048	0.000
White (base)			
Black	147.852	68.217	0.030
Hispanic	28.685	9.427	0.002
Asian	0.855	0.990	0.388
Other	-0.387	1.195	0.746
Ac Comp	0.255	0.127	0.045
Ac $Comp^2$	-0.004	0.002	0.046
Black X Ac Comp	-14.529	6.650	0.029
Black X Ac $Comp^2$	0.472	0.215	0.028
Black X Ac $Comp^3$	-0.005	0.002	0.028
Hisp X Ac Comp	-1.743	0.586	0.003
Hisp X Ac $Comp^2$	0.026	0.009	0.004
Asian/PI X Ac Comp	-0.032	0.030	0.292
Other X Ac Comp	0.011	0.037	0.755
Pilot Qualified (Entry)	0.663	0.040	0.000
Nav Qualified (Entry)	0.377	0.060	0.000
USAFA Prep	-0.425	0.083	0.000
Prior Enlisted	0.158	0.091	0.083
Recruited Athlete	-0.25	0.046	0.000
Home Median Income	0.018	0.009	0.051
Home % Military/Veteran	0.012	0.019	0.540
Constant	-4.366	2.089	0.037
N	5648		
Log Likelihood	-3505.99		

Table B.2: Average Marginal Effect of Each Variable on the Probability of Being Assigned to Each AFSC Category

	AFSC Category			
Variable	**Rated**	**Ops**	**Engr/Acq**	**Support**
BOM Rank	0.020	-0.009	-0.008	-0.003
PPQ or PNQ (Entry)	0.190	-0.074	-0.082	-0.035
Female	-0.174	0.045	0.068	0.061
NH Black	-0.080	-0.023	0.063	0.039
Hispanic	0.029	-0.023	0.012	-0.017
NH Asian	-0.066	0.021	0.061	-0.016
NH Other	-0.006	0.016	-0.004	-0.006
GPA	-0.078	0.001	0.066	0.012
MPA	0.024	0.006	-0.029	-0.001
PEA	0.007	-0.007	-0.004	0.003
USAFA Prep	-0.117	-0.024	0.081	0.059
Prior Enlisted	0.025	0.025	-0.023	-0.028
Recruited Athlete	-0.078	-0.026	0.094	0.011
Joint Spouse	-0.091	0.000	0.002	0.088
Major: Engineering	0.120	-0.122	0.104	-0.102
Major: Basic Sci	-0.015	-0.047	-0.020	0.082
Major: Humanities	0.083	0.015	-0.117	0.019
Home Median Income	0.037	-0.015	-0.017	-0.005
Home Pct Military/Veteran	0.010	0.007	-0.014	-0.002

APPENDIX C: THIRD ESSAY REGRESSION RESULTS

Table C.1: Average Marginal Effects from Full Two-Sided Logit Model of Branch Assignments

	Branch Category		
Variable	**Combat Arms**	**Combat Supp**	**Combat Serv Supp**
OML Rank/100	0.016	-0.003	-0.012
Male (base)			
Female	-0.414	0.178	0.236
White (base)			
Black	-0.138	0.068	0.070
Hispanic	-0.006	0.034	-0.028
Other	-0.033	0.052	-0.018
Age	0.007	-0.005	-0.002
GPA (normed)	-0.059	0.019	0.040
Major: Humanities (base)			
Major: Engineering	0.073	-0.009	-0.063
Major: Professional	-0.067	-0.096	0.163
Major: Sciences	-0.048	0.008	0.040
Military School	0.093	-0.040	-0.053

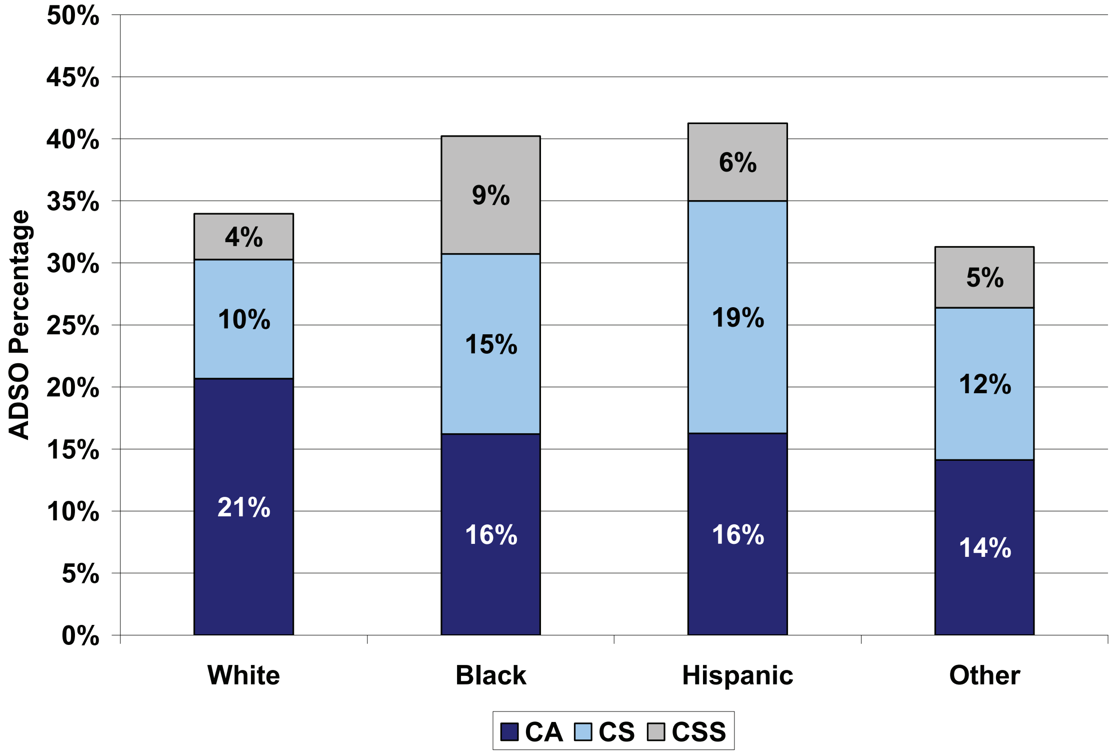
APPENDIX D: THE ARMY ROTC BRANCH FOR SERVICE PROGRAM

As explained in the third essay, Army ROTC cadets have the opportunity to volunteer to add three years to their active duty service obligation (ADSO) in exchange for a higher likelihood of receiving their preferred branch assignments. This program presents an interesting opportunity for lower-ranking cadets to enhance their branch opportunities, so this appendix will briefly describe the demographic patterns in Branch for Service participation. To remove the confounding influence of gender-based combat exclusions, this appendix will only deal with Branch for Service participation among male cadets.

The key demographic pattern in Branch for Service participation is that black and Hispanic cadets were more likely to volunteer, but less likely to use Branch for Service to obtain a combat arms (CA) branch. Figure D.1 demonstrates this pattern, as it shows the percent of male cadets who volunteered for an extended ADSO by race/ethnicity. Each bar is divided into sections depending on the category of the cadets' first preferences—i.e. the category of the branch that the cadets were presumably willing to extend their ADSOs in order to obtain. For example, the first bar shows that 21 percent of the white cadets volunteered for Branch for Service in 2007 and submitted a CA branch as their top preference, 10 percent volunteered and submitted a CS branch as top preference, and 4 percent volunteered and submitted a CSS branch as top preference. Overall, 34 percent of the white cadets volunteered for the Branch for Service program.

Figure D.1 shows that black and Hispanic cadets were more likely to volunteer for Branch for Service—over 40 percent of the black and Hispanic cadets volunteered for the Branch for Service program, compared to the aforementioned 34 percent of the white cadets. However, black and Hispanic cadets were more likely than white cadets to use the Branch for Service program to obtain a combat support (CS) or combat service support (CSS) branch. Only 16 percent of black and Hispanic cadets used Branch for Service to obtain a CA branch, compared to 21 percent of the white cadets.

Figure D.1: Percent of Male Cadets Who Volunteered for Branch for Service Program in 2007, by Race/Ethnicity



Relatively high black and Hispanic participation in the Branch for Service program is probably related to the fact that these cadets tended to rank lower on the OML, since the opportunities afforded by Branch for service participation tend to benefit lower-ranking cadets more than higher-ranking cadets. However, these differences could also reflect racial/ethnic differences in tastes for service commitments. That is, black and Hispanic may be less averse to serving additional time conditional on serving in their preferred branch.

In conclusion, these data show that, while some black and Hispanic cadets do use the Branch for Service program to increase their odds of obtaining a CA branch, Branch for Service participation still reflects the previously documented demographic differences in preferences.

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