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BOOTCAMP ACCESSION TRIMESTER EFFECTS ON PERFORMANCE AND RETENTION

by

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March 2021

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Each year the Marine Corps recruits more than 30,000 enlistees. In an effort to obtain high-quality enlistees, over 40 percent of enlistees ship to bootcamp during the June, July, August, and September trimester. In this thesis, I analyze the Marine Corps' accession plan and the relationship between a Marine's accession trimester and time awaiting training, as well as their likelihood to re-enlist after their first term and the probability of attrition prior to completing their first term. Additionally, this study determines if enlistees from the June, July, August, and September trimester outperform enlistees from the other trimesters. I use linear regression models and graphical trend analysis to estimate the relationships.

I find that June, July, August, and September enlistees have the highest mean days awaiting training. Furthermore, the phasing approach increases the time awaiting training days for the following trimester. The increase in time awaiting training appears to be negatively associated with the probability of re-enlistment. Graphical analysis suggests the June, July, August, and September enlistees did not perform better than their counterparts; however, the differences in performance measure are minor. The attrition model shows a modest negative correlation between time awaiting training and likelihood of attrition. Considering high-quality enlistees accumulate the most days, the estimated effect is logical.

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BOOTCAMP ACCESSION TRIMESTER EFFECTS ON PERFORMANCE AND RETENTION

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LIST OF ACRONYMS AND ABBREVIATIONS

AFQT	Armed Forces Qualification Test
AFADBD	Armed Forces Active Duty Base Date
CDR	Command Recruiting Program
CNA	Center for Naval Analyses
DAG	directed acyclic graph
DEP	Delayed Entry Program
DOD	Department of Defense
EAS	End of Active Service
EELT	Enlisted Entry-Level Training
ELCS	Entry-Level Course Scheduler
FLC	Formal Learning Center
FMAM	February, March, April, May
JJAS	June, July, August, September
LPM	Linear Probability Model
M&RA	Manpower and Reserve Affairs
MAT	Marines awaiting training
MCRC	Marine Corps Recruiting Command
MCRISS	Marine Corps Recruiting Information Support System
MCT	Marine Combat Training
MCTIMS	Marine Corps Training Information System
MCTFS	Marine Corps Total Force System
MOS	military occupational specialty
NPS	non-prior service
OLS	Ordinary Least Squares
ONDJ	October, November, December, January

PRASP	Permissive Recruiter Assistant Program
PRO/CON	Proficiency and Conduct
SOI	School of Infantry
TAT	time awaiting training
TFDW	Total Force Data Warehouse
UUID	unique user identifier

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I. INTRODUCTION

The Marine Corps has distinguished itself throughout history every time America was thrust into war. The individual Marine is the center of gravity for such accomplishments. As the Commandant's Planning Guidance (2019) states:

> Everything starts and ends with the individual Marine. The principal challenge facing the Marine Corps today lies in continuing to fulfill its charter as the naval expeditionary force-in-readiness, while simultaneously modernizing the force in accordance with the NDS, doing both with a leaner force structure, potentially fewer Marines, and a possible reduction in total resources. Marines are the centerpiece of the Corps—our principal emphasis must focus on recruiting; educating and training; instilling our core values and sense of accountability; equipping; and treating them with dignity, care, and concern.

As with other large organizations, both civilian and federal, the Marine Corps' success relies heavily upon the recruitment and retention of high-quality personnel. General David Berger, the 38th Commandant of the Marine Corps, asserted in his planning guidance, "the Service does not have the tools needed to recruit the skills it wants, retain specific talents, advance Marines more quickly based on need, and separate Marines who cannot perform" (p. 7). A significant number of studies focus on the recruitment and retention of high-quality personnel. As such, the Marine Corps spends a vast amount on recruiting, transforming civilians into Marines, and on retaining top performers. Equally as important as recruiting and retaining key personnel is developing a process that does not hinder the desired effects. However, very little has been done to determine if transitioning civilians into Marines affects personnel retention. Although there are two tracks for entering the Marine Corps, officer and enlisted, the most impactful, based on sheer numbers, is the Enlisted Entry-Level Training (EELT). Therefore, the remaining focus of my thesis is on the EELT pipeline.

The EELT pipeline begins with the accession plan and ends with an enlistee attaining a military occupational specialty (MOS). To understand the procedure, a brief description of the process is necessary. The accession provides inputs, via enlistees, into the EELT pipeline. Within this pipeline, multiple training nodes exist to provide adequate

and proper instruction to an enlistee. Once an enlistee cycles through the EELT pipeline, ideally, the cycle consists of one iteration at each node, that enlistee becomes a contributing Marine in the operational forces upon attaining a valid MOS. However, this description overtly simplifies the complex process of transforming a civilian into a Marine. If the overall goal is to recruit and retain high-quality personnel, given the impact and complexity of the EELT pipeline, a firm understanding of the process's effects, both intentional and unintentional, warrants examination.

A. PURPOSE

My study's purpose is to evaluate if the enlisted accession plan process increases time awaiting training (TAT), for enlistees in the EELT pipeline, and to determine if this increase influences retention. For the purpose of my research, TAT is defined by stagnated days an enlistee accumulates in between training environments related to capacity restrictions and training inefficiencies at each node. As such, a qualifying observation must have graduated recruit training. Time accumulated prior to accession falls under the Delayed Entry Program (DEP) and is outside this research's focus. My research does not recommend structural changes in the EELT pipeline; instead, the purpose is to provide analytical information to the decision-makers to implement changes that maximize efficiency and effectiveness in the EELT pipeline.

Observing individual enlistees from various accession periods within multiple years provides information on the accumulation of TAT. With this information, I use the Linear Probability Model (LPM) regression technique to analyze the effects on retention. The primary research question seeks to determine to what degree an enlistee's accession period affect the accrual of TAT and whether or not this accrual of TAT impact retention. The Marine Corps' ultimate goal is to recruit and retain high-quality personnel. Additionally, my study investigates these follow-on questions.

- To what extent do enlistees that attend the most populated accession period perform at a greater level relative to other accession periods?
- In what manner does an increase in TAT affect attrition?

Due to the complex nature of the EELT pipeline and the mandatory transition between multiple nodes, the JJAS accession period causes a compounding effect that increases TAT for JJAS and ONDJ enlistees. The increase in TAT reduces the probability of retaining a high-quality enlistee from these accession periods. Therefore, the EELT structure has an adverse effect on the ultimate goal of retaining high-quality personnel.

B. IMPORTANCE OF RESEARCH

Recruitment and retention of high-quality personnel are vital to the Marine Corps' continued success and growth. Forming a structural process that is efficient and effective at transforming civilians into Marines is the standard to attain. The current Marine Corps process may not meet these requirements. The Commandant recognizes the importance of evaluating the current process. In the planning guidance, the Commandant declares, "our manpower system was designed in the industrial era to produce mass, not quality" (Berger, 2019, p. 7). Determining if our manpower system does not contribute to quality recruitment and retention is crucial.

The need to evaluate the process aside, the Marine Corps needs to cope with a reduction in personnel. The scrutiny of Department of Defense (DOD) budget requests places fiscal and personnel constraints on the Marine Corps. The fiscal year 2021 budget request reveals a reduction of active component personnel by 2,100 Marines (Secretary of the Navy, 2020). An inadequate process coupled with the continued reduction in force exacerbates the recruitment and retention of high-quality personnel. Through the Commandant's guidance, the Marine Corps must ensure the EELT process does not work against the overarching mission, and an analysis of the process must be done.

C. SUMMARY

In this chapter, I introduce that recruitment and retention have the same mission. The mission is to increase the number of high-quality personnel in the Marine Corps. Equally important is determining if the structural process, the EELT pipeline, assists or hinders recruitment and retention goals. My thesis's focus is to provide an analysis of the EELT pipeline and the effects it poses on retention. As budget and personnel continue to decline, the importance of an effective and efficient system becomes paramount.

The structure of the subsequent chapters rationally supports my thesis. Chapter II describes the circumstances that create the EELT framework. Chapter III discloses the academic literatures that relate to my thesis. Chapters IV and V present the data and method associated with my thesis. The final chapters deliver the results, analysis, and conclusion.

II. BACKGROUND

This chapter provides background on the Marine Corps EELT pipeline. I introduce the determinants of accession numbers and standards, accession framework, EELT structure, and identify areas of concern and a brief description of the impact of an inefficient EELT process on the Marine Corps. I conclude with a summarization of the chapter.

A. QUANTITY AND QUALITY

Congressional and DOD authority dictate the quantity and quality of personnel in the Marine Corps. Congressional authority mandates fiscal year end-strength (Congressional Research Service [CSR], 2020). The fiscal year's accession goal depends on the difference of congressional mandate mission and the projected amount retained by the end of the fiscal year. The projected number is the difference between retained, retired, and separated personnel. To maintain a military with the highest standard of professionalism and continued future growth, the DOD mandates two specific quality requirements regarding Non-Prior Service (NPS) enlistees (CSR, 2020). First, 90 percent of all enlistees must have obtained a high school diploma. Enlistees with a high school diploma are Tier I enlistees (United States Marine Corps [USMC], 2011). Second, at least 60 percent of enlistees must have an Armed Forces Qualification Test (AFQT) score above average. An enlistee that meets both quality requirements is a high-quality candidate (Quester, 2010). The following tables are derived from the Defense Primer: Active Duty Enlisted Recruiting (2020) document. Table 1 depicts quantity standards, and Table 2 represents quality standards for the identified fiscal years. These stringent requirements contribute to the structure of the recruitment plan. Even with congressional end-strength fluctuations and DOD mandates on an enlistee's quality, Table 1 and 2 reveals the current accession plan and EELT process result in mission accomplishment on both fronts.

Table 1. Marine Corps Active Component NPS Accession

Fiscal Year	Goal	Achieved	Percent of Goal
2017	31,994	32,059	100.2
2018	31,556	31,556	100.0
2019	31,767	31,777	100.0

Table 2. Marine Corps Active Component NPS Quality Metrics

Standard	Benchmark	FY 2017	FY 2018	FY 2019
High School Diploma	90%	99.8%	99.8%	99.5%
Above Average AFQT	60%	71.6%	69.9%	69.4%

The Marine Corps' approach to the accession of quality and quantity enlistees is economic opportunity and efficiency. Specifically, the economic advantage is the desire to recruit high-quality applicants to avoid the opportunity cost of losing an applicant to the alternatives, i.e., further schooling or other job opportunities (Quester, p. 26). New Oxford American Dictionary (2015) defines opportunity cost as "the loss of potential gain from other alternatives when one particular alternative is chosen over the others." Under these conditions, recruiting high-quality individuals upon availability is beneficial.

B. ACCESSION PLAN

The Marine Corps historically averages over 30,000 active component enlisted accessions per year (Center for Naval Analyses [CNA], 2018). Marine Corps Recruiting Command (MCRC) is primarily responsible for obtaining the number of enlistees to meet this accession goal determined by Manpower and Reserve Affairs (M&RA). With each fiscal year requirement, MCRC distributes the accession goal throughout the year into four-

month increments, appropriately named trimesters. These trimesters break down as follows: (1) October, November, December, and January (ONDJ); (2) February, March, April, and May (FMAM); and (3) June, July, August, and September (JJAS). The 30,000 enlistees are distributed unevenly through the accession trimesters.

To have an economic advantage, MCRC's accession distribution aligns with high school graduation. Sourced from Quester (2010), Figures 1 and 2 illustrate the trimester distribution by gender. Derived from the figures, JJAS accounts for approximately 40 percent of all accessions. Of note, each fiscal year ends on September 30. Once mission end-strength is attained, the remaining enlistee contracts attend the follow-on accession periods beginning in October not to exceed congressional budget constraints. It is no surprise that the second most populated trimester is ONDJ, followed by the FMAM trimester. Although the female accession distribution is not as extreme as the male counterparts, the ordering remains accurate.

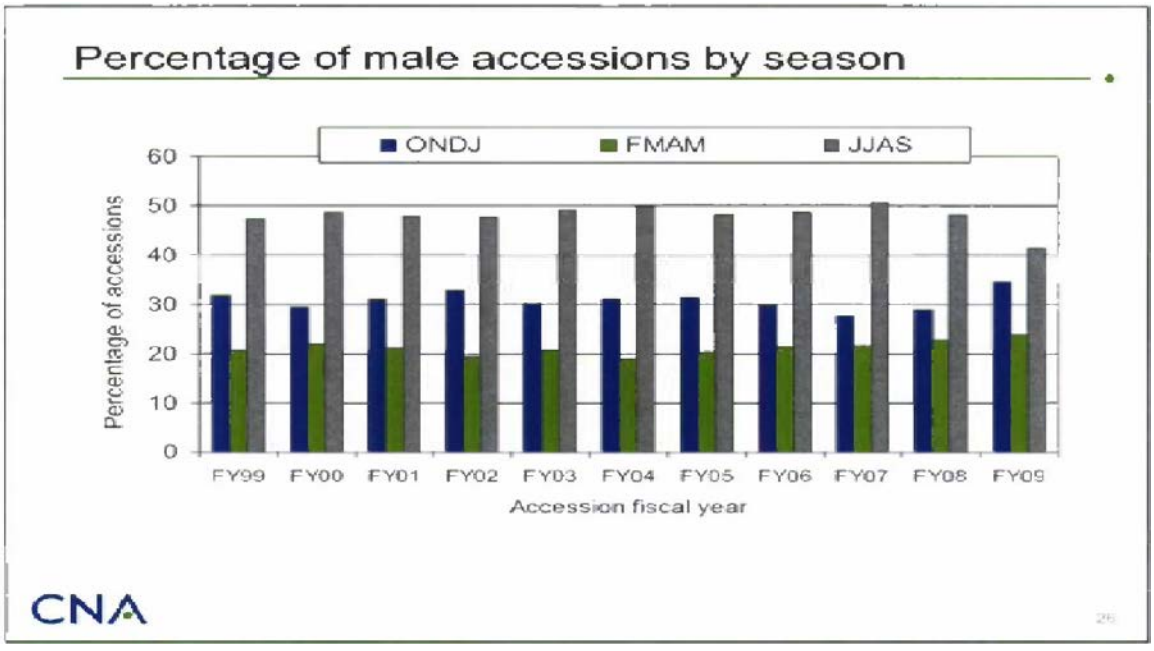

Figure 1. Male Historical Accession. Source: Quester (2010).

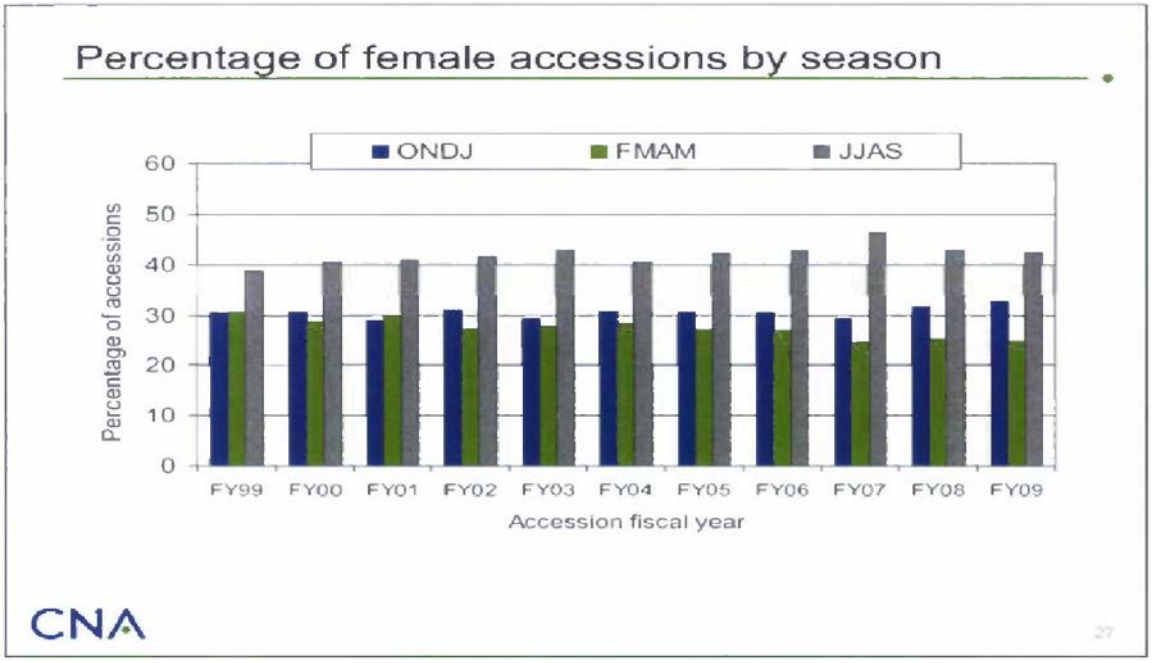

Figure 2. Female Historical Accession. Source: Quester (2010).

As might be expected, the accession framework mirrors a fiscal year construct. The year is divided into manageable trimesters that allow adaptability to unexpected personnel changes and flexibility in the fiscal environment. The large difference in distribution, particularly JJAS distribution, relates to the rigorous enlistee standards placed on the Marine Corps and the economic advantage of recruiting enlistees immediately after high school graduation. Aligning recruitment efforts with the immediate availability of eligible high-quality candidates is the primary reason for increased accession numbers during the summer months.

C. ENLISTED ENTRY-LEVEL TRAINING

The EELT process consists of multiple nodes of training requirements. This section of the chapter describes each node an enlistee must process through. Figure 3 is the illustrative representation of the EELT process.

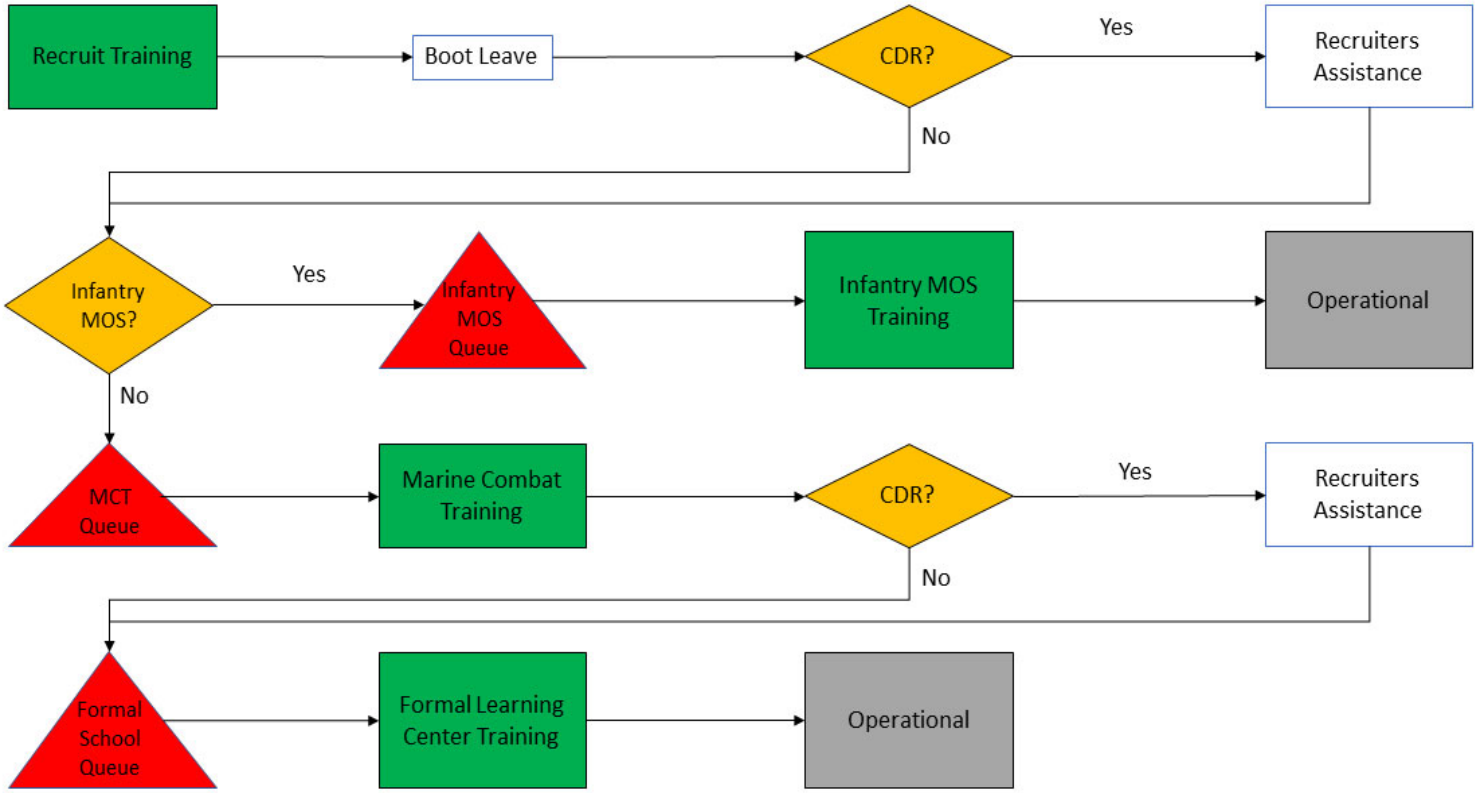

Figure 3. EELT Pipeline Flow Diagram

1. Recruit Training

There are two geographical locations for recruit training: Parris Island, South Carolina, and San Diego, California. All enlistees, regardless of potential MOS, must attend recruit training. At the time of this study, integration of female enlistees into male recruit training has started. For this study, the integration does not change the overall process of EELT. The objective of recruit training is to "produce basically trained Marines who have embraced our core values and legacy" (USMC, n.d.-b). Recruit training is a 13-week evolution that provides instruction on necessary rifleman skills, Marine Corps history, and intense physical training. Upon graduation, enlistees earn the title of Marine.

2. Boot Leave

Boot leave is considered any leave days granted to a Marine upon graduation from recruit training (USMC, 2020). Marines typically take 10 days of leave. There are options to extend days away from training under the Command Recruiter Duty.

3. Command Recruiting Program

The Marine Corps has the means to employ these newly minted Marines in a manner beneficial for recruiting. Command Recruiting Program (CDR) allows for the assignment of Marines to permissive temporary PTAD, at no cost to the government, for a period of up to 30 days to a RS or recruiting substation (RSS) nearest their hometown to assist in the recruiting effort (USMC, 2020). Typical participation in CDR occurs after graduation from recruit training or before instruction at a Formal Learning Center (FLC). Although the term Permissive Recruiter Assistant Program (PRASP) is commonly associated with such duty, MCO 1130.62C states PRASP is officially authorized for Marines that graduate recruit training and are on boot leave but prior to reporting to the School of Infantry (USMC, p. 1-1). For this study, the terms are interchangeable. The programs are a tool to employ Marines with schedules that do not align with FLC or School of Infantry.

4. School of Infantry

All Marines assigned the 03XX MOS at recruit training are sent to SOI for formal instruction. There are two geographical locations for such instruction: Camp Pendleton, California, and Camp Lejeune, North Carolina. As with recruit training, formal instruction is mirrored at each location and does not affect my thesis context. Although there are multiple specialties within the 03XX MOS that require secondary schooling, my thesis is solely concerned with the first official course at an FLC. Upon completing the SOI instruction, Marines are awarded the respective 03XX MOS and become operational contributors upon arrival at their first duty station.

5. Marine Combat Training

Marines that are not in the 03XX MOS, non-infantry track, attend Marine Combat Training (MCT). The MCTs are under the SOI hierarchy. Therefore, the MCTs are geographically co-located with the SOIs. The MCT instruction provides Marines with a foundational understanding of the Marine Rifleman. The training evolution takes 29 days (USMC, n.d.-a). After graduating from the course, Marines are sent to their respective FLC to start instruction on their official MOS.

6. Formal Learning Center

Marines in the non-infantry track can be shipped to a vast range of over 100 different school locations. These schools produce over 160 enlisted primary MOSs. Further confounding the matter, parts of the network are run by other services. Alfonso, Younger, and Oh (2010) discovered that “within that network of over 100 school locations, 37 are operated by the Navy, 26 by the Army, 21 by the Marine Corps, and 18 by the Air Force” (p. 33). Marines may have to attend subsequent courses to obtain a primary MOS, but that is outside the scope of my thesis. Completing the course at an FLC generates Marines with a primary MOS. These Marines become operational contributors once they arrive at their first duty station.

7. Time Awaiting Training

There are three specific areas where a Marine can accumulate TAT and not be an active contributor to mission success. The first area is 03XX Marines in the infantry MOS queue waiting to be absorbed into an official SOI training course. Second are the non-infantry Marines in the MCT queue. Lastly, are the graduates of MCT waiting in the FLC queue to start the official course. Some FLC's may have brief administrative wait periods. My thesis defines TAT as when a Marine arrives at an MCT or FLC but cannot officially start a course due to seating or scheduling constraints.

D. ACCESSION PLAN AND EELT IMPACT

The accession load plan is a critical contributor to the Marine Corps operational environment. As of the fiscal year 2020, accessions accounted for over 16 percent of the 186,200 total end-strength numbers in the active component (Cancian, 2020). Immediately upon accession, these enlistees become a part of the patients, prisoners, trainees, and transients (P2T2) designator. As the P2T2 naming convention suggests, these 30,000 trainees remain in this status until they fill an assignable billet. While in the P2T2 status, the enlistees count against end-strength but do not contribute to the operational environment.

Inefficiencies in the process accumulate shortfalls of valued contract enlistment time. For example, an enlistee signs a four-year contract, and from accession, it takes one year to the fleet. The Marine Corps gains three years of value for the cost of one year of unavailability due to training. Any reduction in TAT by increasing efficiencies is going to increase value while reducing training costs. Opportunities exist to increase the return on investment the enlistees provide.

In addition to fiscal and personnel quantity impacts, the accession plan incurs a cost that the staff of the EELT pipeline absorbs. First, additional staff support is required to maintain and train the influx of enlistees. Second, the influx puts additional stress on the instructors and support staff to provide the same quality of training regardless of size. Lastly, the accession plan increases enlistee attrition from the inability to train over capacity numbers properly.

E. SUMMARY

This chapter introduces the congressional and DOD regulations that set the standards for enlistees' quantity and quality. The responsible agency, M&RA, and executing agency, MCRC, work in conjunction to obtain the number of enlistees to meet end-strength. They accomplish the mission by creating trimesters to manage enlistee flow. Once an enlistee accessions, the enlistee is entered into a complex network known as the EELT pipeline. Given the complexity, inefficiencies occur by way of TAT. The accession plan and EELT pipeline's impact goes beyond input and MOS producing numbers. The plan reduces the available operational force numbers, increases the fiscal cost of producing Marines, and places additional stressors on the EELT pipeline staff. Understanding the effects of the current accession plan can allow decision-makers to make informative decisions to increase the operational force's lethality.

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III. LITERATURE REVIEW

Copious amounts of research have been conducted to assist the Marine Corps in determining performance and attrition predictors. Equally abundant has been the research completed on EELT. The specific focus of EELT research is to reduce TAT. In this chapter, I review the related academic literature to describe the body of research conducted and distinguish those studies from the research conducted in this thesis.

A. PERFORMANCE AND ATTRITION

This section concentrates on research accomplished concerning performance and attrition. The two studies in this section take different approaches. Quester aims to find predictors of success, while Larger validates the measure of performance the Marine Corps currently utilizes to predict future performance. The details of each study and the relation to this thesis proceed in the follow-on paragraphs.

1. Quester (2010)

The Center for Naval Analyses (CNA) study done by Quester most closely represents this thesis. Quester uses a logistic regression model to analyze the marginal effect of accession characteristic predictors on Bootcamp attrition. The study reaffirms the status quo, in which enlistees with higher AFQT scores, better education, meet height and weight standards, and enlist without waivers have lower attrition rates. Other interesting predictors the study associated with lower Bootcamp attrition are DEP participation for three or more months, longer initial contracts, and JJAS accessions. These predictors are not typical and, therefore, require further discussion is required.

DEP is a component of the Marine Corps Reserve (USMC, 2011). The program is eligible for NPS individuals intending to enlist into the active component. DEP is primarily associated with preparing individuals for the physical and mental demands associated with Bootcamp. The program also provides foundational physical instruction and fundamental Marine Corps knowledge. It is of no surprise that DEP participation and preparation yields a greater probability of Bootcamp success.

As with DEP, a further examination into longer contracts as a predictor of success needs to be done. Quester believes that enlistees who sign longer contracts have a more robust "taste" for service to the country. I expect enlistees with longer contracts are entering into a more technical MOS, which is translatable in the civilian sector. The increased desire to serve and achieve a translatable MOS provides the motivation enlistees use to succeed at Bootcamp.

Quester also determines enlistees that accession in the JJAS trimester have lower attrition rates. The results of the study state across all levels of enlistees, the attrition rate is lower in the JJAS period. The reasoning provided is the fostered environment in JJAS increases success. The environment combined with a more significant percentage of high-quality enlistees raises the level of expectation and performance.

Quester's CNA research goes a step further and provides analysis on the entire first term of enlistees. The research aims to answer the question higher Bootcamp attrition reduces overall first-term attrition. The study exposes that attrition Bootcamp attrition, on the margin, cannot reduce or recognize those that would later attrite in the first term for males but maybe a valid predictor for females.

Equally as impressive is the analysis that enlistees who accession in JJAS have a lower probability of attrition in the first term. The logistic regression states males from the JJAS have a 1.6 percentage point reduction from attrition in the first term. The results for females are they have a 2.3 percentage point reduction from attrition in the first term. My thesis builds upon this study and uses a different method for analysis.

2. Larger (2017)

Larger's Naval Postgraduate School thesis, appropriately titled *Effectiveness of the Marine Corps' Junior Enlisted Performance Evaluation System: An Evaluation of Proficiency and Conduct Marks*, uses multivariate regression and factor analysis to assess if the current Marine Corps' system is an adequate measure of job performance and future ability. Explicitly, Larger examines the reliability, validity, accuracy, and practicality of proficiency and conduct (PRO/CON) marks.

In terms of reliability, Larger determines PRO/CON marks appear to be stable, although there are some inconsistencies with individual raters. The study confirms that PRO/CON marks are a valid measure of future performance. Furthermore, according to this study, PRO/CON marks are the strongest predictors of future performance. PRO/CON marks are accurate due to formal guidance provided by Marine Corps Order P1070.12; however, marks are inflated within the assigned ranges. Lastly, PRO/CON marks are practical because raters can observe the marks' traits even though they may be difficult with raters interpreting previous marks. Larger deems, although there is room for improvement, proficiency and conduct marks achieve their intended purpose.

Larger's analysis of the PRO/CON marks affirms they are the best predictors of future performance. My thesis applies this analysis of performance measures to enlistees in each trimester to determine if, in fact, those enlistees that accession in JJAS outperforms the other trimesters. The analysis additionally asserts if high-quality enlistees perform relatively better than those that are not.

B. ENLISTED ENTRY-LEVEL TRAINING

This section concentrates on research completed on EELT. I review four theses that focus on reducing TAT through operation management techniques. Two of the studies produce linear models to generate a scheduler built by the constraints of FLCs. The other two studies analyze the FLCs to determine utilization rates to make recommendations for improvement. Each of the research determines a link from the accession plan to inefficiencies in the EELT pipeline. The details of each study and the relation to this thesis proceed in the follow-on paragraphs.

1. Whaley (2001)

Whaley analyzes the development phase of the EELT pipeline and integrates his study with FLC data for non-infantry enlistees. Ultimately, Whaley produces two linear programming models as a tool for M&RA planners and schoolhouse coordinators to integrate into the planning system to reduce TAT for non-infantry enlistees. The long-term model is for the planning phase two years out from execution. This model aims to reduce

the TAT between MCT and FLC. The model builds an initial demand matrix of enlistees by week, gender, and enlistment program. Whaley's short-term model updates the program plan one year before execution. The model updates FLC data, availability of training seats and builds a final demand matrix of enlistees by week, gender, and enlistment program. Both models place heavy penalties on FLC seating constraints. The matrix becomes a scheduler for MCRC and decides accession flow according to available FLC seats and MOS demand.

From a qualitative perspective, Whaley recommends three changes to reduce TAT. First, at the guidance of Training and Education Command via M&RA to MCRC, there should be a link to the accession plan from the FLC school seat capacity and schedule. Second, MCRC would generate a weekly MOS training request, creating increased flexibility in real-time, to allow for variability at the FLCs. Third, Whaley suggests giving more control to the FLC while in the accession plan's execution phase. Whaley's qualitative approach reflects the quantitative analysis, wherein the penalties for accessioning an enlistee while there are no FLC seats available violates the model.

Whaley's operation management approach finds inefficiencies in the production process and limits enlistee input to match the constraints. The model concentrates on decreasing fiscal cost and lost operational time by reducing TAT through accession smoothing based on FLC constraints. My thesis differs by not trying to smooth the accession plan but determine if the effects reach beyond fiscal and operational costs.

2. Detar (2004)

Much like Whaley's study, Detar's research generates a linear optimization model, Entry-Level Course Scheduler (ELCS), to reduce TAT. Detar's study differs by emphasizing fewer penalties caused by FLC constraints and working within the accession plan to minimize TAT and not eliminate TAT completely. Detar's model specifically concentrates on TAT generated by enlistees transitioning from MCT to an FLC. The model produces a consistent number of Marines awaiting training (MAT) across the fiscal year by accepting TAT. By having a consistent value, Detar assumes planners and coordinators can find useful employment of those transitioning Marines, albeit not in the operational

forces, but an administrative support role such as community relations or base beautification.

Detar identifies areas of improving TAT while working with the economics of the accession plan. The model created by Detar's study is a better fit for realistic operations because the non-absolutes provide flexibility. Detar's model reduces TAT by over 40 percent and intends to generate a more coordinated effort between planners and implementors of the accession plan. Detar offers a consistent number of MAT throughout the fiscal year, contributing to a supporting role. Even with the use of ELCS, my thesis determines if the accession plan, through TAT and regardless of reduction, has unintended effects on retention and attrition.

3. Alfonso, Younger, and Oh (2010)

Alfonso et al. conduct synchronize approach analysis of the EELT process from the planning phase to MOS attainment by using supply chain and operation management techniques. Both techniques seek to improve efficiency. Supply chain management, in their study, seeks to apply the supply chain process from beginning to end of the operations cycle. Operations management in their work seeks to analyze nodes within the process. Alfonso et al. suggest five improvements to the EELT pipeline process. First, they suggest smoothing out the accession plan by offering bonuses and more extended DEP participation. Second, they generate a "pull" system giving more control to the nodes with greater capacity. Third, they restructure the recruit training depots, MCTs, and FLCs during the ONDJ trimester. Explicitly, reducing recruit training capacity at the recruit depots while increasing capacity and courses at the MCTs and FLCs to alleviate cost with overutilization and inventory buildup. Fourth, they suggest establishing a supply chain owner to provide oversight and coordination among the owning agencies in the EELT process, focusing on reducing inventory and cost. Lastly, they recommend modifying Marine Corps Training Information Management System (MCTIMS) to realize the system's full potential. MCTIMS can be the central tool to provide real-time information and coordination to decision-makers and implementors of the EELT pipeline.

The study of Alfonso et al. looks to implement supply chain and operations management into the EELT pipeline. As with another thesis in the section, the study's sole focus is to reduce TAT's fiscal and operational cost. The recommendation to smooth out the accession plan by sending more enlistees through the ONDJ trimester further reiterates the need for understanding the effects of bootcamp accession; my thesis makes an effort to provide this analysis.

4. Ezell III (2011)

A direct continuation of Alfonso et al. study, Ezell uses similar operation management tools and techniques to examine four FLCs within the EELT pipeline. Ezell examines the Personnel Administration School, Financial Management School, Motor Transport Instructor Company, and Marine Artillery Detachment, Fort Sill, for inefficiencies the accession plan puts on those four FLCs. Ezell recommends generating a pre-screening at the FLCs to maximize training opportunities and screen enlistees for the potential to rearrange seating priority. The study also recommends further utilization rate analysis be conducted as the variation of rates were relatively different amongst each other. As with Alfonso et al., Ezell recommends the development of MCTIMS to realize a unified system's potential. The study takes it a step further and recommends integration with other services, as some FLCs fall under brother service authority. Ezell carefully states the accession plan is the subject of much discussion but falls outside the research scope, yet there are other areas in the EELT pipeline that can reduce TAT. My thesis intends to provide an analysis of the effects of the accession plan.

C. SUMMARY

This chapter reviewed six studies involving performance predictors, performance measures, and EELT pipeline analysis. Two of the studies analyze performance from different aspects. Quester's analysis provides predictors of success in bootcamp. The Quester study reaffirms the characteristics associated with quality reduce bootcamp attrition. Distinctively, Quester's report concludes DEP participation, longer initial contracts, and JJAS accession also reduce attrition at bootcamp. In comparison, Larger provides analysis on the performance measuring system the Marine Corps employs. His

research determines the current performance measuring system for junior enlisted Marines can be improved but is a valid mechanism at predicting future performance.

The other four study the EELT pipeline. In Whaley's and Detar's examinations, they both create linear optimization programs that generate streamline scheduling. Their studies emphasize restraining the accession plan to the capacity constraints at the FLCs. The results from their studies reduce TAT and increase efficiency. Alfonso et al. integrate supply chain and operations management into the EELT pipeline to reduce TAT. The results of their study reduce the accession plan inputs to decrease the overhead cost associated with TAT. As for the last study, Ezell focuses on four FLCs to recommend improvements in each FLC to optimize production. His results are that TAT can be reduced with changes procedural changes at the FLC. All four attempt to reduce TAT generated by the accession plan. The next chapter presents the data used by this thesis.

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IV. DATA

Data for this research was drawn from the Total Force Data Warehouse (TFDW). The data was pooled from the Marine Corps Recruiting Information Support System (MCRISS), MCTIMS, and Marine Corps Total Force System (MCTFS). Manpower information provided paneled and cross-sectional data for Marine Corps' enlistees grouped by accession period and fiscal year. The succeeding paragraphs describe the merging process, independent variables, issues and remedies, and provide statistical summary for the data.

A. MERGING OF DATA

The original data was in panel data format from four data sets that consisted of 2,133,349 observations and 58 variables. The data spans from fiscal year 2012 to 2014. The data was converted into longitudinal observations and merged using EDIPI. After conversion, duplicate observations were removed. Each observation contained two unique identifiers, EDIPI and a unique user identifier (UUID). After validating each EDIPI had a randomly generated UUID, the EDIPI variable was dropped to remove personal identifiable information from the data set. The match rate across all four data sets is 100 percent of the observations.

B. DATA SOURCES

1. MCRISS

MCRISS data consists of information on an enlistee prior to accession. The data includes information on demographics, aptitude, and physical measures. Table 3 lists the independent variables provided by MCRISS.

Table 3. Marine Corps Recruiting Information Support System Variables

Variable Name	Description
EDIPI	Electronic Data Interchange Personal Identifier matched with TFDW data
Gender	Indicator for male or female, as reported by enlistee
Race	As reported by enlistee
Ethnicity	As reported by enlistee
AFQT Score	Armed Forces Qualification Test result
Education	Highest level of education completed
DOB	Date of birth
IST Crunches	2-minute crunch repetition score
IST Hang	Flex arm hang score (female measure)
IST Run Score	1.5 mile run time
IST Pull-up Score	Pull-up repetition score (male measure)

2. MCTIMS

MCTIMS data provides date and FLC identifier data for achieved milestones in the EELT pipeline. Table 4 lists the useable milestone dates and identifiers provided by MCTIMS.

Table 4. Marine Corps Training Information Management System Variables

Variable Name	Description
Bootcamp Start Date	Date an enlistee started bootcamp
Bootcamp Grad Date	Date an enlistee graduated from bootcamp
MCT Report Date	Date enlistee arrived at MCT
MCT Convene Date	Official training start date at MCT
MCT Completion Date	Date enlistee graduated from MCT
School Code	Three digit formal FLC identifier
School	FLC name
Report Date	Date the enlistee arrived at FLC
Convene Date	Official class start date at FLC
Completion Date	Date enlistee graduated from FLC

3. MCTFS

MCTFS continuously records, processes, and maintains personnel and pay data for all active, reserve, and retired personnel. MCTFS provides dates and snapshot data from critical times in an enlistee's term. Table 5 lists the independent variables provided by MCTFS.

Table 5. Marine Corps Total Force System Variables

Variable Name	Description
AFADBD	Armed Forces Active Duty Base Date - the date an enlistee officially started active duty
PMOS	Primary MOS an enlistee was assigned
Grade	Rank at the time of snapshot
Proficiency Average Grade	Average proficiency score of a specific rank for an enlistee throughout their term
Conduct Average Grade	Average conduct score of a specific rank for an enlistee throughout their term
Separation Code	Three digit separation identifier
Separation Narrative	Description of separation code
Separation Date	Date an enlistee separated from the Marine Corps
EAS	End of Active Service date an enlistee leaves active duty
Date of Enlistment	Date an enlistee enlists in the Marine Corps

C. GENERATED VARIABLES

Generated variables are extrapolated from the data to isolate the necessary information for IV regression. Table 6 list variables that were created for the purpose of my study.

Table 6. Generated Variables

Variable Name	Variable Description
Age	Age of enlinstee at bootcamp start date
High-Quality	Binary variable identifying an enlistee that is tier I and has a AFQT score above 50
JJAS	Binary identifier for an enlistee that accession in the months of June, July, August, and September
ONDJ	Binary identifier for an enlistee that accession in the months of October, November, December, and January
FMAM	Binary identifier for an enlistee that accession in the months of February, March, April, and May
FY12	Binary identifier for fiscal year period of 2012
FY13	Binary identifier for fiscal year period of 2013
FY14	Binary identifier for fiscal year period of 2014
Combat MOS	Binary identifier for enlistees with a 03XX, 08XX, or 18XX MOS
Aviation MOS	Binary identifier for enlistees with a MOS between 6000 to 7315
General MOS	Binary identifier for enlistees with a MOS between 8000 to 9900
Ground Support MOS	Binary identifier for enlistees with all other MOS not previously listed
High School Grad	Binary for traditional high school as the highest completed education level
College	Binary for some college experience as the highest level completed

Variable Name	Variable Description
Other Educ	Binary for education that does not fit in the other education variables
Bootcamp Attrite	Binary identifier for enlistees that attrite at bootcamp
Attrite	Binary identifier for an enlistee that separates after bootcamp but before EAS
FLC Wait Time	Measurement, in days, of time between MCT graduation and FLC convene date an enlistee waits to start FLC training
Retain	Binary identifier for an enlistee that re-enlisted or extended service past their first-term

D. ISSUES AND REMEDIES

1. Panel Data

The original data set was in panel format that contained multiple snapshot data for each observation's average PRO/CON in grade marks. As the average PRO/CON in grade marks is an aggregate mean for each mark received in grade, the data was converted into cross-sectional data that kept the observation's last mark received for that grade. By transitioning to cross-sectional data, I was able to generate independent average PRO/CON in grade marks for each rank the observation attained.

2. Retain

The data set contained separation codes, narratives, and dates. If an observation did not contain values for the aforementioned variables, the assumption is the observation, as of the date of data collection, is still serving on active duty. For the purpose of my study, the retain variable indicates service that exceeds the first term. Due to the data timeframe, there is a possibility that an observation continued to serve one additional tour past the first term and obtained a separation code. For example, if an observation from fiscal year 2012

served for an additional three years after the first term and then left the service, the observation would have a separation code, date, and narrative. Yet, the observation would be considered retained by my study's standard. To capture this information, an observation receives a retain value of one if their separation date exceeds their EAS date.

3. TAT

Due to limitations of the data set and time constraints, TAT is limited to FLC Wait Time variable response data. TAT days from bootcamp graduation to MCT/SOI start date could not be verified without official leave dates for each enlistee. For the remainder of my study, FLC Wait Time and TAT are interchangeable.

Observations with greater than 120 days of TAT are not in the regression analysis. These observations were likely caused by administrative errors or circumstances not typical of the progression of an enlistee. To properly conduct structural analysis of the accession period's effect on TAT, retention, and attrition, these observations are not considered in the regression models.

4. Sample Restrictions and Missing Data

If an observation had missing data points or unrealistic values, an imputation technique was applied. Imputation consists of aggregating the mean of the variable and inputting the mean as the missing value. Dummy variables were then created to identify the observations with missing values. Table 7 lists the imputed variables and their description.

Table 7. Imputed Variables

Variable Name	Description
X IST Crunch	Binary for missing/overvalued crunch score
X IST Hang	Binary for missing/overvalued flex arm hang score (females only)
X IST Run	Binary for missing/overvalued run score
X IST Pull-up	Binary for missing/overvalued pull-up score (males only)

5. Omitted Observations

Observations were omitted if an observation bootcamp start date or AFADBD did not occur in fiscal year 2012 to 2014. Other omitted observations were due to missing information that could not be cross referenced with other independent variables. After cleaning, 88,103 observations and 100 variables remain.

E. SUMMARY STATISTICS

The data set includes 88,103 enlistee observations between fiscal year 2012 to 2014. The statistical summary of non-binary variables in my study is outlined in Table 8. Table 9 presents the statistical summary for binary variables. Figures 4 to 10 provide distribution data across fiscal years to verify proportional contributions. The lists of MOSs and frequency distribution of each MOS in my study are presented in the appendix.

Table 8. Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
AFQT Score	88,103	61.767	18.326	0	99
Age	88,103	19.677	1.814	17.081	42.867
IST Crunches	78,325	84.636	20.563	0	241
IST Hang	7,310	51.285	20.091	0	220
IST Pull-up	71,125	12.248	5.779	0	215
IST Run	78,270	11.218	1.708	0	95.133
E1 Pro	48,755	42.077	1.955	1	50
E1 Con	48,753	42.023	2.315	1	50
E2 Pro	77,015	43.101	1.969	1	50
E2 Con	77,013	42.887	2.116	1	50
E3 Pro	77,874	43.606	1.619	10	50
E3 Con	77,874	43.524	1.791	10	50
E4 Pro	65,888	44.260	1.602	19	50
E4 Con	65,888	44.234	1.694	10	50
FLC Wait Time	72,830	30.317	28.873	1	120

Table 9. Binary Variables Summary Statistics

Variable	Obs	Mean	Std. Dev.
Female	88,103	.092	.289
Male	88,103	.908	.289
High-Quality	88,103	.705	.456
JJAS	88,103	.493	.500
ONDJ	88,103	.274	.446
FMAM	88,103	.233	.423
Combat MOS	88,103	.253	.434
Aviation MOS	88,103	.203	.402
Ground Support MOS	88,103	.530	.499
General MOS	88,103	.014	.119
Bootcamp Attrite	88,103	.050	.219
Attrite	83,668	.131	.337
Retain	72,670	.210	.408

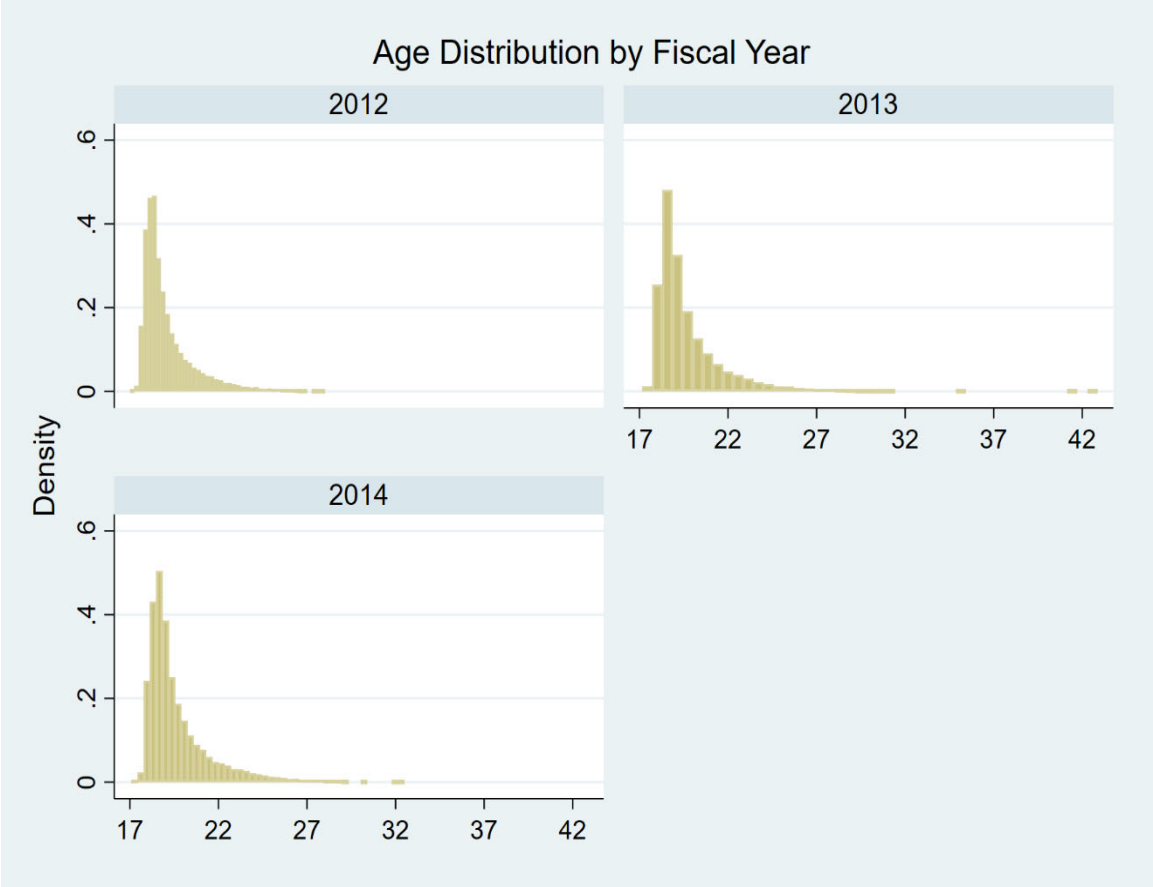

Figure 4. Age Distribution by Fiscal Year

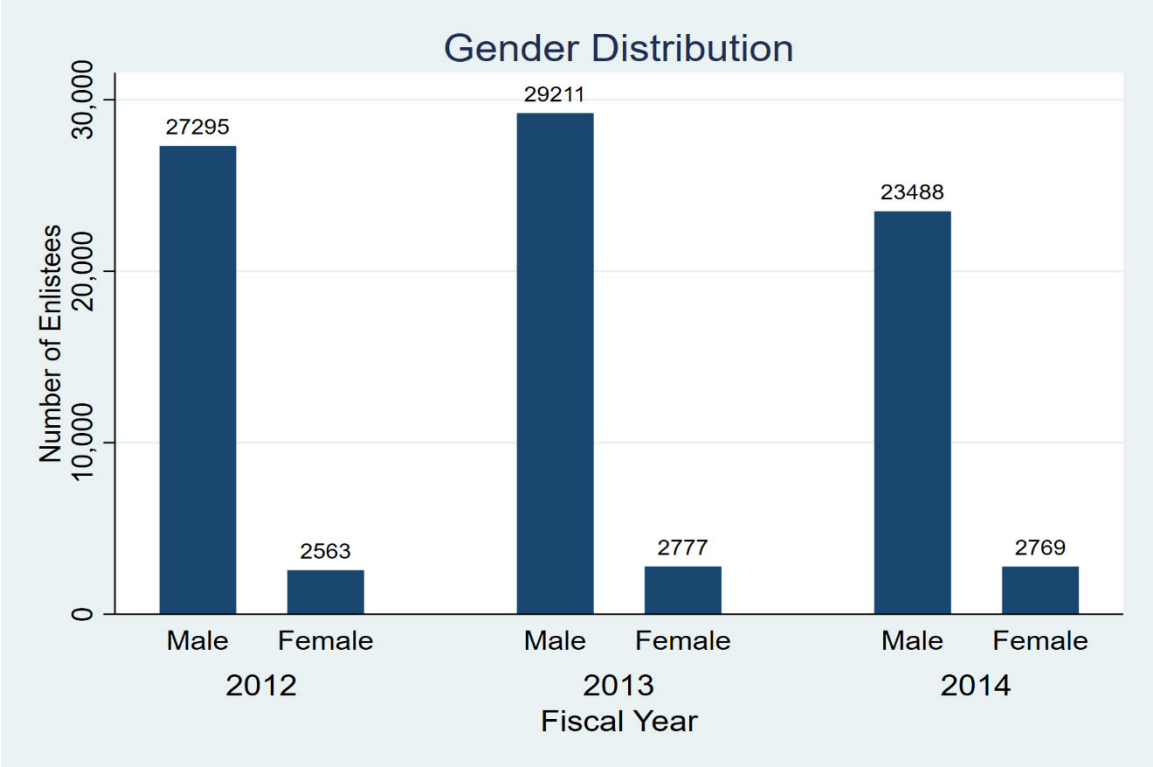

Figure 5. Gender Distribution by Fiscal Year

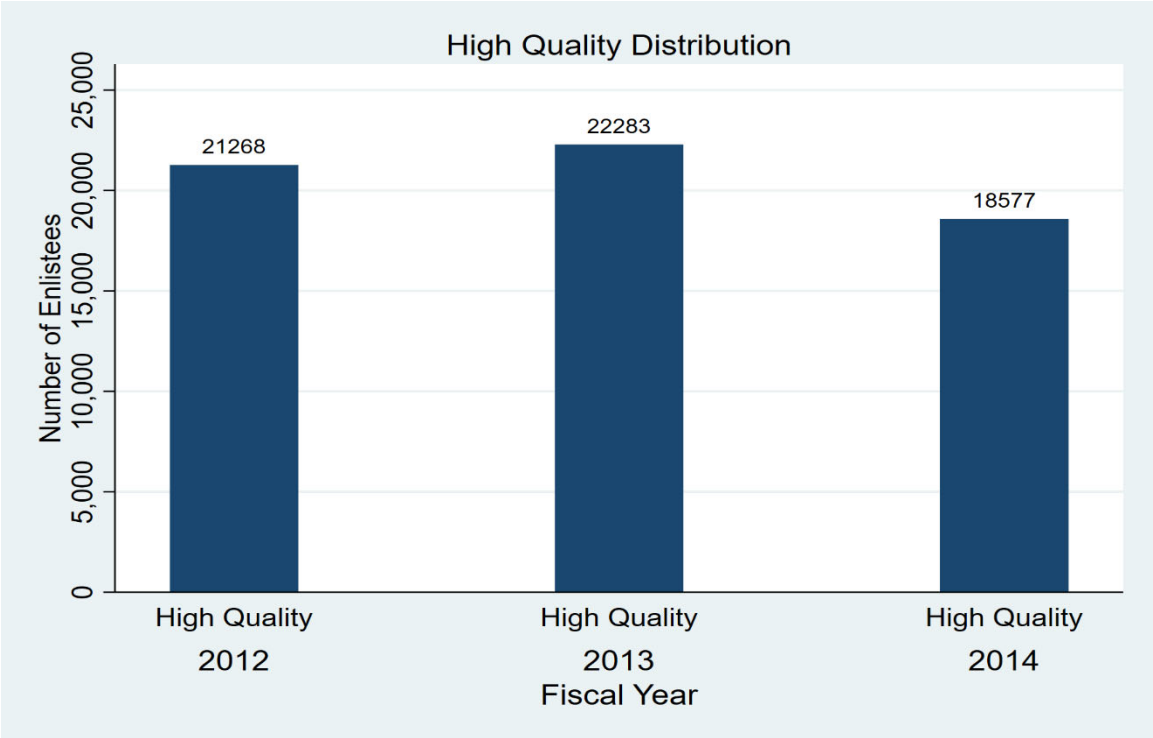

Figure 6. High Quality Distribution by Fiscal Year

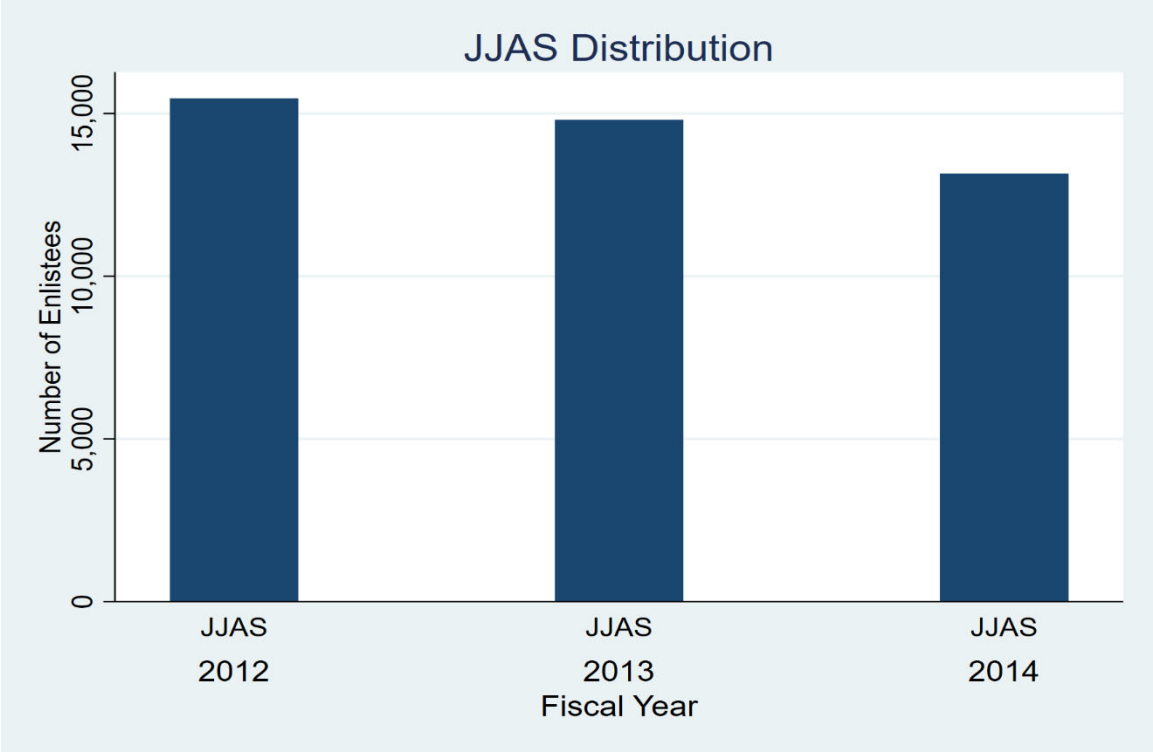

Figure 7. JJAS Distribution by Fiscal Year

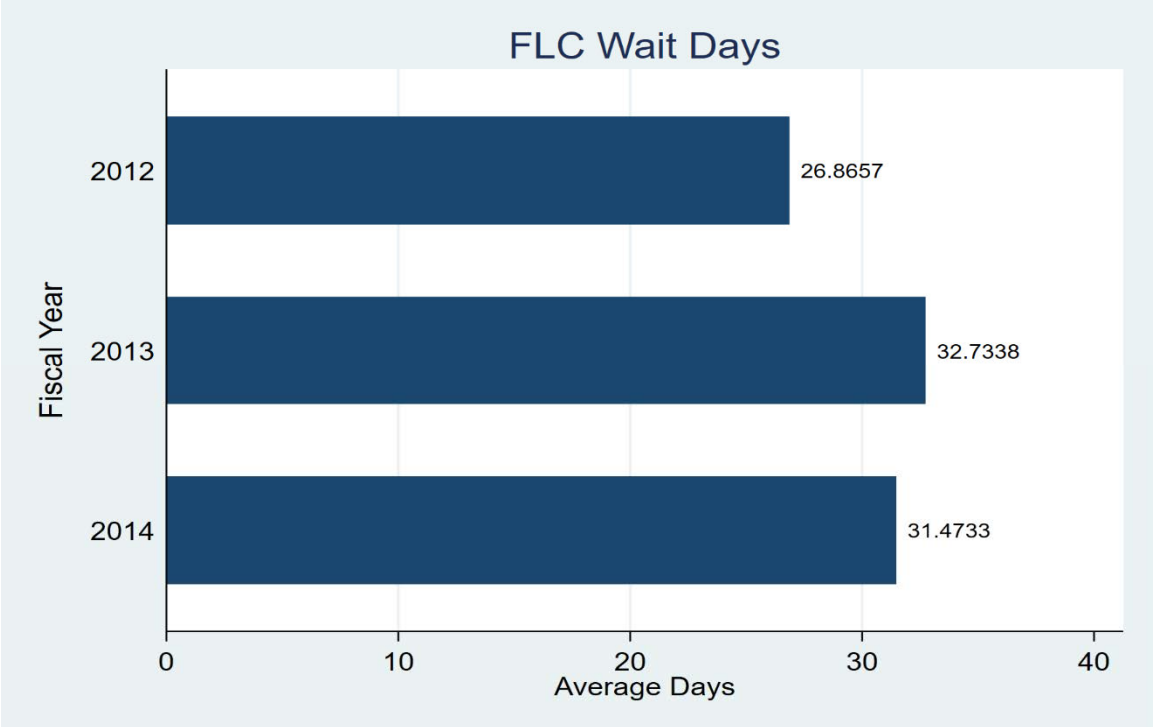

Figure 8. Time Awaiting Training Average Days by Fiscal Year

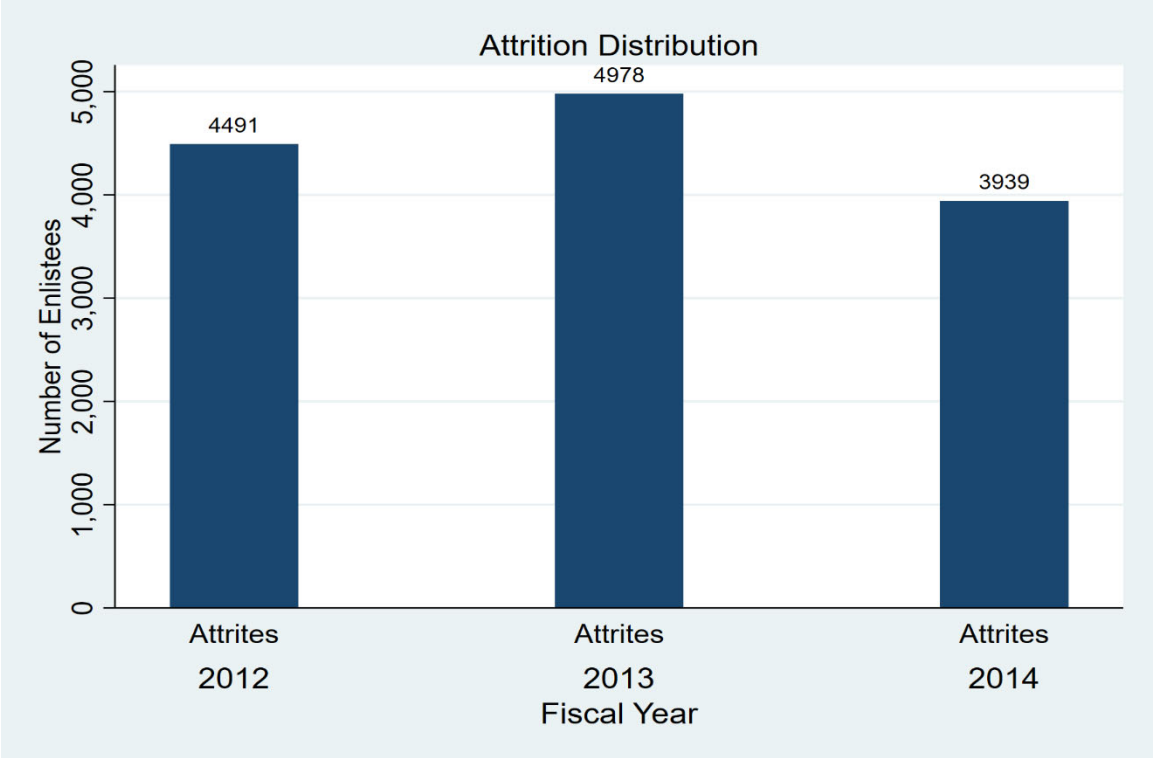

Figure 9. Attrition Distribution by Fiscal Year

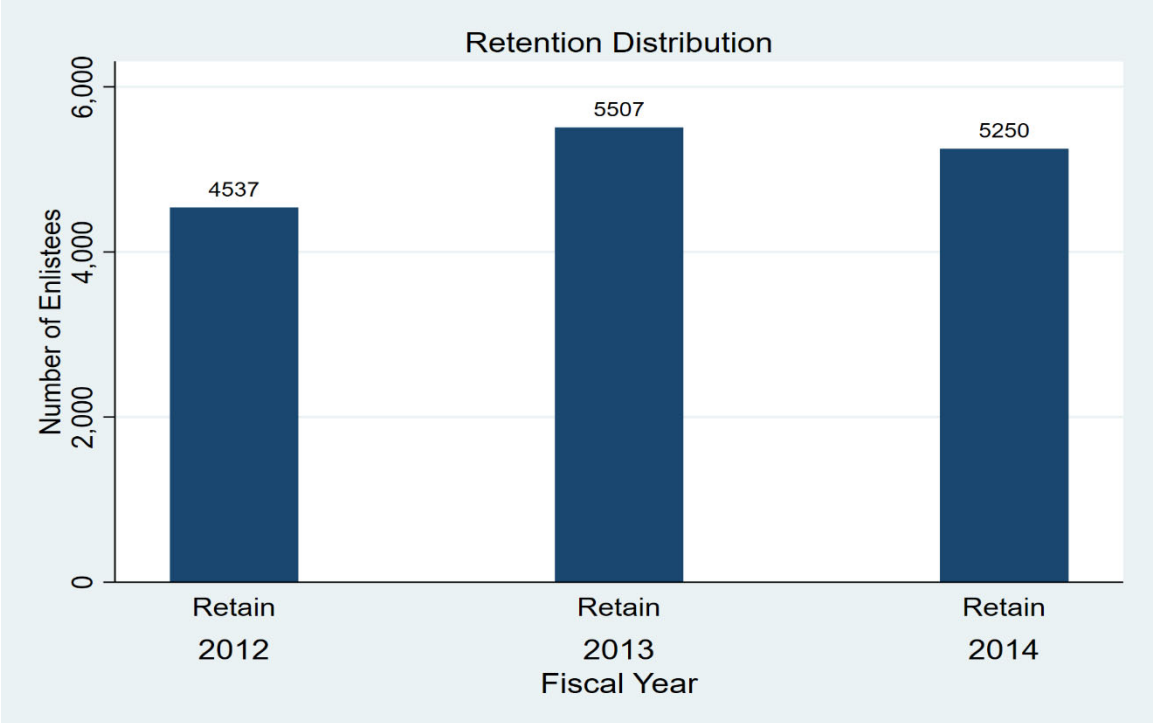

Figure 10. Retention Distribution by Fiscal Year

F. SUMMARY

This chapter introduces the data for analysis. The chapter also introduces a description of the sources and a list of independent variables these sources provide. Additionally, I describe the merging and cleaning process I use on the data. Furthermore, I explain the issues with the data and provide remedies to alleviate problems the data may cause on the regressions. Lastly, the chapter produces summary statistics and distribution evidence that provides a foundation for the methodology in the next chapter.

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V. METHODOLOGY

I use STATA version 16.1 throughout my research. The techniques I use for analysis are Ordinary Least Squares (OLS), LPM, and relative statistics. A detailed description of the techniques, models, and variables is presented in the succeeding paragraphs.

A. PRIMARY RESEARCH QUESTIONS

To answer my primary research question: to what degree does an enlistee's accession period affect the accrual of TAT and whether or not this accrual of TAT impacts retention, I use two steps. First, I use OLS to determine if the accession trimester has a significant effect on TAT. Second, I use a LPM regression to analyze the effects of TAT and accession trimester on retention.

1. RELATIONSHIP BETWEEN TAT AND ACCESSION

I use the OLS regression method to provide analysis on the accession trimester effects on TAT. The dependent variable is continuous and the independent variables are dichotomous. I use the JJAS accession trimester as the reference variable. I validate the model through visual inspection of the residuals and use the Breusch-Pagen test for heteroskedasticity. The regression incorporates robust standard errors to correct for the presence of heteroskedasticity. The following formula is the final model:

$$FLC\,Wait\,Time = \beta_0 + \beta_1 ONDJ + \beta_2 FMAM + \beta_3 Fiscal\,Year\,2012 + \beta_4 Fiscal\,Year\,2014 + \varepsilon$$

2. RELATIONSHIP BETWEEN RETENTION AND ACCESSION

In the second step, I use a LPM regression to provide analysis on the impact of accession trimester and TAT on retention. The dependent variable reflects an enlistee re-enlisting or extending past their first term of enlistment (Retain=1) or leaving the Marine Corps after completion of their first term of enlistment (Retain=0). Therefore, a qualifying observation is conditional on the observation completing their first term of enlistment. The

formula for a LPM differs from OLS as the dependent variable is a dichotomous variable. Arkes (2019) states that LPM has advantages over probits and logits in certain ways, including the simplicity of interpretation. In addition, Arkes (2019) argues that any problems with using LPM are minimal if the mean of the dependent variable is not near zero and the sample size is not too small, both of which are the case here. The final output includes three models. The initial model is a baseline model. I continue to add relevant independent variables to provide analysis on the overall effects. As with OLS, the regression includes robust standard errors to correct for heteroskedasticity. The following formula is the final model:

$$P(\text{Re}\,tain) = \beta_0 + \beta_1 FLC\,Wait\,Time + \beta_2 JJAS + \beta_3 FMAM + \beta_4 Fiscal\,Year\,2012 + \beta_5 Fiscal\,Year\,2014 + \beta_6 Combat\,MOS + \beta_7 Aviation\,MOS + \beta_8 General\,MOS + \varepsilon_i$$

B. SECONDARY RESEARCH QUESTION

To answer the secondary research question: to what extent do enlistees that attend the most populated accession period perform at a greater level relative to other accession periods, I use descriptive statistics to calculate the changes in PRO/CON average grade scores across accession periods. The isolation of accession periods on PRO/CON average grade reveals if there are any stark differences in scores amongst accession periods. I take it a step further and provide descriptive PRO/CON average grade scores for high-quality enlistees to determine if a high-quality enlistee performs relatively better than their counterparts. To conclude, I generate a comparison matrix that summarizes the changes.

C. TERTIARY RESEARCH QUESTION

To answer the tertiary research question: in what manner does an increase in TAT affect attrition, I use LPM regression to provide analysis on the impact of TAT on attrition. The binary dependent variable reflects an enlistee that fails to complete the first term of enlistment (Attrite=1) or successfully fulfills a first term enlistment (Attrite=0). The regression technique allows me to provide analysis on the probability an enlistee will attrite given an increase in TAT. The final output includes three independent models. The initial

model is the baseline model with TAT and accession trimester independent variables. I continue to add relevant independent variables to provide analysis on the overall effect. The regression includes robust standard errors to correct for heteroskedasticity. The following formula is the final model:

$$P(Attrite) = \beta_0 + \beta_1 FLC\,Wait\,Time + \beta_2 JJAS + \beta_3 FMAM + \beta_4 Fiscal\,Year\,2012 + \beta_5 Fiscal\,Year\,2014 + \beta_6 Combat\,MOS + \beta_7 Aviation\,MOS + \beta_8 General\,MOS + \varepsilon_i$$

D. SUMMARY

In this Chapter I review the methodology for each research question. I describe the three techniques I use for my study and explain the models while supplying the variables within these models. This section provides the basis for my analysis in the next chapter.

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VI. ANALYSIS AND RESULTS

The chapter reports the results and interprets the findings from the regressions. As there are multiple models, the chapter is organized by research question to provide an organized approach to the regression analysis and results.

A. PRIMARY RESEARCH QUESTIONS

To determine the degree to which an enlistee's accession period affects the accrual of TAT and whether or not this accrual of TAT impacts retention, I first isolate the effects of the accession trimester on TAT by conducting OLS regression. I use JJAS as the reference for accession trimester and fiscal year 2013 for the year. Table 10 displays the regression output from the model. As shown in Table 10, all values are statistically significant with ONDJ at $\alpha = 0.05$ level and the remaining variables at the $\alpha = 0.001$ level. On average, FMAM enlistees experience 4.3 fewer days of TAT compared to JJAS enlistees. As previous literature suggests, the JJAS accession trimesters appear to significantly affect the accrual TAT. JJAS enlistees accumulate more TAT, on average, than the other accession periods. Additionally, while accounting for the sheer number of accessions in the JJAS trimester, the total TAT days greatly exceed the other trimesters. Interestingly, ONDJ has the second highest average accumulation of TAT days. An explanation of the close averages is the surge in the JJAS trimester generates TAT and the issue compounds for the ONDJ enlistee resulting in similar number of TAT. Furthermore, enlistees from fiscal year 2012 and 2014, on average, spent fewer days awaiting training compared to fiscal year 2013. Figure 5, in the previous chapter, reveals fiscal year 2013 is the most populated fiscal year from the data set.

Table 10. Accession Effects on Time Awaiting Training

Variable	Coefficient Estimate	Standard Error
ONDJ	-0.58*	(0.26)
FMAM	-4.3***	(0.26)
FY12	-6.0***	(0.25)
FY14	-1.4***	(0.27)
Constant	34***	(0.22)
Observations	72,830	
Adjusted R-square	0.012	
Robust standard errors are in parentheses *p<0.05, **p<0.01, ***p<0.001		

Taking into account the statistically significant effect of the accession trimester on TAT, I determine if the accrual of TAT has an effect on retention. Using a LPM, I generate an initial model only controlling for TAT and accession trimester. I ensure the conditional observation standard is met and that the only observations in the model complete their first term. Subsequently, I include year and MOS controls to evaluate the differences on retention. Additional variables, including other trimesters, allow me to observe the estimated effect of TAT on retention. Without these controls, TAT would absorb the interactions of the controls and the result would be a biased estimate. Table 11 shows the results of the LPM regression output in which the binary dependent variable retention is an enlistee that continues to serve past their first term (Retain=1) or exits service after their first term (Retain=0). The initial model discloses all estimates are statistically significant at the $\alpha = 0.001$ level. The model indicates TAT has a negative correlation with retention. Every 10 days of TAT is associated with a reduction in an enlistee's probability of re-enlistment of 0.7 percentage points. Considering the average TAT for the data set is

approximately 30 days, the average enlistee's probability of re-enlistment is reduced by 2.1 percentage points. To put the results into an accession trimester perspective, JJAS enlistees would only need to accumulate 16 days of TAT to nullify the positive correlation of re-enlistment associated with accession in JJAS. The result also indicates JJAS and FMAM enlistees, on average, are more likely to serve beyond their first term compared to ONDJ enlistees. An explanation is the enlistees from ONDJ experience a compounding of TAT generated from JJAS enlistees. There are fewer ONDJ enlistees, yet, on average, the ONDJ enlistees accrue the same number of TAT. This accumulation of TAT reduces the overall Marine Corps experience for ONDJ enlistees and creates an estimated effect on retention.

In the final model, controlling for fiscal year and MOS type, all coefficient estimates remain statistically significant. The only difference in significance level is in the FMAM accession, which is reduced to the $\alpha = 0.01$ level. The coefficient estimates slightly increase for JJAS by 0.03 percentage points and decreases for FMAM by 0.2 percentage points. It is imperative to note that an enlistee who amasses more than 17 days of TAT negates any positive correlation from their trimester, regardless of accession period.

The final model provides other interesting results, such as the opposite correlating effects the fiscal years have. Both fiscal year estimates are statistically significant on the same level but affect retention in different manners. Further analysis reveals the economic environment may have contributed to this relationship. In the year 2016, the year most of the 2012 enlistees must make a re-enlistment decision, the United States economy was steadily growing. In an article by Dorfman (2016), he revealed the unemployment rate dropped to 4.6 percent, the lowest the rate has been in years and the rate was almost half of what it was in 2012. The anticipation that the economy would continue to grow influenced the decision made by the enlistees of cohort 2012. Unlike the enlistees of cohort 2012, at the time of the 2014 cohort's decision, the economy was steady but fell short of the desired Growth Domestic Product rate (Mutikani, 2019). The unemployment rate had marginally decreased and not to the same number experienced by the 2012 cohort (Plecher, 2020). The 2014 cohort decided to exceed their original contract, considering the

economical alternative, and extend or re-enlist. These economic environmental factors contributed to the decision of the respective cohorts.

The MOS group coefficient estimates have a statistically significant effect on retention as well. The MOS coefficients all have significance at the same $\alpha = 0.001$ level. Re-enlistment is restricted to the availability of boatspace for every MOS. For example, if 150 Marines from the 03XX MOS desire to re-enlist but there are only 100 boatspace available for the 03XX MOS, then 50 Marines could not re-enlist. The differences in the MOS coefficient estimates can possibly be explained by the limitations of boatspace for each MOS.

To determine the overall estimated effect an accession period and TAT has on retention, I review the final model and discuss the relationship. TAT, as expected, is associated with a reduction in the likelihood of retention, whereas the JJAS is associated with an increase in the likelihood of retention. The data suggest the opposite influences from each of the estimates imply there is a point in which these actions cancel each other out. For example, if a JJAS enlistee accumulates 17 days of TAT the TAT effect would reduce the likelihood of retention by 1.7 percentage points. That value is the exact number of the JJAS coefficient. Essentially, the accumulated days of TAT nullifies the effect of JJAS.

Table 11. Time Awaiting Training Effects on Retention

Variable	Initial	Adding Year	Adding PMOS
FLC Wait Time	-0.00070***	-0.00076***	-0.00100***
	(0.00006)	(0.00006)	(0.00006)
JJAS	0.016***	0.017***	0.017***
	(0.004)	(0.004)	(0.004)
FMAM	0.017***	0.017***	0.015**
	(0.005)	(0.004)	(0.005)
FY12		-0.031***	-0.032***
		(0.004)	(0.004)
FY14		0.034***	0.033***
		(0.004)	(0.004)
Combat MOS			-0.065***
			(0.004)
Aviation MOS			0.015***
			(0.005)
General MOS			0.299***
			(0.033)
Constant	.219***	0.221***	0.245***
	(0.004)	(0.004)	(0.005)
Observations	63,003	63,003	63,003
Adjusted R-square	0.003	0.007	0.014
Standard errors in parentheses * p < 0.05, ** p < 0.01, *** p < 0.001			

B. SECONDARY RESEARCH QUESTION

To determine the extent to which enlistees who attend the most populous accession period perform at a greater level relative to other accession periods, I generate a comparison matrix with the distribution of average PRO/CON scores per grade by accession trimester. Figures 11 to 14 illustrate the average PRO/CON scores per grade and Table 12 combines this information into a singular matrix for analysis. Table 12 also displays confidence intervals for each score and grade in the appropriate trimester. As shown in Table 12, the enlistees from the FMAM period slightly outperform the other accession periods in the grade of E1 and E2. ONDJ enlistees outperform the other accession periods in the grade of E3 and E4. Initial results indicate JJAS enlistees do not perform at a greater level than the other trimesters.

To test whether the outcomes are statistically significant, I conduct a confidence interval comparison for each score and grade to confirm if the PRO/CON estimated differences are statistically significant. Table 12 illustrates that in the grade of E1, there is no statistical significance in values. However, the gap in intervals for the other grades indicates the values are statistically significant. Even with the statistical significance, the changes in value are relatively close and unlikely to provide managerial significance.

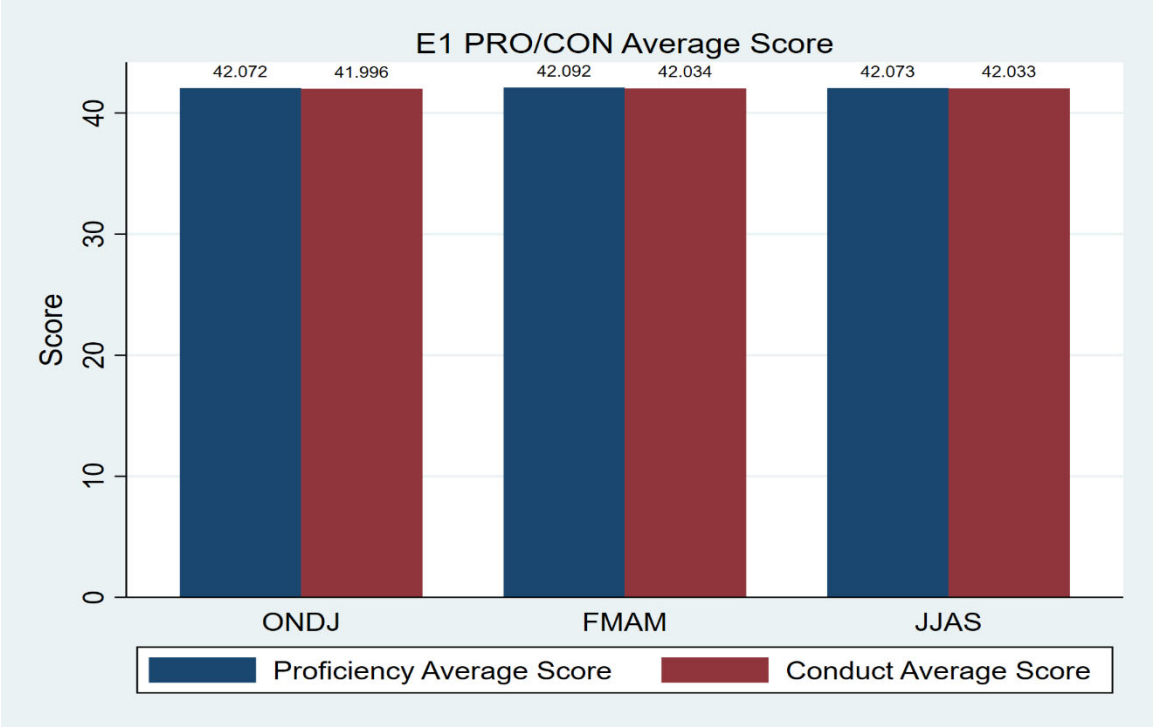

Figure 11. E1 PRO/CON Average Score

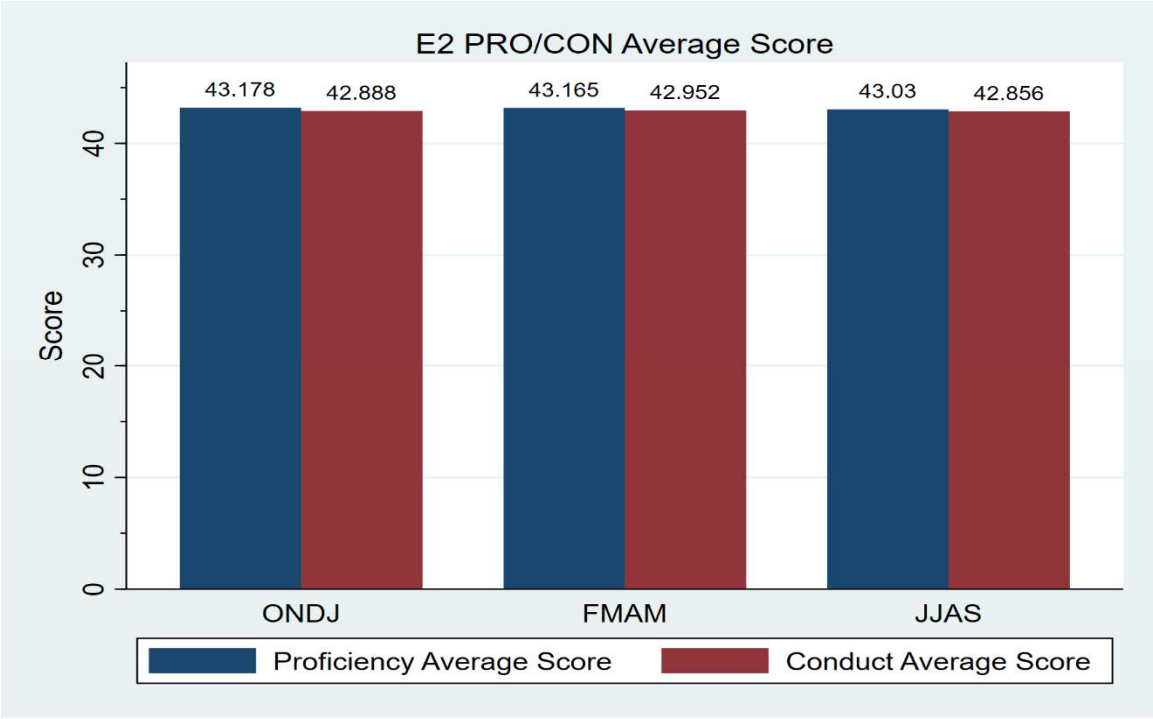

Figure 12. E2 PRO/CON Average Score

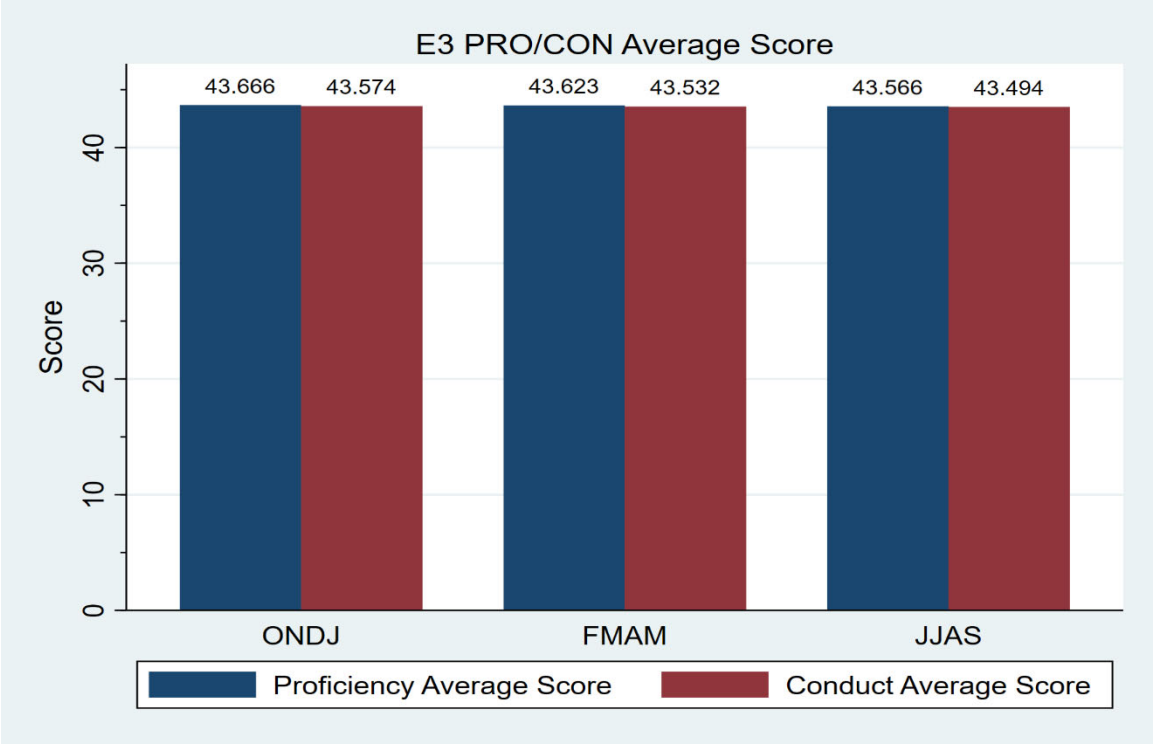

Figure 13. E3 PRO/CON Average Score

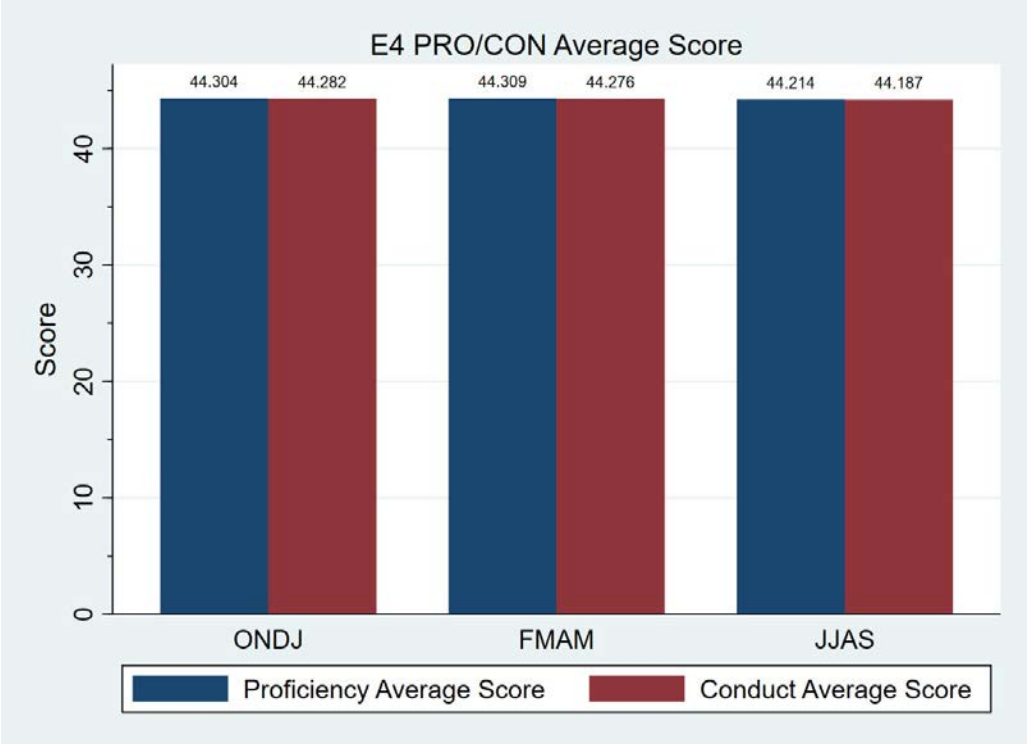

Figure 14. E4 PRO/CON Average Score

Table 12. PRO/CON Comparison Matrix

Trimester	E1				E2				E3				E4			
	Average Proficiecy Score	95% Confidence Interval	Average Conduct Score	95% Confidence Interval	Average Proficiecy Score	95% Confidence Interval	Average Conduct Score	95% Confidence Interval	Average Proficiecy Score	95% Confidence Interval	Average Conduct Score	95% Confidence Interval	Average Proficiecy Score	95% Confidence Interval	Average Conduct Score	95% Confidence Interval
ONDJ	42.072	42.035 - 42.108	41.996	41.953 - 42.038	43.178	43.150 - 43.206	42.888	42.857 - 42.920	43.666	43.644 - 43.687	43.574	43.549 - 43.598	44.304	44.281 - 44.328	44.282	44.257 - 44.306
FMAM	42.092	42.054 - 42.131	42.034	41.988 - 42.080	43.165	43.136 - 43.195	42.952	42.920 - 42.985	43.623	43.599 - 43.647	43.532	43.505 - 43.560	44.309	44.283 - 44.334	44.276	44.249 - 44.303
JJAS	42.073	42.050 - 42.095	42.033	42.008 - 42.060	43.030	43.011 - 43.049	42.856	42.836 - 42.875	43.566	43.550 - 43.582	43.494	43.476 - 43.511	44.214	44.196 - 44.231	44.187	44.170 - 44.206

To test if enlistees not categorized as high-quality influenced the result, I conduct the same relative performance matrix on high-quality enlistees. A high-quality enlistee is an enlistee with a high school diploma and has an AFQT score of 50 or above. As with the previous format, I generate a comparison matrix with for high-quality enlistees. Figures 15 to 18 illustrate the average PRO/CON scores per grade and Table 13 combines that information and the confidence intervals into a singular matrix for analysis. As with the previous comparison matrix, Table 13 shows the high-quality enlistees from JJAS did not perform at a greater level than the other accession trimesters. The confidence interval figures mirror the previous results indicating statistical significance at the grades E2 to E4. As with the previous comparison matrix, the changes in value are relatively small.

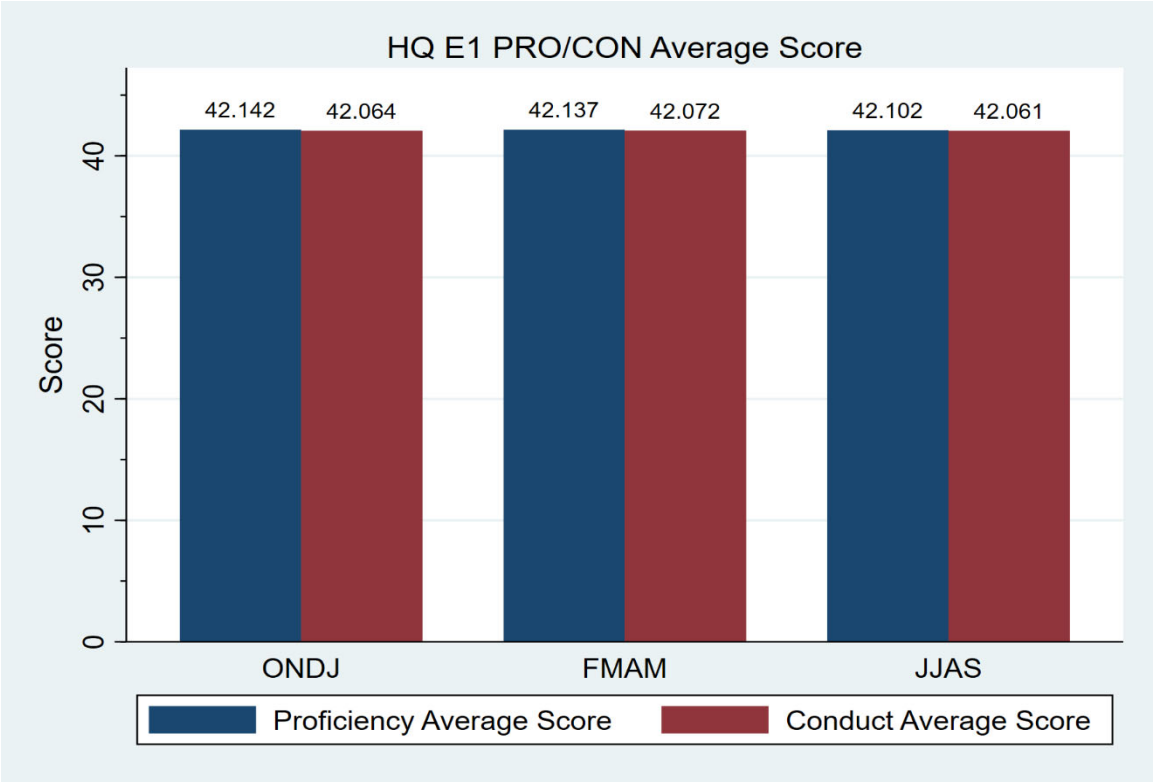

Figure 15. High-Quality Enlistees E1 PRO/CON Average Scores

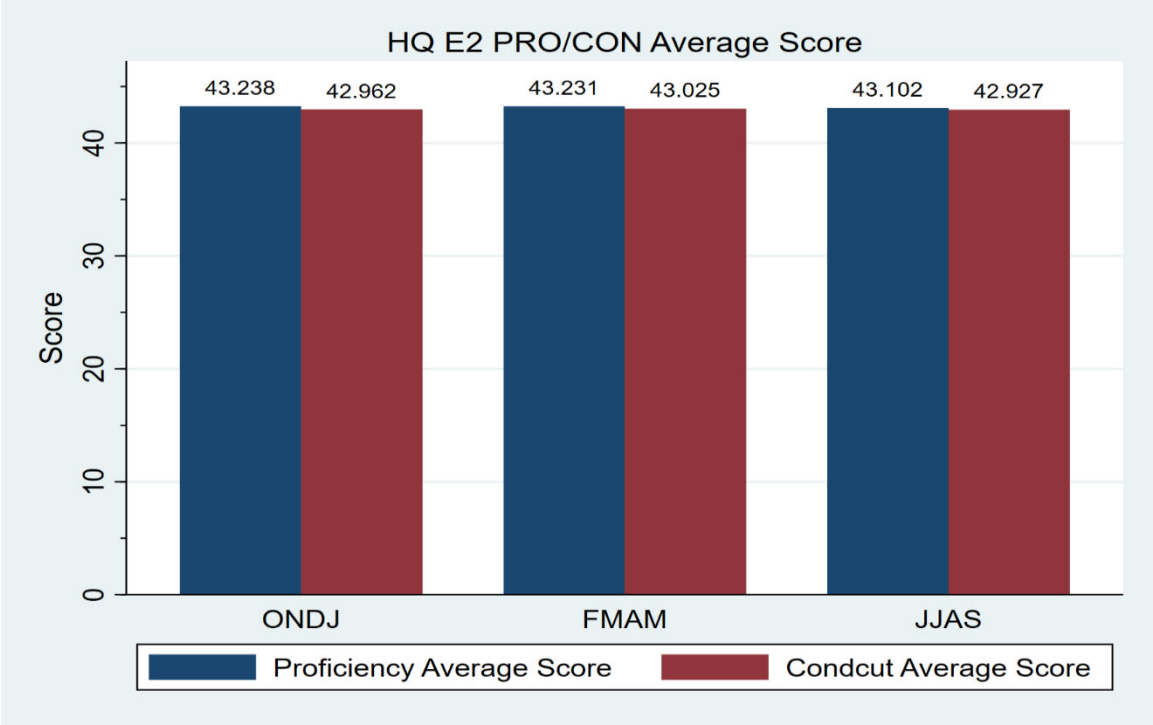

Figure 16. High-Quality Enlistees E2 PRO/CON Average Score

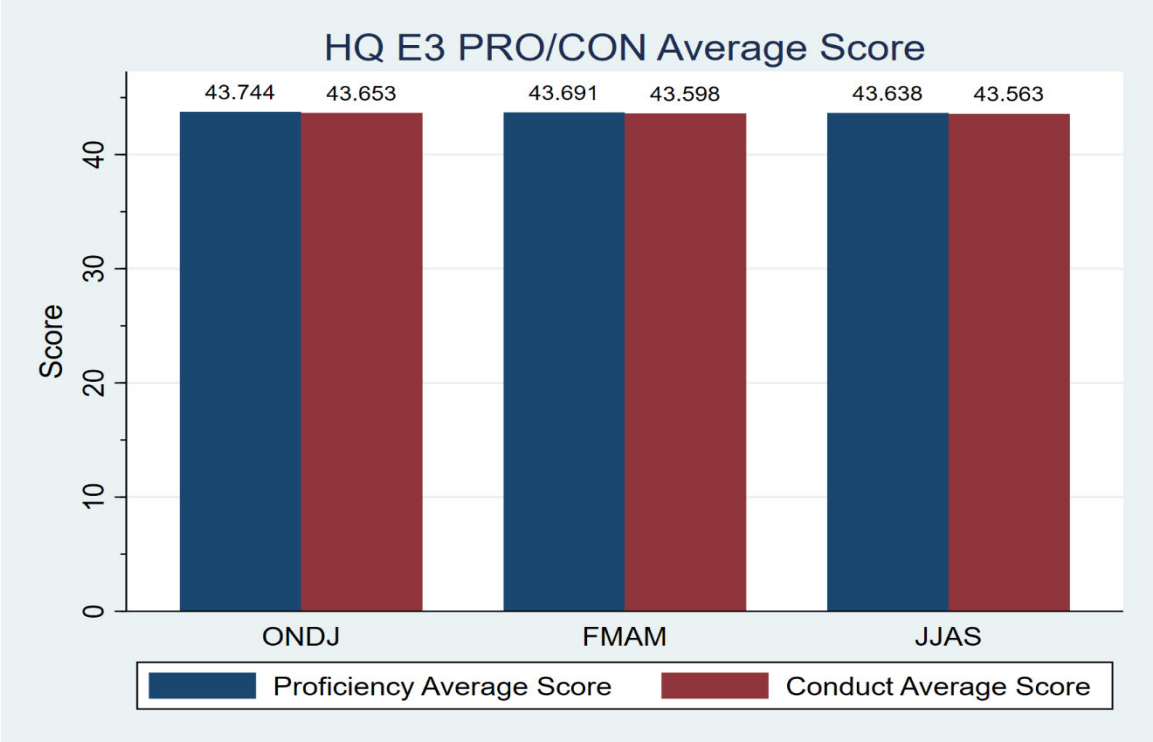

Figure 17. High-Quality Enlistees E3 PRO/CON Average Score

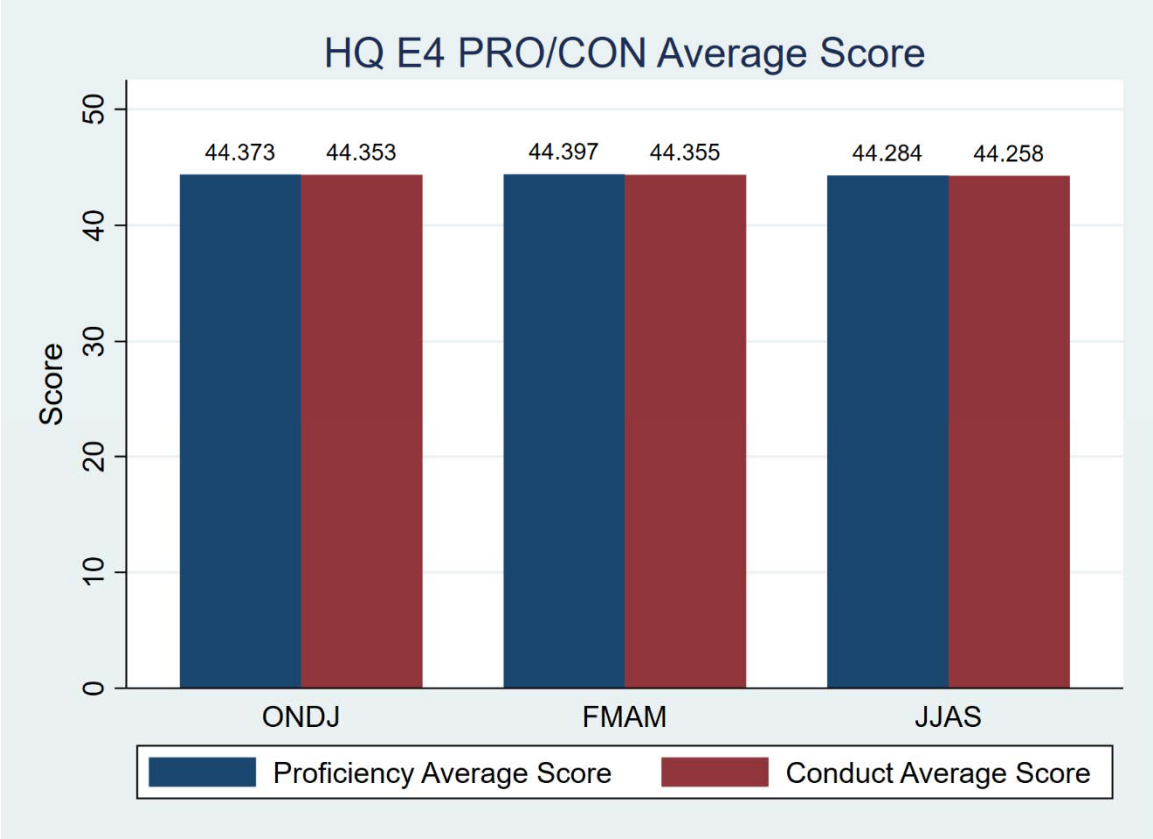

Figure 18. High-Quality Enlistees E4 PRO/CON Average Score

Table 13. High-Quality PRO/CON Comparison Matrix

Trimester	E1				E2				E3				E4			
	Average Proficiecy Score	95% Confidence Interval	Average Conduct Score	95% Confidence Interval	Average Proficiecy Score	95% Confidence Interval	Average Conduct Score	95% Confidence Interval	Average Proficiecy Score	95% Confidence Interval	Average Conduct Score	95% Confidence Interval	Average Proficiecy Score	95% Confidence Interval	Average Conduct Score	95% Confidence Interval
ONDJ	42.142	42.102 - 42.182	42.064	42.0162 - 42.112	43.238	43.205 - 43.271	42.962	42.926 - 42.998	43.744	43.719 - 43.769	43.653	43.625 - 43.681	44.373	44.345 - 44.400	44.353	44.324 - 44.382
FMAM	42.137	42.088 - 42.186	42.072	42.013 - 42.131	43.231	43.195 - 43.266	43.025	42.987 - 43.063	43.691	43.662 - 43.720	43.598	43.566 - 43.631	44.397	44.366 - 44.427	44.355	44.322 - 44.388
JJAS	42.102	42.077 - 42.127	42.061	42.031 - 42.091	43.102	43.080 - 43.124	42.927	42.904 - 42.949	43.638	43.620 - 43.656	43.563	43.563 - 43.583	44.284	44.263 - 44.304	44.258	44.238 - 44.279

C. TERTIARY RESEARCH QUESTION

To determine the manner in which an increase in TAT affects attrition, I continue to use LPM to conduct analysis and interpret the results. Table 14 provides the output of the LPM regression. The binary dependent variable reflects an enlistee that fails to complete the first term of enlistment (Attrite=1) or successfully fulfills a first term enlistment (Attrite=0). The initial model shows the TAT estimate has a statistical significance at the $\alpha = 0.001$ level. However, the result indicates the more TAT an enlistee accumulates the less likely that enlistee will attrite. A possible explanation for this relationship is that a greater number of higher quality enlistees are in the trimesters that accumulate the most TAT and these enlistees are less likely to attrite.

The final model continues to show the TAT coefficient as statistically significant with a small decrease in the coefficient estimate. Fiscal year 2014, aviation MOS, and general MOS estimates are also significant at the $\alpha = 0.001$ level. Fiscal year 2014 has a negative correlation with attrition. As with the retention model, the economic environment helps explain the relationship with fiscal year 2014 and attrition as it did with retention. An enlistee from the 2014 cohort is 1.1 percentage points less likely to attrite than other cohorts in the study.

For the MOS controls, an enlistee in the aviation MOS groups is more likely to attrite than other enlistees in the ground support community. By examining the data set, a possible explanation is aviation MOS has a smaller representation and a single attrite from the MOS greatly impacts the model, when compared to ground support MOS. As for the general MOS group, a closer look at the appendix reveals some of the enlistees are in the 80XX community. The information suggests these enlistees could not attain a valid MOS. Therefore, the result that enlistees in the general MOS, on average, are more likely to attrite than those of the ground support MOS mirrors the data set.

Table 14. Time Awaiting Training Effects on Attrition

Variable	Initial	Fiscal Year	PMOS
FLC Wait Time	-0.00099***	-0.00099***	-0.00098***
	(0.000044)	(0.000044)	(0.000045)
JJAS	-0.0020	-0.0018	-0.0022
	(0.0030)	(0.0030)	(0.0030)
FMAM	0.0025	0.0026	0.0034
	(0.0036)	(0.0036	(0.0036)
FY12		-0.0051	-0.0054
		(0.0031)	(0.0030)
FY14		-0.011***	-0.013***
		(0.0031)	(0.0031)
Combat MOS			0.0021
			(0.0030)
Aviation MOS			0.015***
			(0.0038)
General MOS			0.37***
			(0.023)
Constant	.17***	.17***	.17***
	(0.0029)	(0.0034)	(0.0036)
Observations	72,830	72,830	72,830
Adjusted R-square	0.0070	0.0071	0.014
Standard errors in parentheses * p < 0.05, ** p < 0.01, *** p < 0.001			

D. SUMMARY

In this chapter, I provide an analysis for each research question. The analysis finds that the JJAS phasing approach seems to impact the number of TAT days an enlistee acquires. JJAS enlistees average four more days of TAT than FMAM enlistees. Moreover, the phasing approach increases the TAT days for the follow-on trimester. The accumulation of TAT days appears to reduce an enlistee's probability of re-enlistment past the first term. By comparing performance metrics, the analysis suggests that JJAS enlistees did not perform better than their counterparts. Although there is statistical significance in the estimates, the changes in value are incremental. The attrition model reveals that TAT seem to reduce the probability that an enlistee would attrite in their first term. However, enlistees with the highest mean of TAT days are from the JJAS trimester, which has a higher concentration of high-quality enlistees. Therefore, it stands to reason there is a negative relationship with attrition, as high-quality enlistees are less likely to attrite. These analyses are the foundational elements of my conclusion and recommendations in the succeeding chapter.

VII. CONCLUSIONS AND RECOMMENDATIONS

In this study I conduct analysis on the structural effects of the accession trimester on retention, performance, and attrition. Every enlisted Marine goes through the EELT pipeline. Therefore, it is critical to determine if the accession trimester surge creates unintended consequences. I use three different techniques to provide analysis and obtain interpretable results. Having insight into the structural analysis of the accession trimesters gives decision-makers the information needed to implement policy that maximizes efficiency and effectiveness in the EELT pipeline and increases the overall lethality of the Marine Corps.

A. CONCLUSIONS

1. TAT

To determine to what degree does an enlistee's accession period affects the accrual of TAT, I use a multivariate linear regression model. The model indicates the JJAS accession trimester significantly affects the accrual TAT. JJAS enlistees accumulate four more days of TAT than the average enlistee. The results mirror the other research that has been conducted on TAT. Interestingly, ONDJ has the second highest average accumulation of TAT days. This relationship indicates the JJAS accession period generates increased TAT for two accession periods. The enlistees from these two accession periods nearly average 30 days of TAT. Considering the number of enlistees that process through JJAS, the total TAT days accumulated by the JJAS accession period considerably surpass the other trimesters. The JJAS accession process captures high-quality enlistees but appears to also increase the amount of TAT for JJAS and ONDJ enlistees.

2. Retention

I fit an LPM to determine the effects that TAT and an accession period have on retention. A successful measure of retention is if an enlistee continues to serve past their first term of enlistment. I discover that both JJAS and FMAM appear to have a positive relationship with re-enlisting and that the estimates are statistically significant. According

to the model, JJAS enlistees are 1.7 and FMAM enlistees 1.5 percentage points more likely to re-enlist. TAT has a negative relationship with re-enlistment. One day of TAT equates to a 0.1 percentage point reduction in the probability of re-enlistment. Given the context, 17 days or more of TAT nullify the positive effect JJAS has on re-enlistment.

3. Performance

I measure and compare the average PRO/CON scores per grade by accession trimester and find JJAS enlistees do not perform relatively better than Marines from the other accession periods. While confidence intervals indicate that certain comparisons are statistically significant, the difference are so small they are of no practical use.

4. Attrition

Contrary to previous studies, an enlistee's accession period, according to my data set, has no relationship with the likelihood of attrition. Other studies have included demographics and individual characteristics, such as waivers, as an independent variable. My study focuses on structural analysis and the difference in approaches can explain the differences in the results with other studies. My study does reveal a negative relationship between TAT and attrition. Considering enlistees that accumulate more TAT are from the accession periods with the highest concentration of high-quality enlistees, the relationship is understandable. The high-quality enlistees are less likely to attrite and desire to complete training to become operational.

B. RECOMMENDATIONS

The current accession process generates TAT among the JJAS and ONDJ enlistees. As the accession mission is to attain high-quality enlistees and the retention mission is to retain high-quality Marines, a cost benefit analysis should be conducted to determine if smoothing out the accession plan has a greater cost than the current accession plan. As the average difference for an enlistee from JJAS and ONDJ is a single day, when considering the number of enlistees processed in those trimesters and the average days accumulated by each enlistee, approximately 30 days in this data set, the fiscal consequence of not conducting further analysis is substantial.

My study utilizes only three fiscal years of data. Continued research on structural analysis of the accession process and EELT pipeline should be conducted using larger samples and include the potential accumulation of TAT from bootcamp graduation to the start of MCT/SOI training. The new data should also obtain days an enlistee is on leave or participating in PRASP while in the transition periods to increase the accuracy of the analysis.

My regression analysis does not include demographics and solely attempts to provide analysis on the structural system of the accession trimesters and the overall EELT process. Through my study, there appears to be a statistically significant correlating relationship with accession period, TAT, and retention. My study, taken into conjunction with other studies, provides critical information that can be used to increase efficiency and the overall lethality of the United States Marine Corps.

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APPENDIX: MOS DISTRIBUTION

Table 15. MOS Distribution

MOS	Freq.	Percent	Cum.	MOS Group
0	1	0	0	General
100	252	0.29	0.29	Ground Support
111	3,411	3.87	4.16	Ground Support
151	1	0	4.16	Ground Support
161	229	0.26	4.42	Ground Support
200	269	0.31	4.73	Ground Support
231	994	1.13	5.85	Ground Support
261	84	0.1	5.95	Ground Support
300	1,246	1.41	7.36	Combat
311	10,937	12.42	19.78	Combat
313	466	0.53	20.31	Combat
321	229	0.26	20.57	Combat
331	1,904	2.16	22.73	Combat
341	1,986	2.25	24.98	Combat
351	901	1.02	26.01	Combat
352	832	0.94	26.95	Combat
400	159	0.18	27.13	Ground Support
411	512	0.58	27.71	Ground Support
431	628	0.71	28.43	Ground Support
451	108	0.12	28.55	Ground Support
481	689	0.78	29.33	Ground Support
500	21	0.02	29.35	Ground Support
511	208	0.24	29.59	Ground Support
600	507	0.58	30.17	Ground Support
612	1,061	1.2	31.37	Ground Support
621	3,199	3.63	35	Ground Support
623	109	0.12	35.13	Ground Support
627	191	0.22	35.34	Ground Support
631	25	0.03	35.37	Ground Support
651	1,787	2.03	37.4	Ground Support
671	6	0.01	37.41	Ground Support
800	241	0.27	37.68	Combat
811	1,285	1.46	39.14	Combat
842	168	0.19	39.33	Combat
844	305	0.35	39.68	Combat
847	99	0.11	39.79	Combat

MOS	Freq.	Percent	Cum.	MOS Group
861	296	0.34	40.12	Combat
1100	223	0.25	40.38	Ground Support
1141	458	0.52	40.9	Ground Support
1142	465	0.53	41.42	Ground Support
1161	255	0.29	41.71	Ground Support
1171	464	0.53	42.24	Ground Support
1300	460	0.52	42.76	Ground Support
1316	169	0.19	42.95	Ground Support
1341	751	0.85	43.81	Ground Support
1345	1,038	1.18	44.99	Ground Support
1361	54	0.06	45.05	Ground Support
1371	2,000	2.27	47.32	Ground Support
1391	679	0.77	48.09	Ground Support
1800	145	0.16	48.25	Combat
1812	389	0.44	48.69	Combat
1833	885	1	49.7	Combat
2100	288	0.33	50.03	Ground Support
2111	649	0.74	50.76	Ground Support
2131	108	0.12	50.88	Ground Support
2141	231	0.26	51.15	Ground Support
2146	205	0.23	51.38	Ground Support
2147	212	0.24	51.62	Ground Support
2161	82	0.09	51.71	Ground Support
2171	249	0.28	52	Ground Support
2300	63	0.07	52.07	Ground Support
2311	862	0.98	53.05	Ground Support
2600	581	0.66	53.71	Ground Support
2621	483	0.55	54.25	Ground Support
2631	181	0.21	54.46	Ground Support
2641	34	0.04	54.5	Ground Support
2651	344	0.39	54.89	Ground Support
2671	71	0.08	54.97	Ground Support
2673	55	0.06	55.03	Ground Support
2674	46	0.05	55.08	Ground Support
2676	51	0.06	55.14	Ground Support
2800	1,132	1.29	56.43	Ground Support
2821	89	0.1	56.53	Ground Support
2831	106	0.12	56.65	Ground Support
2841	631	0.72	57.36	Ground Support
2847	317	0.36	57.72	Ground Support
2871	63	0.07	57.8	Ground Support

MOS	Freq.	Percent	Cum.	MOS Group
2887	28	0.03	57.83	Ground Support
3000	174	0.2	58.03	Ground Support
3043	1,639	1.86	59.89	Ground Support
3051	1,443	1.64	61.52	Ground Support
3052	121	0.14	61.66	Ground Support
3100	21	0.02	61.68	Ground Support
3112	242	0.27	61.96	Ground Support
3300	121	0.14	62.1	Ground Support
3381	1,109	1.26	63.36	Ground Support
3400	71	0.08	63.44	Ground Support
3432	481	0.55	63.98	Ground Support
3451	232	0.26	64.25	Ground Support
3500	893	1.01	65.26	Ground Support
3521	2,144	2.43	67.69	Ground Support
3531	4,677	5.31	73	Ground Support
4300	50	0.06	73.06	Ground Support
4341	186	0.21	73.27	Ground Support
4400	54	0.06	73.33	Ground Support
4421	208	0.24	73.57	Ground Support
4541	7	0.01	73.58	Ground Support
4571	3	0	73.58	Ground Support
4600	65	0.07	73.65	Ground Support
4612	54	0.06	73.71	Ground Support
4641	102	0.12	73.83	Ground Support
4671	74	0.08	73.91	Ground Support
5500	49	0.06	73.97	Ground Support
5512	37	0.04	74.01	Ground Support
5524	237	0.27	74.28	Ground Support
5700	62	0.07	74.35	Ground Support
5711	321	0.36	74.72	Ground Support
5800	340	0.39	75.1	Ground Support
5811	1,687	1.92	77.02	Ground Support
5831	340	0.39	77.4	Ground Support
5900	426	0.48	77.89	Ground Support
5939	64	0.07	77.96	Ground Support
5942	10	0.01	77.97	Ground Support
5948	40	0.05	78.02	Ground Support
5951	5	0.01	78.02	Ground Support
5952	40	0.05	78.07	Ground Support
5953	75	0.09	78.15	Ground Support
5954	41	0.05	78.2	Ground Support

MOS	Freq.	Percent	Cum.	MOS Group
5974	53	0.06	78.26	Ground Support
5979	26	0.03	78.29	Ground Support
6000	590	0.67	78.96	Aviation
6042	168	0.19	79.15	Aviation
6046	561	0.64	79.78	Aviation
6048	398	0.45	80.24	Aviation
6062	173	0.2	80.43	Aviation
6072	215	0.24	80.68	Aviation
6073	247	0.28	80.96	Aviation
6074	106	0.12	81.08	Aviation
6092	265	0.3	81.38	Aviation
6111	462	0.52	81.9	Aviation
6112	19	0.02	81.92	Aviation
6113	419	0.48	82.4	Aviation
6114	455	0.52	82.92	Aviation
6116	261	0.3	83.21	Aviation
6122	10	0.01	83.22	Aviation
6123	97	0.11	83.33	Aviation
6124	80	0.09	83.43	Aviation
6132	103	0.12	83.54	Aviation
6152	18	0.02	83.56	Aviation
6153	353	0.4	83.96	Aviation
6154	333	0.38	84.34	Aviation
6156	301	0.34	84.68	Aviation
6173	67	0.08	84.76	Aviation
6174	73	0.08	84.84	Aviation
6176	75	0.09	84.93	Aviation
6200	271	0.31	85.23	Aviation
6212	210	0.24	85.47	Aviation
6213	39	0.04	85.52	Aviation
6216	125	0.14	85.66	Aviation
6217	244	0.28	85.94	Aviation
6218	69	0.08	86.01	Aviation
6222	50	0.06	86.07	Aviation
6223	27	0.03	86.1	Aviation
6227	101	0.11	86.22	Aviation
6251	288	0.33	86.54	Aviation
6252	167	0.19	86.73	Aviation
6253	47	0.05	86.79	Aviation
6256	87	0.1	86.89	Aviation
6257	235	0.27	87.15	Aviation

MOS	Freq.	Percent	Cum.	MOS Group
6258	35	0.04	87.19	Aviation
6276	38	0.04	87.24	Aviation
6281	19	0.02	87.26	Aviation
6282	76	0.09	87.34	Aviation
6283	31	0.04	87.38	Aviation
6286	80	0.09	87.47	Aviation
6287	72	0.08	87.55	Aviation
6288	14	0.02	87.57	Aviation
6300	1,400	1.59	89.16	Aviation
6312	8	0.01	89.16	Aviation
6313	32	0.04	89.2	Aviation
6314	176	0.2	89.4	Aviation
6316	51	0.06	89.46	Aviation
6317	177	0.2	89.66	Aviation
6322	6	0.01	89.67	Aviation
6323	166	0.19	89.86	Aviation
6324	170	0.19	90.05	Aviation
6326	125	0.14	90.19	Aviation
6332	67	0.08	90.27	Aviation
6333	36	0.04	90.31	Aviation
6336	54	0.06	90.37	Aviation
6337	148	0.17	90.54	Aviation
6338	63	0.07	90.61	Aviation
6386	41	0.05	90.65	Aviation
6400	757	0.86	91.51	Aviation
6414	13	0.01	91.53	Aviation
6423	94	0.11	91.63	Aviation
6432	163	0.19	91.82	Aviation
6433	6	0.01	91.83	Aviation
6469	255	0.29	92.12	Aviation
6483	121	0.14	92.25	Aviation
6492	109	0.12	92.38	Aviation
6499	137	0.16	92.53	Aviation
6500	309	0.35	92.88	Aviation
6531	652	0.74	93.62	Aviation
6541	551	0.63	94.25	Aviation
6600	171	0.19	94.44	Aviation
6672	725	0.82	95.27	Aviation
6694	110	0.12	95.39	Aviation
6800	100	0.11	95.5	Aviation
6842	85	0.1	95.6	Aviation

MOS	Freq.	Percent	Cum.	MOS Group
7000	178	0.2	95.8	Aviation
7011	212	0.24	96.04	Aviation
7041	390	0.44	96.49	Aviation
7051	621	0.7	97.19	Aviation
7200	230	0.26	97.45	Aviation
7212	232	0.26	97.72	Aviation
7234	29	0.03	97.75	Aviation
7236	131	0.15	97.9	Aviation
7242	168	0.19	98.09	Aviation
7251	185	0.21	98.3	Aviation
7257	114	0.13	98.43	Aviation
7300	47	0.05	98.48	Aviation
7314	70	0.08	98.56	Aviation
7315	1	0	98.56	Aviation
8000	182	0.21	98.77	General
8011	695	0.79	99.56	General
8900	81	0.09	99.65	General
8972	308	0.35	100	General
9900	1	0	100	General
Total	88,093	100	100	

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