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AN ANALYSIS OF THE MARINE CORPS SELECTION PROCESS: DOES INCREASED COMPETITION LEAD TO INCREASED QUALITY?

by

Eric A. Sandberg

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Thesis Advisor: Jesse Cunha
Co-Advisor: Chad Seagren

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This thesis explores whether increased competition in the selection process of military officers leads to higher-quality officers being chosen. Using the universe of Marine Corps officer applicants from 2009–2017, I estimate the relationship between the quality of selected officers and the ratio of selected officers to the pool of candidates. I first document that there is significant variation of selection ratios across Officer Candidate Course (OCC) and Platoon Leaders Course (PLC) officer selection boards, with most of the variation being across years. I next estimate regression models of the impact of selection ratio on quality, where quality is proxied by Scholastic Assessment Test (SAT) and Grade Point Average (GPA) scores. The estimated correlation between selection ratio and quality is negative and significant when including fixed effects for year, component, geographic location, and demographic components. The negative relationship suggests that a lower selection ratio is a signal of a more competitive board, and the board members are able to choose officers of higher academic quality.

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Eric A. Sandberg
Lieutenant Colonel, United States Marine Corps
B.S., State University of New York, 2000

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March 2018

Approved by: Jesse Cunha
Thesis Advisor

Chad Seagren
Co-Advisor

Bill Hatch
Academic Associate
Graduate School of Business and Public Policy

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ABSTRACT

This thesis explores whether increased competition in the selection process of military officers leads to higher-quality officers being chosen. Using the universe of Marine Corps officer applicants from 2009–2017, I estimate the relationship between the quality of selected officers and the ratio of selected officers to the pool of candidates. I first document that there is significant variation of selection ratios across Officer Candidate Course (OCC) and Platoon Leaders Course (PLC) officer selection boards, with most of the variation being across years. I next estimate regression models of the impact of selection ratio on quality, where quality is proxied by Scholastic Assessment Test (SAT) and Grade Point Average (GPA) scores. The estimated correlation between selection ratio and quality is negative and significant when including fixed effects for year, component, geographic location, and demographic components. The negative relationship suggests that a lower selection ratio is a signal of a more competitive board, and the board members are able to choose officers of higher academic quality.

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LIST OF ACRONYMS AND ABBREVIATIONS

ACT	American College Test
AFRC	Air Force Recruiting Command
AFQT	Armed Forces Qualification Test
AOR	Area of Responsibility
AVF	All Volunteer Force
CNRC	Commander Navy Recruiting Command
ECP	Enlisted Commissioning Program
ERR	Eastern Recruiting Region
GAO	Government Accountability Office
GPA	Grade Point Average
IPEDS	Integrated Postsecondary Education Data System
JROTC	Junior Reserve Officer Training Corps
LRP	Loan Repayment Program
MCRC	Marine Corps Recruiting Command
MCD	Marine Corps District
MCRISS	Marine Corps Recruiting Information Support System
MCP	Marine Commissioning Program
MCP-R	Marine Commissioning Program Reserve
MECEP	Marine Corps Enlisted Commissioning Education Program
MOS	Military Occupational Specialty
NFO	Naval Flight Officer
NROTC	Navy Reserve Officer Training Corps
NRS	Navy Recruiting Station
OCC	Officer Candidate Course
OCCR	Officer Candidate Course Reserve
OLS	Ordinary Least Squares
OSO	Officer Selection Officer
PLC	Platoon Leaders Course
QCP	Qualified Candidate Population
RECP	Reserve Enlisted Commissioning Program

ROTC	Reserve Officer Training Corps
RS	Recruit Station
RSS	Recruit Sub-Station
SAT	Scholastic Assessment Test
TBS	The Basic School
UNSA	United States Naval Academy
USAREC	United States Army Recruiting
USMA	Command United States Military
WRR	Academy Western Recruiting Region
YOS	Years of Service

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I. INTRODUCTION

Using data derived from Marine Corps Recruiting Command officer recruiting records, I estimate the effects selection ratio has on selected officer quality across the Officer Candidate Course (OCC) and Platoon Leaders Course (PLC) commissioning programs. Specifically, I examine applicant selection ratio differences and whether these differences correspond to changes in the quality of applicants. Testing the null hypothesis that lower selection ratio and higher selected officer quality are independent, the evidence strongly suggests rejecting the null. The results of this study suggest first that variation exists in selection ratios between selection boards and air contracts but most notably varies with the change in years. Second, the results show that selection ratio on quality estimates are negative and significant when fixed effects for year, component, geographic location, and demographic components are added. This study seeks to determine if variation exists on officer selection boards and how much effect selection ratio has on the quality of selected Marine officers.

The Marine Corps uses multiple commissioning source programs, two of which—OCC and PLC—make up almost 75 percent of officer accessions (Office of the Under Secretary of Defense, Personnel and Readiness, 2015). These two programs conduct selection boards at the district and region levels in order to determine the best qualified applicants for selection in the officer corps. While both are commissioning source programs, these programs focus on different populations of eligible candidates and each program has a different contact-to-commission timeline. However, selecting high-quality applicants remains the area of utmost importance. Enlisted Recruiters utilize the armed Forces Qualification Test (AFQT) as a metric to attain their quota of high-quality enlistments, as well as for Recruiting Station (RS) commands to access recruiter performance (Dertouzos, 1985). Officer quality metrics focus on Scholastic Assessment Test (SAT) and Grade Point Average (GPA) scores as quality indicators on selection board, and they are the only available variables from which to draw comparisons and conclusions. Though there are numerous other factors considered during the selection process, this study

focuses on two aspects of officer selection, variation on competitive boards and the effect competition has on quality.

One cannot overstate the importance of ensuring that recruiting efforts and overall military personnel composition represent the country's population. For this reason, recruiters are missioned for contracts throughout the nation with the goal of ensuring applicants from all over the nation are submitted for officer selection consideration. Recruiter performance remains a key aspect of obtaining applicants and helps provide selection boards with high-quality applicants for consideration. Numerous studies have researched recruiter performance, covering topics such as the consequences of poor performance (Dertouzos, 1985), incentives and recruiter performance metrics (Government Accountability Office [GAO], 2006), command structure metrics (GAO, 2007), and recruiter team or individual efforts (Dertouzos & Garber, 2007). While this study does not focus on recruiter efforts, it is important to understand the different aspects above that contribute to the selection process. Left to human nature regarding the amount of effort per quality contract, recruiting efforts would eventually migrate toward high population density areas of the country where it is easier to obtain high-quality applicants, thus neglecting portions of the country and reducing the number of selection boards required to meet manpower needs. The current recruiting structure provides adequate recruiter representation across the country's population by ensuring every portion of the country is covered by one of six recruiting districts. Three districts are located in each of the two regions, providing MCRC the structure to ensure geographic diversity, which requires two regional boards and six district boards in order to meet the assigned officer accession mission. The research question related to this is: Does selection rate between geographically dislocated boards differ?

Military applicant–focused research remains an area of interest as military services, recruiting personnel, policy-makers, and economists seek to better understand the impact of individual choice on military accessions. Quality depends as much on who the applicants are as it does the recruiters efforts. Several military-applicant focused studies cover areas such as labor economic factors (Warner, Simon & Payne, 2003), quality retention (Asch, Romley, & Totten, 2006), propensity (Bachman, Segal, Freedman, Doan, & O'Malley,

2000), service decision (Kane, 2005), and others (Mann, 2011) in an effort to determine how decisions to serve are made and who makes them. Additionally, policy decisions significantly impact one's decision to serve. While we do not specifically examine these policies' impact on quality, there is no doubt that policies such as college benefits strongly motivate military service applicants.

The problem with examining officer board selection ratios is understanding the variables affecting the variation in the ratios and determining if variation exists. To address this issue, I utilize an OLS model in which I examine the officer selection ratios across years, districts, and component. I calculate the mean selection ratio by looking at all male and female applicants separately in each year regardless of commissioning source or board location and compare them to those selected in that year. I do the same for all districts and components, resulting in an overview of selection ratios for males and females across year, district, and components. We are able to see significant variation in the selection ratios for two reasons. First, the method highlights variations occurring in all three key areas, years, districts, and components. Further, of the three, we see year has the largest impact in the change in selection ratio. Second, even though selection ratios for males and females differ, the same trends exist. Once I determine variation in selection ratios, I utilize another OLS model in an attempt to observe the impact that selection ratio has on officer quality as measured by SAT and GPA score. The results suggest that selection rate negatively impacts officer quality. Lower selection rates correspond to a more competitive selection process and increased competition, resulting in increased quality observed by increased SAT and GPA scores. The final portion of this thesis examines the reasons why OCC and PLC boards view quality metrics differently.

Two key limitations need to be addressed. First, the findings of this thesis highlight the importance of accurate and complete data for future analysis. Missing data in the SAT and GPA outcome variables make it difficult to capture the true affect selection ratio has on quality. Second, while quality is often measured using available metrics such as SAT and GPA, the Marine Corps values aspects of quality that are not captured in the data but are significant factors in the selection process.

The remainder of this thesis proceeds as follows: Chapter II provides background information on the officer recruiting structure and processes of all four DoD military services as well as a review of the pertinent literature on recruiting, applicants, and recruiting policy. Chapter III describes the data and variables utilized for this research. Chapter IV details my empirical framework and methodology. Chapter V presents results and highlights the correlation between selection ratio and officer quality. Chapter VI concludes and provides recommendations to Marine Corps Recruiting Command (MCRC).

II. BACKGROUND AND RELATED WORKS

Marine Corps recruiting began at the inception of the Corps in 1775. Over our 242-year history, haphazard recruiting practices developed into a structured process with our mission and purpose focused on finding the best to serve within the ranks. The recruiting process experienced numerous challenges throughout the years, but none changed the recruiting structure more in recent history than the elimination of the draft in 1973. From 1973 through the early 1990s, significant improvements in recruiting efforts occurred that ultimately led to the establishment of the Marine Corps Recruiting Command under a single commanding general with a single focused mission stated in MCRCO 1100.2A:

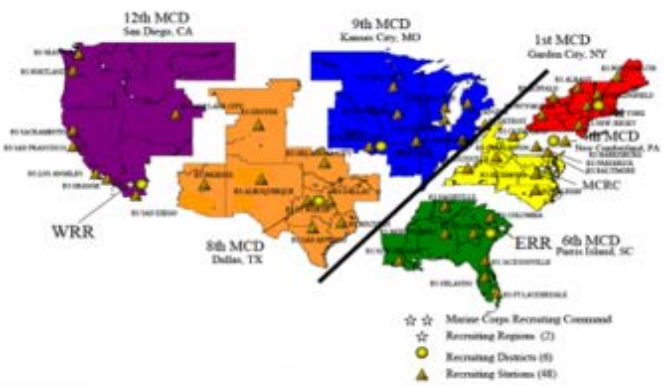
> The ultimate objective of Marine Corps Recruiting Command (MCRC) is the perpetuation of the Marine Corps and the standards of preparedness and military vigor that Marines have upheld since 1775. The immediate impact that recruiting has on the Marine Corps requires that standards for enlistment be strictly set to ensure that future Marines will maintain our tradition of excellence. Accordingly, the mission of the Marine Corps is to "Make Marines, Win Battles, and Return Quality Citizens" to their communities. (United States Marine Corps Recruiting Command, 2013, p. 1-1)

A. MARINE CORPS OFFICER RECRUITING

1. Organizational Structure (Maps, Org Charts)

The organizational structure of recruiting commands between the services varies, and the recruiting Areas of Responsibility (AOR) are specific to each service. The graphical depiction of each service's recruiting commands and AORs can be found for the Navy in Figure 1, Panel A, the Marine Corps in Figure 1, Panel B, the Air Force in Figure 1, Panel C, and the Army in Figure 1, Panel D.

Panel: A. Source: Commander of Navy Recruiting Command (2017).



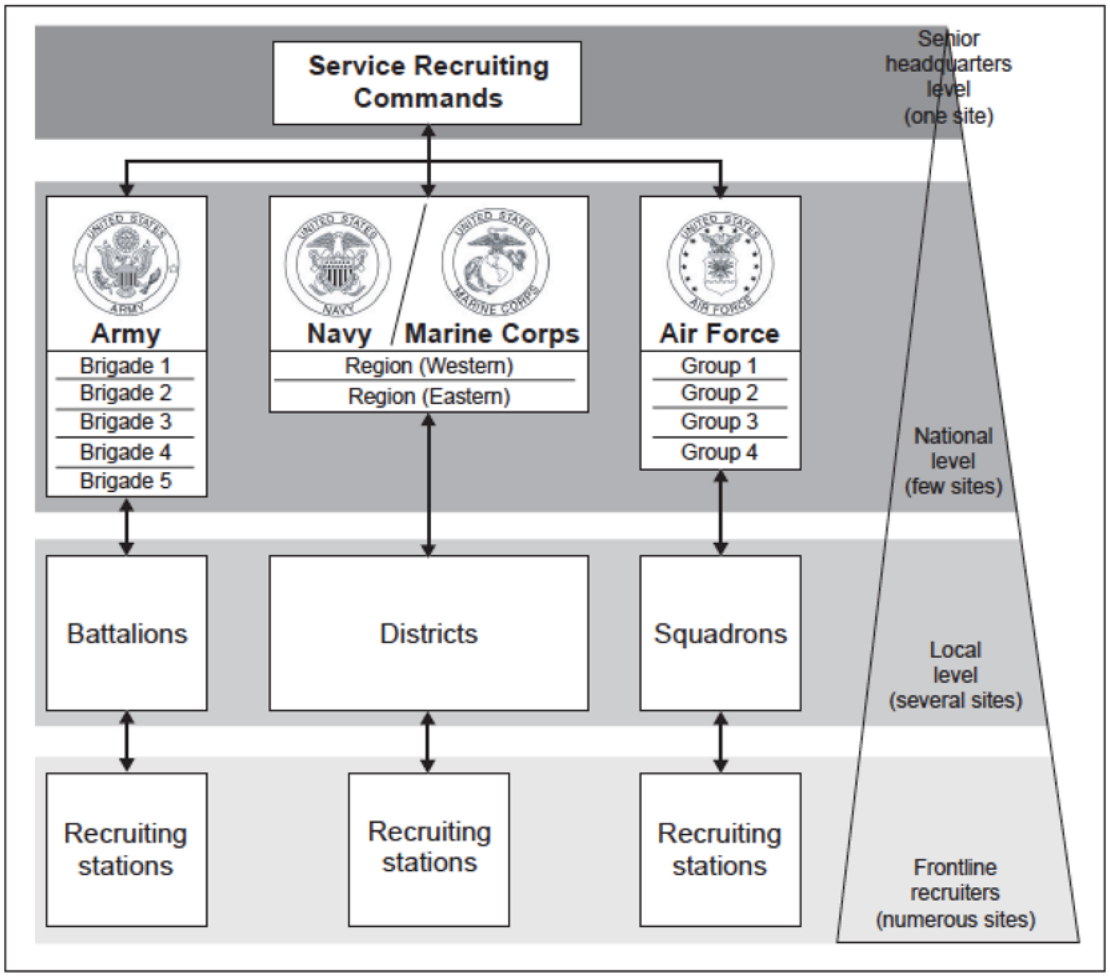
Panel: B. Source: Choike & Zeliff (2010).

Panel: C. Source: United States Air Force Recruiting Service (n.d.).

Panel: D. Source: United States Army Recruiting Command (n.d.).

Figure 1. Military Recruiting Organizational Structure Maps

Each service's recruiting command has similar command structures. First, the Navy recruiting command has five levels: Commander Navy Recruiting Command (CNRC), region, district, division, and Navy Recruiting Station (NRS). CNRC has two regions, East and West, and each region contains 13 districts. Each district has a varying number of divisions depending on the geographical area of responsibility (Commander of Navy Recruiting Command, 2017). Second, the Marine Corps has five levels: MCRC, region, district, RS, and Recruiting Sub-Station (RSS). MCRC has two regions, Eastern and Western, and each region contains three districts. Each district has a varying number of recruiting stations depending on the geographical area of responsibility (United States Recruiting Command, 2013). Third, the Air Force recruiting command contains four levels: Air Force Recruiting Command (AFRC), group, squadron, and flight. AFRC has three groups, and each group contains nine squadrons. Each squadron has a varying number of flights depending on the geographical area of responsibility (United States Air Force Recruiting Service, n.d.). Finally, the Army recruiting command contains four levels: United States Army Recruiting Command (USAREC), brigade, battalion, and company. USAREC has five brigades, and each brigade contains several battalions (5, 6, or 8 depending on the brigade). Each brigade has a varying number of companies depending on the geographical area of responsibility (United States Army Recruiting Command, 2015). Figure 2 depicts of the four service's recruiting command structures.



Source: GAO analysis based on service-provided organizational structures.

Figure 2. Service Recruiting Command Organizational Chart.
Source: GAO (2006).

2. Officer Programs

Examining where each service gains accessions and places their officer recruiting focus helps explain why the military services have different recruiting commands and AOR structures. Each of the services relies on the same types of programs for their source of commission when recruiting officers for accession into their respective service. However, each service focuses on the commissioning source programs differently. For example, Table 1 depicts active component commissioned officer gains: FY2015. As seen in Table 1, the Army strongly emphasizes service academy and Reserve Officer Training Corps

Table 1. Active Component Commissioned Officer Gains, FY15, by Source of Commission and Service. Adapted from Office of the Under Secretary of Defense, Personnel and Readiness (2015).

	Active Component Commissioned Officer Gains: FY 2015				
Source of Comission	Army	Navy	Marine Corps	AirForce	Total
Service Academy	1,013	808	270	833	2,924
	(17.9%)	(20.2%)	(17.0%)	(18.8%)	
ROTC Scholarship	2,038	780	48	8	2,874
	(36.1%)	(19.5%)	(3.0%)	(18.5%)	
ROTC Non-Scholarship	1,191	42	0	2,047	3,280
	(21.1%)	(1.0%)	(0%)	(21.1%)	
PLC/OCC/OCS/OTC	490	1,012	495	571	2,568
	(8.7%)	(25.3%)	(31.3%)	(16.5%)	
Direct Appointment	833	755	80	610	2,278
	(14.7%)	(18.8%)	(5.1%)	(14.6%)	
Other/Unknown	86	610	691	249	1,636
	(1.5%)	(15.2%)	(43.6%)	(10.6%)	
Total	5,651	4,007	1,584	4,318	

Note: Officer gains reflect an addition to the officer ranks. This addition can reflect a new accession, a movement from another component, or the return of the officer from the same component. The OSD definition of an officer gain is the transaction in a database that reflects the addition of an SSN that was no tin the previous file.

1. ROTC - Reserve Officer Training Corps
2. OCS - Officer Candidate School
3. OTS - Officer Training School
4. PLC - Platoon Leaders Course
5. Other/Unknown includes programs such as MECEP and ECP. Some OCC are also classified unknown.

(ROTC) (Scholarship and Non-Scholarship) accession programs accounting for 74 percent of their officer recruiting efforts (Table 1) (Office of the Under Secretary of Defense, Personnel and Readiness, 2015). The Navy has the most well-rounded officer recruiting effort with officer accession distributions of 20.2 percent service academy, 19.5 percent Navy Reserve Officer Training Corps (NROTC), 25.3 percent PLC/OCS and 18.8 percent Direct Appointment (Table 1) (Office of the Under Secretary of Defense, Personnel and Readiness, 2015). The Marine Corps has the narrowest focus with 17 percent coming from the Navy's service academy and 74.6 percent from PLC/OCC programs and other sources (Table 1) (Office of the Under Secretary of Defense, Personnel and Readiness, 2015). Of the four services, the Air Force relies heaviest on ROTC (47.4 percent) and 19.3 percent from their service academy (Table 1) (Office of the Under Secretary of Defense, Personnel and Readiness, 2015). Additionally, the recruiting infrastructures of each of the services

are better understood because it is clear the four services rely on different accession sources to varying degrees. For example, the Army ROTC program contains a significant manpower footprint, enjoys the benefit of feeder programs such as Junior Reserve Officer Training Corps (JROTC), and has a well-established recruiting network, but the ROTC program does not fall under the Army Recruiting Command structure (GAO, 2007). The United States Military Academy, like all service academies, is a very competitive institution and can be selective with applicants. Due to this recruiting structure, 75.1 percent of Army officers come from accession programs outside the Army Recruiting Command (Table 1) (Office of the Under Secretary of Defense, Personnel and Readiness, 2015). In contrast, the Marine Corps obtains 74.9 percent of officer accessions from PLC/Officer Candidate School (OCS) and Other (OCC) programs that fall under MCRC and require significant resources to support, thus increasing the risk of failing to meet assigned mission goals (Table 1) (Office of the Under Secretary of Defense, Personnel and Readiness, 2015).

3. Officer Recruiting Process

a. Officer Procurement Process

All four services have similar officer procurement processes for recruiting qualified individuals into their respective services (Policy and Programs Division, Operations Department, Navy Recruiting Command, 2017; Air Force Recruiting Service, 2012; United States Army Recruiting Command, 2005; United States Marine Corps Recruiting Command, 2015). Figure 3 depicts the Marine Corps officer procurement process from the officer recruiting plan to commissioning (United States Marine Corps Recruiting Command, 2015). The officer procurement process differs from the enlisted recruiting process in that contracts only count toward recruitment goals when the appropriate level board selects them (General Accounting Office, 1998). This incentivizes recruiters to recruit high-quality applicants.

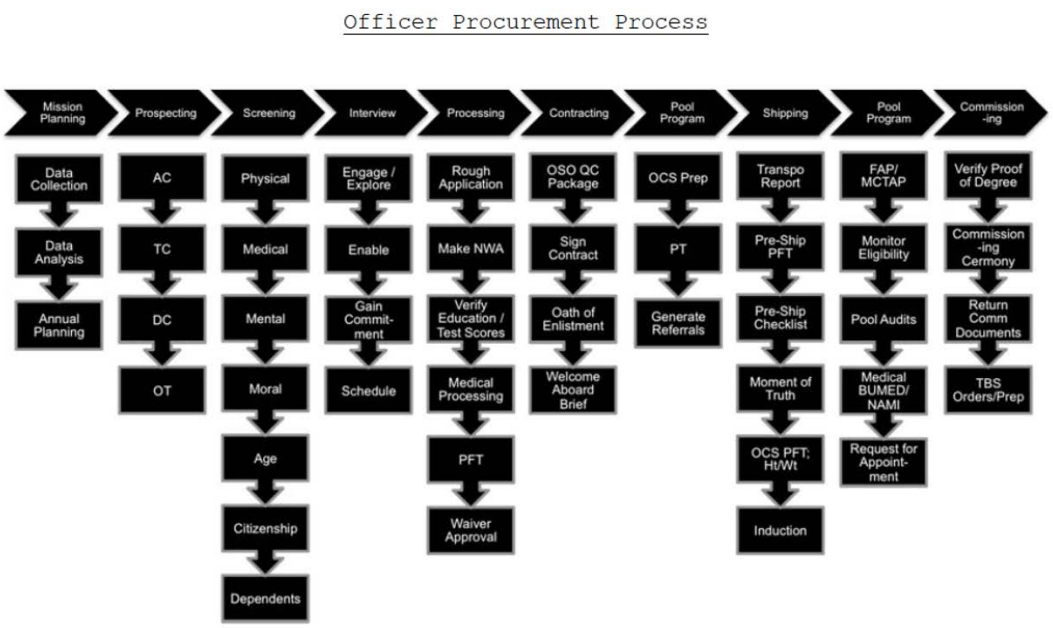


Figure 3. Officer Procurement Process. Source: United States Marine Corps Recruiting Command (2015).

b. Contract-to-Commissioning

The officer procurement process begins with mission planning and concludes with commissioning and order to The Basic School (TBS). Figure 4 depicts a broad view of the contact to commissioning process for Marine Corps PLC and OCC commissioning programs. While there are numerous other commissioning programs such as the service academy, the Enlisted Commissioning Program (ECP), the Marine Corps Enlisted Commissioning Education Program (MECEP), and the ROTC (United States Marine Corps Recruiting Command, 2015), accession quantities from these programs are a small portion of total Marine Corps accessions (United States Marine Corps Recruiting Command, 2013). Additionally, accessions from the service academies, ECP, MECEP, and ROTC sources go through a rigorous screening process prior to being commissioned.

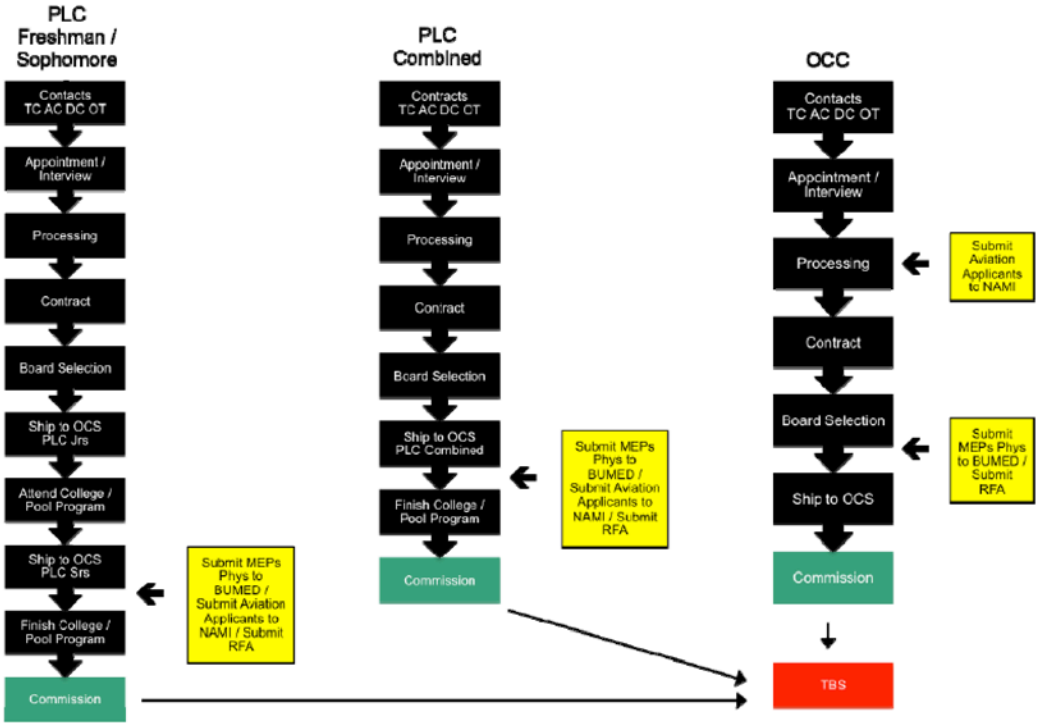


Figure 4. Contact-to-Commissioning Chain for Officer Programs. Source: United States Marine Corps Recruiting Command (2015).

4. Officer Selection Process

Commissioning source selection processes differ by commissioning program and service. ROTC programs serve as a pre-screening recruiting and selection program. The ROTC commander makes the selection decision, and academy admissions boards make the service academy selection decisions. The PLC accession program supports individuals who are in college and desire to serve as a commissioned officer in the service upon completion of school. The OCC accession program supports individuals who have completed college and desire to serve as a commissioned officer in the service. Applications to serve via these programs entail a board selection process that occurs at different levels for each of the services (United States Marine Corps Recruiting Command, 2015). For example, the Navy PLC/OCC selection board occurs at CNRC while the Army conducts their selection boards at the battalion level. In contrast, the Marine Corps conducts PLC selection boards at the district level and OCC selection boards at the region level three

times a year to coincide with the three OCS training periods (January, Summer, and October).

B. LITERATURE REVIEW

A rigorous review of the literature was unable to find any studies on selection ratios to this point. Thus, there are few studies relating to this topic. However, there are three main areas of study that significantly impact this research: recruiter focused studies, applicant focused studies, and policy focused studies.

1. Recruiter Focus

Recruiter performance remains a key factor in meeting service officer recruiting goals. Dertouzos (1985) analyzes how supply and demand factors influence recruiter behavior in recruiting for the enlisted ranks. Dertouzos finds that recruiters can substitute low-quality enlistments for high-quality enlistments at a rate of four to one, and recruiter assigned quotas can impact estimates regarding the effects of the economy and how resources are utilized. Additionally, Dertouzos determines high performing recruiters, that is, those who meet their high-quality assigned quotas, are less likely to change their behavior by increasing production due to incentives than those recruiters who do not meet their high-quality quotas. Dertouzos concludes these findings indicate behavioral differences that a recruiter's productivity can have on the quality of enlistments and demonstrate that recruiter performance can play a significant role in the quality of accessions (Dertouzos, 1985).

Consequently, poor recruiter performance can negatively impact accession quality. A 2006 United States Government Accountability Office report "defines recruiter irregularities as those willful and un-willful acts of omission and improprieties that are perpetrated by a recruiter or alleged to be perpetrated by a recruiter to facilitate the recruiting process for an applicant" (GAO, 2006, p. 3). As such, GAO (2006) highlights recruiter wrongdoing as a potential problem in missing recruiting missions and reducing quality accessions. The report explains that typically the services utilize the number of contracts recruiters sign as a metric for incentive programs such as awards or increased performance evaluations. However, GAO (2006) states "the Marine Corps uses basic

training attrition rates as a key component of the recruiter's performance evaluation" (GAO, 2006, p. 5). The report further asserts that this criterion serves to incentivize recruiters to sign contracts for those who have the qualities required to complete basic training. GAO (2006) states that this policy focuses on enlisted recruiting and is similar to using applicant selection as a criterion for counting officer applicants in officer recruiting. More effective recruiting practices lead to more efficient processes and recruits successfully completing basic training, saving taxpayer dollars and reducing attrition at basic training (GAO, 2006). Additionally, properly incentivized recruiters ensure they are focused on quality and not just quantity (General Accounting Office, 1998).

Another area of study examines the impact changes in population has on the recruiter's mission. Population metrics that support fair and equitable recruiting practices remain a useful tool when developing recruiting plans for the military. Jareb and Parker (2001) study the military officer recruiting market composition and density using the Integrated Postsecondary Education Data System (IPEDS), the Barron's Profile of American Colleges 2001, the College Board College Handbook 2001, and DoD officer accession data to create a Qualified Candidate Population (QCP) based analysis of the officer's recruiting market. QCP provides MCRC with a measure of the estimated recruiter market share, is the basis for officer mission goal assignments, and aligns with MCRC's policy to recruit a diverse, high-quality officer corps (Jareb & Parker, 2001). This study focuses on where officer accessions come from and how to fairly assign missions based on the size of the candidate pool, and they recommend restructuring the recruiting districts for a more equitable QCP distribution to help realign the officer recruiting Officer Selection Officer (OSO) assignments (Jareb & Parker, 2001).

Kelley (2005) updates the QCP to Jareb and Parker (2001) by keeping the analytical approach in determining the QCP the same as the previous report but considers changes in population, college attendance, and demographics. The study reports changes in quantity and diversity, especially in the Hispanic population and was used to aid MCRC in assigning OSOs within the districts and/or to provide OSOs with direction in allocating recruiting resources (Kelly, 2005).

Wenger and Kelley (2006) build on previous research by updating QCP calculations and evaluating QCP estimate predictions by comparing school QCP with schools officers attended. They conclude that 40 percent of Marine officers attend only five percent of the schools in the sample, which tend to be large, selective public schools (Wenger & Kelley, 2006). Additionally, Wenger and Kelly (2006) report that increased productivity at select schools remains in line with varying propensity estimates across districts and recommend OSOs continue to focus on recruiting at these productive institutions (Wenger & Kelley, 2006).

Malone and Kelley (2015) standardize the QCP derivative process for the Marine Corps by specifically focusing on female QCP in response to the potential increase in female Marine's role in combat arms MOSs. Malone and Kelly (2015) calculate QCP for two specific areas, school level QCP and County level QCP, in order to determine if OSO resource reallocation would be necessary to meet a change in female applicant officer recruiting. Malone and Kelly (2015) first categorized total QCP figures by district then by gender and race, and they found that female and male applicants are geographically located in the same places, meaning no OSO resource reallocation was necessary (Malone & Kelley, 2015).

Some studies analyze recruiting program structure and determine decentralized recruiting programs may lead to missing accession goals. A 2007 United States Government Accountability Office report analyzes the potential problems within the Army's officer accession and retention challenges and finds that the decentralized structure of the Army's officer accession programs and lack of their formal coordination with one another makes it difficult for the Army to compensate for shortfalls across accession programs. While the Army is the focus of this report, it comparatively analyzes all services. During the early 2000s, according to the report, all services fell short accessing officers in one or more of the following areas: medical officer occupations, Naval Flight Officers, and some racial and ethnic groups such as African Americans and Hispanics. This report summarizes that the key issue of missing accession and retention goals are traced back to the lack of overall service recruiting structure under a single mission and command (GAO, 2007).

While the GAO (2007) analyzes the recruiting command structure, other studies focus on the recruiting structure of teams versus individual efforts to analyze the effect on the types of officers recruited and screened on officer selection boards. Dertouzos and Garber (2006) aim to provide new insights into recruiter-management policies in the Army by using three datasets. First, they use a 1998–2000 dataset analyzing recruiter performance in enlisting higher and lower quality recruits in an individual basis. Second, they use a dataset for a 30-month period from January 2001 through June 2003 where recruiting missions were assigned and accessed as a team. The third dataset covers a 10-year period from 1987 to 1996 to analyze several outcomes to include who became recruiters, productivity rates, the length of recruiting tours, and the promotion rates of recruiters versus non-recruiters. In their research, they find that teams of recruiters were more effective than individuals, recruiters with dependents' and those from technical, combat, and intelligence Military Occupational Specialties (MOS) tended to be more productive while AFQT score and level of education seemed to have no effect on performance (Dertouzos & Garber 2006).

Recruiters remain an important factor in successful officer recruiting. Incentives motivate recruiters to perform at a higher level, which can impact the quality of applicants being sent to selection boards and ultimately affect the quality of the officer corps. While this study does not focus on recruiter performance, it is important to note the critical role recruiters play in the officer selection process.

2. Applicant Focus

Factors external to the military recruiting structure impact the quantity and quality of officer applicants, which requires careful and deliberate consideration when developing recruiting plans. In an effort to explain the recruiting slowdown, Warner et al. (2003) analyze recruiting from 1989–1997 and note the estimated impacts of economic variables such as military pay and unemployment when compared to the civilian sector. Warner, Simon, and Payne (2003) find that variables associated with recruiting resources, recruiters, and advertising are important factors when trying to explain the recruiting slowdown during this time period. However, their research identifies two trends: the

increase in college enrollment and fewer adult veterans as important factors in explaining fewer enlistments over time (Warner, Simon, & Payne, 2003). Warner, Simon, and Payne's research points out the services experienced an increasingly difficult recruiting time following the end of the data period and responded by making changes, specifically increasing recruiters, advertising, and enlistment incentives. While these actions address the shortfall issues, they increase the cost of obtaining high-quality recruits and may not be cost efficient in the future (Warner, Simon, & Payne, 2003).

Another area of research includes the quality of individuals who enter and remain in service. Asch, Romley, and Totten (2005) analyze the quality of personnel in the enlisted ranks of the armed forces by comparing two methods of quality measurement. The first method they use measures quality from entry through the first enlistment (4 Years of Service (YOS)), and mid- career (8 YOS and 12 YOS) using the AFQT scores of service members as they enter the service. Their findings using this method are as follows: (1) the average quality of those who attrite is not much different than those who complete their first term, (2) the quality of those who reenlist is slightly lower than those who complete their first term, and (3) those who remain in service through mid-career are not much different in terms of quality than those who leave (Asch et al., 2006). Asch, Romley, and Totten argue that generally, the difference in quality, as measured by AFQT, is not much different between those who remain in service and those who leave. They conclude that the average quality person recruited is the quality retained by the service. The second method their research employs uses a quality index that measures other factors of quality such as job match and returned significantly different. Asch et al. state "using the quality index as our measure, we find that those who complete their first term, those who stay until the eighth or twelfth YOS (that is, to their mid-career), and those who are promoted to higher grades are of significantly higher quality" (Asch et al., 2006, p. xiv). The authors contend this is due to the quality index that includes information revealed on the job. These findings illuminate the importance of high-quality accessions and measuring retained quality personnel using more relevant metrics (Asch et al., 2006).

Another area of research has been conducted on who chooses military service and who carries the burden of service. Bachman, Segal, Freedman-Doan, and O'Malley (2000)

examine the factors that lead someone to choose the military as a viable career option and the factors that lead to successful entry into the service (Bachman et al., 2000). Bachman et al. maintain that since joining the service is a bilateral decision, i.e. the individual applies and the service accepts him/her, the study examines the choice to serve and successful entry into the service. They focus on a few key areas in determining military propensity: (1) family background and demographics, (2) educational attainment and plans, and (3) attitudes, values, and behaviors (Bachman et al., 2000). Bachman et al. analyze numerous aspects of propensity to include gender, number of parents in the home, the level of parent education, and plan for college and grades at completion of high school, to name a few, and find as parent education level increases, the less likely their children will have the desire to enlist. This trend is troubling because, as noted in Warner, Simon, and Payne (2003), the rising trend in college attendance is a key contributor in the decline in enlistments. If an increase in parent education level is associated with a decrease in their child's propensity to serve and college participation rates continue to increase, the next several generations of recruiters will find it increasingly more difficult to meet recruiting goals (Warner, Simon, & Payne 2003).

While Bachman, Segal, Freedman-Doan, and O'Malley (2000) examine the propensity of those who apply and are accepted in the military, Kane (2005) examines the demographic composition of two cohorts within the military before and after 9/11, 1999 and 2003. He examines four characteristics: (1) race/ethnicity, (2) region/rural origin, (3) education level, and (4) household income and concludes the demographics of those serving is representative of the population of the United States (Kane, 2005). Similarly, McHugh and Hattiangadi (2006) address the perception that the military option is particularly appealing to disadvantaged youth who might have fewer civilian job opportunities and find no statistical evidence supporting this claim. Together these two studies provide insight into the demographics of those who serve.

Free labor market factors and individual decision remains a significant area of research related to an applicant's decision to serve. Mann (2011) examines military service as a key aspect of the free labor market. Specifically, Mann's research analyzes the factors surrounding an individual's decision to serve in the military with other opportunities by

placing individuals into five categories: (1) serving in active duty military, (2) staying home, (3) serving in reserve military (4) work in the civilian sector, or (5) attending school,. Additionally, Mann further states that if an individual works in the civilian sector or stays home, then he can also serve in the reserve military. Mann (2011) examines an individual's choices in the free labor market and concludes that individuals will attempt to maximize their utility in each time period they must make a decision (Mann, 2011).

Given these studies' findings, factors impacting the applicant's decision to serve also remain important in successful officer recruiting. Economic variables such as the rising cost of college, military pay and incentives compared to civilian alternatives, and the decline of the veteran population coupled with the demographic characteristics of who chooses to serve will define the applicant population military recruiters recruit from. These factors along with the free labor market will shape the applicant pool and can impact the quality of applicants being sent to selection boards and ultimately affect the quality of the officer corps. While this study does not focus on the numerous factors associated with an applicant's decision to serve, it is important to note the critical role economic factors play in the officer selection process.

3. Policy Focus

Policy plays a significant role in developing recruiting plans and government policies, affecting incentives and entitlements that significantly impacts an individual's decision to join the service. Several policy options are available to lawmakers when considering the service's ability to meet recruiting goals and support the nation's military manpower requirements. Warner and Asch (2001) observe that after the draft ended in 1973, the topic of reinstatement emerge during periods of economic success when unemployment rates are low and military recruiting efforts fall on hard times. Warner and Asch examine the history of the All-Volunteer Force (AVF) since 1973 and catalogs the various ups and downs from 1973 until 2001. Based on this history, they conclude the AVF is sustainable, stating "Military recruiting and retention are sufficiently responsive to compensation and other incentives that there exist feasible levels of pecuniary and nonmonetary incentives that will allow the armed forces to meet their strength objectives—

in terms of numbers, quality, and experience-now and in the foreseeable future" (Warner & Asch, 2001. p. 187).

Other policies designed to increase quantity and quality of enlistments are education funding programs. Asch, Du, and Schonlau (2004) conducted a national survey of 17 to 21-year-old high school seniors headed to college, students currently attending college, and students who have dropped out of college to determine the effectiveness of education benefits on enlistment decisions. The Montgomery GI Bill, Post 9/11 GI Bill, College First, and Loan Repayment Program (LRP) are among a few such policies utilized to provide benefits in lieu of increased pay entitlements and enlistment bonuses (Asch, Du, & Schonlau, 2004). The authors assert these programs strengthen recruiting efforts by increasing the quantity and quality of applicants. The authors show that since many service members and applicants generally do not maximize the program benefits, these policies become more cost effective than pay and allowance increases because although the amount of the benefit is high, historically only a quarter of the benefit is claimed (Asch, Du, & Schonlau, 2004).

As a whole, policy remains an important factor in successful officer recruiting. Incentives such as financial entitlements for college or loan repayment programs can motivate applicants to consider military service. These policies can impact the quality of applicants being sent to selection boards and ultimately affect the quality of the officer corps. While this study does not focus on policy implications on the quality of Marine officers, it is important to note the critical role policy plays in the officer selection process.

Finally, previous studies utilizing multivariate analysis on recruiting and accessions indicate the importance of examining variables associated with recruiter ability, applicant choices, and policy decisions in regression models to estimate the impact these areas have on the decision to serve in the military. Prior research demonstrates the necessity to examine the numerous variables associated with the decision to serve. Quality remains a key factor in the Marine officer selection process. Therefore, this study includes selection ratio variables from Marine officer selection boards into the multivariate regression estimates to contribute new independent variables to the body of research concerning officer selection process.

III. DATA AND VARIABLES

I use a MCRC provided dataset from the Marine Corps Recruiting Information Support System (MCRISS) database, which captures all applicants who applied to become Marine Corps Officers between 2007 and 2017. This dataset is at the individual level and contains various demographic information, commissioning program data, component, and academic and physical performance measures for 39,204 observations. The component variable can be further broken down into four subcategories: air, ground, law, and Naval Flight Officer (NFO). I drop individuals from the dataset for three reasons. First, MCRISS contains data on all officer commissioning programs, and this study only focuses on the PLC and OCC programs.[1] Second, observations from 2007 and 2008 contained significant gaps in the data, making these years unreliable. Third, only applicants considered on a selection board for the OCC or PLC officer commissioning programs were retained excluding applicants who were not considered on a selection board. The final sample contains 14,911 observations.

One significant limitation of this dataset is that selection decisions are made based on numerous factors, some of which are present in the data while others or not. As a result, I use SAT/American College Test (ACT) scores and GPA as a proxy for desirable quality. The Marine Corps places significant weight on leadership roles and abilities as quality metrics when making selection decisions. However, such desirable traits are not quantified in the data. Since SAT/ACT scores and GPA can represent levels of intelligence, hard work, and determination and establish a metric for measuring competition on the boards, I use these scores to measure the applicant's quality. The use of SAT/ACT and GPA as quality metrics is similar to Dertouzos, (1985) use of AFQT to measure enlisted accession quality.

[1] PLC and OCC are two of the 12 commissioning programs in the Marine Corps. The other programs are Officer Candidate School Reserve (OCCR), Unites States Naval Academy (USNA), United States Military Academy (USMA), United States Air Force Academy (USAFA), Enlisted Commissioning Program (ECP), Reserve Enlisted Commissioning Program, (RECP), Marine Corps Enlisted Commissioning Education Program (MECEP), Naval Reserve Officer Training Corps (NROTC), Meritorious Commissioning Program (MCP), and Meritorious Commissioning Program Reserve (MCP-R) (United States Marine Corps Recruiting Command, 2015).

Table 2 provides summary statistics for all PLC and OCC applicants that were considered on a Marine Corps officer selection board during this time period. 86.6 percent of the sample are male, 70.8 percent white, 7.7 percent black, and so on. During this time period, 42.2 percent were OCC applicants and 57.8 percent were PLC applicants. As expected due to the manpower needs of the Marine Corps, ground contracts and air contracts make up the largest portion of applicants.

Table 2. Summary Statistics

	Population	
VARIABLES	mean	sd
Male	0.866	0.341
White	0.708	0.455
Black	0.077	0.267
Hispanic	0.119	0.324
Other Race	0.096	0.294
Married	0.065	0.247
High School	0.168	0.374
Some College	0.302	0.459
Bachelor's Degree	0.486	0.500
Master's Degree	0.044	0.206
Number of Waivers	0.569	0.646
OCC	0.422	0.494
PLC	0.578	0.494
Air Contracts	0.186	0.389
Ground Contracts	0.738	0.440
Law Contracts	0.055	0.228
Naval Flight Officer Contracts	0.021	0.142
Observations	14,911	

Raw data obtained from Marine Corps Recruiting Information Reporting System.

Marine Corps recruiting districts are assigned their mission by two categories: components and commissioning programs. For example, First Marine Corps District 2016 OCC assigned mission was 28 air contracts, 143 ground contracts, 9 law contracts, and 2 NFO contracts. PLC and OCC applicants are considered on separate selection boards and are thus analyzed separately according to their commissioning program. Additionally, OCC and PLC commissioning programs consider applicants from different population

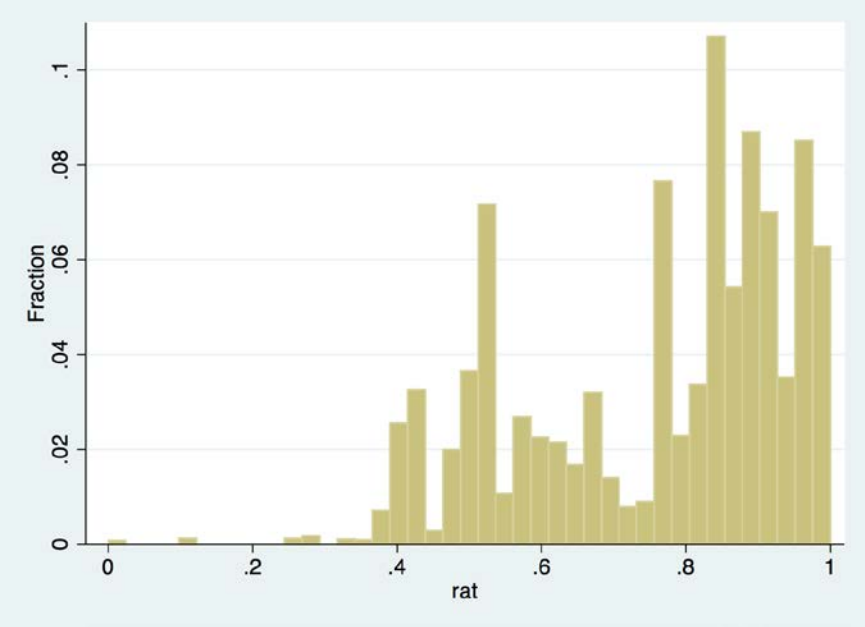
groups. For example, OCC applicants are college graduates while PLC applicants are typically considered on a selection board in their second or third year of college.

Next, selection ratio depicts the ratio between the number of selectees to the number of applicants on a selection board. The number of applicants represents only those that made it to a selection board and excludes applicants that were prescreened as unqualified, applicant withdrawal, or they were removed from consideration by the RS, District or Region for any number of reasons. District assigned mission for each component dictates the officer accession requirement. Once an applicant has been selected they count toward the district mission. Selected applicants include all applicants that were board selected regardless if they later withdrew their application, refused commission, or were dis-enrolled from the program at any point after selection for any reason.

I examine selection ratio across all selection boards, components, commissioning sources, and both genders and observe significant variation. Figure 5 shows the selection ratio across 281 male selection boards in the dataset. For comparison, this figure shows the frequency of selection ratios across all boards varies between 0.4 and 1.0, meaning the competitive nature of the selection boards changes throughout this time period. Females represent 13.4 percent of all officer applicants from 2009 thru 2017 and 9.2 percent of all commissioned officers in the Marine Corps in 2015 (Office of the Under Secretary of Defense, Personnel and Readiness, 2015). Selection boards consider male and female applicants separately by commissioning program and component, resulting in different selection ratios between males and females. Figure 6 shows the selection ratio across 189 female selection boards in the dataset.

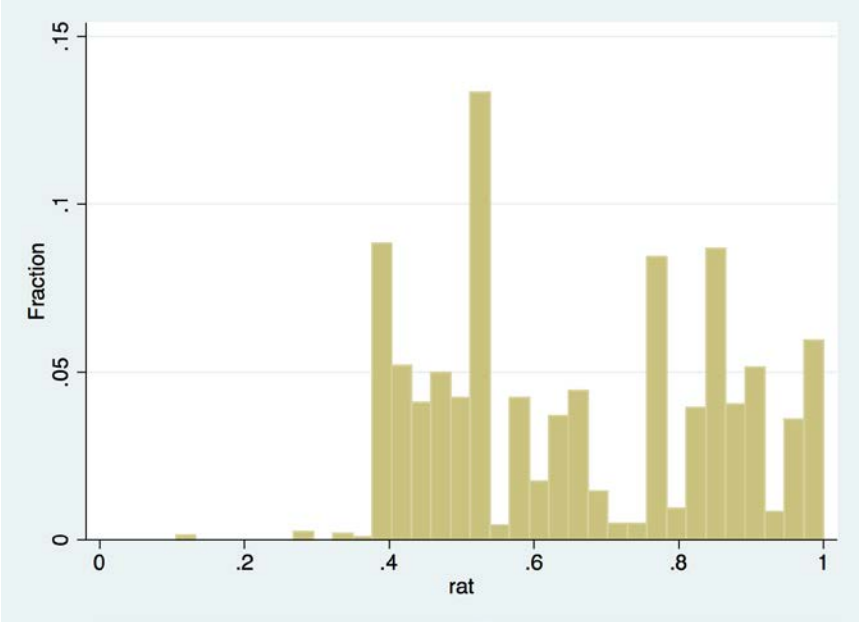
As some applicants took the SAT and others took the ACT, I create a new variable that equals the percentile score on the test that was taken; a few applicants took both tests, and for these individuals I use the mean percentile score.

Several variables required condensing to be useful for analysis. First, education dummy variable Master's degree includes observations containing master's, First professional, and doctorate degrees. Second, marital status is comprised of married or



Raw data obtained from Marine Corps Recruiting Information Reporting System.

Figure 5. Selection Ratio for Males across all Board Levels, Component, and Commissioning Sources



Raw data obtained from Marine Corps Recruiting Information Reporting System.

Figure 6. Selection Ratio for Females across all Board Levels, Components, and Commissioning Sources

single. Divorced, widowed, and annulled are considered single, and separated is considered married.

This research is predicated on the fact that recruiting missions are assigned to six different districts throughout the country by component, gender, and commissioning source and boarded at eight different locations, and each board selects applicants at different rates as a source of variation. Other than applicants moving into a specific district, applicants have no say in which district they can apply to become an officer. Additionally, based on MCRC recruiting policy, MCRC assigns recruiting missions based on the district QCP, ensuring a fair and equitable balance of Marine officer accessions across the districts and ensuring demographic and geographic diversity. Since geographic diversity is a premium, the potential for quality variation among the districts exists.

In short, the dataset from MCRISS appears to be sufficient in size and contains the necessary variables required in order to conduct this analysis. The composition of the dataset demonstrates sufficient variability with respect to gender, race, education level, commissioning programs, type of contracts and the remaining variables. The selection ratios developed from this dataset form the basis of this analysis making it possible to compare ratios between districts, regions, genders, commissioning programs, and components. Additionally, creating the variable test score from SAT and ACT scores plus using GPA to measure quality and utilize them as the outcome variables create the environment to examine the impact competition has on quality.

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IV. EMPIRICAL FRAMEWORK AND METHODOLOGY

The first step in my analysis is to calculate the selection ratios for each board. There is one board for each commissioning source, component, district, and gender in each year for a total of 470 boards. Table 3 shows the variation of selection ratios across the population. For example, the mean selection ratios for males across 31 selection boards in 2009 is 96.5 percent and 88.1 percent in 2010, while the mean selection ratio for females across 18 selection boards in 2009 is 96.4 percent. First Marine Corps District conducted 54 male selection boards with a mean selection ratio of 74.3 percent and 32 female selection boards with a mean selection ratio of 62.4 percent. Variation in the selection ratio suggests that competition between boards change from year to year, district to district, and between components.

Table 3. Mean Selection Ratio for Males and Females across all Years, Districts, Components, and Gender

	Males		Females	
	Mean Selection Ratio	Number of boards	Mean Selection Ratio	Number of boards
	(1)	(2)	(3)	(4)
Year 2009	0.965	31	0.964	18
Year 2010	0.881	31	0.848	16
Year 2011	0.769	31	0.686	20
Year 2012	0.760	32	0.611	21
Year 2013	0.794	31	0.573	23
Year 2014	0.601	32	0.520	20
Year 2015	0.577	32	0.543	21
Year 2016	0.715	31	0.695	28
Year 2017	0.721	30	0.699	22
District 1	0.743	54	0.624	32
Disrtict 4	0.781	46	0.665	27
District 6	0.749	41	0.651	31
District 8	0.761	44	0.677	26
District 9	0.772	48	0.678	33
District 12	0.757	48	0.683	40
Component-Air	0.813	72	0.732	48
Component-Ground	0.749	72	0.651	72
Component-Law	0.719	71	0.701	47
Component-NFO	0.696	66	0.724	22
Total: 470				

Model (1) estimates the effects of the selection ratio on different selection boards using OLS and includes fixed effects for selection board locations, commissioning programs, components, and gender. This model aims to explain the difference in selection ratio between the fixed effects and addresses the question of where variation in selection ratio occurs with respect to these variables. Model (1) explains that the selection ratio *y* of a single board *i* for component *w* and gender *m* at time *t* will vary across these variables. Model (1) describes the variation in selection ratio between years, districts, and components.

$$\gamma_{\iota\omega m\tau} = \beta_0 + \beta_1(Selection\ Ratio) + \beta_2(Region) + \beta_3(District) + \beta_4(Year) + \beta_5(Component) + \beta_6(Male) + \varepsilon \quad (1)$$

Relying on assigned mission and geographic diversity for officer accessions, model (2) uses OLS to estimate the effects of the selection ratio on the two quality metrics I observe in the data: SAT and GPA score for all applicants selected to become officers. Grouping all variables together and examining selection ratios across all years, all components, both genders, and all geographic locations would not isolate the partial correlation between the selection ratio and the outcome because, as Table 3 shows, the selection ratios vary systematically across the observable characteristics of the boards. For example, air contracts are only compared to other air contracts, and ground contracts are only compared to other ground contracts, and male and female applicants are not compared to one another for each component. Each year multiple selection boards are held at each of the six districts and both regions. Thus, model (2) includes fixed effects for year, geographic location, component, and gender while controlling for race, age, marital status, education, year, physical fitness test (PFT), and the number of waivers. Model (2) aims to explain the impact selection ratio has on quality and addresses the question of does increased competition as measured in lower selection ratios increase officer quality. $\beta_1$is the primary coefficient of interest and reflects the partial correlation between selection ratio and the quality of selected officers.

$$\gamma_{\iota\omega m\tau} = \beta_0 + \beta_1(Selection\ Ratio) + \beta_2(Year) + \beta_3(Board\ Level) + \beta_4(Component) + \beta_4(Gender) + \beta_5(Demographic) + \varepsilon \quad (2)$$

V. RESULTS AND ANALYSIS

A. DESCRIBING THE VARIATION IN SELECTION RATIOS

Table 4 displays the results of model (1), the selection ratio of OCC and PLC boards by male and female, show selection ratios vary across year, component, and gender plays a role in how selection ratio varies. Column 1 of Table 4 displays the results of Model (1) for 71 male OCC board observations, Column 2 displays the results for 210 male PLC board observations, Column 3 displays the results for 57 female OCC board observations, and Column 4 displays the results for 132 female PLC board observations.

Model (1) shows a statistically significant male OCC board selection ratio of -0.0664 ($p<0.05$), signifying Eastern Recruiting Region (ERR) male OCC boards is 6.64 percentage points fewer than those on Western Recruiting Region (WRR) boards. Given that the overall average selection ratio for males on OCC boards is 71.7 percent across the population, this signifies a 9.3 percent increase in the selection ratio between the two regions suggesting ERR is more competitive than WRR by 9.3 percent. The female OCC selection boards are not statistically significant suggesting selection ratios of females on OCC boards are the same between the two regions.

The results of Model (1) for males on PLC boards are mixed, showing a statistically significant estimate of -0.0689 ($p<0.05$) for 9th MCD and -0.0611 ($p<0.05$) for 12th MCD when compared to 4th MCD. This signifies the selection ratio on 9th MCD and 12th MCD male PLC boards is 6.89 and 6.11 percentage points respectively less than those on 4th MCD boards. Given that the overall average selection ratio for males on PLC boards is 78.7 percent across the population, this signifies an 8.75 percent and 7.76 percent decrease in the selection ratio for 9th MCD and 12th MCD respectively when compared to 4th MCD, suggesting 9th MCD and 12th MCD are more competitive. The coefficients of 1st MCD, 6th MCD, and 8th MCD are closer to zero and not statistically significant, suggesting that selection ratios of males on PLC boards are the same between the 1st MCD, 4th MCD, 6th MCD, and 8th MCD selection boards. The female PLC selection boards are not statistically

significant, suggesting that selection ratios of females on PLC boards are the same between districts.

Table 4. The Selection Ratio of OCC and PLC Boards by Male and Female

	Male		Female	
Outcome=	OCC Board Selection Ratio	PLC Board Selection Ratio	OCC Board Selection Ratio	PLC Board Selection Ratio
	(1)	(2)	(3)	(4)
Region - East	-0.0664**		-0.0411	
	(0.0324)		(0.0322)	
District 1		-0.0396		-0.0201
		(0.0315)		(0.0385)
District 6		-0.0148		-0.0152
		(0.0319)		(0.0413)
District 8		-0.0579		-0.0458
		(0.0373)		(0.0436)
Ditrict 9		-0.0689**		-0.0375
		(0.0315)		(0.0370)
District 12		-0.0611**		-0.0503
		(0.0293)		(0.0427)
Year 2010	-0.126**	-0.0279	-0.129**	0.0140
	(0.0474)	(0.0355)	(0.0559)	(0.0392)
Year 2011	-0.441***	-0.121***	-0.423***	-0.107**
	(0.0501)	(0.0286)	(0.0560)	(0.0513)
Year 2012	-0.543***	-0.114***	-0.555***	-0.104*
	(0.0680)	(0.0337)	(0.0706)	(0.0526)
Year 2013	-0.545***	-0.105***	-0.509***	-0.118**
	(0.0473)	(0.0299)	(0.0460)	(0.0473)
Year 2014	-0.634***	-0.281***	-0.579***	-0.285***
	(0.0615)	(0.0336)	(0.0460)	(0.0453)
Year 2015	-0.248***	-0.351***	-0.304***	-0.348***
	(0.0819)	(0.0463)	(0.0610)	(0.0555)
Year 2016	-0.152***	-0.344***	-0.152***	-0.350***
	(0.0555)	(0.0334)	(0.0564)	(0.0449)
Year 2017	-0.235***	-0.287***	-0.273***	-0.244***
	(0.0606)	(0.0480)	(0.0529)	(0.0580)
Air Contract	0.0475*	0.108***	0.0503*	0.120***
	(0.0285)	(0.0142)	(0.0289)	(0.0185)
Naval Flight Officer	-0.0391	0.0360	-0.0283	0.0497
	(0.0439)	(0.0333)	(0.0552)	(0.0499)
Law Contract	-0.0185	0.0420	-0.0339	0.0544
	(0.0479)	(0.0274)	(0.0401)	(0.0357)
Average Selection rate	0.717	0.787	0.624	0.709
Observations	71	210	57	132
R-squared	0.750	0.482	0.798	0.560

Notes: *** p<0.01, ** p<0.05, * p<0.1
(1) Robust standard errors in parentheses

Additionally, the year variables show that there is a large variation in selection ratio over time for boards in both commissioning programs for males and females. With few exceptions, year coefficients are statistically significant with very low standard errors, signifying that the difference from year to year on board selection ratios impacts the variation of selection ratios. Coefficients for both male and female OCC selection boards decrease (more competitive) from 2010 through 2014 then increase (less competitive) through 2016. OCC board selection ratios are more responsive to the variation from year to year than PLC selection board trends, but both commissioning programs for both genders follow the same trend. This makes sense because the Marine Corps experienced a reduction in end strength during this time period, which reduces accession missions and increases competition. Since the OCC application to selection timeline can be as little as two to three months and commissioning slightly longer, OCC becomes the first commissioning program to experience rapid changes in mission to meet the Marine Corps' manpower needs. PLC year coefficients move in the same direction but lag behind OCC and are not as significant in magnitude. One possible explanation is that the PLC application to selection timeline can be just as short as OCC applicants. However, commissioning takes two to three years when the applicant graduates college, meaning it takes longer to realize the effect of mission adjustments to the PLC commission program.

Finally, the component variables (Air, Law, NFO) illustrate how contract type affects selection ratio across both commissioning programs for male and female selection boards. Air contract coefficients for both male and female are positive, illustrating that air contracts are less competitive than ground contracts. Additionally, OCC air contract coefficients for both male and female are smaller and less statistically significant than PLC air contract coefficients ($p<0.1$ compared to $p<0.01$), illustrating that OCC air contract selection rates are more competitive than PLC air contracts because they have a smaller impact on the selection ratio. Female air contract coefficients are marginally higher than their male counterparts, suggesting that the selection of female air contracts is slightly less competitive than their male counterparts. NFO and Law contract coefficients are not statistically significant when compared to ground contracts due in part to significantly fewer contracts available per year.

B. THE RELATIONSHIP BETWEEN SELECTION RATIOS AND QUALITY

Table 5 displays the results of Model (2), the effects of selection ratio on test score and GPA score for selected Marine officers, show quality increases and selection ratio decreases. Column 1of Table 5 displays average PLC (z) Test Score containing 4,322 observations of SAT z scores for only PLC applicants. Column 2 of Table 5 displays average PLC (z) GPA Score containing 2,746 observations of GPA scores for only PLC applicants. Column 3 of Table 5 displays average OCC (z) Test Score containing 2,962 observations of SAT z scores for only OCC applicants. Column 4 of Table 5 displays average OCC (z) GPA Score containing 2,883 observations of GPA scores for only OCC applicant's.

I estimate Model (2) for four different populations, as shown in Table 5. As discussed earlier, commissioning program applicants are only compared to other same program applicants. Additionally, the total observations used in model (2) is 12,913, which is less than the 14,911 contained in 470 boards and used to calculate the ratios in Model (1) due to some observations missing SAT and GPA scores. The coefficient of interest for all four populations analyzed in Model (2) is selection ratio impact on the outcome variables Average PLC (z) Test Score, Average PLC (z) GPA Score, Average OCC (z) Test Score, and Average OCC (z) GPA Score. All other variables are relevant and they are included as control variables because they are necessary to differentiate the impact on the outcome variables.

The results of Model (2) suggest that the variation in selection ratio impact the quality of some applicants selected to become Marine officers. Table 5 shows selection ratio changes negatively affect test score and GPA outcome variables, that is, as selection ratio decreases, the quality of selected applicants increases. Both PLC z-score test score and OCC z-GPA score show a statistically significant estimate of -0.319 ($p<0.1$) and -0.530 ($p<0.01$) respectively, signifying that PLC and OCC programs rely on different metrics to measure quality. PLC z-GPA score and OCC z-Test Score coefficients are not statistically significant supporting the idea that these two programs view quality metrics differently.

Table 5. The Effect of Selection Ratio on Test Score and GPA Score for Selected Marine Officers

	Average PLC (Z) Test Score	Average PLC (Z) GPA Score	Average OCC (Z) Test Score	Average OCC (Z) GPA Score
VARIABLES	(2)	(2)	(2)	(2)
Selection Ratio	-0.319*	-0.0928	-0.0462	-0.530***
	(0.168)	(0.286)	(0.383)	(0.190)
Year 2010	-0.0251	0.288**	0.133	-0.0468
	(0.0671)	(0.126)	(0.0887)	(0.0906)
Year 2011	-0.0803	0.0326	0.198	-0.0646
	(0.0679)	(0.109)	(0.177)	(0.111)
Year 2012	-0.125*	0.173	0.277	0.101
	(0.0685)	(0.105)	(0.216)	(0.118)
Year 2013	-0.0113	0.0269	0.264	0.144
	(0.0745)	(0.101)	(0.248)	(0.121)
Year 2014	-0.194**	0.231*	0.222	0.147
	(0.0895)	(0.138)	(0.224)	(0.133)
Year 2015	-0.157	0.370**	0.00542	0.163*
	(0.108)	(0.168)	(0.154)	(0.0883)
Year 2016	-0.0925	0.357**	-0.240***	0.190**
	(0.0985)	(0.158)	(0.0745)	(0.0778)
Year 2017	-0.146	0.370***	-0.197**	0.148*
	(0.0941)	(0.136)	(0.0954)	(0.0748)
1st MCD	0.235***	0.223***		
	(0.0385)	(0.0682)		
6th MCD	-0.0224	0.160*		
	(0.0447)	(0.0814)		
8th MCD	-8.38e-05	0.135**		
	(0.0473)	(0.0632)		
9th MCD	0.0157	0.0862		
	(0.0459)	(0.0544)		
12 MCD	0.0133	0.0518		
	(0.0524)	(0.0607)		
Eastern Recruiting Region			0.0790**	-0.0191
			(0.0392)	(0.0286)
Air	0.190***	0.146**	0.142***	0.0287
	(0.0335)	(0.0586)	(0.0485)	(0.0363)
Law	0.588***	-0.00988	0.557***	-0.232***
	(0.0677)	(0.112)	(0.104)	(0.0716)
NFO	0.279***	0.229**	0.149	-0.0402
	(0.0871)	(0.115)	(0.118)	(0.110)
Male	0.00453	-0.238***	0.309***	-0.0676**
	(0.0448)	(0.0584)	(0.0489)	(0.0319)
High School	-0.0909**	-1.825***	0.0337	-1.553**
	(0.0394)	(0.277)	(0.0919)	(0.672)
Some College	-0.0590	-0.121***	-0.0413	-0.0281
	(0.0414)	(0.0458)	(0.0694)	(0.0276)
Masters degree and above	0.0172	-0.198	0.106	0.358***
	(0.0932)	(0.149)	(0.0971)	(0.0654)
Age	-0.0426***	0.0164	-0.0459***	-0.0309***
	(0.00860)	(0.0124)	(0.0103)	(0.00644)
Black	-0.402***	-0.354***	-0.595***	-0.331***
	(0.0662)	(0.0818)	(0.0586)	(0.0510)
Hispanic	-0.313***	-0.249***	-0.297***	-0.138***
	(0.0496)	(0.0652)	(0.0737)	(0.0324)
Other Race	0.147**	-0.0455	-0.00790	0.00424
	(0.0603)	(0.0697)	(0.0612)	(0.0345)
Married	-0.0308	0.280***	-0.168**	0.147**
	(0.0878)	(0.0876)	(0.0675)	(0.0590)
PFT	0.000448	0.00375***	0.00163**	0.00434***
	(0.000758)	(0.00106)	(0.000678)	(0.000727)
Number of Waivers	-0.0924***	-0.0743**	-0.0982***	-0.106***
	(0.0240)	(0.0303)	(0.0272)	(0.0246)
Observations	4,322	2,746	2,962	2,883

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Statistically insignificant selection ratio coefficients for average PLC z-score of GPA scores imply GPA score is not as significant a measure of quality for PLC applicants. One possible explanation is that SAT scores are the most current and recent stationary performance metric relied upon to make selection decisions. PLC applicants are still attending school and have the ability to impact their GPA, and since their GPA continuously updates throughout an applicant's time in the PLC program, it is a less reliable quality metric. Likewise, the statistically insignificant selection ratio coefficient for average OCC z-score of test scores implies that test score is not as significant a measure of performance for OCC applicants. One possible explanation is that GPA is the most current stationary performance metric, relied upon to make selection decisions and SAT scores are an older metric making it less relevant to OCC applicants. Once an applicant graduates from college, their GPA becomes the most current stationary performance metric.

C. SUMMARY

This study confirms the intuitive answer to the question 'Does increased competition lead to increase quality?' based on the quality metrics available. On average, we find that PLC applicant's test scores increase with a statistically significant decrease in PLC board selection ratio at the district level. PLC selection boards do not use GPA as a quality metric because the applicant has the ability to change their GPA through changing performance. OCC applicants' GPA scores increase with a statistically significant decrease in OCC board selection ratio at the region level. OCC boards do not use SAT as a quality metric because GPA is a more relevant metric of performance.

An analysis of the statistically significant selection ratio coefficients reveals OCC selection boards are more competitive than PLC boards. This could be due to fewer OCC program slots available, resulting in lower mission numbers when compared to PLC. The OCC commissioning program has the shortest contact to commissioning timeline, making it the first program to react to policy changes in the short term while plans to adjust other commissioning programs take time. Overall, this research finds that variation in selection ratio indeed affects quality officer applicant accessions in the Marine Corps.

VI. CONCLUSION

I estimate the effect selection ratio of officer selection boards on the quality of applicants that a board chooses in an attempt to determine if the selection ratio across various commissioning programs, board levels, components, and genders is independent of the quality of applicants. Given a null hypothesis that selection ratio is independent of applicant quality, the results of this study conclude rejecting the null. This study shows that the selection ratio of a board is correlated with the quality of selected officers. Specifically, SAT and GPA scores will increase with more competitive boards as seen with lower selection ratios. Each program relies on different quality or performance metrics when making their selection decision. As the selection ratio of PLC boards decreases, quality of selected applicants with regard to SAT score increases. Additionally, As the selection ratio of OCC boards decreases, quality of selected applicants with regard to GPA score increases.

Recruiting the best applicants possible for officer selection remains a top priority for the Marine Corps. However, the data collected make it difficult to determine if the Marine Corps is in fact selecting the best applicants. SAT and GPA scores can be utilized as proxies for quality, yet several other qualities such as leadership ability, experience, and aptitude are not captured in the data but remain important factors when selecting applicants to become Marine officers. While the results cannot suggest the Marine Corps' policy of setting specific SAT or GPA score metrics might be leading to not selecting some potentially otherwise qualified applicants, the lack of specific data to examine the issue more in depth and accurately remains a concern.

There are a few lessons to be learned from conducting this analysis. First, similar to other studies I find it difficult to quantify and estimate one's leadership qualities and forecast who will become an outstanding performer based on current collected data. I recommend the Marine Corps increase their data collection processes to include leadership ability, experience and aptitude metrics of applicants and maintain records in MCRISS for further study. This means developing a quantifiable metric to capture the intangibles considered on a selection board and recording this data as part of the selection process. Just

as test scores serve as a proxy for intelligence and intellectual ability, an individual's extracurricular activities and life experiences can serve as a proxy for leadership abilities. For example, if current Marine Corps Officers identified as higher performing leaders via their fitness reports share common experiences between the ages of 14 and 22 such as participation in sports, Boy Scouts, volunteering, religious activities, world travel, or tutoring, these variables could signal the leadership qualities the Marine Corps desires in our future leaders. Other variables such as the number of hours spent playing video games, applicant birth order, or if chores were a required part of their household responsibilities growing up could all signal leadership qualities. Additionally, collecting data in areas to include how applicants paid for college such as scholarships, parental financial support, working as a resident assistant while attending school or whether the applicant worked their way through school, or determining how an applicant purchased and maintained their first car could signal leadership abilities. Increasing the data collected would reduce the need to utilize intelligence proxy variables, give future studies the ability to examine the true qualities the Marine Corps values in its officer corps, and provide sound recommendations to ensure the best applicants are being selected for service.

Creating and collecting leadership quality metrics for new applicants would be a step in the right direction. However, it would be of little use for several years without data to compare it to. The Basic School (TBS) does a fantastic job of collecting quantifiable leadership data on lieutenants while they are attending its course, but the data may not translate to the officer selection process. Collecting such data from current Marine officers to include all ranks and performance levels would establish a baseline for comparison and place value on the quality metrics associated with high performing officers. I recommend developing data points of interest and collecting these same intangible leadership data points from current officers pre-Marine Corps experiences as a basis to establish what the Marine Corps defines as quality. While academic metrics are important in evaluating an applicant's ability to perform, there may be other attributes that fit the Marine Corps' definition of quality better than academic performance.

Second, the impact of missing data in MCRISS highlights the limitations present when trying to analyze a problem or answer questions and provide insight. Based on how

selection boards are conducted, selection decisions are made based on numerous factors not captured in the data, making it difficult to analyze the true effects of these variables on the selection process and forcing researchers to utilize proxies. Additionally, selection board's reliance on paper records and MCRISS data entry occurring separate from board proceedings leads to incomplete records and missing data. I recommend the Marine Corps switch to an all-electronic board submission database process in order to ensure all data points are collected and maintained electronically for board processes and future analysis'. Considering that selecting the right applicant for the right job could result in greater retention over the length of one's career, it is important to ensure we get it right the first time.

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